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New Frontiers of Regional and Urban Analysis

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INTRODUCTION

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New frontiers of regional and urban analysis. Why this special issue?

Over the past four decades, the analysis of regional and urban issues has attained a prime position in research, particularly from an economic perspective. Evidently, geographers have always paid very close attention to these matters, as they represent the very essence of their discipline. Moreover, they have also made splendid contributions. Economists, however, took far longer to incorporate spatial considerations into their economic analyses. In fact, only the topic of localisation and some issues on market competition had warranted any measure of theoretical and applied effort, albeit brilliant, in some instances. In other Social Sciences, such as Sociology, Politics and History, the focus on regional and urban issues has also benefitted from some outstanding testimonies and contributions in the past, but such topics rarely enjoyed a clear position within the central cores of those disciplines.

This is not, without a doubt, the situation we are currently in. Today, there are world associations, such as RSAI, RSA and UGI, to cite just three relevant examples between a high number of them, which bring together researchers from different backgrounds in an effort to analyse spatial issues. At the same time, there are numerous academic-scientific journals focusing specifically on regional and urban problems, including our own modest effort. Likewise, several universities offer postgraduate, and even graduate, courses focusing on regional analysis, urban topics, local development and other more or less directly related themes. The present situation is, therefore, clearly very different from that of a few decades ago.

The historical evolution of any field of study requires some form of self-examination from time to time, in order to calibrate and evaluate the current path, and also to explore possible issues that may deserve a closer look by researchers. This is particularly necessary in the case of Social Sciences, more so considering that our societies evolve continuously, as does the global environment, that technological progress is generating changes in wide array of disciplines, that demographic dynamics are generating new problems and demands, and that, to limit this list, international and intrastate migratory movements are bringing new challenges, attitudes and problems. All of this is reflected and materialised very clearly at a spatial level.

Over a year ago, the Editorial Board of this Journal considered that this is a good time to reflect on the developments taking place in the field of regional and urban research and, above all, to explore which issues and approaches might be most relevant for future research. The objective was, and remains, undoubtedly ambitious. In

fact, it clearly exceeded the possibilities of this Journal. However, we believed that it was worth making, at least, a modest contribution to this reflection through a monographic issue seeking to explore the «new frontiers» of Regional and Urban Analysis.

To face this challenge, we asked a group of academics and researchers of international prestige to provide their ideas on certain topics and problems that could represent the new frontiers of Regional Science, always respecting their freedom of choice and approach. The result is this monographic issue. As readers will see, we have gathered contributions from well-known academics and researchers from various continents. Once again, this time with a completed work in our hands, we wish to extend our warmest gratitude to these excellent professionals.

We trust that the variety of themes considered, the authority of our contributors and the multiple suggestions stemming from several works included in this issue will encourage many researchers to advance towards those frontiers of territorial analysis. We also hope that any future contributions will serve to guide the objectives and content of regional and urban policies.

We are in need of theoretical contributions and empirical analyses with a scope beyond mere speculation and strictly scientific and academic values. If there is one goal that social scientists should always strive for, it is to contribute to solve any problems they perceive and which people suffer from, many of which are manifested in the places where they live and work; in other words, their territory. This is clearly the case of poverty, inequality, environmental issues, creation of wealth and employment, and the changes stemming from new technologies and digitalisation, among others.

October 2016

The Editorial Board

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Nuevas fronteras del análisis regional y urbano. ¿Por qué este número especial?

En las cuatro últimas décadas los análisis de los problemas regionales y urbanos han pasado a ocupar una posición destacada en el ámbito investigador, particularmente desde la perspectiva económica. Por supuesto que, desde siempre, los geógrafos habían prestado una atención muy especial a estos temas, en coherencia con lo que constituye la esencia misma de su disciplina. Hicieron, además, espléndidas aportaciones. Los economistas, sin embargo, tardaron bastante más en incorporar los aspectos espaciales al Análisis Económico. De hecho, solo el tema de la localización y algunas cuestiones relacionadas con la competencia en los mercados habían merecido algunos esfuerzos —a veces brillantes— tanto teóricos como aplicados. En otras áreas de las Ciencias Sociales, como la Sociología, la Política, la Historia y otras, la atención a las cuestiones regionales y urbanas también contó en el pasado con singulares testimonios y algunas destacadas aportaciones, aunque estos temas pocas veces figuraban en una clara posición dentro del núcleo central de dichas disciplinas.

Esta no es, sin duda, la situación actual. Hoy existen asociaciones de ámbito mundial, como la RSAI, la RSA o la UGI, por poner solo tres grandes ejemplos, que agrupan a investigadores de muy diversa formación que dedican sus esfuerzos al análisis de las cuestiones espaciales. Al propio tiempo son numerosas las revistas de carácter académico-científico dedicadas especialmente a los problemas regionales y urbanos, entre las cuales modestamente nos contamos. Son muchas, asimismo, las universidades que ofrecen posgrados, e incluso grados, centrados en el análisis regional, los temas urbanos, el desarrollo local y otros que se relacionan más o menos directamente con ellos. Estamos, pues, en un estadio muy distinto del de hace algunas décadas.

La evolución histórica de cualquier ámbito de estudios requiere que, de cuando en cuando, se realice algún tipo de auto-examen para calibrar y evaluar lo que se está haciendo y, también, para explorar qué temas podrían o deberían merecer más atención por parte de los investigadores. En el caso de las Ciencias Sociales esto es particularmente necesario si tenemos en cuenta que nuestras sociedades evolucionan continuamente, que el entorno global también lo hace, que los avances tecnológicos generan cambios en un amplio número de ámbitos, que la dinámica demográfica da lugar a nuevos problemas y nuevas demandas, o que, por no alargar esta lista, los movimientos migratorios a escala internacional y dentro de los Estados comportan nuevos retos, nuevas actitudes y nuevos problemas. Todo lo cual se refleja y se materializa de forma muy clara a nivel espacial.

El Consejo de Redacción de este *journal* consideró hace más de un año que este es un buen momento para reflexionar sobre lo que se produce en el campo de las investigaciones regionales y urbanas y, sobre todo, para explorar qué cuestiones y enfoques pueden ser de mayor interés para futuras investigaciones. El objetivo era y es, sin duda, muy ambicioso. De hecho, excede claramente lo que nosotros podíamos aspirar a realizar desde este *journal*. Creímos, sin embargo, que valía la pena realizar, cuando menos, una modesta aportación a dicha reflexión mediante un número monográfico dedicado a explorar «*new frontiers*» del Análisis Regional y Urbano.

Para afrontar dicho reto recurrimos a un conjunto de académicos e investigadores con un bien ganado prestigio a escala internacional, a quienes solicitamos que, respetando su libertad de enfoque por supuesto, pusieran en negro sobre blanco sus reflexiones sobre algunos de los temas y problemas que pueden estar en la nueva frontera de la Ciencia Regional. El resultado es este número monográfico que, como verá el lector, cuenta con contribuciones de académicos e investigadores muy reconocidos y de varios continentes, a quienes queremos manifestar de nuevo, aunque ahora ya con un producto bien finalizado, nuestro más cálido agradecimiento.

Confiamos en que la variedad de los temas tratados, la autoridad de quienes escriben y las múltiples sugerencias que se desprenden de los distintos trabajos incluidos en este número monográfico incentiven a muchos investigadores a avanzar hacia nuevas fronteras del análisis territorial. Y confiamos, también, en que las aportaciones que vayan surgiendo sirvan para orientar los objetivos y el contenido de las políticas regionales y urbanas. Necesitamos aportaciones teóricas y análisis empíricos cuya proyección vaya más allá de la especulación o de unos valores estrictamente científicos y académicos. Si algo deben perseguir siempre los científicos sociales es contribuir a resolver los problemas que perciben y sufren los ciudadanos, buena parte de los cuales se manifiestan donde viven y trabajan, es decir, en el territorio. Este es claramente el caso de la pobreza, las desigualdades, la conservación del medioambiente, la creación de riqueza y empleo, o los cambios que se derivan de las nuevas tecnologías y la digitalización, entre otros.

Octubre de 2016

El Consejo de Redacción

ARTICLES

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Section ARTICLES

Journal of Regional Research Investigaciones Regionales

Some Challenges for Regional Science Research

Robert J. Stimson *

ABSTRACT: Regional scientists have long faced challenges in developing the interdisciplinary field where their focus is on the spatial context of social, economic and environmental phenomena, and dealing with spatial data presents considerable methodological challenges. This article discusses the evolution of Regional Science, the critiques it has received and the challenges it has confronted. It addresses specifically some contemporary challenges that relate to methodological issues, such as: how to measure and model endogenous regional growth performance; the limitations of using *de jure* regions rather than *functional* regions as the spatial framework in regional analysis; the need to making greater use of unit record data and integrating those data into generalised spatial frameworks; and making use of the opportunities offered by «big data» in urban and regional analysis.

JEL Classification: R1; R3; O1; B2.

Keywords: Regional Science; Regional Analysis; Regional Differentials; Endogenous regional development; *de jure* regions; Functional regions; Unit record/micro data, Micro-simulation, Big data.

RESUMEN: Los científicos regionalistas se han enfrentado a numerosos desafíos en el desarrollo del ámbito interdisciplinario en el que analizan el contexto espacial de los fenómenos sociales, económicos y medioambientales, y asimismo tratar con amplias bases de datos plantea desafíos metodológicos considerables. Este artículo estudia la evolución de la Ciencia Regional, las críticas que ha recibido y los retos con los que se ha enfrentado. Analiza específicamente algunos retos contemporáneos relacionados con problemas metodológicos como: de qué forma medir y los logros del modelo de crecimiento endógeno regional; los límites de la utilización de regiones *de iure* más que regiones *funcionales* como base espacia en el análisis regional; la necesidad de realizar un mayor uso de microdatos o datos por unidad y de integrarlos en estructuras espaciales más generales; y las oportunidades que ofrece la utilización de «big data» en el análisis urbano y regional.

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Clasificación JEL: R1; R3; O1; B2.

Palabras clave: ciencia regional; análisis regional, diferencias regionales; desarrollo regional endógeno; regiones *de iure;* regiones *funcionales*; registros por unidades/microdatos; micro-simulación; *big data.*

1. Introduction

Periodically regional scientists have questioned the direction and relevance of regional science, highlighting the challenges it has faced as an interdisciplinary field of research. From its origins in the US in the 1950s, it is now in its seventh decade having grown from strength-to-strength, with the Regional Science Association International now having a membership approaching 5,000 and with almost 40 Sections in countries spread across the world. (For reviews of the origins and evolution of regional science see Isard, 2003; Boyce, 2004; Florax and Plane, 2004; Batey, 2010; Mulligan, 2014; Nijkamp, Rose and Kourtit, 2015; Stimson, 2015).

In this chapter I first provide a brief overview of the origins and development of regional science and the challenges it has faced. I then specifically focus on some of the contemporary methodological issues regional science needs to address. That includes: discussing issues of measurement for modelling regional endogenous development; the limitations of using *de jure* regions and the need to use functional regions as the spatial framework in regional analysis; the need to make greater use of unit record (micro) data and employing micro-simulation to integrate survey-based and aggregate data in regional analysis; and the potential of «big data» in urban and regional analysis.

2. An overview of challenges in regional science

2.1. Origins and evolution

The evolution of regional science as a discipline in its own right was based on:

> «... a merger of concepts from economics (e.g., general equilibrium theory, input-output analysis, programming theory, production theory), geography (e.g., central place theory, diffusion theory), mathematics and econometrics (e.g., spatial autocorrelation analysis, systems dynamics), and related disciplines such as political science, sociology, and decision theory» (Boyce, Nijkamp and Shafer, 1991, p. 1).

Thus, regional science had *interdisciplinary* roots, arising initially out of the perceived need in the early 1950s for:

— economists to upgrade the low level of regional analysis and to more explicitly incorporate *time* and especially *space* into a comprehensive theory of society and economy (Isard, 1956, p. vii); and

— other disciplines, like geography and planning, to become more rigorous in their approaches (Garretsen and Martin, 2011).

From its beginning, regional science was firmly embedded in neo-classical theory, adopting a mathematical and statistical analytical approach to the empirical investigation of regional phenomena. That was clearly evident in the early seminal books by its founder, Walter Isard (1956; 1960).

Reflecting on the origins, evolution and development of regional science, Isard and Reiner (1968) told how the founders of regional science saw it as focusing on:

> «... the locational dimension of human activities in the context of their institutional structure and function and on the significance of this dimension in the understanding of social behaviour and forms».

The regional scientist was said to be concerned not only with the location decision of the individual decision-maker within an environment, but also with the location itself and the locational framework (Isard and Reiner 1968). Regional science research had a focus on three major classes of decision-maker:

— *individuals* (or households);
— *entrepreneurs* (businessmen or firms); and
— *public bodies* (such as city governments and regional planning organizations).

Certainly from the outset a central purpose in regional science research was to identify and analyze the problems of regions and to suggest solutions (Isard and Reiner, 1968). Thus, it had an applied orientation as well as being concerned with theory and methods. Regional scientists have had an affinity with numerous applied fields to investigate a wide range of issues confronting cities and regions, including: city and regional planning; transportation; public administration; agronomy; and industrial engineering. But, as Isard and Reiner (1968) have emphasised, regional science has differed from those fields in that it takes a more general approach to the role of space in social phenomena, addressing policy issues at various level of scale —national, sub-national, regional, county, city, and local communities.

There was something of a hiatus in the development of regional science during the 1970s and 1980s when it came under attack from critics questioning its relevance and its over-reliance on abstract theory.

However, as discussed in a recent review by Stimson (2015), from the 1990s regional science has undergone a remarkable renewed impetus, which has been spurred by a number of factors, including:

— economist Paul Krugman's (1991) work on international trade, who along with others, called on economists to pay greater attention to economic geography and to renew their interest in regional science (for example, Fujita, Krugman and Venable, 1999);
— the emergence of the *new economic geography* initiated by Romer (1986) and Lucas (1988), which has evolved into what is known as *endogenous growth theory*;

— the *unification of Europe*, especially through the EU's policy emphasis on regional development and its substantial funding of research investigating regional inequalities;
— the rise of *globalisation* and its unequal distributional impacts, along with the massive increase in *urbanisation* and *rise of mega-cities* —especially in Asia— were to drive further renewed interest in regional analysis; and
— from within North America, the *decline of the «rust belt»* and *the rise of the «sun-belt»* and the associated inter-regional migration streams which spurred a renewed interest in regional modelling to investigate the role of amenity factors in migration and regional development.

2.2. Limitations and critiques

It is true that over time there has been a tendency for regional science to be dominated by economists with their inherent focus on developing theories and models - often abstract and as well as complex. Largely regional scientists have applied models using *aggregates* to investigate human behaviour and regional issues, and they have tended to take an optimisation approach to investigating location decisions. This has led to the development of a rich and wide array of models and analytic processes for investigating regional development and performance (see Boyce, *et al.,* 1991; Nijkamp and Mills, 2000), as well as methodological innovations in explicitly dealing with the issues encountered in the analysis of spatial data, such as the modifiable area unit- problem (MAUP) and spatial autocorrelation in spatial econometric modelling (Klassen and Paelinck, 1979; Anselin, 1988).

But the emphasis on theory and models and their inherent degree of abstractness and mathematical and statistical complexity has been something of a catalyst in engendering critiques from time-to-time and calls questioning the relevance of regional science research.

Extreme critiques of regional science occurred in the 1970s, led by Marxist and later post-modernist geographers (see, for example, Harvey, 1973; Barnes, 1976, 2003; Johnston, 1996), and also from planners. Those critics —who tended to be from outside the regional science community— argued that regional scientists lacked social and political commitment and advocacy, and claiming regional science was trapped in what the critics saw as a discredited positivist paradigm. Sayer (1976) suggested that regional science should shift from a model-based approach to one based on political economy. Critics charged that regional scientists were seeking to provide «universal truths rather than particular ones» (Polese, 1995: p. 314).

From within the regional science community, there was a particularly significant critique from the famous Swedish geographer, Torsten Hagerstrand, when he delivered the 1970 Regional Science Association's Presidential Address titled *What about people in regional science?* (Hagerstrand, 1970). He suggested that during the 1960s there had evolved a considerable difference between a preference for North American regional scientists to focus on theory, and a preference for European regional

scientists to «remain closer to issues of application» (p. 7). Hagerstrand (1970: p. 7) said:

> «... we in Europe seemed to have been looking at regional science primarily as one of the possible instruments to guide policy and planning».

He proposed that regional scientists should:

> «... take a closer look at a problem which is coming more and more at the forefront in discussions among planners, politicians and street demonstrators, namely the fate of the individual human being in an increasingly complicated environment or, if one prefers, questions as to the quality of life» (p. 7).

He noted that «the problem is a practical one and, therefore, for the builder of theoretical models, a "hard nut to crack"» (p. 7).

Quoting Isard and Reiner's (1966) statement that «models of human behaviour over space have been almost entirely related to mass probabilistic behaviour», Hagerstrand (1970) noted that the models regional scientists tended to use depended on «large aggregates», often being presented:

> «... without explicit statements about the assumed social organisation and technology that exist at the micro-level from which the individual tries to handle his situation» (p. 8).

Hagerstrand used migration to illustrate the importance of investigating the «fundamental links between the micro-situation of the individual and the large scale aggregate outcome» (pp. 8-9). He referred to what he called a «twilight zone» for exploration between biography and aggregate statistics, that being:

> «... an area where the fundamental notion is that people retain their identity over time, where the life of the individual is his foremost project, and where aggregate behaviour cannot escape these facts» (p. 8).

He urged regional scientists to:

> «... eliminate imprecise thought processes which conceptually drive us into handling people as we handle money or goods once we commence the process of aggregation» (p. 9).

Hagerstrand (1970: pp. 8-9) also advocated the need for regional scientists to:

> «... better understand what it means for a location to have not only space coordinates but also time coordinates».

He emphasised that *time* becomes «critically important» when it:

> «... comes to fitting people and things together for functioning in socio-economic systems, whether these undergo long-term changes, or rest in something which could be defined as a steady state» (p. 10).

He proceeded to suggest that his famous *time-space prism* framework might serve as a basis for investigating the dynamics of complex interactions between the individual (and households) and their operational functional environment, advocating *simulation* as a modelling methodology.

As discussed by Stimson (2015), during the 1980s and 1990s and into the 2000s, critiques of regional science by regional scientists continued, being directed especial-

ly towards what many regarded to be an over-emphasis on a set of standard models and the minor and often «inconsequential tweaking of assumptions to produce results of little meaning» (Bolton, 2004: p. 359).

Those critiques included, for example, the following:

— Richardson (1988) raised questions about the reliance in the urban models on the assumptions of a monocentric city, while the reality was that complex urban areas are clearly polycentric;
— Bolton and Jensen (1995: p. 140) suggested regional science theory and its models had *not* moved far enough in analysing what they referred to as «the ordinary business of life as it is affected by the places where people live, work and consume»;
— Breheny (1984) Rodwin (1987) claimed regional science was «the least reflexive of disciplines», condemning the «deep ignorance among regional scientists of the nature of practical policy making and implementation» (Bolton, 1984);
— Bailly, Coffey and Gibson (1996: p. 153) called for regional scientists to «look a new ways to answer questions raised by our social, economic and political institutions»:
— Clarke and Madden (2001: pp. 1-2) noted there was «very little new» to suggest that the discipline was becoming more people-focused in its modelling, despite the lapse of two decades from Hagerstrand's 1970 plea; and
— Markusen (2005) argued there was a proliferation of research and publications in regional science that came from the so-called the «new left» in Europe —but also from research in North America— that had spurred a plethora of new concepts in investigating the phenomena of uneven regional development and of industrial restructuring (including concepts such as, flexible specialisation, new industrial spaces, industry clusters; re-agglomeration, networking and co-operative competition, social capital, world cities; sustainability, etc.) that were fuzzy concepts lacking clarity and difficult to operationalise.

2.3. Challenges: the big issues for regional science to address

It has also been commonplace for regional scientist to write about the contemporary challenges for regional science research.

For example, at the beginning of the 1990s Boyce, *et al.* (1991 p. 5) identified these five *big societal issues* for regional scientists to address:

— the ageing process;
— environmental questions, including urban sustainability;
— emerging new technologies;
— the new emerging policy map of Europe; and
— infrastructure policy.

A decade later, Nijkamp and Mills (2000) suggested regional science research should deal with these three *profound societal issues*:

— demographic change with its impacts on ageing, labour markets, housing and infrastructure and services;
— social changes, including segregation, emancipation, labour force participation, household composition; and
— economic transitions and industry restructuring.

To those one might have added the implications of technological change.

More recently Nijkamp and Ratajczak (2015: p. 24) have provided a timely reminder that regional science will be «marked by many uncertainties on the dynamics of the space economy», *uncertainties* that are related to:

— global population dynamics, including the urban-rural divide;
— the future of urbanisation;
— the complimentary interface between physical material and virtual digital spatial interaction; and
— the complexity of governance systems.

Nijkamp (2015: p. 4) has suggested a *broad analytical framework* for regional science is needed that involves the following:

— a shift from tangible spatial interactions to intangible cognitive interwovenness;
— the reinterpretation of the scientific and mental map of the space economy, through the awareness of fast and slow spatial dynamic processes, including the emergence of catastrophe, chaos and resilience theory, and evolutionary geography; and
— an increasing recognition of interdependent micro-meso-macro processes in complex spatial systems that have led to advanced innovative studies on spatial statistics and econometrics.

Mulligan (2014: pp. 18-46) has listed 14 *topics or themes for future research* in regional science chosen «especially to encourage new or younger scholars to the field» (p. 4). They are:

— *behaviour and heterogeneity*, especially focusing on non-optimal outcomes and solutions in decision-making;
— *environmental issues*, including quality-of-life, hazards research and climate change;
— *global urbanization*, including the evolution of national city-size distributions, urban primacy and mega-cities;
— *happiness*, including its implications for public policy;
— *housing and land use*, including housing markets, market constraints and regulations;
— *metropolitan sorting*, including the provision of public goods and taxing, inner city revival and suburbanisation;

— *neighbourhood change*, including turnover and cyclical change and neighbourhood effects;
— *networks*, including transport and business and social networks, contiguity effects, feedback effects, and within and between city networks;
— *non-metropolitan living*, including micro-politan and sub-metropolitan growth;
— *post-event growth and development*, including regional growth and development following traumatic event, natural hazards management, and terrorist threats;
— *regional creativity*, including innovation, entrepreneurship, and the creative milieu, and the endogeneity problem;
— *regional decline*, including demographic and economic structural transition, and the role of intangible factors;
— *regional specialisation* and diversity; and
— *resource inequality*, including the associated health and social issues, and informal and shadow activities.

2.4. Methodological issues

There are always important *methodological issues* for regional science to address.

For example, Nijkamp and Ratajczak (2015: pp. 16-17) have specifically posed six on-going *conceptual and methodological questions* for the attention of regional scientists:

— What is a relevant spatial scale of analysis in regional science?
— Should the focus be on geographic entities —such as cities, regions, industrial complexes— or on the behaviour of economic / social objects in a geographic space?
— What is the relationship between space and time vis-à-vis spatial movements and interactions?
— If spatial phenomena are linked —as suggested in Tobler's Law (Tobler, 1970) what are the essential spatial connectivity principles?
— If a geographic space acts as a barrier or an opportunity, what are the implications for exploratory analysis?
— How are concepts from networks and complexity related to regional dynamics?

And Nijkamp and Ratajczak (2015) have also suggested there is scope for regional science to embrace data-driven models.

Regional science might also benefit through *borrowing research methodologies from other disciplines* that are rarely used by regional scientists. That might include, for example:

— using qualitative comparative analysis (QCA) techniques that are widely used in social science research by sociologists, and related techniques such

as: multi-value QCA (MVQCA); fuzzy sets; and the most similar, different outcome/most different, similar outcome (MSDO/MDSO) linked technique (see Rihoux, 2006); and

— the use of quasi-experimentalist methods to derive causal statements with respect to the effectiveness of regional policy instruments (see Mitze, 2014).

Finally, recently Aroca, Haynes and Stimson (2015) have identified four *research methodological and empirical challenges* for demonstrating the *policy relevance* of regional science:

— innovation in using I-O and spatial econometric analysis and simulation to investigate regional disparities focusing on the evaluation of the relationships between concentration/primacy/agglomeration vs dispersal, efficiency, and in regional economic growth and inter-regional equity in the formulation of policy to address uneven development;
— moving from a non-spatial to a spatial framework for evaluation analysis by integrating the independent methodologies of spatial econometrics (SE) and computable general equilibrium (CGE) modelling to create a SECGC modelling approach for analysing the impacts of infrastructure investments in a hierarchical regional scale context to test whether impacts differ when comparing estimations with and without consideration of spatial dependence in CGE (for example, Chen and Haynes, 2015);
— making use of «big data»; and
— integrating micro-data or unit record with spatial objective data and performing spatial microsimulation modelling in urban and regional analysis.

Finally, there is as yet unfulfilled scope for regional science to make greater use of computational agent-based modelling (ABM) integrated with GIS (see Hellenstall, Crooke, See and Batty, 2012), particularly for examining urban issues and how cities operate, including testing theories and hypotheses about urban change based on the individual behaviour of agents (as discussed by Crooks, 2006).

3. Focusing on four specific methodological issues

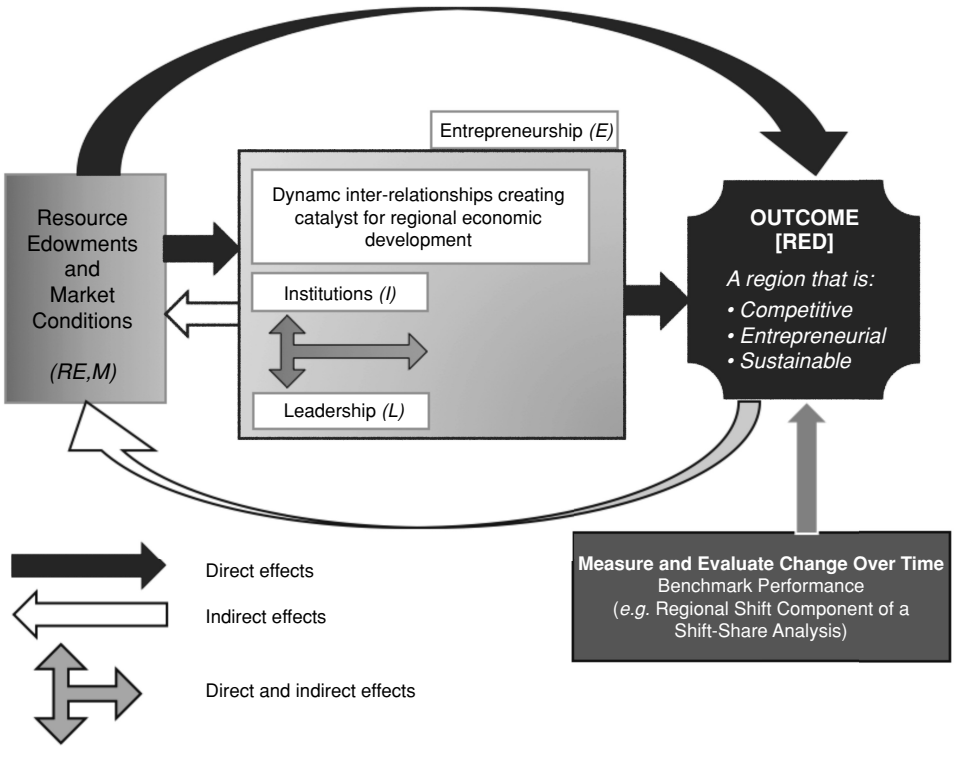
I now turn to explicitly address four number of methodological issues which I believe are important for regional scientists to give greater consider.

3.1. Measuring and modelling regional endogenous growth

Despite the copious literature on *new growth theory* (often referred to as *regional endogenous growth or development theory*), as pointed out by Stimson, Stough and Salazar (2009) there is no agreed way to measure it, and nor is there a widely used operational model framework for investigating those endogenous factors or processes that might explain variations in regional economic performance.

Much has been written on the roles of factors such as human capital, entrepreneurship, institutions and leadership —which are endogenous to the region— in regional economic development. It is often difficult to develop explicit measures of such factors to then use as variables in spatial econometric models to investigate regional endogenous growth. Stimson, *et al.* (2009) have proposed such as model framework (see Figure 1) which has been operationalized in investigations of regional endogenous growth performance of cities across both US (Stimson, Stough, Shyy and Song, 2014) and regions across Australia (Stimson, Mitchell, Rhode and Shyy, 2011; Aroca, Stimson and Stough, 2014). But there are significant deficiencies concerning how to measure factors such as leadership and institution, and such modelling attempts are constrained to use inadequate proxy variables. However, Stimson, *et al.* (2009) have proposed a simple way to measure regional growth performance that is readily computed using widely available regional economic data, namely the change over time in regional employment derived through a *shift-share analysis* in which the *differential (or regional) shift component*, standardised by size of the regional labour market, is taken to be a measure of regional endogenous employment change performance over a specified period of time.

Figure 1. A framework for modelling regional endogenous development



Source: After Stimson, Stough and Salazar (2005).

The model (as developed initially by Stimson, Stough and Salazar in 2005) proposed that:

RED = f [(RE, M) mediated by (L, I, E)]

where:

RED represents regional endogenous development;
RE represents regional resource endowments and market conditions;
L represents leadership;
I represents institutions; and
E represents entrepreneurship.

Operationalizing such a modelling approach raises the question of using alternatives to the standard spatial econometric regression models that regional scientists tend to employ. The structural equation modelling approach that has been used by Aroca, *et al.* (2014) might be more appropriate as it enables one to test hypotheses about the *intervening* or *mediating* roles of factors like institutions, leadership and entrepreneurship in accounting for spatial differentiation in regional economic performance.

There remains, however, a dearth of empirical testing of model frameworks investigating variations in regional endogenous economic growth performance and what might be the explanatory power of factors and processes that are claimed to be within-region in nature (as against exogenous to the region) in accounting for such variations in regional growth performance. This remains a gap in regional science research, and it presents a challenge, in particular to compile regional database of operational variables that are measures of factors such as institutions, leadership, and entrepreneurship. Overcoming this deficiency will require considerable innovation by public agencies that generate spatial statistics as well as by regional science researchers.

3.2. Limitations of *de jure* regions and the need for a functional basis to regional demarcation as the spatial framework used in spatial econometric modelling

Most spatial econometric analysis and modelling investigating the causes of differentiation in regional economic performance across a space economy employs secondary data analysis of official data aggregated into *de jure* regions that are typically administrative areas, such as counties or local authorities.

The demarcation of the boundaries of such *de jure* regions is thus artificial, they being artefacts of administrative convenience or serving a political purpose. They certainly do *not* reflect a *functional economic* basis. As a result we encounter the *modifiable areal unit problem* (MAUP) and the need to account for *spatial autocorrelation*. As discussed by Stimson, *et al.* (2011: p. 132), a whole set of methodological issues arise, such as:

— the analysis of complex high dimensional non-experimental data is inherently difficult;

— the problem of collinearity;
— which variables are likely to have a positive, negative or no association with the dependent variable being used in the model?;
— is a spatial model such as the spatial autoregressive model or spatial error model more appropriate than the traditional OLS linear regression model?; and
— the problem of causation versus ecological association.

A comprehensive literature has evolved in regional science to deal with these issues (see, for example, Cliff and Ord, 1973; Openshaw, 1983; Anselin, 1998a, b; Fotheringham, Charlton,nd Brunsdon, 1998; Fotheringham and Wong, 1991; Anselin, 1995; Getis and Griffith, 2002; Anselin, Syabri and Kho, 2006; Anselin and Getis, 2008). That includes using spatially weighted regression methods and global and local indicators of spatial association, such as the Moran's *I* and Anselin's LISA software package *GeoDa* (Anselin, 2005).

If we were to use a regional demarcation that is functionally-based for spatial econometric analysis and modelling of regional economic performance we should overcome such problems associated with the MAUP and spatial autocorrelation that are inherent in using a *de jure* spatial framework. This has been demonstrated by work in Australia by Mitchell and Watts (2007), Stimson *et al.* (2011) and Stimson, Mitchell, Flanagan, Baum and Shyy (2016) which used the Intramax method (after Masser and Brown 1975) to develop a new functional national geography in which census journey-to-work data is used to generate *functional economic regions* (FERs) that sought to:

— regionalise the nation into meaningful labour market regions; and
— eliminate the spatial autocorrelation problem.

In using that functional-based regional geography to analyse variations in spatial patterns of regional endogenous employment growth/decline in Australia, Stimson *et al.* (2011) showed that their FER national spatial framework seemed to have overcome the spatial autocorrelation issues that were encountered in an earlier analyses by Stimson, Robson and Shyy (2009) in which a *de jure* regional framework of local government authorities was used.

A functional-based regional geography for analysing and modelling regional economic performance also has the advantage of using spatial units that have real meaning as regional labour markets which we know are not confined to, nor defined by, *de jure* administrative areas and their boundaries. As spatial econometric analysis and modelling typically seeks to find explanation for the spatial variation in an aspect of regional employment, conducting such investigations within a functional economic regions spatial framework is much more meaningful.

3.3. Making greater use of unit record (micro) data and integrating with spatial data

Regional scientists have often made use of *micro (individual level) data* —especially data relating to the firm— in investigating economic and demographic issues

such as business and industry operations, entrepreneurship, household dynamics, and income distribution.

Often access to such data is restricted and securitised, and in the US it has been facilitated through secure laboratories initiated by the Census Bureau, with the data being confidentialized (see Davis and Holly, 2006). Those data are provided as Public Use Microdata Samples, as well as national survey datasets, such as the US Census Bureau's Current Population Survey (CPS), the American Housing Survey (AHS), and the Survey of Income and program Participation (SIPP). It is also common for microdata to be longitudinal in nature.

Davis and Holly (2006: p. 280) have noted that facilities like the Research Data Centers (RDCs) —which have been established in the US by the Census Bureau in collaboration with research institutions across the nation— provide a secure environment enabling researchers to apply for accessing and interrogating such micro-data. They make the point that:

> «... essential to regional science research is the availability of detailed geographic identification within analytical data sets» (Davis and Hollly, 2006; p, 294).

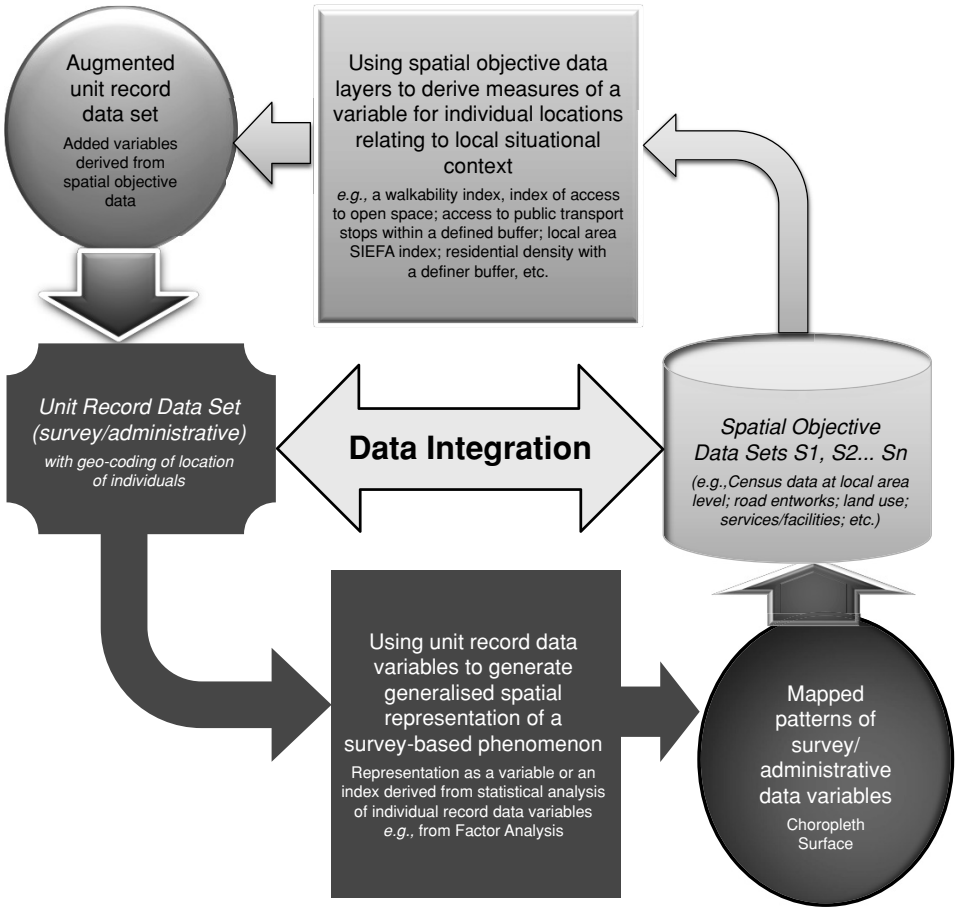
But they lament that the RDCs are an «underutilized resource by the regional science community» (p. 294).

Through the use of GIS technologies it is now easy to facilitate the *integration* of individual unit record (micro) data —including survey-based and administrative data— with other data that is spatially situated and is available from other data sources. This is important as it enables statistical and econometric analysis and modelling to be undertaken free of the strictures of the MAUP and without having to address the issue of spatial autocorrelation, and it avoids the issue of the ecological fallacy that are encountered when using spatially aggregated data. That is particularly important in being able to better inform policy development and for the evaluation of the outcomes of program implementation (see Heckman, 2001 for a discussion of micro-data and public policy).

That *integrative capability* and what it enables is illustrated in the framework shown in Figure 2. It is, of course, dependent on the unit record data file having a *geocoded location* for the individual embedded in the dataset. It enables, for example:

— survey-based individual unit record data to be enhanced/supplemented through the addition of non-survey information by adding variables that relate to the spatial situational setting of the individual, which may then be used as explanatory or intervening variables in modelling relationships between an individual behavioural outcome measure and individual characteristics and the situational setting attributes; and
— the use of *spatial micro-simulation* methods to derive *synthetic measures* of variables for spatial units that are derived from the unit record (micro) data to portray the spatial patterns of a behavioural phenomenon.

Figure 2. Framework for integrating unit record (micro) data and spatial objective data



Source: The author.

O'Donoghue, Morrissey and Lennon (2014) have provided a review of spatial micro-simulation as it has been applied to the investigation of issues relating to demography, welfare, health, regional development, and transport planning, agri-environmental analysis, crisis planning, and land use planning. That includes a review of methodological approaches.

Building on the pioneering work of Hagerstrand (1957, 1967), in which he used micro-analytic tools to simulate first the patterns of internal migration in central Sweden and later the spatial diffusion of innovation, Clarke, Keys and Williams (1979) developed a representational and methodological framework for interacting labour and housing systems, and then researchers in the Department of Geography at the University of Leeds in the UK (see Clarke, Keys and Williams, 1980; Clarke, 1996)

investigated the possibility of using spatial micro-simulation to analyse socio-economic and a wide range of public policies issues including transport, housing expenditures and finance. Other early work also included the Harvard Urban development Model (Kain and Apgar, 1985) and a suite of models were developed by Birkin and Clarke (1988). More recently Tanton and Edwards (2013) have provided a detailed overview of methodological issues.

Certainly spatial microsimulation has become a mainstream analytical tool among social scientists for modelling a wide range of behavioural phenomena in a policy context (see Clarke, 1996; Birkin and Clarke, 2012). That is illustrated by the impressive range of modelling applications by the Leeds group and by the National Centre for Social and Economic Modelling (NATSEM) at the University of Canberra in Australia (as discussed in Donaghue *et al.,* 2014), where both a static and dynamic approach is being taken.

There is an opportunity for regional science research to make much greater use of microsimulation modelling that incorporated a spatial dimension enabling a «place-based» analysis to be incorporated in «people-focused» analyses (see O'Donaghue *et al.,* 2014, referring to Miller, 2007). There is a need for greater effort to generate spatially representative data to undertake such modelling, in particular to inform policy and to better understand behavioural change. This is particularly so as the contemporary advances in spatial microsimulation methodologies are overcoming early criticisms of the deficiencies *vis-a-vis* model validation.

Two examples of research in Australia integrating survey (micro) data with spatial objective data in urban and regional analysis are:

1. The work of researchers at NATSEM in which spatial microsimulation modelling is used to investigate a range of national social and economic policy-related issues in which national sample survey data are used in a microsimulation model to generate from survey data sets of synthetic spatial data (such as estimates of levels of poverty) to appraise the likely spatial impacts of policy changes (such as increasing the single pension rate) on households across local areas within the framework of the national census geography (see Tanton, Vidyattama, McNamara, Vu, and Harding, 2009; Harding and Tanton, 2014).
2. The work of researchers at the University of Queensland (McCrea, Shyy and Stimson, 2006; Chhetri, Stimson and Western, 2006: Chhetri, Stimson, Akbar and Western, 2007; Chhetri and Stimson, 2014) to investigate aspects of human behaviour in which survey data collected for a quality of urban life study in the Brisbane-South East Queensland region in Australia is integrated with spatial objective data to model the relationships between the subjective assessment of quality of urban life and a range of personal demographic and socio-economic characteristics and urban locational and environmental context attributes. That research also illustrates how that type of integrative modelling can be used to derive —from Principal Components Analysis (PCA) of the survey data— a set of broad dimensions that summarise

perceived attributes of local areas that have influenced people's decision to choose where they live, and to then produce maps showing the simulated patterns of those residential attributes across the metro-region.

3.4. The challenge of «big data»

We are living in what Anderson (2008) has called the «petabyte age» in which the proliferation and spread of rapidly emerging new digital technologies are producing massive streams of data —including data in real time and space— that are referred to as *«big data»*.

«Big data» is certainly a hot topic, and it has been the «source of much enthusiasm, hype and a fair amount of cynicism» (Rae and Singleton, 2015: p. 1). There is confusion over the definition of «big data» —it is a «fuzzy» concept. It requires substantial investment in storage, transfer and processing architecture, typically undertaken through public agencies and big business. It is characterized by the *5-Vs* —*volume*, *verity*, *velocity*, *variety*, and *value* (Aikat, 2013).

Rae and Singleton (2015: pp. 3-4) point out that:

> «... Huge volumes of data are generated within regions daily, such as through the use or management of public services (e.g. global positioning satellite (GPS) tracking of law enforcement officials and use of healthcare facilities), or captured from transport-related activities (e.g. road flow information gathered by networks of traffic cameras). Other data are also generated by the private sector, including transaction data associated with consumption or the use of social media, where content are georeferenced by mobile devices».

Miller and Goodchild (2014) tell how:

> «...a large portion of the flood [of "big data"] is from sensors and software that digitize and store a broad spectrum of social, economic, political, and environmental patterns and processes».

They also point out that much «big data» is being generated through massive simulations of complex systems. Miller and Goodchild tell how we are certainly moving from a «data scarce» to a «data rich» world, in which the most fundamental changes are not the volume of data *per se*, but the variety and the velocity at which we can capture georeferenced data.

Indeed Hilbert (2013) has also suggested that:

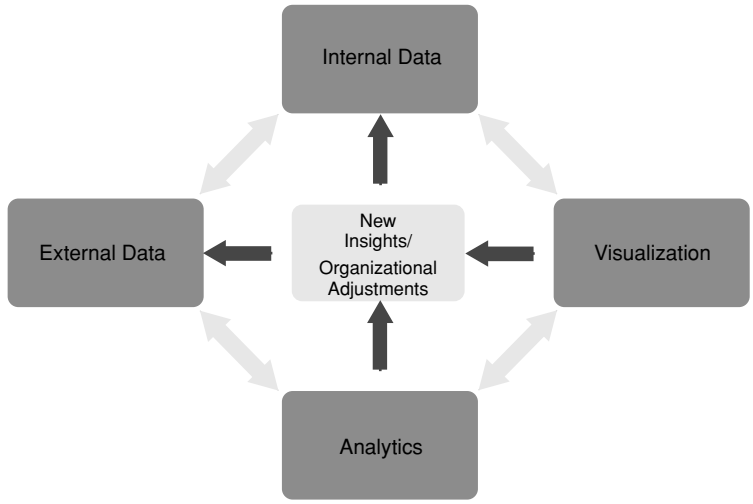
> «... the crux of the "Big Data" paradigm is actually not the increasingly large amount of data itself, but its analysis for intelligent decision-making» (p. 4).

Thus, he has proposed that *«big data analysis»* is a more fitting term to use as:

> «... the key feature of the paradigmatic change is that analytic treatment of data is systematically placed at the forefront of intelligent decision-making. The process can be seen as the natural next step in the evolution from the "Information Age" and 'Information Societies» to "Knowledge Societies": building on the digital infrastructure that led to vast increases in information, the current challenge consists in converting this digital information in to knowledge that informs intelligent decisions» (p. 4).

This is what Malvey, Shrowty and Akoner (2013) have referred to as the *transformative* potential of «big data», which they conceptualise as the «big data revolution» (see Figure 3).

Figure 3. The «big data» revolution



Source: Malvey, *et al.* (2013).

Of particular significance for regional science research is the *integrative* capability of «big data analytics», and this is its potential revolution. As discussed by Batty, Axhausen, Giannotti, Pozdnoukhov, Wachowicz, Ouzounsis and Portuglai (2012), the advances being made in data modelling capabilities using «big data» —such as data mining, large scale simulation models, and agent-based techniques— offer considerable potential to:

— enhance our understanding of the complexities of urban and regional systems; and
— assist in finding solutions to pressing problems.

Batty (2012: p. 102) has suggested that we are at the early stage of making the city *computable* through being able to seamlessly integrate diverse data from:

— sensors;
— hand held devices;
— electronic ticketing;
— in-car devices; and
— social media.

and subject it to sophisticated analytics in order to «make cities more efficient and more equitable». He points out how that is defining the «smart cities movement». As noted by the Centre for Applied Spatial Analysis (CASA 2012), it is all about:

> «... how computers, data, and analytics, which consist of models and predictions, are being embedded into cities»,

to help us make better sense of the complex urban world. That involves a focus on doing so through using advanced visualisation tools.

Important for regional science research is the challenge discussed by Violino (2014) to use «big data» and its associated information and communications technologies to:

> «... deliver sustainable economic development and a higher quality of life, while engaging citizens and effectively managing natural resources».

Rae and Singleton (2015) provide a discussion on using «big data» in regional science and regional studies, which is certainly in its infancy. They point to a number of important investments that have been occurring in:

— *«open data»* initiatives — particularly in the European Community through the Cohesion Policy Open Data platform, and through city initiatives such as London's DataStore and OpenData Paris; and

— «big data» infrastructures, such as the Administrative Data Research Network (ADRN), the Urban Big Data Centre (UBDC), and the Consumer Data Research Centre (CDRC) established through the Economic and Social Research Council (ESRC) the in the UK.

With respect to the CDRC, Lovelace, Birkin, Cross and Clarke (2015) provide an example of how collaboration between regional scientists and industry is using «big data» better understand patterns of regional retail flows in the UK through using datasets held by retail store chains that are derived from consumer loyalty cards.

Batty *et al.* (2012) have outlined how, in Europe, there has been collaborative research effort working towards developing and implementing a program of applications of «big data analytics». That is demonstrated through the *FutureICT* project to investigate a diverse range of issues including:

— housing booms and busts in large cities, linked to financial crises;
— impacts of changes in energy on urban transportation systems and mobility;
— the fracturing of transport networks due to short term problems related to urban conflict, weather and one-off events;
— the efficiencies produced by synthesising different urban data sets;
— the impact of climate change on cities in Europe, particularly sea level rise and rising temperatures on population location;
— the participation of citizens in the development of plans for smart cities of the future focussing on mobility, housing, better design and aesthetics (the city beautiful) and access to opportunities; and
— the impact of immigration phenomena in a global world.

A considerable literature has evolved on the nature of «big data» and «big data analytics». That includes what is called an «urban computing» approach which, interfaced with GIS, is claimed to be opening-up opportunities for:

— new theory development; and
— new and potentially better models for the quantitative assessment of different scenarios for urban development, to:

- inform policy and planning options for the management and delivery of public service;
- support increase stakeholder and community participation in decision-making; and
- improve the lives of ordinary people.

But while there is much enthusiasm and much hype about the potential to harness «big data» —including real-time data in a spatial framework— especially in research into strategies for «smart cities/regions» —there is also some scepticism, with many concerns being expressed about «big data» (see, for example, Kitchen, 2013; Ferguson, 2013; Burris, 2013; Akat, 2013; Goodchild, 2013); Marshall, 2014). For example, there are issues relating to:

— «big brother», privacy concerns, and citizen's rights;
— trust and ethical issues concerning its use;
— data quality and data representativeness and inclusion;
— the blind trust in imperfect algorithms; and
— state and corporate control and manipulation.

Promoters of the wonders of «big data» and «big data analytics» have been even suggesting that it represents the end of science as we know it, that it could even make the scientific method obsolete. This claim has come under considerable questioning, with Serras, Bosredon, Herranz and Batty (2014) suggesting that, even though we are getting massive amounts of «big data», it does not necessarily provide explanatory power about the «underlying decisions and behaviours of city users».

So where does this leave us? Importantly Rae and Singleton (2015: pp. 3-4) have reminded us that:

> «... The syntheses of data into information are hallmarks of both regional studies and regional science research».

That is what «big data» and «big data analytics» is supposed to be facilitating, providing us with the opportunity to capture, store and link temporally rich data within regions. Rae and Singleton (2015) «implore the regional studies and regional science communities to meet head on» (p. 4) this challenge. They urge regional scientists to «*think more, not less*, about big data», and develop successful «big data» examplars to demonstrate the:

> «... massive potential of big data for enlightening citizens and improving our understanding of critical urban and regional processes» (p. 4).

4. Conclusion

As an interdisciplinary field of enquiry, regional science has brought together researchers from a whole range of disciplines to undertake the development of theory and methods to investigate a wide range of social, economic and environmental issues within a spatial framework context, conducting those enquiries at a multitude of spatial scales, and using both data aggregated into those spatial frameworks along

with also using micro-data. Inevitably during its relatively short history of a little more than 60 years, periodically regional science has had called into question its theories and methods. And it has had its relevance questioned, both from outside from within the regional science community. That has been helpful for the development of the regional science to ensure that regional scientists have continued to strive to demonstrate its applied relevance in informing the development of public policy for urban and regional development and planning, to evaluate policy and planning interventions, and to demonstrate applications in business (see, for example, Clarke and Madden, 2001; and the discussion by Stimson, 2015).

Throughout its history, periodically regional scientists have explicitly addressed the challenges regional science has had to confront towards this end of being relevant, identifying contemporary societal issues that might be informed through the application of regional science theory and methods. And regional scientists have pursued methodological innovation focused on explicitly improving approaches to integrating different types of data and for the analysing and modelling data that is embedded within a spatial framework in order to furnish improved understanding of urban and regional development and the behaviour of institutions, firms, and households and individuals within the context of space economies.

This chapter has provided a review of such challenges and issues that have been addressed in regional science and by regional scientists, focusing explicit attention on a number of contemporary methodological challenges that are worthy of greater attention.

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Section ARTICLES

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Envisioning Experiments on Regional Science Frontiers

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ABSTRACT: Science dynamics has become an established part of scientific research. Over the past years, a broad variety of experimental approaches has been developed to explore the frontiers of the current state of the art —and their shifts— in either separate disciplines or scientific domains, such as expert-opinion consultations, multi-level approaches, living labs, joint decision rooms, scenario methods, imagineering experiments, or interactive envisioning methods. The present chapter will contribute to science dynamics in regional science research by offering findings from an envisioning experiment among some 60 well-known regional scientists, with a view to a critical assessment of past and current performance, so as to initiate an open exploration of promising and challenging research endeavours for the next decades of regional science research. This may range from innovative concept formulation to joint use of open access and big data. This experimental approach serves to pave the road towards proactive strategies and conceptualisations in regional science research and regional policy. The main future concern implicit in the brainstorming experiment appears to be related to spatial justice, next to good governance, and consistency between techniques, methods and theories, as well as an effective interaction with students/scholars and society. This exercise shows that important lessons can also be learned from past scientific mistakes, especially those that were associated with policy failures. New scientific ideas are, of course, pushed by the rise of novel techniques and methods, but also and predominately from evolving new realities, either social or technological. Nevertheless, there are still various doubts concerning the future direction of regional science agenda: Which new thoughts and methods are requested? Which policies must be created and improved? What are the scientific possibilities created by new data? The regional science agenda is full of challenges and promises, but how can

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it be effective? This scoping study does not provide definite answers, but serves to explore uncertain future frontiers.

JEL Classification: R10; A13; B40.

Keywords: science dynamics; regional science; experts opinion; Q-Method.

RESUMEN: La dinámica de la ciencia se ha convertido en una parte importante de la investigación científica. En los últimos años, una amplia variedad de enfoques experimentales se ha desarrollado para explorar las fronteras del estado actual de la técnica —y sus cambios— en una amplia variedad de disciplinas y dominios científicos. Dichos enfoques incluyen consultas de opinión de expertos, enfoques multi-nivel, laboratorios, sesiones de decisiones conjuntas, metodología de análisis de escenarios, experimentos de visualización, o métodos de ideación interactivos. En el presente trabajo contribuye en este ámbito aplicándolo a la investigación en ciencia regional, ofreciendo resultados de un experimento con cerca de 60 científicos reconocidos en el ámbito de esta disciplina, con miras a una evaluación crítica del pasado y de la situación actual. El objetivo además es el de iniciar una exploración de los desafíos para las próximas décadas de la investigación en ciencia regional, incluyendo entornos de formulación de conceptos innovadores o el uso de volúmenes masivos de datos. Este enfoque experimental sirve para facilitar la definición de estrategias proactivas y de conceptualizaciones en la investigación de la ciencia y la política regional.

La principal preocupación futura implícita en el experimento está relacionada con la justicia espacial, junto con el buen gobierno, y la coherencia entre las técnicas, métodos y teorías, así como una interacción efectiva entre los estudiantes / académicos y la sociedad. Este ejercicio muestra que las lecciones importantes también se pueden aprender de los errores pasados, especialmente aquellos que estaban asociados con fallos en las políticas. Las nuevas ideas científicas están, por supuesto, reforzadas por el surgimiento de técnicas y métodos novedosos, pero también a partir de la evolución de las nuevas realidades, ya sea sociales o tecnológicas. Sin embargo, todavía subyacen dudas sobre la dirección futura de la agenda regional de ciencia: ¿Qué nuevos métodos e ideas son necesarios? ¿Qué políticas se deben crear y mejorar? ¿Cuáles son las posibilidades científicas creadas por la aparición de nuevos datos? El programa futuro de la ciencia regional está lleno de retos y promesas, pero ¿cómo puede ser eficaz? Este estudio no proporciona respuestas definitivas, sino que sirve como elemento de reflexión para explorar el incierto futuro y las fronteras de la ciencia regional.

Clasificación JEL: R10; A13; B40.

Palabras clave: dinámica de la ciencia; ciencia regional; opinión de expertos; método Q.

«Learn from yesterday, live for today, hope for tomorrow.
The important thing is to not stop questioning»

Albert EINSTEIN

1. Setting the Scene: Introduction

The complex evolution of science, including regional science, has —in terms of knowledge acquisition, inspiration sources, unforeseen challenges, new paradigms, unconventional ideas, heterodox perspectives, unanticipated findings, and societal impacts— over the past years become an important focal point of scientific research. Science dynamics has turned into an established part of cognitive exploration and mapping of unknown pathways for research in a knowledge-oriented society. Science in our modern world is often seen as «the discipline of curiosity» (see Groen *et al.*, 1990), inspired by serendipity motives. A need for targeted social science research is built in our understanding of social processes. It helps to recognise answers to critical challenges, and delivers the understanding needed to activate changes in human actions.

Over the past years, a wide variety of experimental and scholarly approaches have come to the fore in order to identify and trace the frontiers of scientific progress —with particular emphasis on shifting boundaries— in either distinct disciplines or in broad scientific —sometimes thematically-oriented— knowledge domains. Examples of such approaches can be found in studies and reports resulting from scientific brainstorm workshops (Kleinstrauer *et al.*, 2016, on Toxicology and Pharmacology), conferences (Sahin *et al.*, 2016, on Neurology), symposia (Cairo and Pinkerton, 2016, on Pediatrics) and scientific societies roundtables (Diener *et al.*, 2014, on Surgical Research). Establishing research priority questions has been particularly fruitful in environmental sciences (Fissel *et al.*, 2012, Feary *et al.*, 2013, Rees *et al.*, 2013, Ingram *et al.*, 2013, Parsons *et al.*, 2014, and Rudd *et al.*, 2014). Each approach differs in the number of scientists surveyed, the way the research questions are identified and how are they weighted. It goes without saying that for a vital science like regional science an exploration of its frontiers is a sine qua non.

Here we aim to offer a critical assessment of challenges and perhaps paradigmatic changes in regional science research by providing a novel contribution to science dynamics processes in the spatial sciences in a broad sense on the basis of an envisioning experiment, a so-called «brainshaker», among approximately 60 well-known regional scientists from all over the world. This joint experiment was undertaken in the spirit of Doxiades (1963), the founding father of the Ekistics movement of city planning, an endeavour which after a sailing tour with some 70 world-known scientists along various Greek islands led to the world-known Delos Declaration (1963) which offered a path-breaking and influential multidisciplinary perspective on urban science.

The present contribution provides thus a critical assessment of future key research questions identified and evaluated by regional science experts from various countries. In

order to do so we asked first for a critical assessment of past and current achievements in regional science research, which in turn led to an open exploration of promising and challenging research endeavours for the next decades of regional science. This panoramic overview may range from innovative concept formulation to joint use of open access or spatial big data and serves to open up new roads to creative regional research.

This experimental approach outlines pathways towards and frontiers of proactive cognitive strategies and conceptualisations in regional science research and regional policy. This ambitious endeavour appears to call for renewed or intensified interest in spatial justice, urban poverty, sustainable development, human health conditions, science education strategies, and smart governance of cities and regions (see also Nijkamp and Kourtit, 2015; Kourtit *et al.*, 2015). In addition, the achievement of a vital, future-oriented regional science prompts the need for a consistent design of theories, methods and policies, as well as for an informed interaction between theorists and practitioners. Such desiderata have no doubt far-reaching implications for research, training, planning and policy practice, as we have to avoid scientific, educational or planning mistakes that induce policy failures in the spatial domain. Clearly, new scientific ideas and findings are propagated by both technological and societal novel challenges and methodologies.

A prominent question of increasing importance for a future research agenda is: what is a promising and effective regional science agenda in the ever-changing and volatile force field of science dynamics? How can such an agenda complement other research strategies on a high standing in academia? Which program can build sufficiently strong «bonding and bridging» mechanisms for an effective sound relationship and interaction between regional science research, regional policy and regional development?

We follow here a bottom-up approach in a two-step procedure. We firstly issued an open questionnaire, directed to a closed and selected group of researchers involved in a focussed research workshop, which was used to identify a list of 37 themes, statements and priorities of what is the present and specially the future perspective of regional science. In the second step, this list was ranked by some 60 scientists by means of an internet survey. A multivariate analysis was next used to distil meaningful and interpretable statistical results, using the first round as a frame of reference. Our procedure is in line with exercises developed in other disciplines (see Rudd, 2014), but is to our knowledge new in regional science.

Section 2 describes the first step of the procedure, where the research areas are identified, while Section 3 presents the results of the online survey and the multivariate analysis. The chapter concludes with a sketch of long-term oriented lessons and recommendations on frontiers and future research foci in regional science (Section 4).

2. Update the Agenda for Regional Science

To update the research agenda for regional science, well-known regional scientists and experts in this field were invited to participate in a so-called «brainshaker»

experiment in two stages, which aimed at generating original ideas and developing strategic perspectives on the future of the spatial sciences from a multifaceted and translational perspective.. To prompt a heterodox discussion among spatial scientists from all over the world, in the first stage of our exploratory science dynamics experiment, a series of unconventional issues was put forward in a self-composed statements questionnaire at a workshop[1] in Amsterdam. Then, this approach provided a record of the main findings from the responses of the first-stage brainshaker experiments, in which several broad questions (see Table 1) on regional science were raised and answered by some 30 well-known experts in the field. These challenging issues serving to generate heterodox perspectives will now successively be addressed.

Table 1. Provocative statements on regional science

NR	*Statements*
1	Regional science exists for more than 60 years already. Mention 2 unanswered questions in regional science that need to be urgently addressed in the next decade(s), and why.
2	Regional science evolution is characterized by shifting paradigms. Mention 2 ideas/concepts/theories in regional science that will change the world by the year 2050, and why.
3	Regional science is sometimes seen as a collection of disconnected studies without an overarching theoretical conceptualization of spatial phenomena. Mention 2 cornerstones of an indigenous regional science theory, and why.
4	If you were able to make a telephone call with the late Walter Isard, the founding father of regional science, which two questions would you like to ask him, and why.

All respondents filled out the above survey questionnaire. The distribution of the respondents who filled out the «brainshaker» questionnaire is as follows (see Table 2). The respondents to these questions were mainly male (75%), with a slight European bias (58%), and falling in the age cohort between 40 and 60 years old (58%). There were 33% Americans and 8% from the Rest of the World. 21% was younger than 40 and 21% older than 60. These figures are close to the demographics of the 2011 ERSA Conference in Barcelona, one of the largest regional science conference ever, described in Royuela (2012): more than 90% of registered people came from developed countries, two thirds were men, and young people (below 30) representing 24% of attendants. These figures though, contrast a modal cohort at 60-69 at WRSA conferences (Franklin *et al.*, 2011). Our sample thus overrepresents middle-age and established scholars, who are the ones with both experience and upcoming research career; consequently, we believe that the selected group of researchers fits rather well to identify key research and frontier questions in regional science.

[1] Tinbergen Institute Jubilee Workshop 2015 on *«The Future of Spatial Equality and Quality: New Contributions to the Analysis of Human, Social, Entrepreneurial, Creative and Environmental Capital»* on May 7-9, 2015 in Amsterdam.

Table 2. Profile of experts-respondents

Geographical Distribution	*Age Cohorts*	*Gender*
European 58%	> 60 years 21%	Male 75%
American 33%	45-60 years 58%	Female 25%
Rest of the World 8%	> 45 years 21%	

The results of the abovementioned «brainshaker» experiment led to a very exciting and unconventional exchange of views on the future of regional science research among the participants of the international workshop in Amsterdam. The participants in our «brainshaker» experiment engaged later in fundamental thematically organized debates on new and grand challenges in regional science, the care for the next generation, the social and political relevance of regional science research, its broad societal mission, and regional science curriculum development. The main output of this «open questionnaire» is a group of sentences, propositions and questions that we used to identify a list of statements on the regional science agenda that are classified and analysed in Section 3. In order to clarify how we built such a list, we describe next the main elements of every provocative statement.

2.1. Unanswered questions in regional science research

Urgent questions, as yet not addressed in regional science research, may relate to various societal and spatial concerns, as well as to various local or regional problem situations and related policies. About 25% of the unanswered issues in regional science research was focussed on spatial policy and governance, while another 25% was concerned with human aspects, such as happiness, social disparities, poverty and socioeconomic development. Some 10% of the urgent but underrepresented issues were related to spatial sustainability and resource problems, while technical-methodological problems (e.g., the Modifiable Areal Unit Problem, the foundations of the gravity model, spatial-temporal aggregation problems, etc.) also received a relatively prominent position in the answers. It is noteworthy that societal relevance of research —in a general sense— received relatively little attention. From the relatively underrepresented issues in regional science research, 4 topics received a lot of attention, viz., spatial justice (i.e., the product generated by space sustains its development; Dentinho, 2012); smart governance; consistency between techniques, methods and theories; the interaction between academic curricula and society. These four themes will now concisely be discussed.

2.1.1. Spatial justice

Societal values and objectives are an object of research in sociology, social psychology, ethics, philosophy, theology and, more generally, the social sciences and humanities. The spatial sciences incorporate elements from both the social sciences and the humanities, and, in particular, zoom in on the spatial differentiation and coherence of relevant social phenomena in a heterogeneous space. Consequently, heterogeneous space-time patterns should be a focal point of future academic and policy concern in regional science. This prompts the need for due future research attention on spatial (in)justice, not only in terms of its genesis, but also in terms of its impacts and policy remedies. In addition to a meso-macro perspective on spatial justice, there is also a clear need to address the micro backgrounds, in particular in relation to disparities in income, wealth, welfare, access to facilities, happiness, health, safety and security. The spatial sciences ought to regard spatial justice in a broad multidisciplinary sense as a prime focal point of research.

2.1.2. Smart governance

The management of any territory (e.g., state, region, city) is fraught with many hurdles, especially in an open-access society linked together through networks of all kinds. Clearly, spatial justice as a policy objective calls for a balanced governance of regions and cities. The use of cognitive, technological and innovative mechanisms to steer the development of regions and cities towards prosperous, balanced and sustainable territories has led to a new policy conceptualisation, nowadays often called smart governance (Scholl and AlAwadhi, 2016). This novel policy modus operando is strongly supported by digital technology (e.g., e-governance) and has to ensure a symbiosis of economic, social, ecological and technological conditions with a view to achieving a sustainable spatial development. Against this background, smart governance induces far-reaching questions on spatial competences of policies, on property rights and commons in a spatially heterogeneous world, on conflicting behaviours in a multi-actor spatial setting, and on fair financial mechanisms to care for the well-being of all citizens in the future.

2.1.3. Consistency between research methods and theories

Theoretically framed models have become en vogue in regional science research. The need for a consistent mapping of such conceptual-theoretical contributions into the pluriform practice in spatial systems has, however, received far less attention. Sometimes it is not even clear at all whether a model or its underlying theory has been tested. For example, does a rejection of a rank size rule imply that the underlying spatial hierarchy theory or the central place theory has to be rejected as well? This prompts the intriguing question of whether space has its own indigenous theoretical conceptualisation or whether spatial theory is an amalgam of various disciplinary contributions.

The methodological issue at the background is the role of space as an abstract spatial resistance concept or as a concrete action platform. The relationship between

human interaction and spatial gradients deserves both theoretically and empirically more profound attention, as is witnessed by our lack of understanding of complex spatial mobility patterns, such as migration or tourism.

The spatial sciences have strong links with economics, geography, planning, sociology, architecture and network science. The spatial merger of these disciplines in regional science is fraught with complex methodological challenges, with heterogeneous paradigms, with different multi-level analytical frameworks, with an intriguing mix of flexibility and inertia (including resilience) and with varying space-time dynamics in geographical space. The interaction between place, space, channels (or filters) and flows is hard to understand, and forms a major concern in the above mentioned issues of spatial justice and smart governance. Clearly, improved data access and use will enhance sophistication and realism of analysis and modelling in regional science, and may beneficial for all social scientists engaged in spatial research.

2.2. Shifting paradigms

The evolution of regional science shows fascinating pathways, with different research foci and analytical horizons. Regional science is apparently a science in transition, and will always be. The question is, of course, whether new conceptualisations of regional science —novel theoretical framings, unconventional methodologies, heterodox regional or urban policies— will be instrumental in making a difference in the long run. Clearly, realism forces us to recognize that a multitude of concerns calls for permanent adjustments (e.g., health care, climate change, migration). The multidisciplinary nature of regional science calls for an open eye for new developments in many societal domains. Consequently, the evolution of regional science exhibits paradigmatic features.

The answers offered by the respondents demonstrated quite some variety. Several respondents regarded the design and application of novel techniques and methods as a promising research endeavour that matters. Others were of the opinion that rapidly changing social and technological realities in the space-economy would generate a new analysis framework that would make a difference. And finally, another group of respondents highlighted the increasing importance of new classes of actors in the space-economy, such as large urban agglomerations (including mega-cities) or creative classes.

The general view was that new challenges would prompt the development of new analytical techniques (e.g., big data methods, data mining, digital technologies, interdisciplinary modelling approaches), which might also be instrumental in integrative scientific endeavours linking economic, regulatory, social, environmental and infrastructural perspectives to the spatial sciences. Clearly, many respondents shared the view that a more powerful and rigorous analytical apparatus would benefit the scientific knowledge and policy interventions in spatial systems. Such systems are pluriform in nature so that there is no uniform recipe for addressing the regional «problematique» of spatial sustainability and resilience in an open and global network society.

2.3. Myths in regional science

Myths are meant to provide a cognitive framework for coming to grips with a confusing reality. They may be true or false. The science world is full of myths, even though it is the task of scholars to demystify scientific thinking, if there is a contradiction with logical or empirical facts. This also holds for the spatial sciences.

Regional science addresses real-world issues, such as migration, sustainability, urban dysfunctions, poverty traps, and so on, from a multidisciplinary perspective. Some respondents argued that this interdisciplinary orientation is already a myth, as in the absence of a unifying conceptual framework any translational science must fail. Most respondents, however, resorted to the identification of real-world issues as a source of myths. In the view of many participants, a popular but wrong belief in current regional science myths is the proposition of the «flat world» (Friedman, 2007). Instead, barriers in space (either abstract or concrete) may lead to a «spiky world» (McCann, 2007, 2008).

Similarly, the notion of spatial equilibrium as a desirable and end-state of the space-economy was questioned as a serious flaw, based on a myth. Equilibrium is often seen as a mathematical construct, not as a real-world phenomenon.

Indeed, heterogeneity in geographical and socioeconomic spaces constitutes regional science problematic. The challenge is, of course, to design or use a coherent analytical framework for studying such spatial barriers. The real challenge then is whether the belief in new economic geography, cyber geography, spatial econometrics or evolutionary economics/geography would lead to a new myth or to a better understanding of the space-time evolution of our world. Clearly, if scientific results are based on shared and accepted myths, we will no doubt face alarming policy failures. De-mystification is therefore, an important methodological task in future regional science.

2.4. Lessons from the past: What would you ask the late Walter Isard?

Studying the scientific inheritance of one of the prominent founding fathers of regional science, the late Walter Isard, is rewarding and illuminating. It is sometimes shocking to realize that over a timespan of more than half a century, the «real» issues have not drastically changed. Various methodological and policy issues from the past are still with us and bother us. Examples are:

- Is regional science concerned with regions (including cities), or with the spatial behaviour of people, or perhaps with the solution of human or policy problems?
- Is a region a connected spatial entity with some common homogeneity, or is a region an action platform for competition, conflict or even war?
- Are we sure that a painstaking effort to understand the complex space-economy through an interdisciplinary lens provides more and better insights than a rigorous monodisciplinary approach?
- Is an interdisciplinary modus operandi a fixed methodological bastion, or is this methodological approach itself also evolving over time and space as a response to emerging challenges?

- Does regional science aim to test spatial models and methods, or to test the validity of propositions on human spatial behaviour or policies?

The findings briefly outlined in Subsections 2.1-2.4 formed the basis for an intensive group discussion and a vivid exchange of views among the respondents in the brainshaker experiment. This cognitive process is further highlighted in the next sections.

The subsequent step of our envisioning experiment was to undertake a multivariate analysis of the responses of the participating respondents. These results —and their interpretation— are presented in Section 3. The final part of our study on the future of regional science addresses ways forward and frontiers to be faced; various suggestions on unconventional roadmaps can be found in a concluding Section 4.

3. Statements on Regional Science

3.1. Selection of statements

In the light of the inferences from the «brainshaker» experiment, we have selected a list of ideas and findings that were proposed by the participants. In our second-round experiment, we have used this large set of challenging statements on the future of regional science, and we have asked a larger group of researchers to evaluate these.

A prominent concern in the exchange of views among respondents was the lack of a clear role articulation of regional science. Serendipity-oriented research appears to be accompanied by practical policy-oriented research without a clear connection between these approaches. It was recognized that blue-sky research in regional science is needed but, that such fundamental cognitive exercises would have to be geared toward the resolution of real-world problems. Think-tank activities would need to find a pragmatic balance between different research orientations. This new institution should be a «breaker» and promoter of ideas. The attention in such a think-tank setting might be focussed, inter alia, on the following elements of our knowledge horizon:

- A better understanding of the backgrounds, characteristics and impacts of human goals and values in the context of space and time.
- An improvement of the consistency between the theoretical framework of regional science and the available research toolkit.
- An enhancement of our insights into the spatial-functional role of cities, regions and nations as a spatially connected network of actors, places and spaces.
- A more thorough examination of the functionalities of space (including its barriers) in relation to connected places and actors in a given territorial system.

In this spirit of such fundamental issues in regional science, 37 phrases were selected; most of the thoughts were taken into consideration while avoiding redundancies (see Table 3).

Table 3. Statements on regional science

NR	*Statements*
1	What really matters in the spatial sciences is economic growth, happiness, quality of life and well-being.
2	We need to look more at territorial disparities and conflicting behaviours.
3	It is important to study the reasons why culture influences welfare distribution.
4	The kind of regional policy, where and for whom, deserves more attention.
5	The question on how effective policy is in reducing regional inequities is important.
6	We need to analyse the differential spatial-economic impacts of megatrends, such as ageing and climatic change.
7	The role of cities, regions, nations and unions, and how to invent the best governance for the world, is a prominent research issue.
8	The role and functions of the common in the city of the 21st century is relevant.
9	It is important to address the question on how to plan housing and suburban growth in the context of unstable and informal economic relations.
10	There should be a general theory of human interaction that goes beyond what we have learnt so far.
11	Reconciliation of the rank-size rule with the theory of the urban economy is an important research challenge.
12	It is important to find out what we can learn from industrial districts to promote creative and innovative districts.
13	It is relevant to know what the relation is between investments in global financial markets and the location of activities.
14	What will be the impact of free migration becomes an important issue.
15	It is important to know how we can trace the path / timing / dynamics of adjustments to exogenous shocks in a regional economic system.
16	How perceptions and cognition impact the development trajectory of regional economies is an important question.
17	How people behave and respond to new spatial (physical and non-physical) connectivity structures needs more attention.
18	Improved data availability and reporting will enhance sophistication and realism of analysis and modelling.
19	When the constraint of telecommunication is overcome, the main constraint will be communication between humans.
20	All studies of new technologies will pass.
21	Regional science paradigms have always been challenged by analytical techniques.
22	We need the integration of the analysis of global economic, social and demographic dynamics into spatial, localized decisions.
23	We should look at space as a theoretical object of research.

Table 3. *(continue)*

24	Christaller's and Lösch's work represent the cornerstones of an indigenous regional science theory.
25	Celso Furtado with Raúl Prebisch argue rightly that underdevelopment tends to self-perpetuate under changing forms.
26	What unifies regional science is the object, not the theory (Medicine, as a discipline, does not have a paradigm and does not need one).
27	Regional science is an interdisciplinary group of people who usually do not mix and talk to each other.
28	Walter Isard moved towards peace science; was it to address the question: why are most wars and conflicts territorial?
29	We need to promote teaching workshops recognized by universities.
30	We need to certify courses that are provided by universities.
31	Regional science main courses are: regional economics; urban economics.
32	Regional science main courses are: geographical information systems; territorial planning.
33	Regional science main courses are: research methods; econometrics.
34	Regional science main courses are: input-output analysis, spatial interaction and CGE models.
35	Regional science main courses are: decision support systems and planning models.
36	Regional science main courses are: transport and network economics.
37	The main task of regional science is to become a recognized discipline.

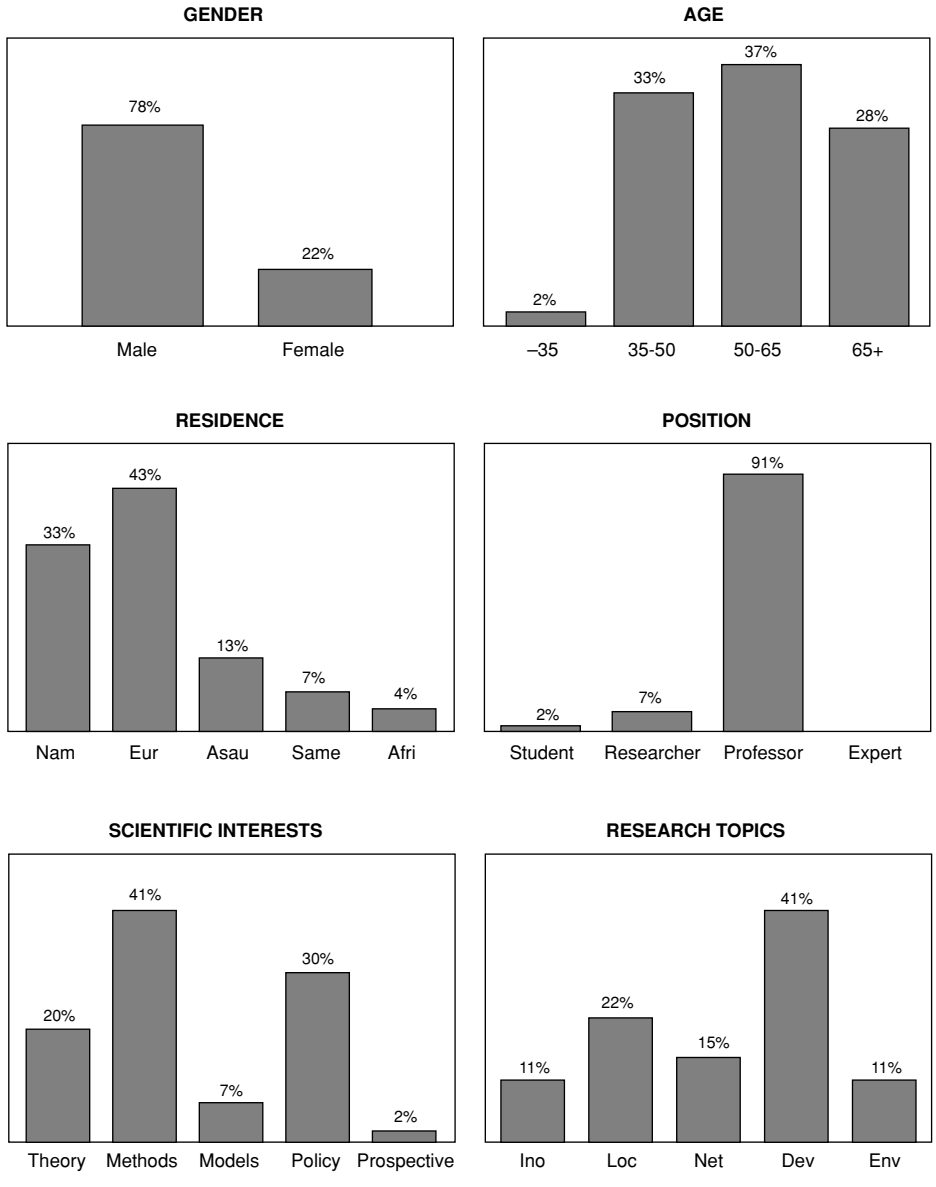
3.2. Ranking of statements on Regional Science

Those phrases were sent to a group of regional scientists that were asked to classify them according to the level of agreement. The surveyed group was intentionally formed mostly by established scholars. We tried to work with a representative group of people and at the same time be diverse in terms of several variables. The respondents, with some overlap with the first group, were identified by gender (male, female), age (< 35, 35-50, 50-65, > 65), residence (Europe, North America, South America, Asia-Oceania and Africa), position (PhD Student, Researcher, Professor and Expert), scientific interest (Theory, Methods, Models, Policy, Prospective Analysis) and research topic (Location, Development, Innovation, Networks and Environment).

Most of the 46 participants[2] in the questionnaire were male, senior, coming from Europe or North America, Academics, more interested in Methods and Policies than theory of policy, and mainly focused on Development issues (see Figure 1). Again,

[2] This sample size is more than enough for the Q method analysis that is undertaken (Robbins and Krueger, 2000).

Figure 1. Characteristics of the respondents



some of these demographics are similar to the figures of regional science attendees to international conferences[3].

[3] In a revision of the main trends of regional science by analyzing the 51st ERSA conference in Barcelona, Royuela (2012) found that 63% of attendants were men, being such proportion higher (79%) for Full professors.

Crossing some of these data, academics interested in *Innovation* and *Location* are more keen on theory; those more focused on *networks* are more attracted towards *methods*; the ones who prefer *development* issues are also more inclined to favour *policy evaluation*; finally, *environmental issues* are mainly related to *prospective analysis*.

Out of the 37 statements, some received a higher level of agreement while some others were less supported by all participants. Three phrases received a negative total grade: «All studies of new technologies will pass» (20), showing that regional scientists take seriously their interest in innovation issues. This is further reaffirmed when they deny that «Regional science is an interdisciplinary group of people who usually do not mix and talk to each other» (27). Finally, they hope that development can reach all, rejecting «Celso Furtado's and Raúl Prebisch's argument that underdevelopment tends to self-perpetuate under changing forms» (25). On the other hand, the three winning and preferred phrases show that there is a clear interest in spatial justice by inquiring «How effective is policy in reducing regional inequities?» (5). This can change, for better or worse, due to uncontrolled scenarios, expressed in the question: «What are the differential spatial-economic impacts of megatrends, such as ageing and climatic change (6)?», while the following statement is clearly liked: «Improved data availability and reporting will enhance sophistication and realism of analysis and modelling» (18). Table 4 summarises the support for each individual statement.

Table 4. Statements on future regional science ordered by the support received

NR	*Statements*	*Wheigted Support*
18	Improved data availability and reporting will enhance sophistication and realism of analysis and modelling.	122
6	We need to analyse the differential spatial-economic impacts of megatrends, such as ageing and climatic change.	118
2	We need to look more at territorial disparities and conflicting behaviours.	112
5	The question how effective policy is in reducing regional inequities is important.	112
1	What really matters in the spatial sciences is economic growth, happiness, quality of life and well-being.	111
7	The role of cities, regions, nations and unions, and how to invent the best governance for the world, is a prominent research issue.	110
4	The kind of regional policy, where and for whom, deserves more attention.	95
22	We need the Integration of the analysis of global economic, social and demographic dynamics into spatial, localized decisions.	89
13	It is relevant to know what the relation is between investments in global financial markets and the location of activities.	82
10	There should be a general theory of human interaction that goes beyond what we have learnt so far.	74
3	It is important to study the reasons why culture influences welfare distribution.	73

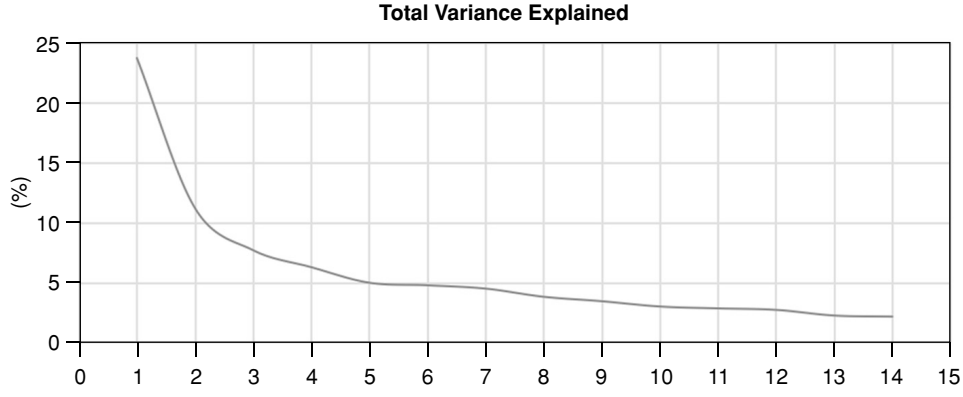
Table 4. *(continue)*

29	We need to promote teaching workshops recognized by universities.	70
31	Regional science main courses are: regional economics; urban economics.	67
12	It is important to find out what we can learn from industrial districts to promote creative and innovative districts.	65
8	The role and functions of the Common in the city of the 21st century is relevant.	63
33	Regional science main courses are: research methods; econometrics.	54
9	It is important to address the question how to plan housing and suburban growth in the context of unstable and informal economic relations.	53
23	We should look at space as a theoretical object of research.	51
30	We need to certify courses that are provided by universities.	48
16	How perceptions and cognition impact the development trajectory of regional economies is an important question.	46
19	When the constraint of telecommunication is overcome, the main constraint will be communication between humans.	44
32	Regional science main courses are: geographical information systems; territorial planning.	40
36	Regional science main courses are: transport and network economics.	40
34	Regional science main courses are: input-output analysis, spatial interaction and CGE Models.	39
24	Christaller's and Lösch's work represent the cornerstones of an indigenous regional science theory.	31
37	The main task of regional science is to become a recognized discipline.	30
26	What unifies regional science is the object, not the theory (Medicine, as a discipline, does not have a paradigm and does not need one).	27
35	Regional science main courses are: decision support systems and planning models.	24
21	Regional science paradigms have always been challenged by analytical techniques.	23
11	Reconciliation of the rank-size rule with the theory of the urban economy is an important research challenge.	14
28	Walter Isard moved towards peace science; was it to address the question: why are most wars and conflicts territorial?	13
25	Celso Furtado with Raúl Prebisch argue rightly that underdevelopment tends to self-perpetuate under changing forms.	-17
27	Regional science is an interdisciplinary group of people who usually do not mix and talk to each other.	–25
20	All studies of new technologies will pass.	–35

3.3. Regional science perspectives

Clearly, our sample to explore the relative preference of each phrase is limited. Nevertheless, the sample is more than enough to identify the main perspectives on regional science. To get this, the valuations provided by the respondents were standardized and a principal component (PC) analysis taking the respondents as variables was undertaken. This Q Method approach identified 14 factors with eigen-values higher than 1, that explain 84% of the total variance of the respondents» valuations. Even though this first result does not express a strong consistency among regional scientists, such a diversity is quite common when interviewees are not really stakeholders defending their interests, but independent academics who care about a scientific approach to human interaction in space. We also interpret these results as a sign of diversity in the 37 selected statements resulting from the first experiment explained in point 2 of this chapter. Clearly, the large number of identified factors is a consequence of both the diversity in the perspectives that regional science has to cover but also the outcome of the different points of view of scientists. Next, we describe the main factors resulting from our PC analysis, including the characteristics of the people supporting the main arguments.

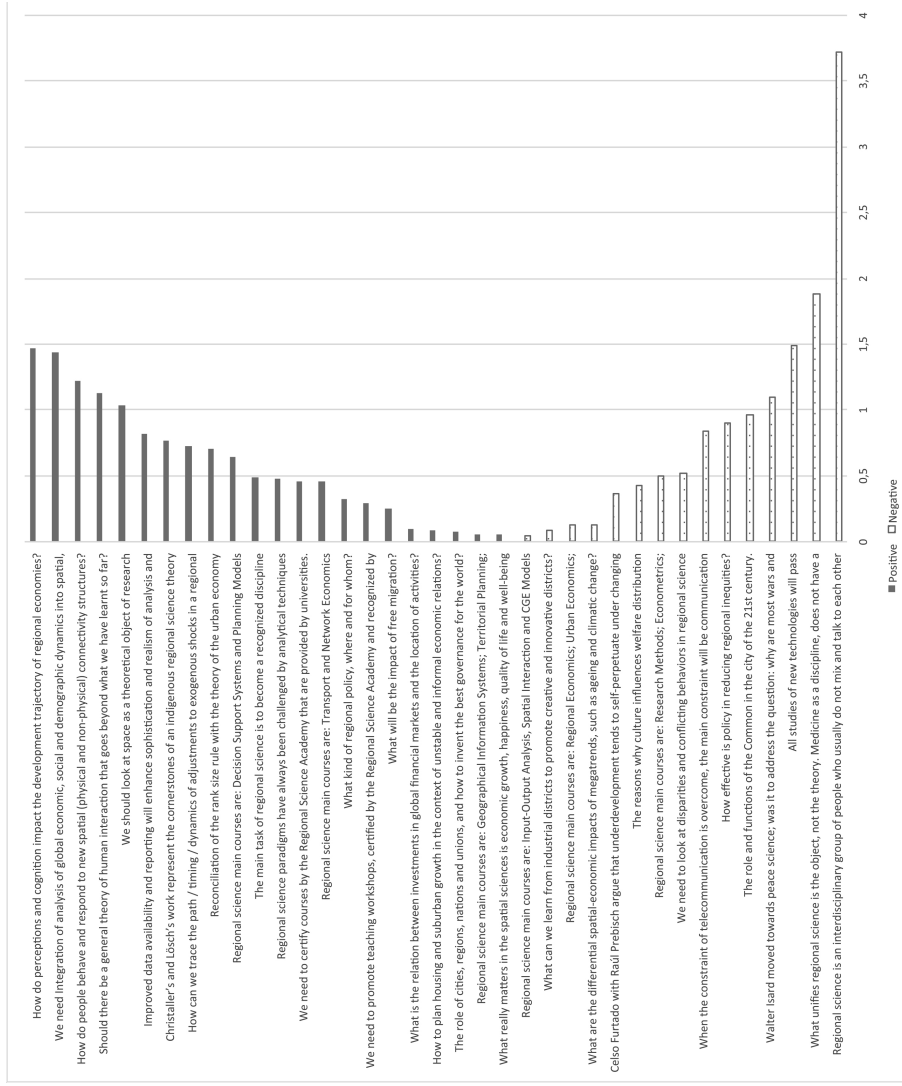
Figure 2. Variance Explained by the Factors of the Principal Component Analysis



- ***Factor 1: Human Interaction in Space***

The first factor from a Principal Component Analysis is united in denying that «Regional science is an interdisciplinary group of people who usually do not mix and talk to each other». This general denial of a provocative statement is compensated by a clear focus on object of study: *Regional Science tries to understand Human Interaction in Space and with Space*. This is a perspective shared by most of the regional scientists interviewed. Nevertheless, those who are more identified with it are young, female, coming from all continents, mostly interested in *methods* and *policy*, and very much focused on *networks and development*.

Figure 3. Factor 1: *Human Interaction in Space*



- ***Factor 2. Spatial Interdisciplinarity for a General Theory of Human Interaction***

The second common factor can be found in the denial of the need for regional science to become a recognised discipline. It is noteworthy that this factor supports complementing different disciplines around a *General Theory of Human Interaction in Space* and *with Space*, while refusing that any discipline or method can be more important than any other one. Spatial data seems to be the major concern of this perspective. The respondents that favour this point of view are mostly middle aged, male, coming from all continents, with diversified scientific interests but relatively more interested in development and environmental issues than their colleagues who identified more with other perspectives.

- ***Factor 3: Advanced Training for Territorial Competence***

The third factor can be named *Advanced Training* for *Territorial Competence*, since it favours addressing territorial issues (development, conflicts, etc.) supported by advanced training. The representatives of this position are: relatively young, mixed, coming from various parts of the world, focused on policy and methods, but with diversified topics to be addressed.

- ***Factor 4: Regional Science - Science of Cities. Methods and Training for Better Spatial Regulation***

Principal component 4 values most statements stressing the role to be played by cities in the 21st century. It can be also interpreted as supporting *Methods* and *Training for Better Spatial Regulation*. It is somehow similar to Factor 5, but more focused on improving regional policies. The defendants of this attitude are: relatively young, strongly mixed, coming from remote places of all continents, mostly interested in methods, and very much focused on location topics.

- ***Factor 5: Regional Policy: Regional Science for a Better World***

Perspective 5 puts a high value on the role to be played by regional policy. Regional and urban analysis has to look into the behaviour of people, institutions and organizations in space. Scientists associated with this perspective are: relatively young, mixed, coming from Europe and North America, interested in theory, and aiming at addressing development topics.

- ***Factor 6: Scientific Response to Emerging Challenges***

Perspective 6 refuses that space be the object of study and that regional science should be a territorial discipline, but defends that regional science should become a

Figure 4. Factor 2: Spatial Interdisciplinarity for a *General Theory of Human Interaction*

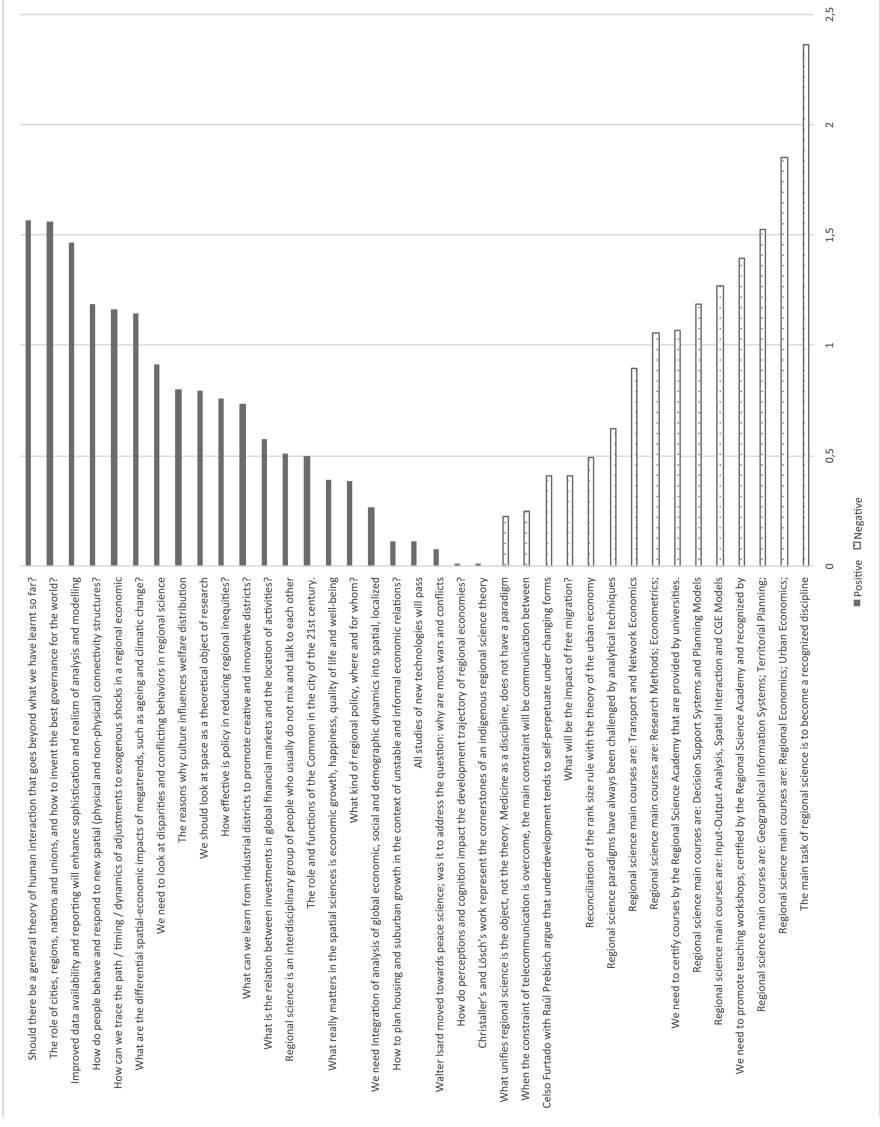


Figure 5. Factor 3. Advanced Training for *Territorial Competence*

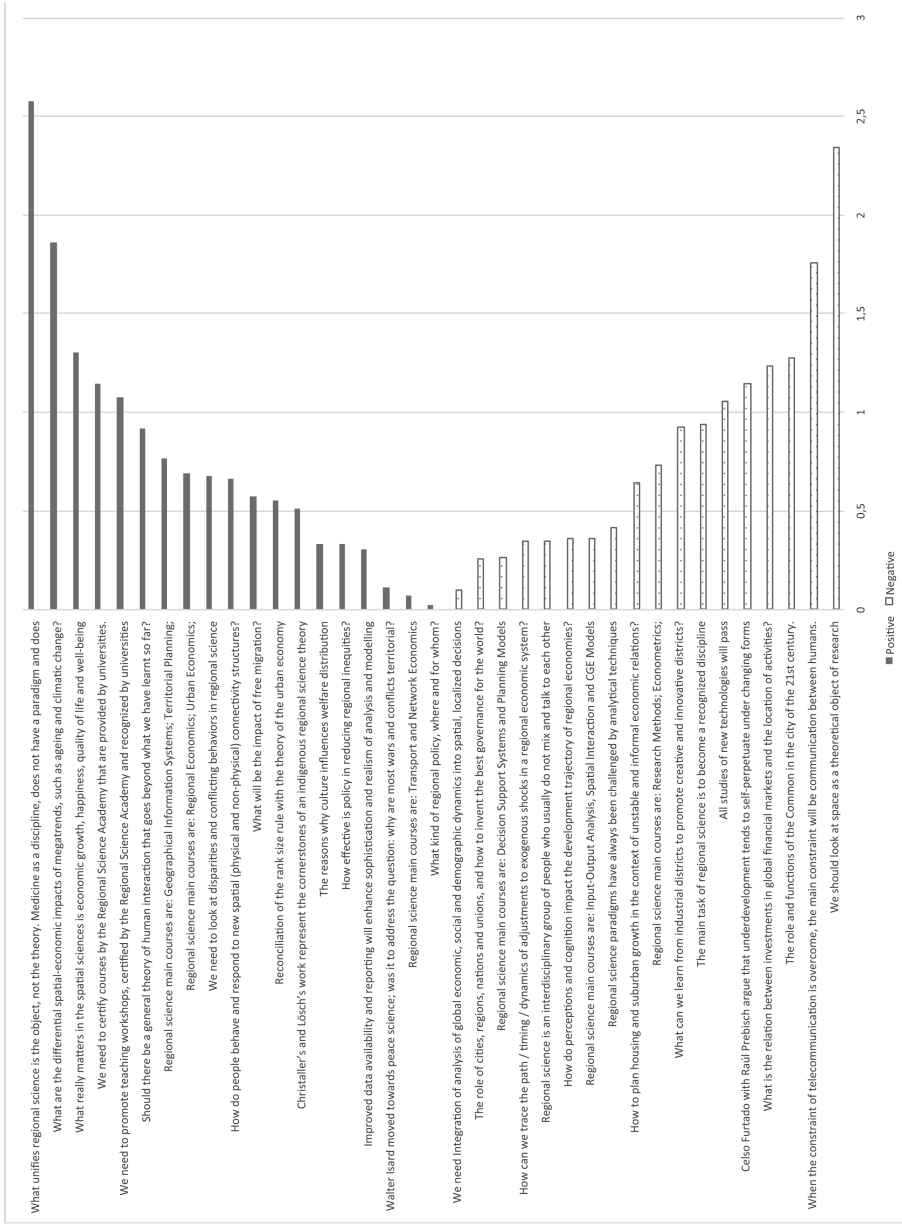


Figure 6. Factor 4. *Methods* and *Training for Better Spatial Regulation*

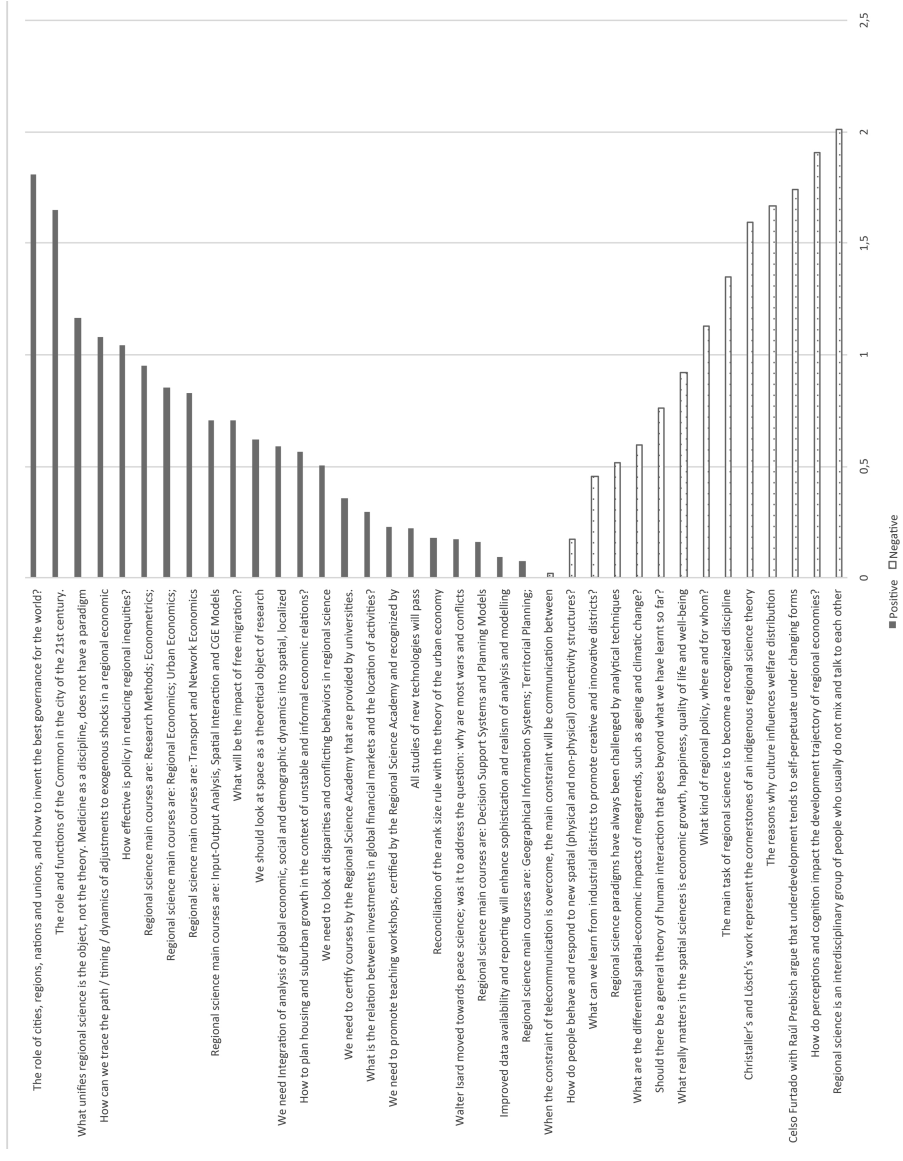


Figure 7. Factor 5. *Regional* and *Urban Economic Theory* for a Better World

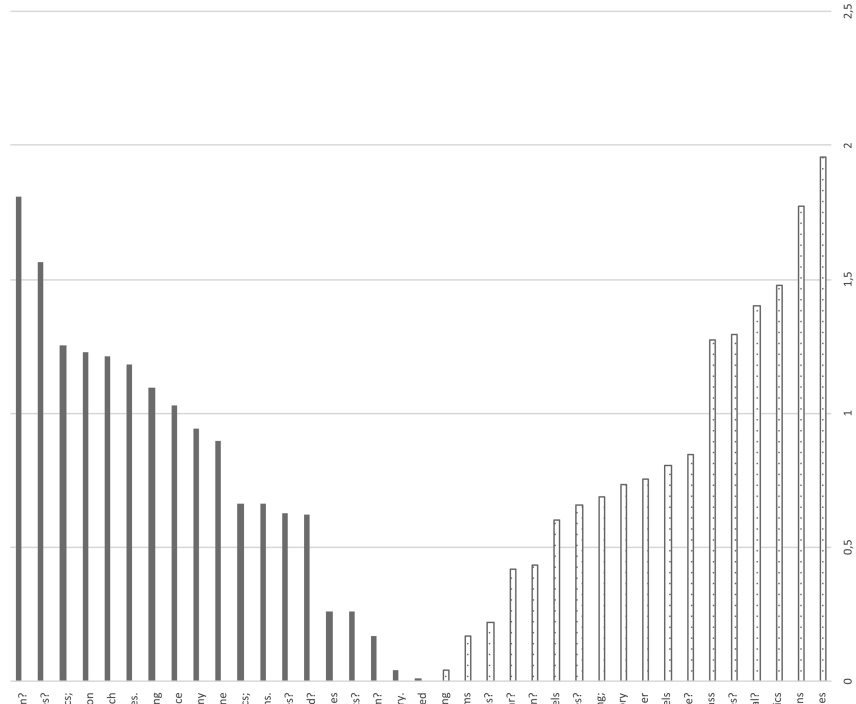
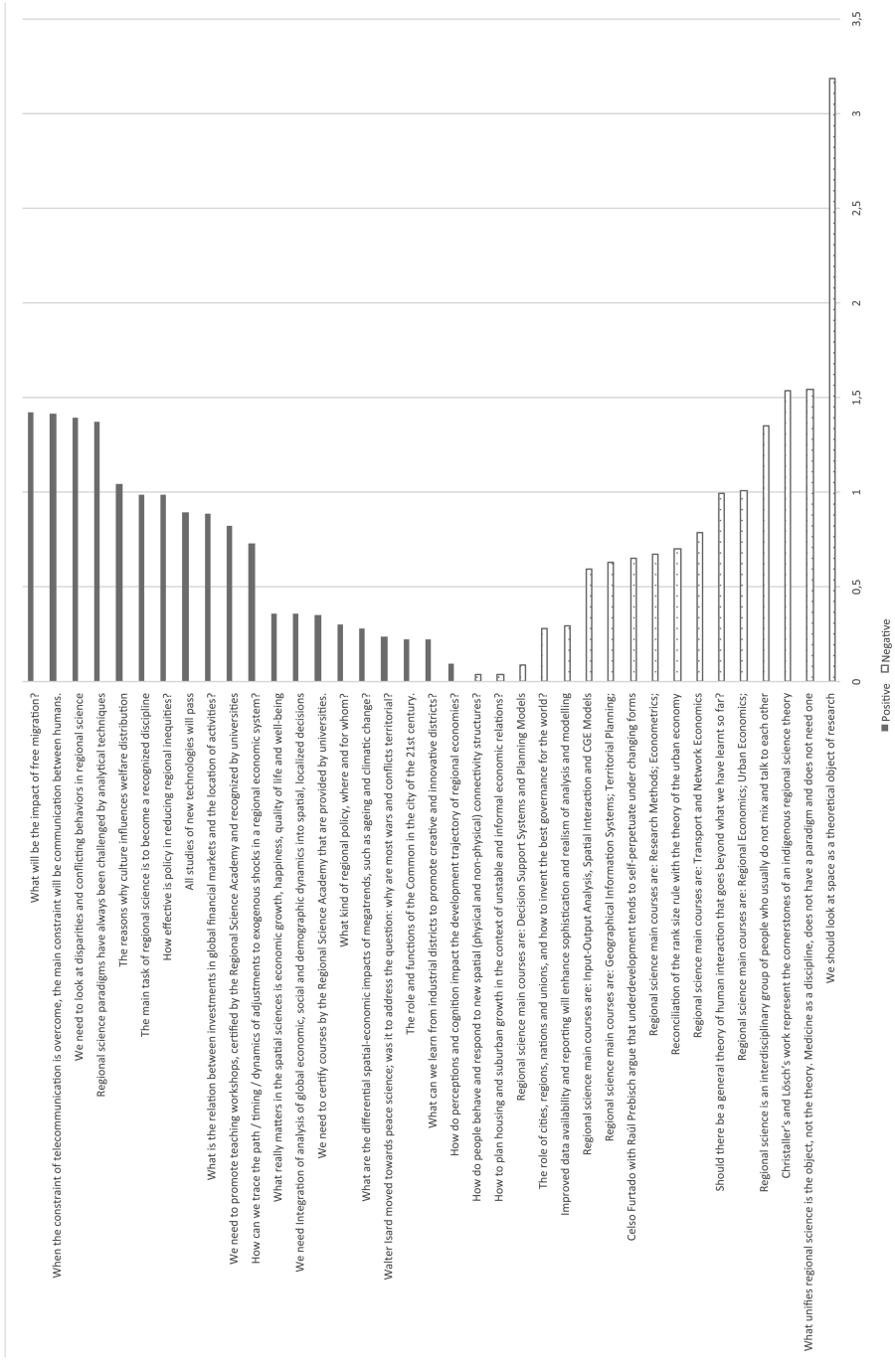


Figure 8. Factor 6. Scientific Responses to *Emerging Challenges*



recognized discipline by responding to emerging issues such as migration, technological change, conflicts, disparities and so on. Respondents that are more identified with this point of view are: from different age cohorts, male, coming Europe and North America, interested in methods and policy, and focused on sustainable development.

- ***Other Perspectives***

There are eight more statistically significant perspectives, but whereas the first six represent 60% of the total variance, the other eight ones represent only 20% of the variance. Notwithstanding, it is interesting to identify them:

- Factor 7: Regional science is a discipline based on econometric methods, operational models and Christaller's and Lösch's seminal works. This perspective is represented by: seniors, males and North-American academics, interested in methods, and focused on networks and development.
- Factor 8: Regional and urban economics to address sustainable regional development issues is defended by senior, male and European academics interested in theoretical approaches to sustainable development.
- Factor 9: Urban planning for the 21st century is associated with: relatively young, male and European researchers concerned with policy and urban sustainable development.
- Factor 10: A group of people that do not mix and talk to each other, although being rejected by most of the respondents, has representatives that are concerned about data and modelling. They are: male, North American or European, and concerned with communication between humans.
- Finally, factors 11,12,13 and 14 are represented by: relatively young, male and western academics concerned with global issues and with the recognition of regional science as a discipline (and its curriculum).

The tentative findings from this imagineering experiment are that the core interests of regional science are to be found at the interface of individual and collective human behavior and geographical space (be it physical or virtual).

3.4. Interactions between perspectives

There is a great consensus on the first factor that regards *Regional Science* as *the Study of Human Interaction*, most of the time in a spatial referential situation and sometimes with space itself. The other factors represent different, but complementary methodological approaches to understand human interaction in space. Perspective 2 clearly defends an interdisciplinary approach to spatial data to feed and test a *General Theory of Human Interaction*. Perspective 3 starts from the problems that should be addressed by *Territorial Competence*. Perspective 4 is very much similar to Perspective 3, but most of the territorial problems are policy failures and those are the needles

to be found behind the problems. Like all other perspectives, Perspectives 5 and 6 are interested in a better world; Perspective 5 does so through regional economic theory, and Perspective 6 by looking at problems from a scientific point of view.

Most respondents agree that *Regional Science* is the *Study of Spatial Human Interaction*, competing with other approaches that use spatial data for spatial planning and regional policy, but with a variety of expertise to deal with emerging territorial problems and long-term sustainable development problems through an interdisciplinary dialogue, sound research methods and well-structured and still evolving theories and analysis frameworks.

4. Conclusion

Regional science has a rich history and challenging agendas. It has attracted the attention of thousands of scholars from all over the world. Measured in term of conference participation and research publications, it has turned into a vital research approach to spatial issues in relation to human interaction and place orientation.

It goes without saying that such a rich history created the potential for a promising future agenda of regional science. In fact, the concern about real-world regional and urban development issues has led to a solid research tradition and orientation that is forced to combine conceptual and applied research in a fruitful and creative manner. To cope with such challenging research tasks in the decades to come requires innovative and advanced research endeavours that are at the forefront of modern social science research. Regional science is work in progress, at the frontiers of our knowledge on the space economy.

The experiment presented in this study has brought to light enlightening findings. The multidisciplinary focus on human interaction in space, in a geographical or in a topological sense, is a common element in the majority of regional science research. A paradigm shift towards entirely new horizons is not very likely.

The challenge to focus human interaction in space has increasing potential due to the growing access to spatial data and with improving methodologies based on geographical information systems, methods which improvement requires applications and training, pushed and pulled by people's issues, aims and policies.

Clearly, regional science has to find a respected place «in a wonderland full of human spatial interactions». Of course, it ought to be recognized that spatial (regional, urban, rural) development is no longer a policy issue in itself, but ought to be positioned in a broader context of technological innovation, cyber space developments, social tension, environmental threats, sustainable development and economic competitiveness at both local and global levels. Regional science and regional development are tied together. The alarming issues related to regional development in poor countries highlight the broad societal relevance of regional science, now and in the future.

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Section ARTICLES

Journal of Regional Research Investigaciones Regionales

The gravity model of migration: the successful comeback of an ageing superstar in regional science*

Jacques Poot **, Omoniyi Alimi **, Michael P. Cameron ** and David C. Maré ***

ABSTRACT: For at least half a century, and building on observations first made a century earlier, the gravity model has been the most commonly-used paradigm for understanding gross migration flows between regions. This model owes its success to, firstly, its intuitive consistency with migration theories; secondly, ease of estimation in its simplest form; and, thirdly, goodness of fit in most applications. While fitting gravity models of aggregate migration flows started taking backstage to microdata analysis in the 1980s, a recent comeback has resulted from increasing applications to international migration and from the emergence of statistical theories appropriate for studying spatial interaction. In this paper we review the status quo and argue for greater integration of internal and international migration modelling. Additionally we revisit the issues of parameter stability and distance deterrence measurement by means of a New Zealand case study. We argue that gravity modelling of migration has a promising future in a multi-regional stochastic population projection system —an area in which the model has been to date surprisingly underutilised. We conclude with outlining current challenges and opportunities in this field.

JEL Classification: J11; J61; R23; F22.

Keywords: Gravity model, migration flows, spatial interaction, parameter stability, distance deterrence measurement.

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RESUMEN: Durante al menos medio siglo, y basándose en observaciones que habían sido hechas en primer lugar un siglo antes, el modelo de gravedad ha sido el paradigma más comúnmente utilizado para entender los flujos brutos de migraciones entre regiones. El éxito de este modelo se debe, en primer lugar, a su intuitiva consistencia con las teorías sobre migraciones; en segundo lugar, también destaca su fácil estimación en sus modalidades más simples; y en tercer lugar, porque se ajusta muy bien a muchas aplicaciones. Aunque en los 80s. los modelos de gravedad de flujos de migración agregada empezaron tomando como base el análisis de microdatos, recientemente han vuelto a estar de actualidad por las crecientes aplicaciones a las migraciones internacionales y por la emergencia de teorías estadísticas apropiadas para estudiar la interacción espacial. En este trabajo se revisa la situación y se argumenta a favor de una mucho mayor integración de los modelos de migraciones internas e internacionales. Adicionalmente revisamos también los problemas de medición del parámetro de estabilidad y de la disuasión derivada de la distancia aplicándolo al caso de Nueva Zelanda. Al final sostenemos que los modelos de gravedad de las migraciones tienen un futuro muy prometedor para la proyección de un sistema estocástico multi-regional de población, un área en la que —sorprendentemente— el modelo se ha utilizado muy poco hasta la fecha. Al final concluimos subrayando algunos retos y oportunidades actuales en este campo.

Clasificación JEL: J11; J61; R23; F22.

Palabras clave: Modelo de gravedad; flujos migratorios; interacción espacial; medición de parámetros de estabilidad; medición de la disuasión por la distancia.

1. Introduction

One of the most pervasive empirical regularities in regional science is that any form of spatial interaction (migration, commuting, trade, information exchange, etc.) has the property of flows being positively related to stocks, whichever way measured, and inversely related to distance. Thus, the «law» of spatial interaction in human behaviour (see also e.g. Anderson, 2011) resembles Newton's 1687 law of gravity. The idea of applying a physics law to population movement between two locations was first formally advocated by John Q. Stewart who established the 'social physics' school (Stewart, 1950). However, the gravity-like properties of internal migration flows had already been confirmed much earlier by Ravenstein (1885, 1889). There is of course no reason to expect that spatial interaction operates *exactly* as the gravity law of physics would dictate and Zipf (1946) already established that for US intercity movement of persons the flows were inversely related to distance and not to distance squared.

In its most commonly applied form, the gravity law of population migration states that

$$M_{ij} = G\frac{P_i^{\alpha} \times P_j^{\beta}}{D_{ij}^{\gamma}} \tag{1}$$

in which: M_{ij} refers to the number of people resident in area j who at an earlier point in time (usually one or five years) resided in area i; P_i (P_j) refers to the population of i (j) usually measured at the beginning of the period over which migration is measured; D_{ij} is some measure of distance between i and j; α, β and γ are parameters to be estimated and G is a proportionality constant that is context specific (dependent on the geography, time dimension, etc.). The popularity of this simple model was undoubtedly related to the ease with which the model could be estimated by ordinary least squares after a transformation into logarithmic form:

$$\ln M_{ij} = \delta + \alpha \ln P_i + \beta \ln P_j - \gamma \ln D_{ij} + \varepsilon_{ij}, \tag{2}$$

in which a zero-mean error term has been added to the equation and the constant term ln G has been replaced by the parameter δ[1]. Historically, the absence of any migrants for certain specific origin-destination combinations (which is common in large and sparse gross migration matrices) was a cause for some concern, although easily ameliorated by substituting a small number such as 0.5 for such zeros. Count models (e.g., Biagi *et al.*, 2011) or direct nonlinear estimation of migration model parameters (e.g., Fik and Mulligan, 1998) are nowadays quite common alternative approaches.

Parameter estimates of Eq. (2) vary across countries. An interesting recent project by Stillwell *et al.* (2014), called the IMAGE Studio, has been concerned with comparative modelling of internal migration in a wide range of countries. This project highlights the sensitivity of the distance decay parameter to the geography of the available data, specifically the boundaries and areas of the spatial units. In a UK application, Stillwell *et al.* (2014) find that the estimate of γ converges to around 1.5 to 1.6 once the country is carved up into 50 or more regions. In a New Zealand application, Alimi *et al.* (2015) find estimates of γ between 0.8 and 0.9 when the data refer to migration between 39 urban areas. As illustrated by these examples, distance decay in migration is generally less than 2, which is the value implied by Newton's law of gravity.

Estimates of α and β vary across applications as well. In the New Zealand case, estimates of α and β are commonly between 0.8 and 0.9 (Alimi *et al.*, 2015). The two parameters are unlikely to be identical in the migration context. Given that $D_{ij} = D_{ji}$ in most applications and $E(\varepsilon_{ij}) = E(\varepsilon_{ji}) = 0$, the expected value of net migration between any origin and destination pair, $E(M_{ji} - M_{ij})$, is zero when $\alpha = \beta$. This is rather unrealistic given that there are in most countries regions that structurally gain population through internal migration while others lose population. We can use Eq. (1) to obtain an equation for net migration as follows:

$$M_{ij} - M_{ji} = M_{ij}\left[1 - \frac{M_{ji}}{M_{ij}}\right] = M_{ij}\left[1 - \left(\frac{P_i}{P_j}\right)^{\beta-\alpha}\right] \tag{3}$$

[1] The fact that the errors are unlikely to be statistical «white noise», i.e. independently and identically distributed, has been largely ignored in many applications. Curry (1972) was the first to tackle spatial correlation in the gravity model (of commuting) but major advances in statistical theory of spatial interaction modelling did not emerge until LeSage and Pace (2008). For a recent review of this literature, see e.g. Patuelli (2016).

which shows that, when $\beta > \alpha$ and $P_j > P_i$, $M_{ij} - M_{ji} > 0$. The system has then a tendency for larger regions to be population gainers through internal migration while smaller regions lose population that way. This configuration could reflect agglomeration forces leading to, on average, expansion of the larger cities through net inward internal migration. One example is internal migration in New Zealand for the five-year periods between population censuses from 1981 until 2001, as will be shown in the next section.

Despite its simplicity, the gravity model fits internal migration data remarkably well —often yielding adjusted R^2 values of between 0.8 and 0.9. This makes the model useful for embedding in sub-national population forecasting procedures, as will be elaborated in Section 3. It is also possible to justify the gravity model of migration in terms of microeconomic foundations. For example, Poot (1995) shows that in a labour market in which workers can draw wage offers from distributions of jobs in each region among a set of potential destination regions, migration flows are positive related to the size of the labour force in origin and destination regions and inversely related to the cost of migrating from one to the other.

However, such a stylised description of migration as the gravity model provides is of limited use for those attempting to quantify the *processes* that drive population redistribution. The latter has been achieved over the last half century by many developments across a range of disciplines. Comprehensive reviews of modelling internal migration flows and propensities to migrate include Greenwood (1997). Clearly, the potential endogeneity of many determinants of internal migration flows remains a challenging issue for estimation. Suitable instruments are often difficult to find and it is common practice to use «deep lagging» of right-hand side variables as a statistically acceptable practice in cross-section and panel models of gross migration flows.

One fundamental weakness of the basic gravity model is the absence of any systemic effects. This was first addressed by Wilson (1970) in the doubly-constrained spatial interaction model in which (1) is replaced by

$$M_{ij} = A_i M_{i.} B_j M_{.j} D_{ij}^{-\gamma} \tag{4}$$

with M_i referring to total out-migration from i, $M_{.j}$ referring to total in-migration into j and A_i and B_j are balancing factors that ensure that gross origin-destination migration flows add up to exogenous and pre-set out-migration and in-migration flows for each region. If structural equations are added to (4) that include macro-level determinants of $M_{i.}$ and $M_{.j}$, Alonso's (1978) general theory of movement results. The empirical estimation of this model gained some popularity during the 1980s (see e.g. De Vries *et al.*, 2001, for a review and Poot, 1986, for a New Zealand application). While the Alonso model has also interesting theoretical properties in a dynamical setting (see Nijkamp and Poot, 1987), its nonlinearity complicates interpretation. Since the 1980s the internal migration literature has predominantly moved to micro-data analysis (Cushing and Poot, 2004). In contrast with that, there has been growing interest in more recent years in explaining gross international migration flows by gravity models (e.g. Mayda, 2010; Ramos, 2016). Recent econometric issues in gross migra-

tion modelling include the challenge of accounting for spatial spillovers in such flow models (e.g., LeSage and Pace, 2008; 2009). Another issue is that of spatial heterogeneity in the parameters (e.g., Peeters, 2012). A further interesting development has been the interpretation of migration flows as a weighted network, with applications both in internal migration (e.g., Mayer and Vyborny, 2008) and international migration (Tranos *et al.*, 2015; Fagiolo and Mastrolillo, 2013; Davis *et al.*, 2013).

Given its enduring popularity, we revisit in the next section several key issues in estimating conventional gravity models of migration. We firstly focus on the temporal stability of gravity model coefficients; secondly, on the best measurement of the distance deterrence effect; and thirdly, the extent to which reduced long-distance travel time and costs have spurred additional migration. Additionally, one of the main deficiencies of internal migration modelling to date is the common neglect of accounting for international migration flows. We therefore show that inter-urban migration flows can be easily embedded in an expanded gravity model that also includes international (and urban-rural) flows. Considering international migration flows in spatial population redistribution is nowadays particularly important given the rapid growth in the stock of foreign born in most developed countries. We use New Zealand data to look at each of the four specific issues stated above. New Zealand is an attractive case to consider given that geographical mobility is high and the foreign born account for about one quarter of the population.

It is well known that a model that describes the evolution of a multiregional population leads to biased forecasts when population change is modelled as a function of net migration rather than gross migration (Rogers, 2015). Yet it still remains common, when forecasting population change in a multiregional system, to use assumed age-specific net migration numbers for each region that are subsequently calibrated to ensure that total net migration in the system is zero (this applies to the assumed net international migration by country in UN global population projections too). In section 3 we briefly outline the possibility of developing a multi-regional population projection system that includes a gravity model of interregional migration.

Given that the gravity model of gross migration has returned to prominence as a tool for analysing and projecting multi-regional populations, we may expect a range of new development triggered by new types of data, such as «big data» obtained by various electronic information systems and new techniques for statistical analysis of dyadic data generated by population movement. The final section of the paper, section 4, briefly elaborates on such potential developments.

2. Sensitivity of the gravity model to specification choices —a New Zealand case study

The distance variable included in Eq. (1), (2) and (4) of the previous section is open to a range of interpretations and measurements. It is usually thought of as a proxy of the cost of migration and measured in various ways. Most applications of the gravity model to migration usually select only one single measure of distance

between origin and destination, such as the railroad distance (Fan, 2005), straight line distance (Lewer and van der Berg, 2008), airline miles travelled between origin and destination airports (Karemera, Oguledo and Davis, 2000) and road travel distance (Courchene, 1970). In this section we first consider the sensitivity of the gravity model to three different measures of distance, namely: straight line distance (distance as the crow flies), road travel distance in kilometres and road travel time in minutes. We use New Zealand data to test the sensitivity of the gravity model to these different measures of distance.

Some measures of distance change over time, for example due to changes in preferred transport modes, transport technology, new infrastructure or changes in the speed limit imposed on road use. Hence we also test the extent to which changes over time in distance between specific origin-destination pairs impact on the corresponding migration flows. Moreover, in today's world in which cross-border migration flows are increasingly important (e.g. Poot, 2015), we also consider the impact of modelling internal and international migration flows simultaneously. New Zealand is a good case study for this, given that about one quarter of the population is foreign born[2].

Migration data are recorded in the New Zealand Census by means of a question on «usual residence five years ago». The census is held every five years, except for the 2011 census which was postponed until 2013 due to a major earthquake in February 2011 in Christchurch, where the Statistics New Zealand (SNZ) census division is located. We assembled data from six censuses, starting in 1986. We focus on each of the 40 areas identified by SNZ as main and secondary urban areas in New Zealand in 2013[3]. The population is restricted to individuals aged between 25 and 54 in order to model predominantly labour migration and exclude movements of students and retired persons. We also embed inter-urban migration in a population flows matrix that includes international migration and migration between urban and rural areas. Since the census includes only people who are actually in New Zealand at the time of the census, emigration from New Zealand is not recorded in census data but has been estimated by a residual method[4].

Excluding international and rural-urban migration, the specification of the gravity model is identical to Eq. (2). To include international and rural-urban migration we first note that «international» and «rural» do not have a specific location, so that the distance between these areas and the set of urban areas may be considered un-

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[2] The importance of considering the interactions between interregional and international gross migration was previously considered, for example in the United Kingdom case, by Raymer *et al.* (2012), and Lomax *et al.* (2013).

[3] Urban areas in New Zealand have a population of at least 1000 people, but population size is not the only criterion to classify urban areas —factors such as remoteness, economic activity and location of employment of the majority of the population are also used to define and further differentiate the type of urban area. Statistics New Zealand categorises three types of urban areas: main urban areas which have a population of at least 30,000 people; secondary urban areas are ones with a population of between 10,000 and 29,999 people; and minor urban areas have a population of between 1,000 and 9,999.

[4] Given that censuses are held at the same time every five years, cohorts can be followed over time. After accounting for immigration, internal migration and observed registrations of deaths, emigration can be calculated as the residual change in the size of a cohort. Of course the resulting numbers are measured with some error, due to census undercounting, etc.

defined. Similarly, we consider the population of the generic international and rural areas undefined (the total rural population is known, but it is a spatially dispersed rather than compact mass). We now define five dummies variables. Firstly, $U_{ij} = 1$ if and only if both the origin i and the destination j are urban areas and 0 otherwise. Secondly, $E_j = 1$ if and only if the origin i is an urban area and the destination j is abroad (i.e., these correspond to the emigration flows). Thirdly, $I_{ij} = 1$ if and only if the origin i is abroad and the destination j is an urban area (i.e., these correspond to the immigration flows). Fourthly, $O_{ij} = 1$ if and only if the origin i is an urban area and the destination j is rural (i.e., these correspond to the urban to rural flows). Finally, $R_{ij} = 1$ if and only if the origin i is rural and the destination j is an urban area (i.e., these correspond to rural to urban migration flows). The specification of the gravity model with international and rural-urban migration then becomes:

$$\begin{aligned}\ln M_{ij} = {} & \delta_0 + \delta_1 U_{ij} + \delta_2 E_{ij} + \delta_3 O_{ij} + \delta_4 I_{ij} + \delta_5 R_{ij} \\ & + \alpha_1 U_{ij} \ln P_i + \alpha_2 E_{ij} \ln P_i + \alpha_3 O_{ij} \ln P_i \\ & + \beta_1 U_{ij} \ln P_j + \beta_2 I_{ij} \ln P_j + \beta_3 R_{ij} \ln P_j - \gamma U_{ij} \ln D_{ij} + \varepsilon_{ij}\end{aligned} \tag{5}$$

For interpretation, this gravity model equation can also be rewritten in the following form:

$$\begin{aligned}\ln M_{ij} = {} & \delta_0 + U_{ij}\left(\delta_1 + \alpha_1 \ln P_i + \beta_1 \ln P_j - \gamma \ln D_{ij}\right) \\ & + E_{ij}\left(\delta_2 + \alpha_2 \ln P_i\right) + O_{ij}\left(\delta_3 + \alpha_3 \ln P_i\right) \\ & + I_{ij}\left(\delta_4 + \beta_2 \ln P_j\right) + R_{ij}\left(\delta_5 + \beta_3 \ln P_j\right) + \varepsilon_{ij}\end{aligned} \tag{6}$$

Eq. (6) shows that for exclusively inter-urban migration flows ($U_{ij} = 1$, $E_{ij} = 0_{ij} = I_{ij} = R_{ij} = 0$) the model simply reduces to that of Eq. (2).

Note that for estimating Eq. (5) the values assigned to the population abroad, the population of rural areas and the distances between urban areas and abroad, or between urban areas and rural areas, are irrelevant[5]. Figure 1 below shows the origin-destination matrix and the dummy variables accounting for each type of flow.

An important limitation of the current specification of the gravity model is the treatment of zero flows, given the specification of the model in logarithms. Here we set $M_{ij} = 0.5$ where the reported migration flow is 0[6]. Alternative methods, such as exclud-

[5] In the estimation in Stata we have set these values to one. Also note that perfect collinearity is avoided by defining international migration from and to rural areas as the benchmark category of the migration matrix.

[6] To preserve confidentiality, New Zealand census counts are rounded to multiples of 3: an actual count of 0 is reported as such, but an actual count of 1 is rounded down to 0 with probability 2/3 and rounded up to 3 with probability 1/3, with the reverse probabilities for rounding a count of 2. If the low frequencies were uniformly distributed, a rounded value of 0 is therefore reported in 2/3 of the cases rather than 1/3. However, the distribution of low frequencies is unlikely to be uniform, with 0 likely to be much more common than 1 or 2, particularly in migration matrices referring to small areas or relatively small groups. In this case count models that allow for excessive zeros, such as the zero-inflated Poisson model (see e.g. Bohara and Krieg, 1996) would be more appropriate than the simple gravity model.

Figure 1. Origin-destination matrix and dummy variables signalling inter-urban, urban-rural and international migration flows

Origin-Destination Matrix	**Destination**							
Origin	UA 1	UA 2	UA 3	UA 4	.....	UA 40	Rural	International
UA 1 UA 2 UA 3 UA 4 ⋮ UA 40	X	X	Inter-urban flows (U_{ij}=1)			X	Urban to rural migrants (O_{ij}=1)	Emigrants from UA ($E_{ij} = 1$)
Rural	Rural to urban migrants ($R_{ij} = 1$)						X	Emigration from rural areas $U_{ij} = O_{ij} = E_{ij} = R_{ij} = I_{ij} = 0$
International	Immigrants to UA ($I_{ij} = 1$)						Immigration to rural areas $U_{ij} = O_{ij} = E_{ij} = R_{ij} = I_{ij} = 0$	X

Note: X refers to the main diagonal, which represents intra-area mobility. This is not observed and excluded from the analysis.

ing zero flows or using count data models, are also possible to address this problem, but zero flows in our data form only around 5 percent of the total flows in all Census periods. We checked the sensitivity of the results by excluding zero flows from the regressions and found that none of the main results were sensitive to the way we treated zero flows.

Three different measures of distance D_{ij} are used in this study. The first is the amount of time in minutes it would take to travel from the city centre of an origin to the city centre of a destination. This measure is referred to as D_{ij}^{Min}, with the data corresponding estimates of travel time obtained in 2013 and 1984 from Google Maps and the 1984 Mobil Map respectively[7]. There are 1,560 (40×39) origin-destination pairs available to estimate distance deterrence with 2013 travel time data. However, the 1984 measures were available only for 25 urban areas, reducing the origin-destination pairs to 600 (25×24). The second measure of distance is distance by road, in kilometres, between the city centre of an origin urban area and destination urban area, as represented by D_{ij}^{Km}. Again, estimates for 2013 and 1984 of this variable were obtained using Google Maps and the 1984 Mobil Map, respectively. The final distance measure is the straight line distance between urban areas, denoted by D_{ij}^{Skm} and calculated as the straight-line distance between population-weighted centroids in origin and destination areas[8]. A description of the variables and summary statistics can be found in Table 1.

[7] Manukau city centre was the reference point for the South Auckland urban area, Henderson for West Auckland, North Shore Information centre for North Auckland, Kapiti Coast District Council for Kapiti and Auckland city centre for the Central Auckland urban area.

[8] Geographic centroids were calculated for each meshblock, derived from 2006 meshblock shape files available on the Statistics New Zealand website. Population-weighted means of longitude and latitude were then calculated for each urban area to give the representative location of the urban area.

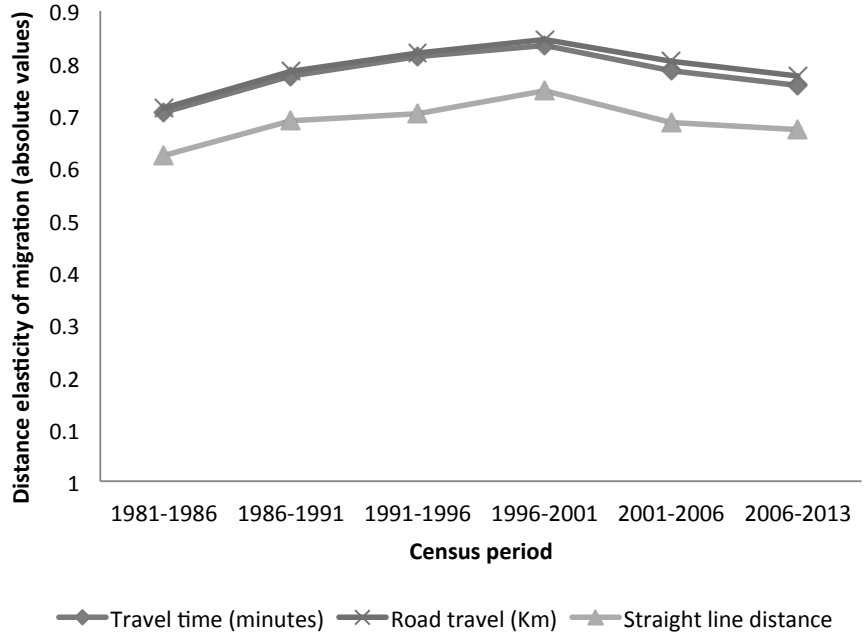
Table 1. Summary statistics by census period

Census Migration Period	*Variable*	*Number of observations*	*Mean*	*Std. Dev.*	*Min*	*Max*
1981-1986	Population (P_i and P_j)	40	23,890	28,335	1,821	113,250
	Inter-urban migr. (M_{ij})	1,560	81	311	0	6,648
	All migration (M_{ij})	NA	NA	NA	NA	NA
1986-1991	Population (P_i and P_j)	40	26,373	32,003	2,484	129,483
	Inter-urban migr. (M_{ij})	1,560	89	364	0	7,647
	All migration (M_{ij})	1,722	259	1,177	0	24,846
1991-1996	Population (P_i and P_j)	40	29,614	37,318	3,879	155,658
	Inter-urban migr. (M_{ij})	1,560	86	361	0	7,197
	All migration (M_{ij})	1,722	250	1,196	0	26,814
1996-2001	Population (P_i and P_j)	40	31,138	40,337	4,185	168,867
	Inter-urban migr. (M_{ij})	1,560	95	400	0	8,289
	All migration (M_{ij})	1,722	309	1,550	0	29,817
2001-2006	Population (P_i and P_j)	40	33,037	44,137	4,098	184,146
	Inter-urban migr. (M_{ij})	1,560	99	436	0	9,393
	All migration (M_{ij})	1,722	335	1,738	0	37,551
2008-2013	Population (P_i and P_j)	40	33,550	45,589	3,732	193,188
	Inter-urban migr. (M_{ij})	1,560	92	440	0	8,937
	All migration (M_{ij})	1,722	330	1,744	0	32,430
Time invariant measures						
	Straight line distance in kilometres D_{ij}^{Skm}	1560	417	284	12	1288
Time variant measures						
	2013 Travel time in minutes D_{ij}^{Min13}	1,560 (600)	481 (553)	346 (357)	14 (41)	1,440 (1440)
	2013 Road Travel distance in kilometres D_{ij}^{Km13}	1,560 (600)	568 (649)	391 (406)	10 (48)	1,784 (1784)
	1984 Travel time in minutes D_{ij}^{Min84}	600	757	465	55	2,035
	1984 Road Travel distance in kilometres D_{ij}^{Km84}	600	664	414	50	1,852

Observations for population are those for 40 urban areas. For migration flows and distance measures, there are 1,560 (=40*39) observations, i.e. the origin-destination pairs formed from these 40 areas. Current travel time in minutes and current road travel distance in kilometres are distance measures between origin and destination obtained from Google Maps in 2013 (except for Queenstown and Rangiora which were obtained in 2016). The 1984 distance measures are the travel time in minutes and road travel distance in kilometres between origin and destination obtained from the 1984 Mobil map, with data only available for 25 urban areas. Current travel time and distance in parentheses are the corresponding current travel time and distance for the journeys for which travel time and distance were available in 1984.

Three different gravity model specifications, each based on a different measure of distance, were estimated for each of the six censuses from 1986 to 2013 to make a total of 18 regressions. Figure 2 plots the change over time in the distance elasticity of inter-urban migration. The full regressions are reported in Table 2. All the variables are significant at the one per cent level of significance for all time periods. The results from the models show that the specifications with distance measured in minutes yield the best fit. This is plausible given that travel time is economically a better measure of travel cost than travel distance in kilometres. Travel time will reflect the opportunity cost of using that time for other activities. The specification with straight-line distance has the worst fit in terms of migration modelling in all periods, as we would expect.

Figure 2. Estimates of the distance elasticity of inter-urban migration for each five-year period preceding the New Zealand population censuses between 1986 and 2013



In all periods, the absolute value of the distance elasticity of migration is largest when distance is measured in kilometres. However, distance in minutes yields almost identical distance elasticities. Using straight-line distance suggests elasticities that are about 0.1 lower, again as expected. Regardless of the measure of distance, estimates of the distance elasticity of migration show an increase in all pre-census five-year periods between 1986 and 2001 before decreasing subsequently in 2006 and 2013. The rise in the distance elasticity of migration is against the expectation that the greater connectivity between urban areas would have reduced the distance deterrence effect

Table 2. Estimated gravity models (three measures of current distance, six periods)

Variables	*1996-2001*			*2001-2006*			*2008-2013*		
	D_{ij}^{Min}	D_{ij}^{Km}	D_{ij}^{Skm}	D_{ij}^{Min}	D_{ij}^{Km}	D_{ij}^{Skm}	D_{ij}^{Min}	D_{ij}^{Km}	D_{ij}^{Skm}
ln P_i (Population of origin)	0.913*** [0.0182]	0.919*** [0.0184]	0.930*** [0.0201]	0.899*** [0.0178]	0.906*** [0.0180]	0.918*** [0.0200]	0.921*** [0.0182]	0.928*** [0.0185]	0.940*** [0.0208]
ln P_j (Population of destination)	0.914*** [0.0182]	0.921*** [0.0184]	0.931*** [0.0201]	0.936*** [0.0178]	0.944*** [0.0180]	0.954*** [0.0200]	0.922*** [0.0182]	0.930*** [0.0185]	0.941*** [0.0208]
ln D_{ij}^{Min} (Travel time in minutes)	–0.706*** [0.0205]			–0.775*** [0.0200]			–0.813*** [0.0207]		
ln D_{ij}^{Km} (Travel time in kilometres)		–0.714*** [0.0213]			–0.784*** [0.0209]			–0.819*** [0.0216]	
ln D_{ij}^{Skm} (Straight line distance)			–0.623*** [0.0237]			–0.690*** [0.0236]			–0.703*** [0.0249]
Constant	–10.37*** [0.286]	–10.31*** [0.291]	–11.25*** [0.314]	–10.17*** [0.281]	–10.10*** [0.287]	–11.10*** [0.314]	–10.31*** [0.290]	–10.27*** [0.297]	–11.39*** [0.330]
Observations	1,560	1,560	1,560	1,560	1,560	1,560	1,560	1,560	1,560
R-squared	0.808	0.804	0.766	0.823	0.818	0.776	0.819	0.812	0.762

Standard errors in brackets
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 2. *(continued)*

Variables	*1996-2001*			*2001-2006*			*2008-2013*		
	D_{ij}^{Min}	D_{ij}^{Km}	D_{ij}^{Skm}	D_{ij}^{Min}	D_{ij}^{Km}	D_{ij}^{Skm}	D_{ij}^{Min}	D_{ij}^{Km}	D_{ij}^{Skm}
ln P_i (Population of origin)	0.883*** [0.0173]	0.890*** [0.0176]	0.900*** [0.0197]	0.931*** [0.0166]	0.937*** [0.0167]	0.947*** [0.0190]	0.944*** [0.0168]	0.950*** [0.0168]	0.959*** [0.0188]
ln P_j (Population of destination)	0.937*** [0.0173]	0.944*** [0.0176]	0.954*** [0.0197]	0.831*** [0.0166]	0.838*** [0.0167]	0.846*** [0.0190]	0.844*** [0.0168]	0.851*** [0.0168]	0.858*** [0.0188]
ln D_{ij}^{Min} (Travel time in minutes)	–0.834*** [0.0201]			–0.786*** [0.0197]			–0.757*** [0.0200]		
ln D_{ij}^{Km} (Travel time in kilometres)		–0.845*** [0.0209]			–0.804*** [0.0203]			–0.775*** [0.0206]	
ln D_{ij}^{Skm} (Straight line distance)			–0.747*** [0.0239]			–0.687*** [0.0236]			–0.673*** [0.0235]
Constant	–9.928*** [0.278]	–9.840*** [0.284]	–10.85*** [0.315]	–9.639*** [0.268]	–9.510*** [0.271]	–10.60*** [0.305]	–10.24*** [0.270]	–10.11*** [0.273]	–11.08*** [0.302]
Observations	1,560	1,560	1,560	1,560	1,560	1,560	1,560	1,560	1,560
R-squared	0.831	0.826	0.780	0.829	0.828	0.776	0.827	0.826	0.783

Standard errors in brackets
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

over time. We would expect the declining cost and increasing quality of internet-based information exchange to have lowered job and housing search costs and also the psychic cost of being away from one's family and friends. The distance elasticity of migration did decrease between 2001 and 2013, but over the whole 1986-2013 period the elasticity increased in absolute value for all three measures. Two effects may work here in opposite direction. There are strong agglomeration forces at work in New Zealand that have led to relatively fast population growth in the largest city, Auckland, which accounts for about one third of the population. Hence the growth in Auckland's share of the total population would have increased the estimated distance deterrence effect. On the other hand, relatively fast income growth outside Auckland and Wellington after 2001 (see e.g. Alimi *et al.*, 2016) could be responsible for the decline in the estimated elasticity post 2001.

As shown earlier, distance measured in minutes provides the best fit in the gravity model compared with the other two measures. However, travel time and road distance between places are not constant over time. Improvements in transportation technology, new roads and changes in government legislation, such as maximum speed limits, do affect travel time and road distance between places. We examine evidence on the effect of changing distances between specific origin-destination pairs over time, using historical and current road travel distance information. During the decades that correspond to the available migration data there have in fact been significant changes in some road distances and travel times. For example, the 793 km journey from Whangarei to Wellington which currently takes around 9 hours 23 minutes (based on 2013 information) was an 839 km journey that took 15 hours 5 minutes in 1984. For the 600 origin-destination pairs for which we have comparable data, there was about a 30 percent average decline in travel time between 1984 and 2013. It is important to see whether such improvements actually matter for migration. Pooling the 1986-1991 and 2008-2013 migration flows data, as well as the roughly corresponding 1984 and 2013 distance data, we have 1200 observations with which we can run the following two-wave fixed effects panel model regressions (one for distance in time and one for distance in kilometres):

$$\ln M_{ijt} = \delta_* + \alpha_* \ln P_{it} + \beta_* \ln P_{jt} - \gamma_* \ln D_{ijt} + \theta_{ij} + \mu_t + \varepsilon_{ijt} \tag{7}$$

The results from these two regressions are presented in Table 3.

The results do not show evidence that reductions in distance (time or kilometres) have increased migration flows. The coefficient on both time-varying measure of distance is even positive, albeit not statistically significant at the 5 per cent level. These results imply that the improvements in connectivity brought about by factors such as upgraded road infrastructure, advances in transportation technology and increases in highway speed limits have not led to increased migration flows. This result is indicative that there could be other factors at work, such as changes in commuting behaviour —with improved connectivity leading to increased long-distance commuting instead of encouraging migration. In any case, the positive distance coefficients in Table 3 are consistent with the upward trend in distance deterrence in Figure 2.

Table 3. Fixed effect model estimating the effect of time variation in distance measures

Variables	*Log of migration flows*	*Log of migration flows*
ln P_i (Population of origin)	1.132*** [0.0913]	1.132*** [0.0914]
ln P_j (Population of destination)	0.695*** [0.0913]	0.694*** [0.0913]
ln D_{ij}^{Min} (Time varying measure of distance-Minutes)	0.111 [0.189]	
Time dummy (μ_t)	–0.533*** [0.0748]	–0.570*** [0.0375]
ln D_{ij}^{Km} (Time varying measure of distance-Kilometres)		0.0231 [0.255]
Constant	–15.06*** [1.765]	–14.49*** [2.077]
Observations	1,200	1,200
R-squared	0.312	0.312
Number of origin-destination pairs	600	600
Fixed effect	Yes	Yes

Standard errors in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Given the rapid growth in international migration throughout the world, an increasingly important question is the extent to which such gravity models of internal migration are affected by concurrent international migration flows. As noted earlier, New Zealand provides a good case study to investigate this given that one quarter of its population is foreign born. To ensure that all forms of migration are accounted for, we also simultaneously consider migration from and to rural areas. We estimate the effect of urban population push and pull on international and rural-urban migration by means of Eq. (5). The results are reported in Table 4. For brevity, we restrict this estimation to the case of travel distance measured in minutes[9]. Note that, by design, the coefficients related to inter-urban flows, i.e. the coefficients of $U_{ij} \ln P_i$, $U_{ij} \ln P_j$ and U_{ij} and $U_{ij} \ln D_{ij}^{Min}$ are the same as the corresponding ones in Table 2 (see also Eq. (6)). These are therefore not further discussed here.

By design, the case of all dummy variables being set to zero refers to the migration from abroad to rural areas and vice versa. For example, the predicted value of these two flows is about $e^{9.784} = 17{,}748$ over the 1986-1991 period[10]. $E_{ij} \ln P_i$ and O_{ij}

[9] Results of the regressions for the other measures of distance are available from the authors upon request.

[10] The predicted value of net migration between abroad and rural areas is in this model zero.

Table 4. The impact of incorporating international and rural-urban flows

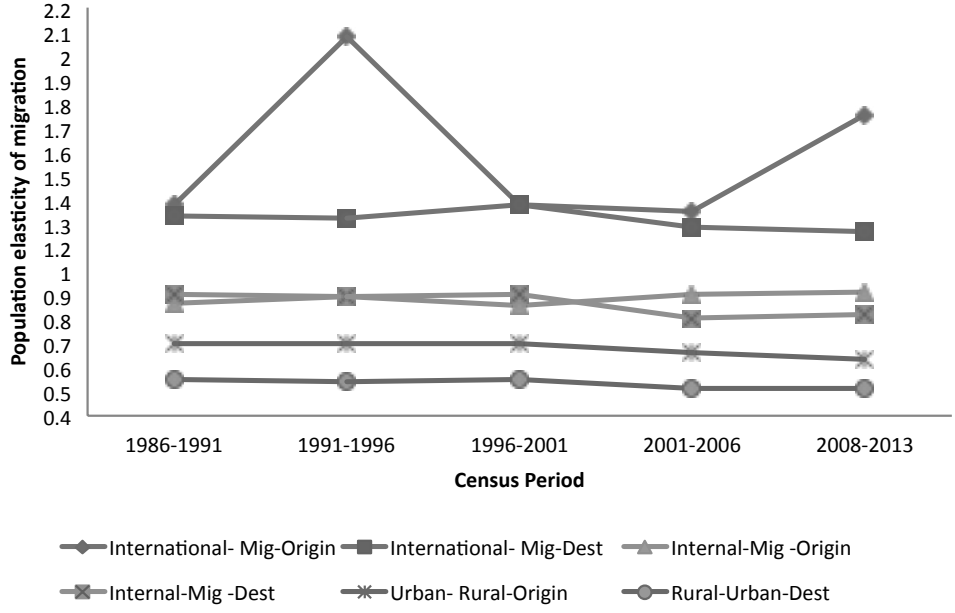
Variables	*1986-1991*	*1991-1996*	*1996-2001*	*2001-2006*	*2008-2013*
U_{ij} ln P_i (Origin pop. in inter-urban migration)	0.899*** [0.0172]	0.921*** [0.0195]	0.883*** [0.0168]	0.931*** [0.0161]	0.944*** [0.0174]
E_{ij} ln P_i (Origin pop. in emigration)	1.330*** [0.107]	2.073*** [0.121]	1.328*** [0.105]	1.301*** [0.101]	1.726*** [0.108]
O_{ij} ln P_i (Origin pop. in urban to rural migr.)	0.719*** [0.107]	0.717*** [0.121]	0.717*** [0.105]	0.679*** [0.101]	0.648*** [0.108]
U_{ij} ln P_j (Destination pop. in inter-urban mig)	0.936*** [0.0172]	0.922*** [0.0195]	0.937*** [0.0168]	0.831*** [0.0161]	0.844*** [0.0174]
I_{ij} ln P_j (Destination pop. in immigration)	1.286*** [0.107]	1.272*** [0.121]	1.332*** [0.105]	1.231*** [0.101]	1.211*** [0.108]
R_{ij} ln P_j (Destination pop. in rural to urban)	0.555*** [0.107]	0.547*** [0.121]	0.564*** [0.105]	0.516*** [0.101]	0.517*** [0.108]
U_{ij} ln D_{ij}^{Min} (Travel time in minutes)	–0.775*** [0.0194]	-0.813*** [0.0222]	–0.834*** [0.0194]	–0.786*** [0.0191]	–0.757*** [0.0207]
Intercept terms					
Constant	9.784*** [0.498]	9.629*** [0.568]	9.788*** [0.497]	9.621*** [0.489]	9.878*** [0.531]
U_{ij} (Inter-urban dummy)	–19.95*** [0.568]	–19.94*** [0.647]	–19.72*** [0.565]	–19.26*** [0.554]	–20.12*** [0.600]
E_{ij} (Emigration from urban area dummy)	–15.96*** [1.151]	–24.86*** [1.313]	–15.77*** [1.137]	–15.64*** [1.102]	–20.19*** [1.187]
O_{ij} (Urban to rural migration dummy)	–9.720*** [1.151]	–9.628*** [1.313]	–9.823*** [1.137]	–9.160*** [1.102]	–9.257*** [1.187]
I_{ij} (Immigration to urban area dummy)	–15.53*** [1.151]	–15.12*** [1.313]	–15.93*** [1.137]	–14.32*** [1.102]	–14.54*** [1.187]
R_{ij} (Rural to urban migration dummy)	–8.290*** [1.151]	–8.262*** [1.313]	–8.450*** [1.137]	–7.731*** [1.102]	–8.178*** [1.187]
Observations	1,722	1,722	1,722	1,722	1,722
R–squared	0.880	0.850	0.887	0.888	0.874

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

ln P_i measure the *push* effect of origin urban population on emigration and urban to rural migration respectively. Similarly, I_{ij} ln P_j and R_{ij} ln P_j estimate the *pull* effect of destination urban population on immigration and rural to urban migration respectively. The coefficients of O_{ij} ln P_i (urban to rural migration) are much larger than their inward migration counter-parts (i.e. the coefficients of R_{ij} ln P_j). The coefficients of E_{ij} ln P_i (emigration from urban areas) and I_{ij} ln P_j are roughly the same, except

between 1991 and 1996 and between 2008 and 2013[11]. The urban population elasticities of migration are shown in Figure 3.

Figure 3. Origin and destination urban population elasticity of migration for international, inter-urban and urban-rural flows



Several conclusions can be drawn from Figure 3. Firstly, comparing large urban areas with small urban areas (in terms of population), the former experience relatively more migration *to* rural areas and relatively less migration *from* rural areas than the latter (because the estimated coefficients of origin urban population in urban to rural flows are always much larger than those of destination urban population in rural to urban flows). Secondly, the population elasticities of inter-urban migration are always larger than those of urban-rural migration. Hence, larger urban areas generate relatively more inter-urban than urban-rural migration than smaller urban areas. Thirdly, international migration is even more selective of population size, with the largest urban areas generating relatively much more international migration than inter-urban (or rural-urban) migration. This selectivity of migration, with the greatest cross-border mobility rates observed in the large metropolitan areas is a well-known phenomenon globally (e.g. Gorter *et al.*, 1998).

[11] This means that emigration has been disproportionally more common among the larger urban areas in 1991-1996 and 2008-2013 than among the smaller urban areas. While we should avoid a temporal interpretation of changes in coefficients estimated with successive waves of cross-sectional migration data, it is worthwhile to note that New Zealand has experienced much greater temporal volatility in emigration, relative to population, than in immigration (see e.g. Cochrane and Poot, 2016).

3. Gravity model and subnational population projections

We saw in the previous section that, once correctly calibrated, a simply gravity model is a very effective means of describing patterns in observed gross migration flows. It links populations of subnational areas at the beginning of a period with subsequent inward and outward migration. It is therefore not surprising that the gravity model has been increasingly applied to international migration flows (e.g., Ramos, 2016; Beine *et al.*, 2016; Karemera *et al.*, 2000) while the model continues to be applied to internal migration flows (e.g., Etzo, 2011; Peeters, 2012). While the literature makes it clear that there continue to be econometric challenges once researchers move to more advanced versions of the model that include systemic and dynamic effects combined with many push and pull factors, and spatial spillovers, a relatively underexplored topic is the role which the model might have in a multi-regional population projections methodology. In this section we argue that the gravity model of gross internal migration may be helpful to improve subnational population projection methodologies. International flows and rural-urban flows can also be taken into account as specified in Eq. (5).

The most common method employed for projecting the population (at both the national and subnational levels) is the cohort component model, dating back to the work of Whelpton (1928). The cohort-component model is a stock-flow model that is based on the following fundamental «accounting identity» of population growth:

usually resident population in area *i* at the *end* of year *t*
= usually resident population in area *i* at the *beginning* of year *t*
+ births to mothers residing in area *i during* year *t*
– deaths of residents of area *i during* year *t* (8)
+ inward migration from other regions and from overseas into region *i during* year *t*
– outward migration of residents from area *i* to other regions or to overseas *during* year *t*)

By applying assumed fertility, mortality and migration rates for each of the components (usually by age and sex), the model is then run sequentially one year at a time to project the future population of area *i*. Cohort component models are widely employed because of their simplicity and because they require only projections of future fertility (usually based on an assumed future overall total fertility rate and age-specific fertility profiles), future mortality (usually based on assumed future life expectancy and age-specific survivorship rates), and future migration (either in-migration and out-migration separately, or net migration —and in both cases with either internal and international migration separately or combined).

With respect to migration, the «conventional» method for projecting future migration at both the national and subnational levels —used by Statistics New Zealand and by many other national statistics agencies— is to assume a certain *level* of net migration in each area in each future year (or five- or ten-year period). This level, plus an assumed age-sex distribution, can be varied across several population projection

scenarios. A net migration level approach helps to ensure that net migration in subnational areas satisfies the «adding-up constraint», i.e. that the sum of net migration of all areas considered is equal to the overall net migration at the national level (which is, by definition, zero for net internal migration in a country). This constraint is necessary because statistical agencies usually adopt a top-down projections approach, whereby the national-level population projection is estimated first, before the set of subnational projections. This approach ensures that the sum of projected subnational populations is indeed equal to the projected national population.

The disadvantage of this conventional method is that it does not take account of the fact that the *volume* of net migration is likely to be related to the *size* of the population, as can be easily seen by combining Eqs. (1) and (3) above. An alternative approach, which explicitly captures this effect, is to project net migration in the form of net migration rates, either at the level of total population or at the level of individual age groups (e.g. Cameron and Poot, 2010; 2011; Cameron *et al.*, 2007). However, the use of net migration rates is problematic for at least two reasons. First, the denominator in the net migration rate is the population of the projected area —for out-migrants this is their origin, but for in-migrants it is their destination— which presents a problem of theoretical inconsistency given that origins and destinations have different roles to play in migration processes, as we saw in the previous section. Second, the net migration rate is silent as to the sources of in-migration (or destinations of out-migration) and is insensitive to changes in surrounding populations which might be expected to impact on migration to and from the area of interest. It is precisely for such reasons that Rogers (1968) developed multiregional mathematical demography with a focus on events and populations that are exposed to the *risk* of experiencing them. Thus, Rogers (2015: 111) notes that «there is no such individual as a net migrant, and attempts to explain the behaviour of net migrants are likely to lead to misspecified models and biased findings».

Gravity models offer a way of explicitly capturing the influence of the source and destination of in-migration and out-migration respectively. This is important because end users of population projections are increasingly concerned about the «black box» nature of forecasting, and want reassurance that models are capturing the underlying dynamics of population change in their areas. In our experience, both the conventional method and the net migration rates method have been unable to fully satisfy end users in this regard.

Integrating a gravity model within a population projection modelling framework is a relatively straightforward exercise. Historical data are first used to parameterise the model, as in the previous section. In the simplest of gravity models, this requires only data on origin-destination migration flows, population, and distance. The model can also be extended to include other variables of interest known to influence migration flows, such as income, unemployment rates, migrant stocks, climate, and so on (e.g., see Piras, 2016; Aldashev *et al.*, 2014). The key constraint to using such additional variables in an augmented gravity model is that in order to derive population projections from the model, forecasts (or assumptions about the future values) of these additional variables will be required.

Then, in each time-step of the projections, the origin and destination populations and distance, as well as any other variables included in an augmented gravity model, are used to project dyadic migration flows (from origin to destination). The sum of in-migration flows minus the sum of out-migration flows obtained from the gravity model is net migration. The ability to project directional migration flows, as well as to pinpoint the specific push and pull factors driving those flows (through the parameters in an augmented gravity model), is useful in achieving «buy-in» from the end users of population projections, since it avoids to some extent the «black box» problem noted earlier.

International migration should also be incorporated explicitly in the multi-regional population projection system. The internal migration matrix is then augmented by a row of regional immigration and a column of regional emigration (see Figure 1). The projected gross internal migration matrix has by definition the property that when adding across all rows and columns, net internal migration is zero for the country. By contrast, the cross-regional sum of emigration in developed countries is of course usually much less than the cross-regional sum of immigration, given that most developed countries gain population through international migration. In a multi-regional projection system immigration can either be exogenously set (which is reasonable when there are strict controls of external borders) or modelled in some way [12]. Emigration can be projected by sub-group specific rates.

To account for differences in migration propensities and spatial distribution by age groups, two approaches are possible. The first is to estimate a gravity model for the entire population and then apply an assumed age profile to inward and outward migration in each of the regions. The age profile is likely to be different for in-migration as compared with out-migration (e.g., consider the difference between the ages of in-migrants and out-migrants in a university town), or might be different for different origin-destination combinations (e.g. consider the difference between the typical ages of rural-urban migrants and rural-rural migrants). The age profiles need not be static over time and may instead be projected as well.

The alternative approach is to estimate gravity models for separate age-sex groups. To our knowledge, this approach has not been attempted. Given that it is likely that different age-sex groups are influenced differently by push and pull factors, this approach offers some promise for improvements in the quality of population projections. Of course, the greater the level of disaggregation of population, the greater the need to account for zero flows in a statistically satisfactory manner.

A number of further extensions are possible. Projecting migration flows by education level is certainly possible, and given that fertility rates are closely related to education levels, projections of migration flows by education level are potentially important (e.g. see the recent work on international migration by level of educational

[12] See e.g. Gorbey *et al.* (1999) for a New Zealand application. The assumption of exogenous levels of immigration is of course relatively more realistic for a remote island nation like New Zealand than for, e.g. the case of the European Union, as the situation regarding refugee migration in recent years has made very clear.

attainment by Samir and Lutz, 2015; and Samir *et al.*, 2010). Push and pull factors are likely to differ between groups with different levels of educational attainment, so augmented gravity models of education-level-specific migration flows offer much promise.

Another promising extension of gravity models is the projection of multi-regional ethnic populations. Ethnic population projections present a challenging case because, unlike race, ethnicity is a fluid concept (Burton *et al.*, 2010). Hence in this case both spatial migration (from origin to destination) as well as inter-ethnic mobility (as people change their ethnic affiliation) should be taken into account in principle. In fact the gravity property may even have some predictive power in the context of inter-ethnic flows (although the situation is different from that of spatial movement in that individuals may have multiple ethnicities but are usually assigned to only one location). In any case, the appropriate measurement of the 'distance' between different ethnicities remains a major challenge, although some progress has been made in recent years (e.g. Wang *et al.*, 2016). Of course, explicit measures of either spatial or ethnic distance do not need to be observed if such distances are time invariant and successive flow matrices are observed. In that case transition probabilities can be calculated either deterministically or by means of fixed effects models. Using the latter approach, the proposed methods have much in common with those of multi-regional mathematical demography (Rogers, 2015). Overall, gravity models offer a highly promising avenue for improving population projection methodology. In our experience, end users appreciate the greater depth of understanding that these models provide.

4. Retrospect and prospect

In this paper we have reviewed how a common workhorse of regional science, namely the gravity model of spatial interaction, continues to be a very effective means of describing gross flows of human migration. Indeed, the gravity model of migration flows has seen somewhat of a comeback in recent years after it was relegated to a less prominent role during the years in which microdata on population mobility became more readily and comprehensively available. A quick check with Google Scholar shows that the number of papers with «gravity model», or «gravity» and «migration», in the title increased by more than 40 percent in the first half of this decade, as compared with the second half of the previous decade[13].

This increasing interest in the gravity model is not surprising given the growth in availability of dyadic flow data, for example in international migration, but also in long-distance commuting, temporary worker flows and student mobility. Statistically, the development of estimation techniques that account for spatial correlation in

[13] Of course, some of these papers focus on trade or investment flows rather than migration. The increasing popularity of gravity models in economics undoubtedly applies to all kinds of flows (see also Ramos, 2016).

spatial interaction matrices (as reviewed e.g. by Patuelli, 2016) may have provided an impetus for new work in this area too.

When estimating an internal migration gravity model for New Zealand, we have found that, perhaps counter-intuitively, distance deterrence has increased over time and we hold agglomeration forces predominantly responsible for this result. At the international level, the trend in the distance deterrence parameter is yet to be assessed. It may well be that the impact of the sharply declining real cost of air travel and communications leads to a growing global dispersion of international migrants and hence, a smaller value of the parameter. On the other hand, regionalism in spatial interaction generally and regional concentration of migration in Europe and the Middle East in particular —such as resulting from the explosive growth in refugee migration in recent years— may well result in an increasing value of the distance deterrence parameter.

As we have argued in this paper, there are three areas where future developments of the gravity model of migration would appear to be particularly promising. One is the linking of migration matrices of cross-border flows and internal flows. The second is the embedding of gravity models in multi-regional population projection systems. The third is the further development of spatial econometric interaction models.

Nonetheless, significant challenges remain. Firstly, the growing complexity of spatial mobility, in which individuals may have more than one residence (think e.g. of children in families with separated parents or older couples with a second home abroad) requires a fresh approach to the notions of residence, mobility and transitions (see also e.g. Poot, 2015). Secondly, the greater availability of very rich mobility data (both in terms of personal characteristics and temporal-spatial patterns of movement) begs the question of the desirable level of disaggregation in gravity modelling. Clearly, disaggregation by migrant type and for small areas would lead to very large migration matrices that may contain many cells with a migration count of zero. Count models that explicitly allow for an inflated number of zeros are essential in that context (see e.g. Burger *et al.*, 2009). However, we would not expect such a model to be appropriate for embedding in small area population projection methodologies, for which a range of other approaches are available such as microsimulation and time-series modelling (see e.g. Wilson and Bell, 2011). In a sense, we could argue that —as in physics— there is as yet no unified theory that captures behaviour both at the very small level as well as at the macro level!

A third challenge will be to revisit systemic approaches, both from the theoretical perspective and from the statistical perspective. Path-breaking exploratory work with spatial econometric interaction models can already be found in LeSage and Pace (2009), but the extension of this work to systemic models, such as Alonso's (1978) theory of movements, are still to be explored, particularly in a dynamical setting. A difficulty in this area is the high dimensionality of the parameter space, given that n dyadic flows may generate up to n^2 potential spatial spillover terms even in the simplest setting. Applications of spatial econometric interaction models are likely to take off once estimation techniques become embedded in common statistical soft-

ware such as *Stata* or *R*. In this context, the increased availability of network flow measures, such as internet or phone traffic, may open up opportunities to examine dyadic factors other than distance. Migration flows may vary with the strength of interactions, or socio-economic similarity, in ways not captured by standard distance metrics (Beine *et al.,* 2016).

In conclusion, the gravity model of migration may be expected to have many more years of vitality left — both in terms of contributing to a better understanding of human mobility processes, as well contributing to enhanced population projection procedures.

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Section ARTICLES

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Afterthoughts on urban economic theory and its focus

Roberto Camagni *

ABSTRACT: An interesting part of the present scientific debate in urban economics concerns the appropriateness of some theoretical —and consequently empirical— definitions of the city and its role, underlining the reductive character of purely functional approaches in terms of agglomeration economies. Many scientific achievements have been attained exploiting the virtues of these approaches, residing in their strong internal consistency (within their logical assumptions) and sophisticated formalization. What appears to be left is the inspection of the true nature of cities, going far beyond their agglomerated physical form and the consequent benefits on transactions and communications.

The paper suggests that the geographical-functional approach should be complemented by two other approaches, implicit in classical economics and in evolutionary economic theory, which allow the inspection and (perhaps) a proper interpretation of other constituents of the nature of cities: what I call the relational-cognitive approach —interpreting the city as a cognitive *milieu*, generating knowledge, creativity and innovation— and the hierarchical-distributive one, interpreting the relationships with the non-city, the «countryside» of classical economists, in terms of control and monopolistic determination of relative prices. The former approach looks at the intrinsically generative role of the city and its capability of developing continuously new activities and functions; the latter at power relations on space and control on income distribution.

If the functional approach looks nowadays quite consolidated, the cognitive one needs still in depth reflections, as it implies the (at least partial) abandonment of methodological individualism that permeates neoclassical economics, with the advantage of better utilizing the conceptual achievements of other social disciplines. On the other hand, the hierarchical and distributive approach looks today quite unexplored.

At the end, a tentative, formalized model of agglomeration economies is presented, with the goal of stimulating the attention on the empirical measurement of the effects of the cognitive and control roles of the city. Two main open issues emerge, both referring to income distribution: how are the advantages of increasing returns to urban scale being distributed among the internal production factors (and urban social classes, including land owners) and how could we measure the urban power in terms of income distribution in space.

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JEL Classification: R10; R12; O49; O31, B51.

Keywords: Urban economics; functional approaches; relational-cognitive approach; hierarchical-distributive approach; creativity; income distribution; urban power.

RESUMEN: Un interesante aspecto del actual debate científico sobre economía urbana se refiere a la apropiación de algunas definiciones teóricas —y en consecuencia, empíricas— de la ciudad y de su papel, señalando al mismo tiempo el carácter reductivo de las aproximaciones puramente funcionales en términos de economías de aglomeración. Muchos resultados científicos se han logrado explotando las virtudes de estas aproximaciones funcionales, basándose en su fuerte consistencia interna (a partir de sus lógicas restricciones) y su sofisticada formalización. Lo que parece que se ha olvidado es la toma en consideración de la verdadera naturaleza de las ciudades, yendo mucho más allá de su forma de aglomeración física y de los consecuentes beneficios en relación con las transacciones y las comunicaciones.
El artículo sugiere que la aproximación geográfico-funcional debería complementarse con otras dos aproximaciones, implícitas en la economía clásica y en la teoría económica evolucionaria, que permiten la investigación y (quizá) la adecuada interpretación de otros aspectos que constituyen la naturaleza de las ciudades: lo que yo llamo la aproximación cognitiva-relacional —interpretando la ciudad como un *milieu* de conocimiento, generador de pensamiento, creatividad e innovación— y la aproximación jerárquico-distributiva, interpretando las relaciones con la no-ciudad, el *countryside* o área rural del entorno de los economistas clásicos, en términos de control y de determinación monopolística de los precios relativos. La primera de estas aproximaciones se fija en el papel intrínsecamente creativo de la ciudad y en su capacidad para desarrollar de forma continua nuevas actividades y funciones; la segunda pone su atención en las relaciones de poder en el espacio y de control sobre la distribución de la renta.
La aproximación funcional se encuentra actualmente muy consolidada, pero la cognitiva todavía necesita algunas reflexiones en profundidad puesto que implica (al menos de forma parcial) abandonar el enfoque metodológico individualista de la economía neoclásica, con la ventaja de utilizar mejor algunos logros conceptuales procedentes de otras disciplinas sociales. Por otra parte, la aproximación jerárquico-distributiva todavía se nos presenta hoy como bastante inexplorada.
El artículo incluye al final, a modo de tentativa, un modelo formalizado de economías de aglomeración, con objeto de estimular la atención hacia las mediciones empíricas de los efectos de los roles cognitivo y de control de la ciudad. Dos importantes problemas abiertos surgen a raíz de este ejercicio, ambos referidos a la distribución de la renta: cómo son las ventajas de los rendimientos crecientes a escala urbana que se distribuyen entre los factores de producción internos (y entre la clases sociales urbanas, incluyendo a los propietarios del suelo), y, por otra parte, cómo sería posible medir el poder urbano en términos de distribución espacial de la renta.

Clasificación JEL: R10; R12; O49; O31, B51.

Palabras clave: Economía urbana; aproximación funcional; aproximación cognitiva-relacional; aproximación jerárquico-distributiva; creatividad; distribución de la renta; poder urbano.

1. Introduction

Along with the new attention to the role of cities in economic development and policy that took place in the last fifteen years, a parallel attention was —hopefully— paid to the urban economics discipline: manuals, handbooks and monographies have flourished in recent time, structuring the underlying theory, enriching the field with new relevant issues and more recently suggesting a necessary reorientation of conceptual and methodological approaches.

Earlier works, at the beginning of this century, were mainly addressing the relatively new theme of urban sustainability, underlining the specificity of the concept with respect to the general accepted definition linked to natural environments (Willis *et al.,* 2001; Paddison, 2001) and sometimes trying to include the theme as a new dimension in self-organizing complex systems analysis (Bertuglia *et al.,* 1998). Later on it was the turn of a new general issue, namely the role of cities in the new globalization era (Scott, 2001; Taylor *et al.,* 2007), while other contributions tried to include new conceptual approaches coming from other, less formalised disciplines, particularly geography, sociology and planning, pointing out the fruitful results that could derive from a scientific convergence among differentiated conceptual and methodological codes (Capello and Nijkamp, 2004 and 2009; Capello, 2015).

In more recent years, a dichotomy is emerging between contributions that bring the application of mainstream economic tools to a huge sophistication level (Duranton *et al.,* 2015) and some critical contributions emphasising new conceptual roles of the urban «milieu», residing in creativity-enhancing and knowledge creation (Fusco Girard *et al.,* 2011; Cusinato and Philippopoulos-Mihalopoulos, 2016). These latter contributions, which were accompanied by many critical and innovative reflections on the conceptual and methodological side, imply a relevant turn in the way the city is interpreted in economic terms: the functional approach to the city that is typical of mainstream spatial economics and of economic geography, both old and «new», should be at least complemented by a cognitive approach acknowledging the specific and non-mediated role of the city as a collective learning device, producer of knowledge, codes and symbols.

This turn is by no means simple or straightforward: in fact it does not only imply a change of research perspective but rather a change in a basic credo and epistemological habit of (mainly neoclassical) economists —the ones that reached the highest scientific achievements in urban location theory in the last fifty years—: the abandonment of methodological individualism and the acknowledgement of the existence and theoretical relevance of collective agents (like the city). Furthermore, such a paradigm shift could be achieved not just showing a necessary new logical pathway but building along it a set of consistent new axioms, concepts, theories and formalisations liable to empirical testing.

Since the appearance of regional science as an autonomous discipline, many intuitions and conceptual proposals can be found, here and there in a casual way, but they did not generate sufficient consensus and above all the inter-disciplinary cooperation that is a necessary precondition for a paradigmatic advancement. No academic or research center could claim today to be the depositary or the hub for the development

of the new paradigm. This could be one of the main research challenge for urban economists in the next years, opening a series of new scientific questions and related sub-fields of inquiry; and this is the main subject of this paper, trying to put together in a logical sense the scattered suggestions that were put forward by many scholars, including myself, and taking inspiration from the fathers of other social sciences and disciplines: great historians, sociologists, geographers and political scientists.

Cities exist since there was history, civilization and progress; we find and found them in all latitudes; the concept, and the archetype of a city is so embedded in our mind and so familiar in daily life that economists for a long time did not pay but rare attention and curiosity to it —preferring to explore the time dimension first rather than the spatial one. They never tried to define the city as a special and specific form of organization of society, or a device, capable of self-organisation, for the achievement of the maximum welfare and development of human society. Was it blindness or humility? Probably both, but what is certain is that economic studies were mainly an application of the methods and tools of economics to the city as an object rather than an inspection of the «urban» as an original organisational model of economic and social activities and an interpretative paradigm of reality (Camagni, 1992, Introduction).

A great historian like Fernand Braudel long ago gave us his relevant conclusion after years of analyses of historical developments: «A city is always a city, wherever located, in both time and space. [...]. Cities speak necessarily the same fundamental language: the continuous dialogue with the countryside, first requirement for daily life; the provision of people [...]; their self-respect and willingness to distinguish from other cities; their necessary position at the center of short and long-distance networks; their relationships with suburbs and other cities» (Braudel, 1979, p. 548, author's translation). Therefore Braudel, accompanied by the entire French school of the *Annales* and by other great historians like Pirenne, Le Goff or Roncayolo, justifies this generalisation concerning the concept of the «urban», against the position of those scholars in love with the specificity of each city, like Abrams (1978: «New York = Timbuctoo?») or of those who more recently claimed that no relevant Marshallian and «milieu» effects come from agglomeration and proximity (Amin and Robin, 1991; Amin and Thrift, 2002). Cities can be assumed as collective (economic) actors and are not the simple result of individual actions oriented towards the individual advantage[1].

But this generalization was never accepted by official economic theory. It is true that great results were achieved by economists inspecting the internal structure of cities and the logics of location of economic and residential activities around an —unexplained— singularity called «center», following the pioneering intuition of Heinrich

[1] Some time ago, justifying the concept of territorial or urban competitiveness, I wrote: «if individual firms and individual people undertake collective activities, facilitated by (and creators of) trust and local social capital; and if significant cognitive synergies, readily apparent in the local *milieu,* result from their various interactions; and finally if these actions and these processes draw additional vitality from cooperation with local public administrations; then it appears justifiable to go beyond methodological individualism —which regards only single firms as operating and competing— arguing the logical validity of a "collective" concept such as that of *territory,* and to affirm that territories compete among themselves, using the creation of collective strategies as their instrument» (Camagni, 2002, p. 2406).

von Thünen; it is true that economists taught planners and sociologists the true nature of urban land rent, which does not depend on land speculation but on locational advantages; but did all this tell us anything at all about the nature of cities? And when the concept of agglomeration economies was coined in order to explain why cities exist, did economists realise that scale economies in the production of goods and public services and «pecuniary» externalities attained through market transactions do not explain the huge gap in efficiency, wealth and dynamism between the very large and the small city? Did economists realise that, considering the city under the form of an agglomeration, they were proposing the same reductionist action put in place when the rich Marshallian and Becattini's concept of industrial district (Becattini, 1979 and 1990) was equated to that of «cluster»?

We owe to cities the idea, and the practice, of civilization, culture, liberty, democracy, modernity: doesn't this suggest us anything concerning the «generative» role of cities? Cities in all times were hosting the crucial functions of the respective social, economic and technological regimes: defense, organization of large public works, administration, astronomy, justice in ancient times; finance, commerce, culture and education afterwards; industry in modern times; headquarter, tertiary and information-intensive functions in the last century; knowledge-intensive, scientific and creative functions nowadays. Isn't this fact something on which an economic analysis, mainly addressing the spatial division of labour and income distribution, could fruitfully intervene?

The inclusion of territorial power and control in the scientific representation of the nature of cities and the related question of income distribution in space —on which some fundamental inspiration comes from some classical economists like Smith and Marx— is the second issue that this paper tries to underline as a crucial task for the incoming years.

The main idea underlying this general reflection is that three methodological approaches have to merge if a non-partial, interpretative picture of the urban realm has to be achieved: the traditional functional-geographical (section 2), the new cognitive-relational (section 3) and the still unexplored hierarchical-distributive ones (section 4). A simple tentative model interpreting agglomeration economies in the wider sense is presented in section 5. The relevance of this research programme does not reside only in abstract scientific advances, but in two potential practical uses: as an orientative compass for the exploration of likely trends in urban structure and performance and as a guide for new consistent policy goals and related tools.

Of course, these afterthoughts are not systematic nor fully consistent, as the main goal is to raise interest and curiosity, not to build a new economic theory of the city.

2. The traditional functional-geographical approach: the city as agglomeration

The functional approach to the nature of cities represents the traditional one, and encompasses both a spatial and a network point of view. In the first case the city is equated to an agglomeration, and agglomeration per se delivers economic advantages

in terms of scale economies and urban externalities. In the second case, the city is perceived as a node, or better an interconnection inside differentiated long distance networks —physical networks, communication networks, cultural and power networks (Camagni, 2001). «One of the central features of urbanization has always been its efficiency-generating qualities via agglomeration» and the fact that «cities have *always* functioned as nodes in systems of long-distance trade» (Scott and Storper, 2014, p. 4).

Agglomeration economies account for the possibility of exploiting scale economies in production and local public services; of developing internal specialization and division of labour; the advantages represented by large local labour markets and those deriving from the presence of numerous sub-contracting and ancillary firms (Krugman, 1991). Beyond that, an urban context supplies easy inter-personal communication possibilities through face-to-face contacts, pecuniary externalities due inter-industry transactions and urbanization economies coming from presence of public goods, services and infrastructure. Density of contacts, proximity and sectoral differentiation, which represent the distinctive characters of cities (Jacobs, 1969), allow information circulation, reduction of transaction costs and consequently enhance productivity of the typically small urban companies; on the other side, global connectivity raises tremendously the effectiveness of the activities involved.

In the course of time, this interpretation of the role of cities in terms of agglomeration economies was partially improved, especially with reference to the component of face-to-face contacts. Roland Artle (1973) presented probably the first model considering the city and its center as a public good characterised by non-excludability and interaction among users, where utility increases with the number of users («sharing-and-interaction»). Glaeser (1999) presented a similar model of urban learning, where people absorb knowledge through contacts with other people working in the same industry, whose probability increases with city size. Storper and Venables (2003) interestingly analyse F-2-F contacts as a communication technology allowing high frequency, rapid feedback, inclusion of visual and body language cues, easier detection of lying, acquisition of shared values; all this allows an easier interpretation of information and enhances the efficiency of transactions, and this is why individuals working in scientific, creative, economic, financial and government fields are eager to enter «the buzz environment» through co-location in cities. Finally, Duranton and Puga (2004) built a micro-founded model of interaction («sharing»), job search («matching») and information flows («learning») in order to explain agglomeration economies. In all cases a conceptual advancement is present, but the link information → knowledge → innovation is not explained and the role of local economic space remains linked to the sum of interacting agents.

All these approaches fail in the interpretation of urban growth and in particular leave us with the —superficial— idea that, in the economics of cities, bigger is always better. Influential scientists and institutions are recently supporting the idea that very large cities, because of the existence of agglomeration economies, present also the highest growth rates, are the true drivers of development and deserve the highest policy support (World Bank, 2009; Glaeser, 2011). When agglomeration economies are assumed to directly lead to urban growth the presence of a logical shortcut is very clear. The superior efficiency and productivity of large cities is totally accepted but it emerges

from a static, or a comparative static, representation: a size derivative, which is different from a time derivative (Camagni *et al.,* 2016). As Henderson (2010) puts it, the «association between urbanization and development [...] is an equilibrium not causal relation» (p. 518) and «urbanization per se does not cause development» (p. 515).

Krugman, trying to justify the equation «superior efficiency → higher growth», refers to the locational choice of the single firms: they will chose to move and locate in large cities rightly because they are more efficient (Krugman, 1991). But also in this case the answer is unquestionable: firms do not decide location on the basis of a differential in gross advantages between the large and the small city, but on the basis of a differential in net advantages, including the higher costs of the large city (Camagni *et al.,* 2016). Net advantages show a much more homogeneous condition throughout the urban hierarchy than gross ones.

The picture that emerges from the functional representation of the city remains intrinsically static, as confirmed by the citation at the beginning of this section, speaking of «efficiency-generating qualities via agglomeration» (p. 4)[2]. Advantages which are attributed to the city emanate directly from the location of activities and urban facilities and from the relative, individual locational decisions. Internal interactions end up in an upgrading of efficiency of individual firms and in the consequent reduction in transaction costs or in pure enlargement of revenues. No generative endogenous process is perceivable, possibly leading to novelty, invention, innovation.

3. The cognitive-relational approach: the city as *milieu*

If urban growth is intended as development, structural change and innovation, there is nowadays sufficient agreement that the city should be analysed as, and equated to, a *milieu* (Camagni, 1991; Rémy, 1999 and 2000; Crevoisier and Camagni, 2000; Cusinato, 2007 and 2016b; Cusinato and Philippopoulos-Mihalopoulos, 2016). In this way in fact static agglomeration externalities become dynamic ones, generating not just a reduction of costs and an expansion of revenues but a reduction of dynamic uncertainty, typical of innovation processes, and an expansion of Schumpeterian profits through novelty, effective entrepreneurship and innovation (Camagni, 1992 p. 63). The approach becomes a cognitive one and the nature of the city turns to a generative one: of creativity, knowledge and socio-cultural innovation.

Two concepts of a *milieu* are present in literature: in sociology and in regional economics. The first is Emile Durkheim's one, where the *milieu* is intended as a device generating original social facts, «an aggregation of individuals that give rise to a psychical individuality of a new kind [...] that acts in a completely different way with respect to its single members» (Durkheim, 1895, p. 101 of Italian edition). Cusinato interprets this definition of a *milieu* as «an institution consisting of values, conventions, norms representations and goals shared inside a local system, generating original behaviours [...] and caracterised by «dynamic density» of social relationships» (Cusinato, 2007, p. 54).

[2] Cusinato (2016a) has underlined this surprisingly traditional approach, which in my opinion represents a step back with respect to other contributions of these authors.

Jean Rémy borrows Durkheim's concept of «dynamic density» in order to explain the urban *milieu*'s potential for the creation and valorization of knowledge: this potential resides in the transmission of formalized information coupled by the access to informal and undetermined information whose pertinent content is unknown ex-ante (Rémy, 1999). The city thus becomes «a specific production unit generating, along original processes, some products in which it maintains a monopoly power»: namely «knowledge», which can be used as «a final consumption good, an investment good or a production factor» (pp. 1 and 2; author's translation). The core process is one of «exploration» and possibly of innovation, when «the city becomes a place of non-intentional convergence among a plurality of individual and collective trajectories ending up in a solidarity of effects» (Rémy, 2000, p. 41). It is important to note that, according to Rémy, learning processes and creation of new codes happen thanks to the plurality and even the conflict among existing and differentiated codes inside the city, given the internal diversity of the city itself (a «*milieu* of *milieux*»). Along similar lines two sociologists stated that the city «produces intelligence: it chokes internal uniformity and develops with the shock of diversity» (Ansay and Schoonbrodt, 1989, p. 18, author's traslation).

In regional science, and referring to a special case of agglomeration, that of local production systems and industrial districts, a *milieu* was defined as a system of actors and activities characterised by a high density of relationships; sharing of languages, behavioural and cognitive codes; sharing of values, representations and sense of belonging. All these characteristics facilitate cooperation, synergies, ex-ante coordination of actors; and most of all generate a reduction of dynamic uncertainty and processes of collective learning (Camagni, 1991; Capello, 1999a)[3].

The generation of these last two dynamic processes represents the conceptual and original role of local economic space. First of all, uncertainty, which pervades and hampers innovation, is reduced through important collective processes: socialized selection, screening and in particular transcoding of information, mainly taking place thanks to F-2-F contacts; ex-ante coordination among actors for the development of «collective actions» (namely the private production of public goods and commons) or for joint projects and investments. The second, intrinsically cognitive role of local space is the hosting of «collective learning» processes that can take place, outside the single firms but embedded in the local context, through internal mobility of skilled labour and the dense cooperation and synergy processes among firms (Camagni, 1991; Capello, 1999b).

The use of these conceptualisations —originally introduced for the interpretation of industrial districts and local production systems— to interpret the urban agglomeration came naturally, given the logical value added provided by the differentiation of urban activities, the nature of «*milieu* of *milieus*» that the city may assume, its «functional» characteristics linked to size and global connectivity (Crevoisier and Camagni, 2000).

Recently, the interpretation of the city as a cognitive *milieu* has been enriched through a hermeneutic approach: the symbolic aspects of the urban context were inspected, underlining the relevance of public physical spaces symbolically recognized

[3] This conceptualization mainly came from what was called «evolutionary regional economics» (Calafati, 2009). See: Camagni, 1991; Capello, 1999a; Crevoisier and Camagni, 2000.

and appropriated by a local community in an identitarian way. This on turn generates enjoyment, emotion, an atmosphere of relationality and even affection and, through this, reflexive forms of learning, creativity and knowledge creation (Cusinato, 2016b).

The highlights of the relational-cognitive approach are sketched in Table 1, together with the other two approaches presented in this paper. As said before, the first

Table 1. The nature and roles of the city: a theoretical taxonomy

Spatial Logic / *Hermeneutic Logic*	*Territorial Dimension*	*Network Dimension*
FUNCTIONAL-GEOGRAPHIC DIMENSION	*CITY AS AGGLOMERATION* — Volume and density of contacts. — Internal heterogeneity. — Specialization. — Concentration of externalities. — Reduction of transaction costs. — Space for selective or casual meetings — Coexistence of interaction and anonymity.	*CITY AS INTERCONNECTION* — Node in multiple and interacting transport, economic and communication networks. — Interconnection between place and node. — Supplier of global connectivity.
RELATIONAL-COGNITIVE DIMENSION	*CITY AS MILIEU* — Relational density, sharing of codes and values. — Sense of belonging, identity. — Substratum for collective learning — Uncertainty-reducing operator through: • Socialized transcoding of information. • Ex-ante co-ordination (collective action). — Image space, shared symbolic representations. — Provoker of enjoyment, affection, emotions. — Enhancer of reflexive forms of learning.	*CITY AS KNOWLEDGE-CREATING MILIEU* — link among global milieus. — creator and global exchanger of symbols, codes, and languages. — city as powerhouse/transformer of internal and external energy. — blending of different forms of knowledge: analytic, synthetic, artistic.
HIERARCHICAL-DISTRIBUTIVE DIMENSION	*CITY AS TERRITORIAL CONTROL* — Capability of continuously recreating crucial, strategic and driving functions. — Construction and maintenance of a monopoly power on urban functions. — Control on spatial division of labour.	*CITY AS CONTROL ON INCOME DISTRIBUTION* — City as control over space and time. — City as symbol of territorial mastery. — Exploitation of monopoly powers on typical urban functions in terms of income distribution.

Source: adapted from Camagni, 2001 and 2016a.

approach, the functional-geographic, is rather traditional and relatively consolidated; the cognitive one is still to be improved and carried out in more depth, especially concerning the critical passage from information to knowledge and to innovation. The third approach, the hierarchical and distributive one remains. Still quite unexplored and looks fertile of potential scientific returns.

4. The hierarchical-distributive approach: the city as territorial control

«The greatest division of material and mental labour is the separation of town and country. This antagonism begins with the transition from barbarism to civilization [...] and runs through the whole history of civilization to the present day» (Marx and Engels, 1970, p. 49). This sentence of the young Marx concerning the «contradiction» between city and countryside looks as the conceptual and theoretical starting point of the third approach to the nature of cities.

Great historians have subscribed to this research programme. Let's read Fernand Braudel once again. Cities «were born from the most ancient, the most revolutionary division of labour: countryside and agriculture on the one side and so-called urban activities on the other»; «cities are kind of electrical transformers: they emphasize tensions, accelerate exchanges, continuously stir human lives» (Braudel, 1979, p. 547; author's translation). Between the two archetypal spaces profound relationships were established, the former providing knowledge and tools, the latter food for the survival of cities, produced beyond the necessities of rural people (Jacobs, 1969).

Marcel Roncayolo follows up, going in depth into the city-countryside relationship: the city is not only, in functional-geographical terms, «the topographic and social device that guarantees the highest effectiveness to exchange among men» but, in economic and hierarchical terms, «presents itself, in different degrees, as the place from which a territorial control is established» (Roncayolo, 1990, p. 27 and 29; author's translation).

These relationships were never just functional ones, of pure technical division of labour. They implied a mutual dependency —for subsistency on the one side and for productivity-enhancing inputs of an institutional, economic and cognitive nature on the other. These bilateral relationships were easily exploited in history by the stronger partner, using military power or more sophisticated economic means (Camagni, 1992, Introduction).

Plato, in his *The Republic,* showed to be perfectly aware of this political issue. As long as the city remained linked to primary needs and activities, an equilibrated functional specialization and exchange with the countryside took place; but when, in the course of time, it became «feverish», turning to secondary needs and developed the full array of service activities, from health to justice, arts and leisure, it needed a wider hinterland to feed its citizens, and consequently it «went to war» (Plato, 1990, p. 62-3). In Marxian terms, the city-countryside relationship turns into a «contradic-

tion» (Friedman, 1969) and economic space becomes a «relational space» of functional but also hierarchical interactions (Camagni, 1980).

In modern times, the use of strength is no more accepted, but the «contradiction» remains and is managed in economic terms, through monopoly power and control on income distribution between the two spatial archetypes. In fact, the privileged condition of the city appears in three different ways: as control-space on the social division of labour; as location of specific, selected and high-ranking activities; as ruling space on income distribution through the determination of the relative prices of urban vs. rural productions (*terms-of-trade*) (Camagni, 1992, Introduction).

According to Adam Smith, the functional division of labour between city and countryside assigns to the city the top directional activities concerning government, order, security and liberty, but also technology, administration and infrastructure management; activities that are at least partially traded against food and row material from the countryside. The public share of these activities is financed through taxation, i.e. through power relationships. The private share - encompassing services addressed to upgrading of rural productivity (or nowadays, of the productivity of decentralized industrial activities), namely technological, organizational, financial and commercial services - finds the rationale for an urban location in its information-intensive and knowledge-intensive nature and is priced through the market; a market, however, particularly sensitive to the scarcity of supply and to monopolistic conditions.

But still in Adam Smith we find a perfect description of the unbalanced fixation of relative prices between city and countryside, taken from the medieval times, witnessing his awareness of the fact that the functional division of labour hides often a hierarchical, unbalanced relationship. «The government of towns corporate was altogether in the hands of traders and artificers, and it was the manifest interest of every particular class of them to prevent the market from being overstocked, [...] which is in reality to keep it always understocked. Each class was eager to establish regulations proper for this purpose, and was willing to consent that every other class should do the same. In consequence of such regulations, indeed, each class was obliged to buy the goods they had occasion for from every other within the town, somewhat dearer than they otherwise might had done. [...] So that in the dealings of the different classes within the town with one another, none of them were losers by these regulations. *But in their dealing with the country they were all great gainers; and in these latter dealings consists the whole trade which supports and enriches every town*» (p. 102, emphasis added...). The inhabitants of a town, being collected into one place, can easily combine together. [...] The inhabitants of the country, dispersed in distant places, cannot easily combine together» (Smith, 1976, pp. 103-104).

Recalling that in all times the city was hosting the strategic and crucial functions, and that this implies not just the capability of retaining these functions but also of continuously recreating and substituting these with new ones, we understand what Braudel sometimes called the «growing tyranny of cities» (Braudel, 1977, p. 16). Can we forecast any sort of possible «vengeance of the countryside», as consequence

of the pervasive, non-space-sensitive effects of information technologies and internet? I personally have doubts on this: the use-capability of information is still very space-selective and the evolutionary process sketched here is destined to be continuously replicated, in space (new forms of the north-south divide) and time (the ongoing revolution of creativity and knowledge-intensive activities). A formalized model illustrating possibilities and conditions for an urban/rural monopoly game on knowledge-intensive functions was built by this author many years ago (Aydalot and Camagni, 1986) and remains one of the few attempts in this direction.

Early evidence on the most recent trends in urban development following the new economic paradigm shift towards creativity, culture and knowledge shows the emergence of an already visible divide in social and also spatial terms. The new cultural and cognitive paradigm which is emerging is generating a new social polarization between a class of workers endowed with intellectual and creative skills, operating on symbols and codes and a class of low-wages manual and service workers (Scott, 2005). In a spatial perspective, this social polarisation may result in the striking confrontation of new rehabilitated and glamour neighborhoods and clusters, hosting creative production activities but also residential, cultural and leisure activities, mainly located in the inner city, vis-à-vis displaced peripheries left in squalor conditions, hosting lower and impoverished lower-middle classes. In other words, the core of the large metropolises, hosting leading edge activities, might shrink in physical size, hugely expanding its wealth, while peripheries might expand and lag behind, crashed between the impossibility of capturing advanced functions and the growing tendency of its recent specialization sectors, namely manufacturing and low quality services, to be transferred off-shore.

The hierarchical and distributive approach to the nature of cities, not sufficiently practiced up to now, raises important questions and problems in terms of its empirical testing. How to measure relative prices (terms-of-trade) between city and countryside, or between urban advanced services and rural industry and agriculture? How to disentangle the effects of the different production mix, in sectoral but also in quality terms, between the city and the non-city? How to separate the pure functional element given by quality of productions —very difficult to measure in the case of services— from the monopoly element acting directly on prices of urban productions? And, at last but more basically, how to define empirically the non-city in a (western) world where more than 80% of population is defined as urban? From which city-size does the distributive-monopolistic effect start?

A first attempt carried out in tentative and first approximation terms is presented in the following section.

5. A tentative model of income distribution in space

The three approaches to the nature and role of cities illustrated before might be synthesized in three elements: typology of productions, quality of productions (cognitive content) and their pricing. Models encompassing in a consistent conceptual framework the three approaches should be built, adequately formalized so that their

predictions could be verified statistically, and econometrically applied to reality. But empirical work is still very scarce on this subject.

A two-space model of trade between city and countryside was already quoted (Aydalot and Camagni, 1987), but it works on an abstract level. A tentative, partial and highly simplified model for an initial empirical investigation is presented here, as follows. A spatial production function is shown, referring the level of GDP of cities in a national context to the traditional factors: fixed capital and labour (K and L), with a term, population (P), indicating the presence of agglomeration economies. This term is divided by C (constant), an element indicating the minimum urban size for the appearance of a superior urban efficiency, that we interpret as a monopoly power of the city in the exchanges with the countryside. Arithmetically P/C is a coefficient: > 1 in case of presence of this distributional power and < 1 in case of dependency; in principle, it should be endogenously estimated by the model (equation 1).

The term A (usable area) has, in our mind, just an econometric meaning, as it avoids possible multicollinearity among the independent variables, and not an economic meaning: it is not meant as the contribution of the land factor to urban production, as land (and land rent) have only a distributive and not a productive role in classical economics. In a moment we will see that it is not easy to get rid of it in the determination of urban output.

$$Y = K^{\alpha} L^{\beta} A^{\gamma} (P/\overline{C})^{\delta} \qquad [1]$$

Unfortunately, this equation cannot be estimated directly, as the C term merges into the constant term and it is not possible to define it endogenously in the present form. An alternative specification of the model in two steps looks more effective (equations 2a and 2b): the contribution of the traditional production factors is estimated first, and the residual (error term, referring to *Y*) is then regressed against population, in search of an evidence of the form of agglomeration economies. The best specification presents *P* at the first, second and third power:

$$\ln Y_r = \text{const.} + \alpha \ln K_r + \beta \ln L_r + \gamma \ln A_r + \ln \varepsilon_r \qquad [2a]$$

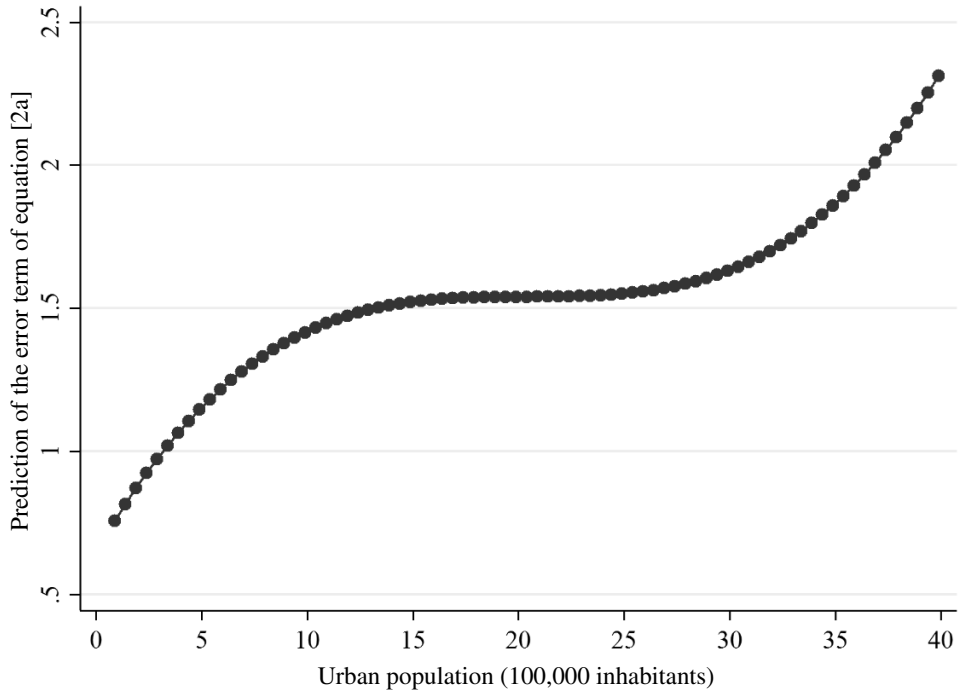
$$\varepsilon_r = \text{const.} + \delta_1 P_r + \delta_2 P_r^2 + \delta_3 P_r^3 + \omega_r \qquad [2b]$$

This model is applied to the Italian metro areas, approximated by Nuts3 regions (provinces)[4]. The results look statistically robust and quite interesting: the entire model shows increasing returns to all factors altogether, decreasing returns to capital and labour and agglomeration economies clearly visible starting from the third quintile (medium-large and large metro areas)[5] (Figure 1).

[4] The model is estimated for year 2006; capital stock is built through the permanent inventory method; economic values are supplied by ISTAT and Eurostat; usable land comes from Corine Land Cover data, Espon database.

[5] Some elaborations on equation 1, not shown here (with P at power 1 expressed in quintiles) indicate that the urban areas belonging to the last two quintiles, but especially to the last one, show an exponent

Figure 1. Agglomeration effects (eq. 2b): predicted values of the GDP residual of equation 2a as explained by pure population size - Italian Provinces, 2006



Source: author's elaborations on Eurostat, Istat and Espon data.

Statistical significance of estimated coefficients in equation 2a is very good: values of α and β are reasonable also if intended as income shares; results of equation 2b are less significant statistically but acceptable given the limited ambitions of the model (Table 2 and 3).

Very large metro areas show positive and increasing returns to urban scale: size, and consequently quality and price of urban output, rise continuously at the expense of lower ranks of the urban system. Interestingly the exponent of usable land A is positive[6,7].

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of P, namely δ, significantly higher than 1 (increasing returns to urban scale). In the other lower quintiles δ is positive but < 0, showing decreasing returns. From Figure 1 we see that for some medium-size cities there are even no returns to urban scale.

[6] A negative exponent was conceptually expected as expressive of the negative effects of enlarging land in presence of constant levels of the other factors. In fact, this density effect was captured in the alternative model of equation 1 recalled in footnote 5, where the exponent of A was showing a significant and negative value.

[7] We interpret the positive exponent of A as an average contribution of land to growth and a distributive share of rents, independently to the presence of agglomeration advantages.

Table 2. Results of equation 2a: GDP generated by production factors in Italian metro areas, 2006

Variables	*Coef.*	*Robust Std. Err.*	*t*	$P > \|t\|$
Capital (ln)	0.373***	(0.115)	3.24	0.002
Labour (ln)	0.621***	(0.127)	4.88	0
Area (ln)	0.127*	(0.065)	1.95	0.054
Constant	–2.626**	(1.094)	–2.4	0.018
Observations	103			
R-squared	0.728			

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, ° $p < 0.15$.

Table 3. Results of equation 2b: GDP generated by pure agglomeration economies in Italian metro areas, 2006

Variables	*Coef.*	*Robust Std. Err.*	*t*	$P > \|t\|$
Population	0.131**	(0.056)	2.35	0.021
Population^2	–0.006°	(0.004)	–1.57	0.120
Population^3	0.000°	(0.000)	1.47	0.145
Constant	0.646***	(0.149)	4.33	0.000
Observations	103			
R-squared	0.118			

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, ° $p < 0.15$.

A further question and distributive issue arises at this stage: which urban social classes do appropriate the benefits achieved thanks to urban agglomeration economies? The class of urban owners of production means in terms of extra-profits? Labour, and in particular qualified labour in terms of some form of extra-wages? Probably both, at least in some part. But what about the most relevant income distribution share, the one appropriated by rent and land owners? Looking at the multiplier in unit prices of the sqm. of floorspace in the city center of large cities with respect to the centers of small cities (approximately 20 times in London and New York, 10-15 times in Milan), one would guess that rent is the major beneficiary. But also in this case, due to fuzziness of statistics on land rents and scarce attention of the scientific *milieu,* empirical evidence is scarce.

Economic theory and results achieved by the New Urban Economics may give us some hints, though referred to abstract cases. On this subject in fact a well-known theorem of rent theory states that in equilibrium the city's surplus equals, or is absorbed by, the total differential land rents (Fujita, 1989, p. 151). The surplus is rep-

resented by the difference between the total output or income generated by the city (in its equilibrium population size) and total population cost, given by the sum of transport costs, costs for purchase of all other goods and opportunity cost of land, viz. agricultural land rent; in equilibrium, it is equal to total differential land rent, appropriated by landlords. In case that a city, other things being equal —namely marginal value product of labour and transport conditions— presents a higher level of amenities and urban quality with respect other cities, it will tend to grow and will show a greater value of total land rents (*ibid.*).

But the outcome of these models depends on the general initial assumption of perfect competition on markets (and in our case monopoly powers are present!) and perfect mobility of firms and households; what does it change if the real conditions are taken into account?

Moreover, concerning profits, it is well-known that in all rent models à la von Thünen-Alonso-Fujita, in equilibrium profits are kept down to their «normal» levels by rents, which appropriate the surplus generated by social production. Given the fact that land rents are a natural condition, in spite of their nature of «non-earned incomes», and that, in a private property regime, they accrue to private land owners, the most appropriate policy philosophy in this field would be that of an equilibrated taxation (Camagni, 2016b)[8].

The model presented has limitations and deserves more appropriate econometric specification and estimations. In conceptual terms, it could be enriched through the inclusion of other variables concerning presence of other classes of «territorial capital» — such as qualified labour and cognitive capital, innovation capability, quality of planning — in order to allow a more precise measurement of the effects of pure agglomeration. But statistical, multicollinearity problems emerge when size enters equations. Much work is —hopefully— crucially needed now on.

6. Conclusions

The paper starts from some results of the present scientific debate concerning the appropriateness of theoretical and empirical works concerning urban economics and agglomeration economies in particular, sharing the critique of the reductive character of purely functional approaches. Many scientific achievements have been attained exploiting the virtues of these approaches, residing in their strong internal consistency (within their logical assumptions) and sophisticated formalization. What appears to be left is the inspection of the true nature of cities, beyond their agglomerated physical form and the consequent (partial) economic benefits.

The paper suggests that the functional-geographic approach should be complemented by two other approaches, which allow the inspection and (perhaps) a proper

[8] The paper presents, among other things, a prey-predator dynamic model where rents are the predator and profits are the preys, generating an urban life-cycle (Camagni, 2016b).

interpretation of other constituents of the nature of cities: what I call the relational-cognitive approach —interpreting the city as a cognitive milieu, generating knowledge, creativity and innovation— and the hierarchical-distributive one, interpreting the relationships with the non-city, the «countryside» of classical economists, in terms of control and monopolistic determination of relative prices. The former approach looks at the intrinsically generative role of the city and its capability of developing continuously new activities and functions; the latter at power relations on space and control on income distribution.

If the functional approach looks nowadays quite consolidated, the cognitive one needs still in depth reflections, as it implies the (at least partial) abandonment of methodological individualism that permeates neoclassical economics, with the advantage of better utilizing the conceptual achievements of other social disciplines. On the other hand, the hierarchical and distributive approach looks today quite unexplored.

All this opens wide space for new elaborations, on the conceptual and empirical side. A formalized model of agglomeration economies which intends to illustrate some relevant issues concerning the theme (and some econometric difficulties too) is presented here. Two main open questions emerge, both referring to income distribution: how are the advantages of increasing returns to urban scale being distributed among the production factors and urban social classes, including land owners? And how could we measure the urban power in terms of income distribution in space?

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Section ARTICLES

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Service industries and regional analysis. New directions and challenges

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ABSTRACT: The service sector currently accounts for the largest share, both in terms of GDP and employment, of all developed economies, as well as many of the so-called emerging or developing ones. In spite of this, it has been the subject of far less research than manufacturing, although the situation has started to change in the past three decades and it must be pointed out that some activities —such as finance, commerce, transport and those most closely linked to tourism— do have significant analytical literature. In any case, this sector is undergoing very notable changes deriving from new technologies and the progress of digitalization, as well as economic globalization, in which services are playing a particularly relevant role. These changes demand specific and in-depth analyses to explain their causes and to understand their spatial and territorial effects. The objective of this work is to underscore the need for greater research effort focusing on the regional and urban aspects of services, and to suggest certain facts and trends that seem particularly relevant. Undoubtedly, services should occupy a privileged position in the new frontiers of Regional and Urban Analysis. This work aims to justify that need and pose some topics of interest for new research.

JEL Classification: L80; R11; R34; O33.

Keywords: Service sector; growth factors; location and concentration; ICT and digitalization; research agenda.

RESUMEN: El sector Servicios es hoy el que mayor peso tiene en todas las economías avanzadas, tanto en términos de PIB como por el número de personas ocupadas, pero también en muchas de las economías calificadas como emergentes o en proceso de desarrollo. Sin embargo, ha recibido mucha menos atención investigadora que las manufacturas, aunque esto ha empezado a cambiar en las tres últimas décadas y hay que reconocer que algunas de sus ramas — como las finanzas, el comercio, el transporte o las más vinculadas al turismo — cuentan con una notable tradición analítica. En todo caso, es un sector que está registrando cambios importantísimos derivados de las nuevas tecnologías y de los avances de la digitaliza-

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ción, a lo que se suma también la globalización económica, donde los servicios están jugando un papel particularmente relevante. Estos cambios demandan análisis específicos y en profundidad para explicar sus causas, pero también para conocer sus efectos espaciales o territoriales. El objetivo de este artículo es, precisamente, subrayar la necesidad de realizar mayores esfuerzos investigadores sobre los aspectos regionales y urbanos de los servicios y sugerir algunas tendencias y hechos que parecen particularmente importantes. Los servicios deben ocupar, sin duda, un lugar destacado en las nuevas fronteras del Análisis Regional y Urbano. Este artículo se orienta, precisamente, a justificar esta necesidad y a plantear también algunas cuestiones de interés para nuevas investigaciones.

Clasificación JEL: L80; R11; R34; O33.

Palabras clave: Sector Servicios; factores de crecimiento; localización y concentración; TIC y digitalización; una agenda para investigaciones.

1. Introduction

Although the most developed countries are still called «industrialized economies», it is a fact that they have all become *service economies*. The data gathered from many European countries, the US, Canada, Japan and other economies are absolutely clear. In all of them, service activities account for around 70% or more of total employment and GDP. Additionally, it is also true that the process of economic «tertiarization» is an established fact in a large number of less developed economies, as well as in all those labelled as emerging, even though the picture is highly heterogeneous across some groups of countries [1].

World statistics (UN, OECD) clearly show that the service sector has grown worldwide since the seventies, although at a different pace in each region. Empirical evidence also shows that, while services growth in developed economies seems to follow a rather constant pattern, developing and emerging economies are characterized by much more irregular trends, due not only to the structural changes accompanying their growth processes, but to the implementation of market-oriented reforms and the uneven effects of their internationalization processes.

Additionally, there is another important and well-known feature that ought to be highlighted. The service sector is composed of a wide variety of market and non-market activities, ranging from transport and retailing, to hotels, restaurants, financial activities, business and personal services, education, health and the public administrations. The internal structure of service sector GVA and employment in each economy clearly reflects this fact, as well as the logical differences when comparing certain

[1] Tertiary activities in Central-Eastern European economies represent a lower share, ranging between 52% and 66% of their employment and GDP. In Latin American countries, the service sector accounts, on average, for 59% of GDP but some remarkable differences exist between them too. In developing Asia, services account for around 50-55% of GDP, on average, but India leads this ranking (62%) and Singapore reaches much higher levels due to its high specialization.

countries with others. At the same time, it is evident that not all service industries grow at the same rate or display the same dynamism. OECD figures show that, in the most developed countries, finance, insurance and business services are the largest and most dynamic group of activities, followed by community, social and personal services, wholesale and retail trade, hotels and restaurants. In any case, cross-country analysis shows not only that important differences exist between economies but also illustrates the fact that, in recent years, some service industries[2] have lost employment due to restructuring processes and the speedy development of new technologies. The share of transport and communications in total employment, for example, has stagnated and even shrunk in practically all OECD countries, but their contribution to GVA has clearly increased.

All these changes —the global increase of the service sector, its heterogeneity and the internal changes of the sectoral structure— require specific and in-depth analysis in order to explain ***«why»*** and, above all, ***«where»*** they are taking place and their consequences. The reason seems evident: these changes and ongoing processes are clearly reflected at a **regional and urban scale** and **their effects are not homogeneous**. In particular because, in the medium- and long-term, they determine a higher or lower growth capacity for regions, and also because the evolution of some specific service activities can be used to explain both the modernization processes, or lack thereof, of some regions (and/or cities) and the existing and potential socioeconomic dynamics operating between them. Finally, these factors require, as we will show, more and increasing research efforts on the part of regional scholars and researchers.

This work is structured into four sections following this introduction. The first (section 2) focuses on highlighting the reasons why services activities, which were once marginal, nowadays have and must hold a particular interest for regional research. Section 3 looks at the changes currently undergone by some service industries which have given rise to the expression: «new service economy», implying the creation of new services, changes in some traditional services and, likewise, new attitudes in the demand for services by households and individuals, as well as businesses. This aspect is closely tied to technological progress, the digitalization of the economy and rapid globalization processes. Section 4 examines whether the currently prevailing process, from a territorial perspective, is a strong concentration of services and, if so, which of them seem to lead this trend, or if there are also some decentralization and de-concentration processes in action. The reasons and questions associated to both scenarios are linked to urban and regional analyses and the need for further, in-depth studies. Lastly, Section 5 offers some ideas of a possible agenda of topics which seem to require further research from a territorial perspective. Certain ideas are posed in this respect which, naturally, do not account for the full range of possible fields of study that would enable progress towards new frontiers of knowledge. The work is closed with a brief final remark aiming to underscore the reasons that have led us to it.

[2] E. g.: wholesale and retail trade, with substantial changes in the companies, their dimension and operation.

2. From an underestimated sector to a clearly increasing analytical interest

Literature on the service sector has increased substantially over the last two/three decades, particularly from a macro point of view (employment, productivity, prices, economic growth,...) and also regarding some specific activities, like commerce, business and financial services, transport and tourism. However, despite recent and important advances, services are still lacking considerable attention by researchers and they are also frequently underestimated by politicians. The historical background considering services as unproductive activities still persists[3]. In fact, it was not long ago that certain theses were posed, such as those by W. Baumol, J. Nusbaumer, J. de Bandt and others[4], arguing that, sooner or later and as a consequence of their inferior productivity, the expansion of services would cause countries (regions) to register decreasing economic growth rates and even a certain trend towards stagnation. In addition, this is compounded by the fact that some policy makers continue to consider services as second-order activities for economic growth, both at a national and regional scale.

Nowadays, these attitudes are changing, particularly in the most developed countries. The number of books and articles on service trends, problems and policies has greatly increased between the mid-90s and the present, and there are many arguments supporting the need to pay much closer attention to the role of service activities in our societies and, of course, in the field of Regional Science. Firstly, as previously mentioned, because they account for the main share of our economies but, above all, because service activities are increasingly integrated into the overall production system. It is a fact that all manufacturing activities, as well as many service industries, require services as inputs to produce, design and distribute their goods and/or final services. Secondly, because service industries are playing a truly active role in market integration and the globalization process, both at a national and international level. Thirdly, the creation of new jobs, added value and income is increasingly tied to the performance of services, and this is not only true at a national level but also from the regional point of view. Finally, because the development of certain service activities (education, health, leisure and personal services) is directly related to the increasing welfare of our countries, regions and cities.

The nearly constant growth of services (Figure 1) has pushed the analysis of the reasons for this growth and its driving factors. This, in turn, gave rise to certain theories and answers which, for the most part, focused on the only possible «suspect», to use the theatre term. This was the position adopted by Fourastié (1949), among others, whose ideas were recently joined by some more descriptive than explicative theories, like the thesis of tertiary expansion waves (Eichengreen and Gupta, 2009).

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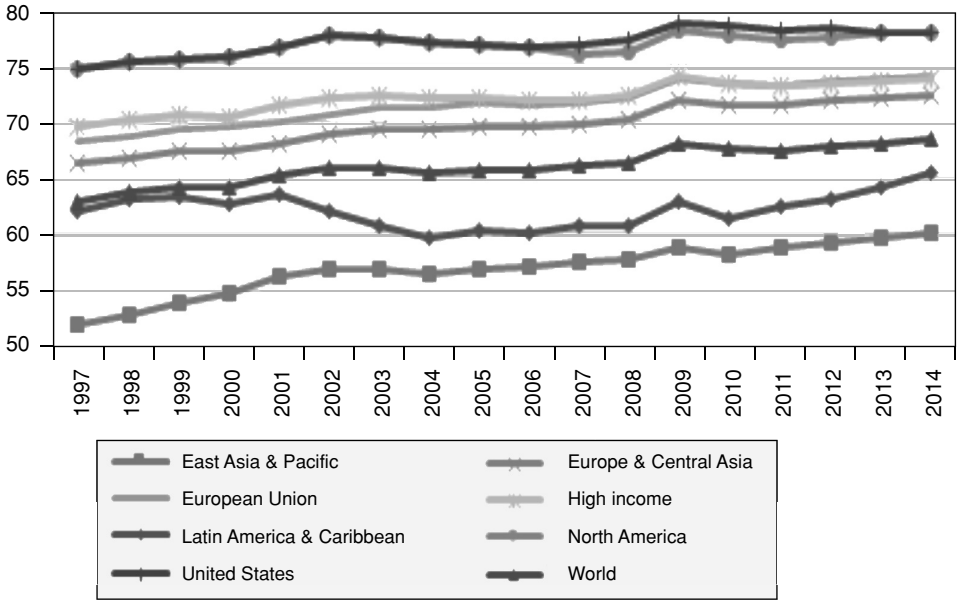
[3] From A. Smith, J. B. Say and other authors of the Classical School to the first Neo-Classical and some more recent approaches to economic growth and their factors. See: Studenski, 1958; Nusbaumer, J., 1987; Petit, P., 1986.

[4] Baumol, W., 1967; 1986; 1989; Nusbaumer, J., 1987; De Bandt, J., 1991.

Figure 1. Service sector evolution in % of GDP



Source: World Bank data.

The conclusion reached in recent years is that tertiary growth cannot be understood based on just one or two key explanatory elements. Instead, a large number of factors and components concur and the specific weight of each one varies in each economy. In summary, it is currently agreed upon that the growth of services in economies is due to the concurrence of a large number of both demand and supply-side factors (Cuadrado-Roura, 2013a).

From the demand side, Engel's law helps to explain why households tend to increase their demand of services when income grows, although there are also other relevant factors which area pushing the increase of service expenditure by individuals and families, including changes in social behavior and working schedules, the widespread incorporation of women into the workforce, the effects of the urbanization process and the dominant trend in most population pyramids. In recent years, there has been an increase in the research efforts associated to all of these topics at a country and cross-country analysis, but there are still many aspects that have been scarcely or poorly studied at a regional scale. Moreover, it is also evident that the variations observed at a regional and urban scale are not stable, but instead show differences in their intensity and causes when comparing several years and/or when studying events throughout various decades.

Along with consumption demand, and even more importantly from the standpoint of its weight and the perspective of intersectoral relationships, is the increasing importance of the demand for services by manufacturing, agriculture and service

industries, including outsourcing processes of some services previously provided within industrial firms. The analyses conducted for some European countries indicate that the «services» component of manufacturing always follows a rising curve in input-output comparisons, and that, in some manufacturing activities (agro-food industries, metal transformation, chemistry and pharmaceutical, transport equipment, etc.), services account for over 28.5% of the total inputs, direct and indirect.

We must also take into account «servitization» processes currently taking place in the manufacturing sector[5]. These spreading processes are also related to a progressive integration between industry and services. A growing number of businesses —large, medium and also small— are offering services alongside their products: training the staff who will use their equipment, replacing obsolete models, payment for hours of use (as exemplified by Rolls-Royce with aircraft engines), designing transport programs as a prior step to supplying rolling stock, etc.

Lastly, there are two more factors on the demand side which favor services growth: the increasing international trade of services, particularly taking into account value added chains (see OECD and WTO new data series on Added Value and Trade)[6], and services demand by Public Administrations (at state, regional and local levels), both in the decision-making processes of these institutions and to enable private companies to supply some social and public services through outsourcing and concession systems.

From the supply side, perhaps the most accepted factor explaining services growth is the low productivity traditionally associated with this sector, which is linked to the increasing number of people required to raise the production of a good number of services. Nevertheless, although the idea that services productivity is always very low and that the sector acts as a «delayer» has been gradually questioned in recent literature[7], it is still valid to understand the increase in employment in many service activities, e.g.: retail, hotels and restaurants, personal services, education and others. As it has already pointed out, some recent analyses have shown that, indeed, certain services activities register labor productivity and multifactorial productivity levels and growth rates which are comparable to manufacturing industries, generally associated to better results. Such is the case with some branches of transport, finance and business services. This point has practically not been tested at a regional scale and merits a closer look, although the expected results are not very different from those obtained in national and cross-country analyses.

In addition, other factors explaining services growth from the supply side include those non-market services produced by public administrations and linked to the welfare state development. Of course, it is also necessary to point out recent decisions re-

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[5] See: Ahamed *et al.*, 2013; Crozet and Milet, 2015; Neely, 2013.

[6] WTO: International Trade Statistics; Manufacturing Trade and Services Commerce.

[7] See f. ex: Triplett and Bosworth, 2006; O'Mahony and Van Ark, 2003; Bosworth and Triplett, 2007; Maroto, 2012 and 2013a; and Maroto and Cuadrado-Roura, 2009. W. Baumol rectified his previous position pointing out the role of innovation, knowledge and ICT in the recent evolution of services and the productivity of some service industries (Baumol, 2002).

garding the liberalization of service markets and several stunning ICT developments, which are contributing to create new services and to improve some of the more traditional ones. ICT has become one of the most significant driving forces for services development, generating a large number of new services, modifying and transforming traditional services and introducing clear changes in the channels of services delivery. As pointed out in various recent analyses, there is hardly any service that has not been or is currently being affected by ICT, either directly or indirectly.

3. Towards a «new» service economy?

Today, nobody can argue the strong interactions existing between services and the other economic sectors (including the services sector itself). It is also clear that the economic system cannot operate efficiently without well-established and dynamic financial, communication, distribution and transport mechanisms, and this is valid not only from a national and supranational perspective, but from the point of view of regions and cities. On the other hand, the importance and the crucial role of business services, from consultancy, to engineering, design or information, is beyond any doubt in relation to the development of any national or regional economy and its progress in terms of efficiency and competitiveness. However, as previously indicated, most analyses address individual countries or establish comparisons between countries, whilst the number of publications adopting a territorial —regional— approach is far lower. This is particularly true for analyses of less-developed regions, which have received less attention and whose possible role as part of regional development policy programs has been dismissed. Some cases have unexpectedly shown that the development of a services activity —like tourism, for example— could become a growth engine and even a more stable activity than several manufacturing processes, particularly in terms of long-term evolution.

There is also a fact that should be clearly highlighted. It is linked to the «changes» taking place in both the production of existing services and the rise and development of new ones. This has led to extensive discussion and work on what has been called the «**new services economy**», which have registered a considerable increase in the literature in recent years[8].

There are several aspects lending support to the idea of a «new services economy» and justifying an intense study of some new activities linked to innovative technologies, as well as the changes undergone by some, more traditional services.

Firstly, many of these services, like the e-services group, are indeed *new*, and it is also true that many old or traditional services —from distribution to personal services— are now being provided on a *new basis*, as pointed out in the previous section. Nowadays, an increasing number of services have been digitalized, for example, and can be stored and exchanged through additional electronic transactions. There is no

[8] I. Miles, 2005; Rubalcaba, 2007; Maglio, P. P., Kieliszewski, C. A., and Spohrer, J. C., 2010; Gallouf, F., and Djellal, F., 2010; World Investment Report, 2012.

doubt that a major transformation of services is taking place. Such transformation is mainly being driven by **digital technologies and ICT networks**. Digitalization allows that many services can be reproduced very cheaply and accessed very easily, thus substantially increasing the economies of scale associated to their production.

Secondly, the «new services economy» can be characterized by a concept of services no longer confined to the boundaries of an economic sector or to a big set of heterogeneous activities. The «new services economy» transcends the traditional division between services and manufacturing activities. This is rather logical, as the relationship between industry and services cannot be actually understood or analyzed separately. As I have suggested in other works, we are actually progressing to a serv-industrial economy.

Finally, new trends in terms of demand for services by households and individuals are also changing, particularly in the most developed countries. This change is partly owed to the fact that new technologies —particularly through Internet developments— modify several traditional services and leave space for new services, therefore also changing the way in which they are supplied and used.

A patent evolution of the cultural and social habits and practices is taking place in this field, mainly due to the internationalization and globalization processes that are clearly observable in services. Examples of this trend abound, as in the case of demand for services provision, acquisition of books, music, travel tickets, retail commerce in general, etc., and are directly affecting the companies which supplied these products in the past. This is undoubtedly impacting, directly or indirectly, the more traditional businesses established in both the richest and the least developed cities and regions, as in the case of bookshops, travel agencies, film and music rental and purchase stores, training centers, etc.

All these changes have a fairly direct relationship with new aspects which can also be observed in the evolution of cities. As pointed out by Anttiroiko et al. (2013), recent changes in service environments have changed the preconditions for their production and consumption. These changes include unbundling services from production processes, growth of the information economy, the search for creativity in service production and consumption and the expansion of digital technologies. These contextual changes affect city governments because they provide a range of infrastructure and welfare services to citizens. Indeed, concepts such as «*smart city*», «*intelligent city*» and «*knowledge city*» establish new horizons for cities in undertaking their challenging service functions in an increasingly cost-aware, competitive and environmentally-oriented setting.

Summarizing, although the term «new services economy» may perhaps seem exaggerated, it appears to be beyond all doubt that a large segment of service industries are undergoing a revolution that affects both the production of their services, and their range and delivery, as well as the position of their consumers, whether they be individuals, households or businesses. All this is directly related to the changes taking place at a territorial level, some of them very rapid. Undoubtedly, this is a field which requires further regional study.

4. Services, regions and cities. Concentration or de-concentration?

From what we have seen, it seems clear that the expansion and changes experienced and/or in process by services have a **variety of important territorial consequences and effects**. These aspects are receiving increasing attention by regional and urban researchers, but it is clearly a field which requires new contributions and further updates.

As previously mentioned, some of the changes observed are taking place too rapidly for any conclusive theoretical approaches and empirical analyses to be settled. For example, in the field of localization and spatial distribution of services activities, where the contributions by Christaller (1933) and other pioneering authors on the location and concurrence and agglomeration models are still being fruitfully used to explain how and where services industries tend to locate (Mulligan, Partridge and Carruthers (2012). The gravity models developed on the basis of work carried out by Reilly (1931), the probabilistic models (Huff, 1963), and the spatial interaction models are still useful, although there are recent and interesting contributions regarding the localization of business services and «knowledge-intensive business services» (KIBS) (Gallego and Maroto, 2012), as well as retail and wholesale. The new approaches developed on the basis of the NEG (New Economic Geography)[9] must also be taken into account, as well as some recent contributions to urban economy and the role of big cities and their growth in recent decades. Many of these contributions pay special attention to the processes of services concentration which are taking place from a spatial standpoint, as well as the factors which explain it, both at a regional and city level. In this sense, some works on monocentric cities and central business districts have set out very interesting working lines (Anas *et al.,* 1998; Glaeser and Gottlieb, 2009, for example). Nevertheless, parallel de-concentration processes have also been detected, both in some previously traditional activities, like the commerce sector and new forms of retail and wholesale (malls, hypermarkets...), and some professional activities, logistic centers for land transport and others.

S. Illeris (1989a and 1989b) summed up some of the most prominent features of services location in the 1980s. According to this analysis: 1) service employment is (was already) more concentrated in big cities than the population as a whole; 2) financial services, business services, and wholesale trade are overrepresented in big cities; 3) retail trade and public services were and are more evenly distributed following the distribution of population; and 4) some activities show special localization patterns; e.g. hotels/restaurants logically overrepresented in tourist areas.

[9] The bases of NEG were set out by Krugman, 1991, 1998, and Fujita, Krugman and Venables, 1999, but subsequent development has been carried out by numerous authors who have delved deeper into center-periphery relationships, agglomeration economies and trends towards or away from concentration of productive activities. An assessment of the objectives and approaches, as well as the degree of novelty and limitations of this methodological school is carried out by Cuadrado-Roura, 2011, 2014.

These trends showed that many services tended generally to be **spatially concentrated**, particularly in large cities (Taylor, 2004; Taylor, Hoyler and Sanchez-Moral 2013; Cuadrado-Roura, J. R. and Rubalcaba, L., 1998; and Cuadrado-Roura, 2013b). However, the analysis carried out within the FAST II program (European Commission)[10] revealed that in most countries (in the EU and also in the United States), some services showed higher growth rates in rural areas and small towns in the periphery than in big cities[11]. Furthermore, the relationship between industry and services and the capacity of large industrial centers to attract services were also highlighted. In fact, many papers published in the 1980s emphasized the role of services in enhancing the prospects of attracting and retaining manufactures[12].

The role of services in agglomeration economies lies within the foundations of a good number of recent contributions. Yet, the focus on this issue and its better understanding has much in common with «New Economic Geography» (NEG) approaches (Ottaviano & Puga, 1998; Venables, 2001; Duranton and Puga, 2002 and 2005) and also with the contributions to the growth of cities and other contributions linking agglomeration economies with ICT and cities (Glaeser et al.,1992; Glaeser and Gottlieb, 2009). However, this type of economies were not only linked to cities as protagonists, but also to the relationships between the expansion of services and regional development, as well as the regional disparities caused by the different growth rates of services and their composition.

It is unquestionable that the spatial distribution of services shows notable asymmetries in several countries and, naturally, at a regional scale. As illustrated in Table 1, services-oriented regions are almost systematically headed by a capital-city or some metropolitan regions in Europe. The share of service activities in total employment is highest in central regions located in the United Kingdom, Belgium, Sweden, France, Germany, Luxemburg, the Czech Republic and a good number of countries. Of course, regional disparities are very important in Europe. The share of Inner London's services in total employment in the area is above 87%, as is also the case in Brussels and Stockholm, whilst the lowest share corresponds to Nord-East region, in Romania, with 29.4%. Statistics show that practically all European regions have experienced an increase in the share of employment held by services between 2000 and 2015. However, this has been accompanied by a simultaneous concentration process in terms of people occupied in service industries, as well as activities qualified as «advanced services».

The location of services, including their diversity and the most influential factors and drivers, is one of the topics that has been most widely explored, but it

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[10] Numerous documents were prepared (*Fast Occasional Papers)* as part of the FAST II (Forecasting and Assessment in Science and Technology) 1982-1986 program. The subjects of expansion, employment and localization of services, as well as the influence of new technologies was analyzed within the framework of this program.

[11] However, several recent studies have shown that, along with the dominant force of concentration, there are also other factors at work driving de-concentration and dispersion of services.

[12] Pedersen, 1986; Bailly and Maillat, 1988; Stabler and Howe, 1988; Illeris, 1989a and 1989b; Hansen, 1990; Maroto, 2009.

Table 1. Regional Specialization in Services in the EU-28

Country	*Top ten regions in 2010*	*Share of Services in Total employment (%)*
UK	Inner London	87.7
BE	Brussels-capital region	86.7
SE	Stockholm	86.2
FR	Corse	84.9
DE	Berlin	83.2
FR	Île de France (Paris region)	83.0
CZ	Prague	81.7
LU	Luxemburg (Grand-Duchy)	81.4
UK	Outer London	81.1
UK	Surrey, East/West Sussex	80.9

Source: Eurostat. Services include NACE codes G to Q.

continues to be an open subject about which no conclusive statements can be made. As I have pointed out previously, the fast development of ICT and its incorporation into services, together with the creation of new services and the organizational changes in companies are **altering some of the conclusions that seemed to be valid in the past,** although some changes taking place recently had already been foreseen. Cities and large metropolitan areas are the major protagonists of the concentration of services, both because they generate the highest percentage of demand (increasing population size, plus the purchasing power of their inhabitants as consumers, plus the concentration of headquarters,...) and also because they attract the location of «new» service industries. However, the development of transport (Glaeser and Kohlhase, 2004; Rietveld and Vickerman, 2004) and the technological changes (ICT and digitalization) have transformed distances, making it possible for services not to be necessarily located at the center of a large area, but also in the periphery of cities. Could we talk about a «de-concentration» of services in large metropolitan areas? What is the relevance of being able to obtain more services from our homes or offices without the need to move or travel, be it purchasing goods, travel tickets, books, acquiring information or resolving administrative issues?

At the same time, some medium-sized cities and rural areas have also managed to attract service providers whose market does not depend on the surrounding population. This is the case of professionals involved in activities such as design, engineering, leisure, architecture, etc., although this phenomenon cannot be generalized. A more specific case, mainly covering more extensive areas, is the concentration of tourist supply and demand, which in many cases has provided very significant growth advantages to regions previously registering medium or even low development.

5. Agenda of possible topics related to services requiring further research

The previous sections have underlined some of the reasons to pay increasing attention to services activities from the territorial perspective. We have considered several questions and already mentioned some of the aspects and processes that seem particularly relevant, and which could/ought to be the subject of new empirical analyses and theoretical contributions. Nevertheless, it is possible to make certain additional suggestions to be taken into account regarding possible «new» analyses of services activities at a regional and urban scale.

The following list is, obviously, not a comprehensive one. But an analysis of current developments in the sector and its main branches, as well as a review of the recent literature, lead to suggest certain issues and aspects requiring further research:

1. ***In-depth analysis of factors and drivers underlying services growth***. Two issues have become clear regarding the factors explaining the expansion of services, particularly in the most advanced economies. The first is that there is no single factor, not even a main factor, but several of them. The second is that other types of factors are in place, besides economic ones. Although the increase of services expenditure by individuals and households is primarily related to the increase of their incomes, other factors clearly affect the changes in household expenditure structure, including increasing urbanization processes, the entry of women into the labor market, the population ageing, and the incorporation of young people as consumers. Additionally, other factors pushing services from the demand side are the *inter-industrial demand* of services by manufacturing (linked to outsourcing processes), international trade and the demand for market services by public administrations.

From the supply side, two factors are also helping to increase the tertiarization process of economies: i) the low productivity of a good number of service activities, which always require larger workforces to increase their production, in turn leading to an analysis of the regional structure of services and the evolution of their productivity; and ii) the role and weight of non-market services supplied by States and other public authorities linked to welfare state developments. Other factors, such as ICT development and de-regulation processes, are also influencing the production of both traditional and new services.

Finally, it is also worth paying more attention to the increasing direct and indirect (through value chain analysis) international trade of services (and the role of particular regions in this field), the presence and developments of «creative» services and the experiences of policies aimed at promoting them. From a regional and urban perspective, all of these topics offer a wide field for new analyses.

2. ***Globalization, trade and foreign investment***. The globalization of tasks rather than sectors, offshoring and outsourcing of service functions, de-industrialization in favor of services and decentralization of intertwined functions are reshaping the division of labor in the subnational economies of advanced and emerging economies. Regional economies and cities are increasingly competing to seize the opportunities

which these new trends offer. All these changes affect the service sector. It is through the service sector that most outsourcing of tasks takes place, it is the service sector that is the most engaged in offshoring of functions and it is in the service sector that jobs and productivity are most affected by the new globalization trends. Empirical analysis carried out distinguishing between «highly globalized regions» and «local regions» [13] has shown that higher productivity growth rates are associated with advanced services industries in globalized regions. In Western countries globalized regions are the only ones where a significantly higher specialization in advanced services activities is associated with the virtuous regions. Thus, the overall conclusion is that the service sector is increasingly important for regions to be able to compete in a globalized world.

Globalization is also strongly related to the increase of international trade and Foreign Direct Investment (FDI) in services. Trade in services has grown faster than in goods and it now represents about 20% of world GDP. However, as pointed out previously, the contributions based on the analysis of value chains and added value show that the weight of services in exports is over 50% in developed countries, and this should also be tested at a regional scale because differences between regions can be, and in many cases are, very pronounced. In addition, there has been a marked shift of FDI, from the manufacturing sector towards services activities worldwide.

The latter point is clearly reflected in the growing presence of international capital in service supply chains of all kinds, from retail to healthcare and, of course, business services (in particular, KIBS) [14], which are increasingly internationalized and operating through the Internet. The analysis of these changes from a regional perspective —and also from the urban standpoint— provides wide fields with scarce knowledge and clear implications for the real growth and potential of any region or city.

3. ***Services productivity and regional growth***. A wave of economic literature on productivity in the services sector has been supporting the conventional thesis that the continuous increase of services and the low productivity of these activities, as compared to manufacturing, entail a clear threat for future growth, whereby its rates should be pushed down. Nevertheless, the relationship between growth of services and labor productivity has been re-examined by recent literature (see section 2). Some service activities show an increase in productivity which is comparable to, or even higher than, those observed in manufacturing. Some regional analyses have led to conclude that structural change still plays an important role in the improvement of productivity of each region as a whole [15] and that certain services industries (financial and insurance, and some branches of transport and telecommunications) are at least as productive as the most dynamic manufactures.

The analysis carried out demonstrated that the growth of services and productivity is or tends to be positive and significant. Moreover, it has been verified that there is a

[13] See: Capello, R., and Fratessi, U., 2013.

[14] Gallego and Maroto, 2015; Delgado and Garcia-Velasco, 2013; Wood, 2006; Muller and Doloreux, 2009.

[15] Molle, W., 1996; Cuadrado, Garcia and Raymond, 1999; Bonatti and Felice, 2008; Maroto and Cuadrado-Roura, 2013.

process of convergence between those regions registering higher productivity levels at the beginning and the most backward regions. It has also been confirmed that regions that are highly specialized in services register more positive dynamics regarding productivity growth. Finally, as expected, services branches subject to market conditions have a greater impact on the variation of productivity, and this is contrary to the case of non-market services. All these conclusions need more contributions to test the observed and not entirely proven regional differences between the productive structure and the evolution of productivity (labor and multifactorial). The increasing availability of new databases with greater disaggregation by branches of activity will undoubtedly open up new opportunities to analyze the issue and provide results and possible explanations.

4. ***Employment, qualification and regions.*** Several factors concur to make services activities increase employment. Industry has transferred jobs to the services sector via outsourcing processes, and still continues to do so, but, in addition, manufacturing demands an increasing amount of services in order to produce and export goods; household expenditure on services is growing and driving new jobs, particularly because many services are of a personal nature; welfare policies have given rise to more public and private employment in services (education, healthcare, social services, administrative services...); and industrial servitization processes have led to the creation of services jobs within the manufacturing sector itself. The latter aspect has even led to the question: should everybody be in services?[16].

This job creation process observable in practically all economies has two dominant features. First, employment shows a clear duality: positions are created in routine and low qualification tasks and, in contrast, other positions tend to require high-qualification. Second, tertiary employment has facilitated and driven the integration of women into the labor market.

These changes are reflected at a regional scale in varied and interesting ways and their analysis already has abundant contributions. However, the dynamics of change in the sector and its employment are not stable or immobile, but rather under a constant evolution that is opening new research fields. In this regard, the tertiary sector has registered an increase in qualified work above that of industry (OECD, 2005). Moreover, the result is very different and attracts other businesses, or not, depending on which services are growing or developing in each territory in cities and metropolitan areas.

The analyses of regional and urban economic behaviors cannot overlook this issue. Another essential aspect is the relationship existing between some services —for example, many services for businesses— and the available workforce. At the same time, an increase in qualified and specialized stable employment appears to be linked to advanced services where the accumulation of expertise is essential. This in turn links localization of some of these services to the existence of qualified workers and the possibility of attracting them, in addition to a review of educational and professional training systems, as well as incentives for businesses

[16] Crozet, M., and Milet, E., 2015.

and individuals to invest in ongoing training. Further studies are required about the effectiveness of some regional policies aimed at attracting new services or developing activities with a significant potential (tourism, logistic centers, business parks, etc.). Such policies may be driven by both the public and private sector.

5. ***Innovation as a key of the «new services economy».*** Contrary to a widespread perception that services industries are somewhat overshadowed by manufacturing in terms of innovation, an increasing amount of current innovation actually occurs in services[17]. As was already pointed out in section 2 and 3, this is related to technological changes and the development of the so-called «digital economy», but also to the application of recombined or «modular» knowledge bundles, which takes place but is more rarely written about from the perspective of the manufacturing industry. Service innovation, especially in more advanced economic platforms like ICT services, takes one or a combination of three forms: i) architectural, meaning a major reconfiguration of the key elements of the innovation network; ii) modular, meaning a recombination of separate but related elements which contribute to the implementation of innovations; and iii) exploration innovation, where the result of knowledge exploration, or research, can be the catalyst for innovation on a large, or even global, scale, as with the other modes.

Service innovations are opening new opportunities for regions to modernize their services and regional policies must pay much more attention to this field, which is strongly related to increasing regional productivity and to improving supply of traditional and new services. All this is particularly related to R & D & i policies and to regional scientific-technological systems.

6. ***The problem of the spatial concentration of services in major cities and the attraction of capital-cities***. The analysis of geographical concentration of services industries in OECD regions reveals[18] that the services sector is more spatially concentrated than economic activities in all sectors. Financial and business services are particularly concentrated amongst service subsectors. Additionally, specialization in financial and business services appears to be higher in capital regions and regions with large cities, and such specialization has increased among OECD regions more than other services. Nevertheless, it is clear that services sector activities are not spatially homogeneous. Some regions can be far more dependent on services, in some cases accounting for nearly 90% of their total GVA (e.g. New York, Brussels, Oslo, Ile de France, Attiki and Lazio). In contrast, services in some regions can account for less than one third of total GVA and employ less than 45% of the workforce (e.g. Campeche and Tabasco in Mexico, Atacama and Bio-Bio in Chile, Gyeonbuck in South Korea and Central Transdanubia in Hungary).

As previously mentioned, the spatial distribution of services has received significant attention by the recent economic geography and also in regional economy stud-

[17] Chesbrough, 2004; Harwing, 2004; Smith, 2004, Finish Ministry of Employment and Economy, 2010; Heiskanen *et al.*, 2007; Den Hertog, 2010; Droeg *et al.*, 2009; Salter, A., and Tether, B. S., 2014.

[18] OECD regional data base; 355 regions (TL2) in 34 OECD countries; Regional Development Policy Division.

ies [19]. It seems clear that business services and KIBS have attracted special interest, as their location is clearly more concentrated than other services and responds to the new role of services in relation to industry and globalization and production innovation processes.

One of the conclusions drawn from some of these studies on localization of services companies is that, at an international level, but also within each country, the globalization process confers advantages to large cities, and particularly to capital cities, boosting the concentration of headquarters of large services companies. Agglomeration economies favor increasing concentrations of services and headquarters through the supply of human capital, good connections and convenient international accessibility. In Europe, this is clearly the case in London and Paris, as well as Brussels, Stockholm, Copenhagen, Madrid, Warsaw, Dublin, Lisbon, Wien and Prague. Nevertheless, dynamic cities with a significant economic role, sometimes even higher than capital cities, are also very likely to attract this type of firms and foster concentration of advanced services. Some European examples include Milan, Amsterdam, Frankfurt, Zurich and Barcelona. Connection to the network of world cities is a key factor. Europe as a whole has numerous cities which are comparatively well-connected within such a network due to its multiple states. The analysis of UK, Germany and Spain, despite major differences in national urban structures, shows that all the leading cities have reasonable overall connections and the major cities have strong connections to the competing centers of economic globalization. This front clearly requires further, in-depth studies.

However, it seems necessary to point out that the mentioned facts are not necessarily permanently stable. There are various events and decisions that can promote the expansion and international presence of a city. One case, albeit not always successful, is the hosting of worldwide events by a specific city, like Olympic Games for example, which drive its attraction and recognition. Even clearer examples can be drawn from supranational political decisions (for example, the designation of Frankfurt as home of the ECB, within the EU), and the completion of large infrastructures (two examples of this would be the Eurotunnel joining France and the UK, and the Oresund bridge and tunnel joining Denmark and Sweden).

Works assessing this kind of changes from a regional standpoint are still scarce and there are clearly many other examples worthy of attention throughout the rest of the world. It is undeniable that the regional and urban effects of some of the mentioned examples are extraordinarily important, and may become even more so in the future, not just from the perspective of international commerce and tourism, but also in relation to the development of transport services, finance, services networks, etc. In this same vein, the effects of image policies with an international scope applied by some cities in seeking to become large, attractive hubs for fashion, music, fairs and

[19] Ström, 2015; Bryson and Daniels, 2015; Tanaka and Okamon, 2008; Nachum, 2000; Sheamour and Doloreux, 2014, 2009, 2008; Delgado and García-Velasco, 2013; Hanssens, H. *et al.*, 2013. See also: Cuadrado-Roura, 2013b.

exhibitions, as well as through the erection of unique buildings, like Bilbao's Guggenheim Museum[20], require further analysis.

6. A final remark

The main objective of this work has been to offer a set of reasons for services activities to occupy the place they deserve within the agenda of future regional and urban research. Until (relatively) recently, this sector had been mostly overlooked within economic and geographic research, even though some of its branches of activity, like finance, commerce, some modes of transport and activities linked to tourism, had merited attention. The focus and interest of most geographers was generally on the localization and agglomeration of services activities, even though the approaches adopted were descriptive in a high number of cases.

Moreover, economic analyses were also conditioned by widespread ideas about the low productivity of the sector, which displaced the interest of policymakers when it came to designing regional economic growth programs. Thus, the promotion of industry has always headed economic development initiatives, as well as other fronts including promotion of innovation, ideas on science and technology systems, and exports almost exclusively related to goods.

Fortunately, this situation has gradually changed and should continue to do so further, particularly from the standpoint of spatial analysis, where it seems unquestionable that there are wide number of analytical possibilities. New researches and analyses can and must contribute to explain not just issues such as territorial disparities and regional economic concentration processes, but also the potential offered by services to drive regional development and the changes which have taken place and are expected in urban settings.

Therefore, there are ample reasons to consider that Regional Science studies analyzing the services sector, factors driving its expansion, internal changes in some of its activities, interrelationship with industry, role in economic growth and the widening, or not, of regional gaps, have a wide field for development ahead. In addition, the changes that are taking place as a result of the introduction of ICT and the progress towards digitalization also open new research avenues that should be investigated from both the regional and urban perspectives.

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Section ARTICLES

Journal of Regional Research Investigaciones Regionales

Entrepreneurship and Regional Economic Development: Some reflections

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ABSTRACT: This paper is a reflection of the author's views on recent research developments at the interface of entrepreneurship and regional economic development and growth. The paper begins with an overview of the recent rise of interest in entrepreneurship in general and, in particular, with respect to its influence on regional economic growth and development. Following an introduction the formation and development of high growth firms (HGFs) and their disproportionately large contribution to job creation are examined. Entrepreneurship ecosystems are then examined in an effort to understand the factors that contribute to high levels of HGF production and job growth. This analysis raises a question about the role of culture, governance and institutions in the collage of factors that influence the development of entrepreneurship systems. These factors are then comparatively examined using three case studies for the U.S., Europe and China which raise the question of how to manage the role of government policy to promote entrepreneurship while, at the same time, preserving other seemingly contradictory factors such as risk taking and self-reliance. The last part of the paper focuses on equity considerations that have served as rationales for government intervention in regional and national entrepreneurship systems. Gender, age, migrants, family, technology groups are examined briefly in an effort to provide deeper insight into how public policies in these areas are rationalized. At the end of each major part of the paper relevant research questions are described and discussed. A summary of the paper is presented at the end.

JEL Classification: L26; R11; R58; O12.

Keywords: Economic development; Economic growth; Entrepreneurship ecosystems; Family entrepreneurship; GEDI/REDI; Gender; Governance; High growth firms; Innovation; Institutions; Regions and seniors; Technology and youth entrepreneurship.

RESUMEN: El artículo es una reflexión con los puntos de vista del autor sobre los recientes desarrollos en las relaciones entre emprendedurismo y desarrollo regional y crecimiento. Se inicia con una visión general del reciente aumento del interés en el emprendedurismo, en general, y con respecto a su influencia en el

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crecimiento y el desarrollo económico regional, en particular. A partir de una introducción a la formación y desarrollo de las empresas de alto crecimiento (HGFs/EAC) se examina su desproporcionadamente amplia contribución (más del 50%) a la creación de empleos. Los ecosistemas de emprendedores se analizan a continuación, con un esfuerzo orientado a conocer los factores que contribuyen a los altos niveles de producción y de empleo de las empresas de alto crecimiento (HGF/EAC). Este análisis plantea una pregunta sobre el papel de la cultura, la gobernanza y las instituciones en el conjunto de factores que influyen en el desarrollo de los sistemas de emprendedores. Estos factores se analizan comparativamente utilizando tres casos de estudio referidos a Estados Unidos, Europa y China, los cuales plantean el problema de cómo gestionar el papel de la política del gobierno para promover el emprendedurismo, a la vez que se respeten al mismo tiempo otros factores aparentemente contradictorios, como la asunción de riesgos y la autoconfianza. La última parte del artículo se centra en las consideraciones de equidad que han servido como guía para las intervenciones de las autoridades en los sistemas de emprendedurismo regional y nacional. Se examinan brevemente cuestiones como el género, la edad, los inmigrantes, la familia, los grupos tecnológicos, en un esfuerzo orientado a proporcionar una visión más profunda sobre cómo se racionalizan y justifican las políticas públicas en dichas áreas. Al final de cada parte más importante del artículo se plantean algunas preguntas de investigación que son relevantes y que se describen y discuten. El artículo se cierra con un resumen final.

Clasificación JEL: L26; R11; R58; O12.

Palabras clave: Desarrollo económico; Crecimiento económico; Ecosistema de emprendedores; Familia; Emprendedurismo; GED/REDI; Género; Gobernanza; Empresas de alto crecimiento; Innovación; Instituciones; Regiones y seniors; Tecnología y jóvenes emprendedores.

Part I: Introduction

Great interest in entrepreneurship and its contribution to economic development has unfolded over the last two decades. This interest stems from several sources not the least of which has been from knowledge that rests on the shoulders of others such as Adam Smith (1776), Joseph Schumpeter (1983) and Israel Kirzner (1973) to mention a few. More recently an enormous growth of information and knowledge driven by developments in the information technology and communications industries have not only contributed to this growth but also to the ability to manage and use it when applied to manufacturing and services production. This in turn has created many new products and services that could not have been imagined even a few years ago. The huge growth of knowledge has also created expanded opportunities for innovation and entrepreneurship and related growth at a seemingly ever increasing rate.

In such a rich knowledge environment it should come as no surprise that interest in promoting company formation and growth in many countries has grown considerably since the beginning of the new millennium. Likewise, the increase in entrepre-

neurship degree programs and centers in universities grew from 20 or so in the early 1990s to more than 300 by 2016 (Princeton Review, 2016). With this large and growing interest in entrepreneurship and its perception as a driver of economic growth, the aim of this paper is to examine the state of thinking about entrepreneurship and its role in regional economic development and to consider emerging and future research directions. At the same time along with the growth in the interest in entrepreneurship there has been a huge production of scholarly work. Given the size of this body of work the topics covered in this paper are selective. Further, the topics considered are high on the authors list and thus reflect his thoughts and not necessarily those of other scholars in the field. To the extent that I may have failed to recognize other important topics and issues I beg forgiveness.

At the outset it is important to consider some definitions. Entrepreneurship is often defined as the process of starting and growing a business making entrepreneurs those who start and grow businesses. More recently various forms of entrepreneurship have been recognized that add to this definition. For example, much interest has focused on social entrepreneurship which is viewed as starting and growing a new organization for goals other than making a profit (Shockley *et al.,* 2008). Likewise, others have considered the public sector ripe for a more entrepreneurial approach with a growing literature entertaining the concept of public sector and policy entrepreneurship (Stough and Haynes, 2009). Further, there are other areas of functional specialization that are emerging including: Youth; older and retired persons; female; minority/ethnic; family; health; technology; emerging, developing and developed nation states; and regional entrepreneurship. Some of these are described and examined, in brief, along with related recent research in Part III of the paper.

A more theoretical view partitions traditional entrepreneurship into three parts: productive, unproductive and destructive following Baumol (1989). Productive entrepreneurship equates with the creation and growth of high growth firms (HGFs). Such firms, when successful, rapidly produce jobs and contribute to the critical current policy focus on job creation. Contrarily, non-productive firms are those that are created more for life style or supplemental income; but, not for rapid growth, large scale job creation or for innovation. For example, "mom and pop" groceries or convenience stores and the farmer that mans a vegetable stand are, in the Baumol typology, non-productive in that they produce few jobs or have other minimal economic outcomes. Another way to think about the Baumol distinction is in terms of intentionality: productive entrepreneurship equates with goals of high growth while non-productive is motived to supplement one's income or enabling a specific life style. Destructive entrepreneurship refers to the exploitation of economic opportunities by taking advantage of potentially monopolistic markets created, for example, in war zones, immediate post war settings, and/or by monopolizing markets as gangs or mafia do. The focus here will be mostly on productive entrepreneurship.

These definitions still leave the issue of how entrepreneurship creates sustained economic growth. In the history of economic thought two schools offer an explanation of what causes economic growth. The Adam Smith view (1776) is that economic growth comes from innovation that leads to increases in the division of labor which

in turn propels increasing returns. Schumpeter's thinking on entrepreneurship starts from Smith's conception of its role in economic growth. Kirzner (1973), who views entrepreneurship as the process that recognizes and acts upon a previously unrecognized opportunity, provides an engine that propels Smith's theory of economic growth (Holcombe, 1998). In contrast to Smith's view, Ricardo (1821) sees growth being produced by the factors of production, a view that undergirds the production function approach to growth. Ricardo's theory has enjoyed considerable attention from economists partly, as Holcombe (1998) notes, from the application of the production function approach using regression modeling, e.g., Solow (1956); and Tinbergen (1956). A problem with this approach is that ultimately growth is seen as primarily a function of capital. But this fails to provide an explanation for increasing returns and thus economic growth according to critics (Holcombe, 1998). For this paper the Smith conception of what causes growth is adopted. Admittedly this brief explanation of the Smith and Ricardian theories of economic growth are superficial but because these perspectives critically underlie the discussion they needed to be introduced. The interested reader is referred to Holcombe's (1998) paper that provides a detailed description, analysis and critique of the theories provided by Smith and Ricardo.

The general focus in this paper is on entrepreneurship in regional economic growth and development. Regional economic development is viewed as the sum total of the means of production and its management much as viewed from the perspective of endogenous growth theory (Romer, 1994 and Lucas, 1988) and Stough (1998) at the regional level. As such it includes the regionally based physical or hard infrastructure and the institutional fabric or functionality of the soft infrastructure or institutions (Williamson, 2000) such as informal practices, governance, political and social organizations and culture. An important focus in this context, including formal and informal institutions, is the machinery that a region has to regulate and guide its relationship with higher levels of government such as states or provinces, nations or multi-national regions. Consequently it includes communication, transport and trade, water supply and waste water systems, natural resources, work force size and quality, government policy, regulations and operations, culture, and governance.

The remainder of the paper is presented in three parts following this Introduction (Part I). Part II is an examination of entrepreneurship in regional economic development and the measurement of entrepreneurial ecosystems. The role of governance and institutions in entrepreneurship driven economic development are also considered in Part III. In Part IV, the nature and recent contributions to functional areas of entrepreneurship are examined. And in Part V the results from Parts I and IV are summarized and discussed along with directions for future research.

Part II: Entrepreneurship in Regional Economic Development and Growth

Entrepreneurship, defined as creation and growth of new establishments or firms has been increasing throughout the world since the early 1990s (Acs and Szerb, 2010).

In the U.S. this increase was from about 560,000 in 1994 to 720,000 in 2006 and after that it experienced 4 years of decrease to 560,000 in 2010 and again grew to 680,000 by 2015 (U.S. Department of Labor, 2016). However, from 1994 jobs decreased from about 4.1 million to 2.5 million in 2010 but then increased to 3.0 million. In short, while new establishments grew overall during the period 1994-2015 the job creation of those establishments declined (U.S. Department of Labor, 2016). Thus, entrepreneurship in the U.S. has not been performing particularly well in terms of job creation.

This and similar experience in other countries including members of the EU, recognizing that high growth firms (HGFs) account for a very small percentage of new enterprises (3-6 percent) but more than 50 percent of new jobs have increasingly focused on growth oriented enterprise policies (Mason and Brown, 2014), i.e. the growth of HGFs. Thus, policy, at least in the OECD countries and the EU, has recently focused on promoting high growth firms because their growth is viewed as a major force driving and enhancing productivity, creating new employment, increasing innovation and promoting business internationalization (Brown *et al.,* 2014). Moreover, the number of HGFs was relatively constant before, during and after the 2008 global economic recession and generated more than half of all news jobs which strongly suggests that HGFs are significant producers of jobs in both economic growth and recession periods (NESTA, 2011), i.e. they tend to be recession proof. These observers are increasingly recognizing that the HGFs are critical in overall enterprise development. This conclusion has been responsible for a shift away from traditional enterprise development policies such as, generating more entrepreneurs, grants, tax and other business incentives, subsidies, financial assistance, intellectual property and patents, and generally top-down implementation of policy as these have had limited economic development effectiveness (Mason and Brown, 2014, p. 4). The shift has been to a focus on specific types of entrepreneurs such as HGFs, networks of entrepreneurs and related clustering, advisory assistance in place of across the board financial assistance, innovation development and management systems, and with adoption of policies increasingly implemented at the regional or local levels (Mason and Brown, 2014, p. 4). Policy makers are recognizing that HGFs evolve more effectively in supportive environments that include a core of large and sustained businesses, entrepreneurial recycling, information rich context, culture, availability of start-up and growth capital, presence of universities and service providers (Mason and Brown, p. 4). These supportive environments have come to be called entrepreneurship ecosystems (Global Economic Forum, 2012).

This is not the first time the ecosystem concept has been adopted to help define economic systems. One of the first references to this was by Georgesque-Rogen (1971) with subsequent work by Daly (1991) and Daly and Farley (2004) which established the field of ecological economics. Ecological economics views economics as composed of interdependent human and natural variables that co-evolve over time and geography space. Here the ecological metaphor works quite well in that it assumes a set of inputs and outputs including feedbacks across human and natural contexts that define a complex system. It is not surprising then that this metaphor has been adopted to conceptualize the factors that support entrepreneurship in general and HGF entrepreneurship in particular.

Much thinking has gone into the development of ecosystems for entrepreneurship by academics, government and the development community including non-profits. The approaches are diverse and include such measured dimensions as sectoral focus, geographic and time scales, and dimensional specificity and other attributes related to inputs and outputs to the entrepreneurial process. The Aspen Network of Development Entrepreneurs (ANDE, 2013) discusses and assesses a sampling of nine of these: The Babson Entrepreneurship Ecosystem Project (Babson College); Asset Mapping Project (Council on Competitiveness); Global Entrepreneurship and Development Index (GEDI) (George Mason University); Innovation Rainforest Blueprint (Hwang, V. H.); Six + Six (Koltai and Company), Information and Communication Technology Entrepreneurship (GSM Association); Entrepreneurship Measurement Framework; Doing Business (World Bank); and, Entrepreneurship Ecosystem (World Economic Forum). The GEDI and its regional version REDI are examined below because this model it has been and can be applied at both the national and regional levels while most of the others have less inclusive applications.

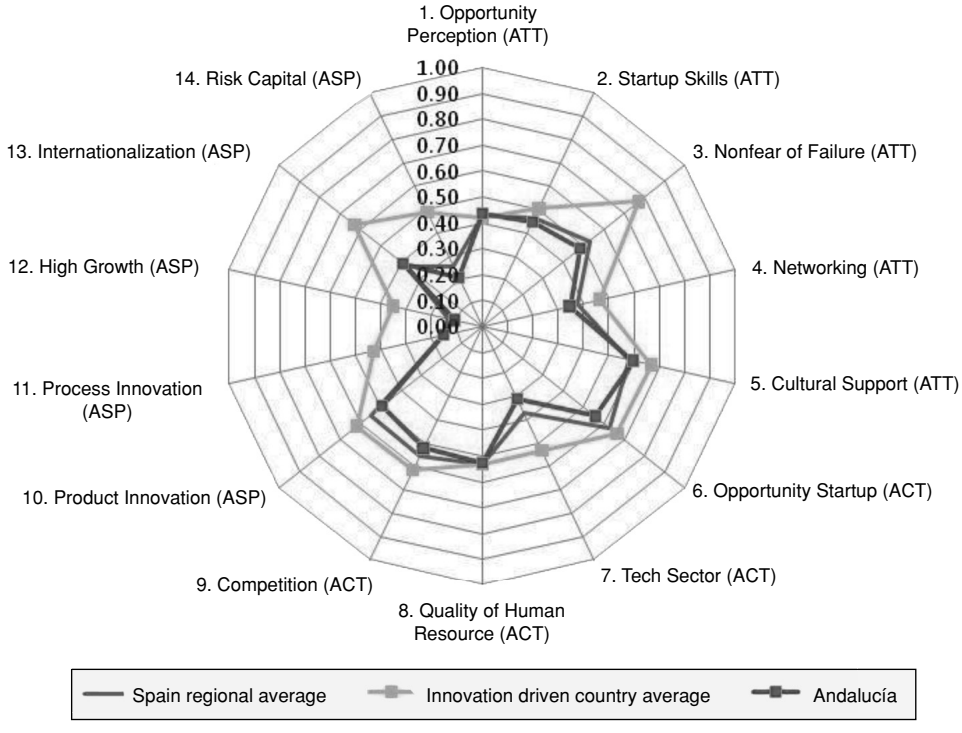
The GEDI is illustrated in Figures 1-3 which show the 14 dimensions of this Index applied to several of Spain's autonomous regions, Andalucia, Madrid and Extremadura, and Spain along with average dimension scores for a group of more innovative countries. The GEDI and REDI organize the dimensions of the index around 3 frameworks: Attitudes (ATT), Action (ACT) and Aspiration (ASP) as designated in Figure 1. Attitude dimensions include Opportunity Perception, Startup Skills, Non-fear of Failure, Networking and Cultural Support; Action dimensions include: Opportunity Startup, Tech Sector, Quality of Human Resources, and Competition. The Aspiration dimensions are: Product Innovation, Process Innovation, High Growth, Internationalization and Risk Capital. Each of the dimension index scores is measured by a combination of several variables that are syntheses of the correlate into a dimensional rating score.

The GEDI and REDI applications, serve as a basis for policy development and evaluation, and guidance. For example in Figure 1 both Spain (GEDI) and Andalucia (REDI) score nearly the same on all dimensions; and, both are likewise weak on the same dimensions compared to the innovative country group. More specifically, Andalucia and Spain have relatively low scores on non-fear of failure (attitude) and process innovation, high growth, internationalization and risk capital (aspiration). These specific areas of weakness indicate where policy can to be directed by both Andalucia and Spain to improve their ecosystems and, further, that coordination between the two will likely lead to stronger outcomes for both. Aspiration scores for Spain and Andalucia are almost the same as for the innovative countries suggesting that these areas or parts of the ecosystem provoke less concern. This example also shows how this index identifies multi-level policy considerations and the potential for policy coordination between Andalucia and Spain as well as also pointing to the opportunity to coordinate with international agencies, e.g., OECD, EU, World Bank, etc.

The GEDI and its regional level application, REDI, illustrate the type of efforts that are being made to measure national and regional entrepreneurial ecosystems in ways that inform and enable policy development, evaluation and management.

There are of course problems with the GEDI and REDI as well as other attempts to measure ecosystems. These include scalability to different geographic units of analysis, level of correlation of variables used to measure the conceptual dimensions, weighting of variables when combined to measure ecosystem dimensions, replicability of measures for various time periods that would enable a dynamic comparison of performance and policy evaluation, supporting evidence for the hypothesized positive relationship between ecosystem scores and entrepreneurship performance, i.e., job creation, other forms of economic growth such as income and wealth creation, and innovative outcomes. Further, as with all ecological systems there are potential problems of logic called the ecological fallacy (Robinson 1950) defined as inferring attributes of the whole to individual members. This potential problem is mitigated in part given the GEDI can and has been applied to sub-regions not just countries of which they are a part. Conceptual thinking and experience suggests that the ecosystem approach can be followed in an effort to measure entrepreneurship and its relation to development. However, more research is needed to better understand the nature of entrepreneurship ecosystems as complex systems and their relationship to entrepreneurship and economic growth at the regional level.

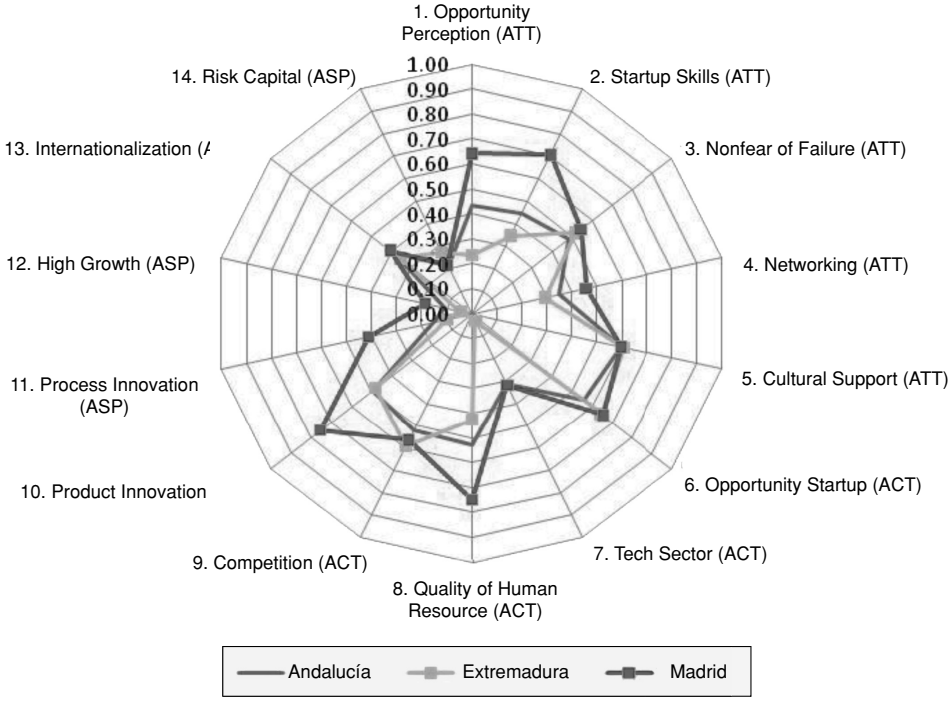
Figure 1. The GEDI Applied to Spain, Andalucia and Innovative Country Averages



Source: Acs *et al.,* 2012, p. 37.

Figure 2 shows the data for the Madrid urbanized region compared to the Spain and Innovation driven countries ecosystem scores. Madrid is the top performer in Spain and also performs well compared to the innovation countries. It shows exceptional strength in opportunity perception and start up skills in the attitude category but also outperforms Spain and the innovative countries group on all measures except risk capital, but in that case the gap is only slightly less than the others. Catalonia often viewed as the center of business and entrepreneurial acumen in Spain has a similar profile to Madrid. At the other extreme in Spain is Extremadura.

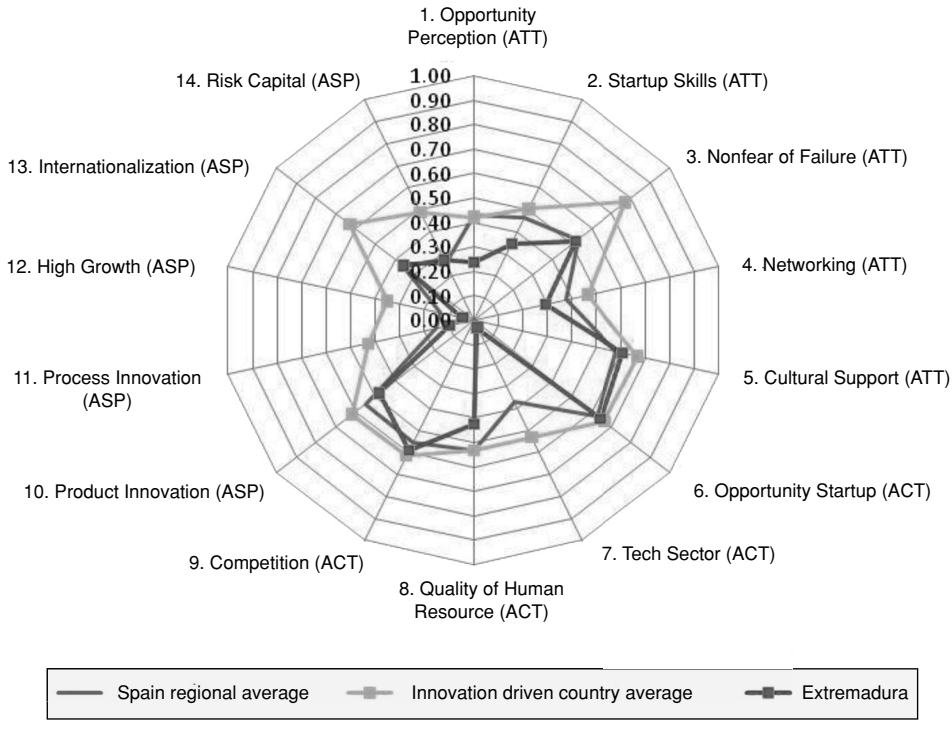
Figure 2. The REDI Applied to Spain, Madrid and Innovative Country Averages



Source: Acs *et al.,* 2012, p. 36.

Figure 3 shows the data for the Extremadura region compared to Spain and the group of innovative countries, and it underperforms both of the referents in almost all aspects. It does perform about on par in the areas of cultural support (attitude), opportunity startup (action) and competition (aspiration). However, the data shows that it needs improvement in almost all other areas including and in particular: opportunity perception, start up skills, technology sector, and quality of human resources, process innovation, high growth aspiration, international and risk capital. Extremadura is not likely to be able to enhance entrepreneurship performance without a solid general economic development plan that is well integrated with action at the Spain and EU levels. Particular attention in such a plan appears to be needed in the perception of opportuni-

Figure 3. The REDI Applied to Spain, Extermadura and Innovative Country Averages



Source: Acs *et al.,* 2012, p. 38.

ties, startup skills, process and product innovation (or just innovation), and improved aspiration to high economic growth, a more international and trade oriented perspective, and risk capital. Particular emphasis should be placed in improving the quality of human capital. This is of course a superficial interpretation of the data on this region as conditions there suggest a systemic pattern of poor economic performance. An integrated economic development and entrepreneurship plan would appear to be required.

It is important to recognize that examples provide only working hypothesis type guidance for policy development and policy making. Local context specific knowledge is also critical. Most applications of the GEDI and REDI include sets of focus group meetings to "ground truth" the quantitative findings and to explore potential applications with local representatives and officials.

The cultural support dimension of the GEDI/REDI is of considerable interest in that it provides the basis for a country or region's institutional framework and, in particular, its governance and institutional model. I use the term institution here in keeping with the institutional economics definition of the term (Williamson, 2000): informal and formal rules that inform and guide behavior. For example, an institution that contributes teaches in any culture is called education or in the view of institu-

tional economics includes the rules that define education and the education process in a specific culture. In this context schools are mere organizations.

The next part of the paper examines the role of governance and related institutions in entrepreneurship using examples from the U.S., Europe and China. These cases provide insight into some of the problems that arise when trying to use common or broadly similar variables for the cultural support metric of an entrepreneurship ecosystem not the least of which is the possibility of committing the ecological fallacy as noted above.

Part III: Governance and Institutions in Entrepreneurship

Governance and institutions are two key factors, which of course are interrelated, that help define a county or region's culture. While the GEDI and REDI both include measures of cultural support for entrepreneurship, applying those measures across cultures may not adequately measure this aspect. That is because different cultures have different ways of identifying and developing not only economic development but more importantly, for this discussion, how they provide support or not. Governance and institutional concepts are now compared among the U.S., Europe and China to illustrate some of the related issues and thus why it is an area that begs for more research. The following discussions are by necessity somewhat superficial and tree top in nature. These are also very short given the space constraints of this paper and the fact that thousands of books and papers have been written about the culture, institutions and governance of these societies. References are provided for those that wish to explore these discussions in more detail.

The U.S. is an example of a country that has a history of strong and sustained entrepreneurship and economic performance. Some argue that the philosophy of American Exceptionalism (Lipset, 1996) provides an explanation of why the U.S. has historically and in a contemporary context been a highly innovative and entrepreneurial country. American exceptionalism argues that the country's origins in a new land mostly unsettled except for Native Americans provided a context (the frontier) for settlers from Europe that lasted nearly two centuries. As early settlement gradually unfolded across the North American continent, the land remained sparsely populated as the frontier moved west and provided new land for population growth. Survival required great individual skills with little or no help from an organized government as even local government was slow to evolve in many places until much later in the history of the country. Survival required enormous self-reliance in solving problems and simply surviving.

Further, frontier America had a great distaste for central government that derived from the effect of control exerted by European kings that led to the American Revolution. As a consequence, central power was divided in the new country's constitution with states retaining some of the powers (social and economic welfare welfare) except when multiple states of the U.S. were involved. The remaining power was mostly accorded to a central government, and therein with judiciary, legislative and executive

branches of government to ensure that attempts to expand central control would face staunch barriers. So another element of the U.S. governance model is that power for governing was highly decentralized reflecting the founding fathers' fear of the effects that strong central government control could have on individuals' rights. This is the source of the strong individualist cultural trait that emerged and still persists in the U.S.

Residents of villages and towns, given their relatively small scale, like individuals and families living on the frontier, evolved with a strong sense of community self-reliance with groups often forming to solve local problems as noted by de Tocqueville in the mid-19th Century (Lipset, 1996, 17-20). Such actions among the European nations were viewed as the responsibility of the king or government. This strong individualist and self-reliance tendency in the growing U.S. national helped support and internalize traits such as a lack of fear of failure and willingness to start a company or even think of entrepreneurship as a way of economic support. These are traits related to and often believed to be required for entrepreneurial behavior. So, support in the U.S. for the institutions that support entrepreneurship are embedded in the evolution of the country, its institutions and people, and its governance model.

The American culture and its governance and institutions are, like in most countries, a function of historical development erected on given natural resources including geography. As a consequence of America's unique and "exceptional development", cultural support for entrepreneurship is embedded deeply in the ethos of its people and reflected in its institutions and governance which in turn reward individual merit and determination, and a belief that government support for entrepreneurship should be limited to few boundary defining regulations. The U.S. does provide special support (see *SBA.gov* for these programs) for those who are disadvantaged e.g., handicapped, the poor, other special groups such as women, minorities, and lagging regions. This is not much different than in other countries including the European Union. However, the scale and level of support appears to be less in the U.S.

Europe's countries and regions for the most part have evolved out of relationships that developed in medieval times whereby people were part of a feudal society headed by a lord that granted land and other favors to vassals (larger land holders) and tenants (that were granted lessor favors). In turn vassals and tenants were obligated to contribute militarily and productively to the lord's fiefdom (the land domain that made up the lord's land). In turn the lord was expected to provide safety and security and general community support and welfare services (see Stephenson, 1942 and Bloch, 1961) to these dependents. Adam Smith (1776) refers to this period of European society as a «feudal government». The feudalism concept like all labels summarizes societal patterns and thus a concept that only partially and imperfectly captures the reality (Brown, 1974 and Reynolds, 1994). Nonetheless, given the summary form of the discussion the concept of feudalism, it is used to provide insight into the origins and partial nature of governance and institutions in many European settings. There are of course caveats.

The medieval world provided a hierarchical social order with the king at the top, lords that were granted land by the king, vassals that were granted land by the lords

and tenants that were all provided safety and support by the vassals, lord(s) and the king for services. This created a society, economically at least, of linear dependency that can be argued to have had an expectation and dependency on the part of the tenants that leadership for solving problems would be provided by the vassals, lords and king in that order. Some argue that this set a norm of expecting «government» to assume responsibility for solving communal problems (Lipset, 1996). Today, some argue, that members of the European countries and many of their former colonies (e.g., Canada and Australia) look to and expect their government to solve problems more so than in the U.S.[1] The governance model that has prevailed in these countries tends to place a commitment on a stronger role of government for supporting entrepreneurship. Thus, the rationale for government involvement in promoting the economy and entrepreneurship is stronger in these countries than in, for example, the U.S. At the same time, government's role in supporting entrepreneurship and innovation development in China is much stronger as described below. A strong supporting role of government for entrepreneurship is viewed as seemingly contradictory in that by its very nature self-reliance is required, not dependency. The possible roles of government are examined at the end of this part of the paper.

In contrast to the U.S. and to some extent the European countries, China was formed and reformed under various centralized dynasties over several millennia that produced a culture with a belief in a strong central government whereby citizens assume that it is the responsibility of the central leadership to solve many communal problems, especially in the larger settlements. In the rural areas problems often fell to individual initiative for resolution. This combination of a strong central government and entrepreneurial and communal self-reliance, while seemingly contradictory, appear to be viewed as cultural elements that have persisted for centuries in China (Kerr, 2013).

With the beginning of the Opening Up policy in China in 1979 it took the first step toward modernizing its economy and society. Opening Up promoted engaging markets of the world, first with increased imports to China, and later moving from an import first to export oriented growth strategy. Nascent manufacturing led by State Owned Enterprises (SOEs) existed and were expected to provide expanded goods production for export as this strategy unfolded. It also advocated decollectivizing its huge and bulging agricultural sector where most of its population lived (Kerr, 2013).

From 1990 to 2015 China became the dominant manufacturing economy in the world mostly fueled by imitation innovation. Yet, one part of the Opening Up policy agenda was for China to become a self-innovation based economy. From the beginning of modernization of the economy and subsequently, China has devoted huge resources to building the innovation/entrepreneurial economy (Yu *et al.,* 2016). Many of the efforts such as the Torch Program and the technology innovation initiatives failed to generate more than a few self-innovation outcomes (Yu *et al.,* 2016). Recently some observers sense that this is changing with significant advances occurring in many of the inputs to the innovation process such as the R&D expenditures, in-

[1] Of course there are exceptions in each country but the purpose here is to identify and describe broad and representative patterns.

creased engineering graduates, a major presence of Chinese companies in technology intense sectors such as telecommunication and information technology, internet and social media, and a number of world class innovation centers (Wired July, 2014. The rise of four Chinese internet and social media technology companies into the top ten ranking in the world with three joining only since 2013[2] (Financial Bitcoin & Cryptocurrency News, 2015) provide evidence for this claim. While China's economy is still not a fully developed self-innovation economy, it has made significant progress toward this goal. So, how has it been possible to have achieved developed country status in the span of little more than one generation?

China's combination of strong central planning and control (strong compared to most developed countries) combined with an experimental approach are largely responsible for its rapid economic growth and development. This seems to be consistent with its cultural history as the government has played a strong and major role in building and evolving the economy from undeveloped to the verge of being a full innovation based economy.

Bell (2014) argues that the Chinese model of governance is multi-tiered. Its highest level leaders reach the top positions only on the basis of meritorious performance over many years that include a wide range of training and testing in addition to detailed evaluation of outcomes. Bell notes that at the community level (village and districts in cities) political leaders are, for the most part, elected and at this level the Chinese governance process may be considered to be democratic. Very importantly the middle level is experimental.

China's development has been led by numerous experiments whose evaluation has led to adoption of practices that both enable modern development to occur while at the same time fitting into a strong central government including diffusion of best practices to sub-national regions. Bell's model is, of course, conceptual and applies more in some cases and times, rather than others. That said Bell's argument is that this governance conception applies generally and provides a backdrop for understanding how governance works in China. The use of experimentation and related methods and their results have enabled broad adoption of best practices that have in turn enabled China to become one of the large and dominant economies of the world.

China has had to make many adjustments to begin to reach its goal of becoming a self-innovating economy. While innovative and entrepreneurial behavior was a recognized attribute of the largely rural and uneducated population, much of that adaptive tendency appears to have been lost as its higher education system expanded to produce increasingly large numbers of scientists and engineers, and college graduates employing primarily a rote learning model, at least until recently. The result of change oriented experiments led recently to altering the rote based education system to one that also values extracurricular activities where "learning by doing" and from "making mistakes" are more valued than in the past, and where the score on the national entrance examination is not the only college admission criterion.

[2] These Chinese top 10 internet and social medial companies are: Alibaba, Baidu, Tencent and Xiaomi.

Experiments to learn how to innovate as illustrated by the early technology and innovation centers led in time not only to the change in education policy but also to adoption of a strong repatriation program that would bring experienced Chinese expatriates to assist and help guide the further development of the innovation centers. Only with these and other changes has China become a more self-innovation capable economy. Despite these developments it is clear that China is not yet a fully developed innovation economy as suggested by various critiques of this effort (Yu *et al.,* 2009 and Applebaum *et al.,* 2016). What seems to be at the core of its move toward a more self-innovative and entrepreneurial economy is its governance system that vets aspiring leaders through elections and only advances them to top positions on merit coupled with an experimentation used to find and guide a pathway to the desired outcomes and then disseminating learned best practices to other parts of the country.

China's governance model is by far the most committed to centrally controlled support for entrepreneurship and development. It has enabled allocation of huge resources for several decades to the pursuit of self-innovation and entrepreneurship and with some recent success as witnessed by recent reports. Yet it has not fully created a self-innovation and entrepreneurial economy (Yu *et al.,* 2009, and Appelbaum *et al.,* 2016). That said the success that China has had in a relatively very short period raises the question as to what is the optimal role of government's participation in promoting entrepreneurship. It seems that most countries despite their culturally based governance systems and institutional frameworks have general agreement that the central government's role should include assistance of various forms to those who are in some ways disadvantaged and that some boundary conditions need to be set by government via regulatory means to guard against unfair competition and monopolistic outcomes. Both Europe and to an even greater extent China have demonstrated that significant strides in entrepreneurship and innovation can be achieved with stronger government assistance programs than in the U.S. The research question that faces entrepreneurship scholars and practitioners is how to shape this assistance for optimal outcomes within the context of regional and national governance and institutional frameworks. This is a major research question that is fundamental to discovering the best role of government in supporting entrepreneurship development. The answer to this question is embedded and evolving as the experience of the three governance models for the U.S., Europe and China unfolds. Of course there are other governance models than those discussed here but they can be organized on a continuum from strong government involvement to relatively weak involvement. Comparative research of the development of the role of government under the three different governance frameworks is needed to learn what the optimal government role in entrepreneurship development is.

Part IV: Special Groups in Entrepreneurship: Research and Policy

There are various functional areas to which many countries opt to provide assistance to. These are rationalized on the basis of enhancing equal opportunity. These

include: Gender, age (elderly and youth), race, ethnicity and poverty. Other areas that have emerged as important in development policy and thus the literature include: Family, health, and technology based entrepreneurship. In this part of the paper several of these more specific sub areas of entrepreneurship are examined and discussed.

Age: Seniors and Youth

It is not well appreciated that the rate of new firm startups is higher in the over 64 population segment than is commonly believed and is higher than for most other age groups (Zhang, 2015 and 2007). There are several reasons for this. First, many elderly have income shortfalls after retirement which motivates them to start or continue to grow their businesses. Second, many also are bored in retirement like my neighbor who is 83 and has started or acquired many companies in his life yet he just acquired a new company to reenergize his life. According to him he was bored! Third, the elderly often have a great deal of entrepreneurial knowledge and business experience, and thus have relatively well developed and relevant skills that make starting and growing a new business a viable option. Finally, life spans are increasing along with health quality, which is enabling seniors to work longer and more effectively, and, some prefer to work for themselves. With the elderly proportion of the population aging and enjoying good health, entrepreneurship in this group will continue to increase.

Yet we know only a little about entrepreneurship and the elderly at the local or regional level regarding their ease of starting a business, types of assistance needed, contribution to job growth and what the primary correlates at the regional level are. Also, one questions how much of entrepreneurship at this age group is productive or just mostly unproductive? For sure some is unproductive in an effort to simply increase income but some may also produce HGFs. Knowing the proportions here would be helpful in setting effective job creation policies in general and for the elderly. Entrepreneurship among the elderly is a research area that is ripe for research in general and more specifically at the regional level today and in the future. For example, there are many unanswered questions about the geographic distribution of elderly startups. For example, are the elderly more likely to start a business when residing in a retirement community or elderly clusters than when living in more distributed locales?

Jack Goldstone in his Foreign Affairs article entitled «The New Population Bomb» (Goldstone, 2009) examines the rapidly growing youth segment of the population in developing countries. The proportions are high, well above 20 percent of the total population in many cases, as are youth unemployment rates. These large youth populations with high unemployment levels are associated with idleness and attraction to alternatives other than work that is generally not so available such as joining terrorist groups and pursuing other socially destructive pursuits. This is Goldstone's ticking time bomb! Among the solutions, all of which will take time, is entrepreneurship. Promotion of entrepreneurship among the youth segment of population

should thus be one of the high priority society and government assistance programs throughout the developing world. While some progress has been made in understanding what is required in the way of hard and soft infrastructure for successful youth entrepreneurship. Such measures include "makers places" that offer instruction as needed and access to resources to undertake innovative activities including starting companies and organizations in the for profit, non-profit and public sectors. Much research is needed to learn how to more successfully attract and assist youths to undertake entrepreneurial activities.

Innovation and integrating knowledge into the creation and growth of organizations is what entrepreneurs do, i.e. one may view entrepreneurs as the managers of the innovation process. Innovation is often if not usually a local process, at least at start up because the process requires not only general knowledge but also tacit knowledge as well which is frequently only locally held. Thus, any youth unemployment and entrepreneurship initiative should be embedded in its local regional context. This conclusion is valid even in the age of the internet that enables considerable knowledge collection but as to date the knowledge of how to create new successful companies and organizations without face-to-face communication is not well understood. Research into youth entrepreneurship is ripe for major development and in this context there is an opportunity for further clarification of the role of both the government and internet communication.

Gender

The level of women entrepreneurs in most developed countries is measurably less than 50%. There are several reasons for this. First, there is a lower proportion of the female population in the workforce due to historical factors like the more traditional care giving and supporting role of women in society, child rearing and nurturing. Also, research has emerged that provides evidence that women in general tend to be more risk averse than men (Borgans *et al.,* 2009 for one example). This latter aspect is problematic in that even if the data is correct, and some argue that it may not be or at least agree only when it is highly qualified (Nelson, 2012), it is an ecological fallacy to make this assertion. Many women have been successful entrepreneurs and the number and proportions have been increasing steadily over the past decade or two. To imply that individual women are or tend to be risk averse because they are female is problematic. Further, there are a variety of mitigating factors in the general pattern, e.g., men's risk taking tends to increase if the decision is in keeping with achieving strategic goals or when under stress, women's risk taking tends to decrease under stress (Sundheim, 2013). Finally, age, income, education and physical height may also be mitigating factors in the propensity for entrepreneurial pursuit among both men and women and are likely positively correlated in both groups. There remain many questions about what the positive and negative correlates are that may be impacting the level of entrepreneurship between and for the sexes. Additional research is needed for a better understanding.

Most important for the current discussion is that women are increasingly rising to senior business and organizational leadership positions and they are also increasingly undertaking the formation of companies. Not only are the numbers significant and growing but more than a few females have risen to senior leadership roles and performed well. Despite these developments there is a role for government and universities to create specific training programs for women aspiring to entrepreneurial careers and for assisting them in other ways such as helping prepare, find and link female advisors, investors, trainers and those who have held senior leadership positions in private and non-profit organizations to aspiring female entrepreneurs. Providing such support in addition to that already available like that offered by the U.S. Small Business Administration (*SBA.gov*) will help propel female entrepreneurship. The same arguments can be made for other disadvantaged groups including minorities, other capped and the poor.

There is a need to evaluate female entrepreneurship assistance programs that are provided by government agencies and non-profits One effort in this direction is the publication of the first Global Women Entrepreneur Leaders Score Card in 2015 (Aidis *et al.,* 2015). This scorecard is similar in structure to the GEDI tool and in fact inspired by it in that it has multiple measures that are bundled into a fewer number of dimensions that in turn provide scores for measuring the level of women entrepreneurial performance across many countries of the world. While this is a good start for developing an evaluation tool it, like the GEDI, REDI and other ecosystem measurement systems, suffers from the potential problem of attributing aspects of the population of women at the national level to all women and individual women, i.e. committing ecological fallacies. Research at highly disaggregated levels is needed to help reduce misleading conclusions about female entrepreneurship. So there is an opportunity for new research at the sub-national regional level which is the lowest level that can be argued to be a functional economic region.

Family and Technology Groups: and Entrepreneurship at the Regional Level

There are other groups with an evolving or huge literature concerning entrepreneurship: Family and Technology Businesses. The literature on families and entrepreneurship and growth in the regional context is quite recent and has been area of at best modest inquiry for some time. Recent research (Stough *et al.,* 2015) has provided some insight into the role that family businesses and entrepreneurship play in regional economies. For example, some regions have a high proportion of family businesses that play a huge role in the strategic development and maintenance of the regional economy. Further, there are regions where family businesses are spinning off many new startups. The advantage of family based startups is that the entrepreneur has access to large amounts of high quality business processes and skill knowledge including readily available capital. Yet, despite these cases and possibilities, little is known about the role family businesses play in general regional economic develop-

ment in guiding investment and policy there. There is considerable opportunity for new and interesting research initiatives in the role of family businesses and entrepreneurship in field of regional economic development.

A huge body of literature has evolved over the past 25 years in the area of technology driven regional economic growth. Consequently there is insufficient room in this paper to treat this topic in much depth. The reader is invited to review work by Ed Makecki to gain greater insight into this area (Malecki, 2011 and 2007). It is important to note that waves of new technologies have and continue to unfold and that entrepreneurs have effectively helped fuel the formation of companies that have translated the associated research and technology possibilities into new marketable products and services (Stough *et al.,* 2013). Most regions around the world are investing in technology development and related innovation and entrepreneurship policies in an effort to participate in associated growth including the use of industrial clustering and embedded entrepreneurship (Stough, 2015). Often these efforts are embedded in policies fostering industrial cluster based economic development and growth. Some regions have been highly successful at this and others not so successful. In applying a life-cycle model to the interpretation of technology cluster dynamics Stough (2015) provides evidence that entrepreneurship levels rise as clusters pass through the early development stages and decline as cluster maturity and decline set in. Entrepreneurship may also be critical to cluster resiliency and regeneration. The quest to learn more about how regions can build economic ecosystems that can support fruitful technology driven economic growth continues and will remain an important regional research topic for some time as it is a central feature of economic growth in the knowledge age. As noted the role of entrepreneurship in promoting technology and cluster related economic growth is important and begs for research to further understand the relationship between cluster dynamics and entrepreneurship.

Part V: Summary and Conclusions

This chapter has focused mostly on high growth companies and firms (HGFs) and the factors that appear to be responsible for their origins, development and growth. Entrepreneurship ecosystems are argued to be fundamental to the development and growth of HGFs. The measurement of these ecosystems was examined in some detail with a case description of the GEDI (and its regional orientation REDI) for measuring them. The application of GEDI and REDI to regions in Spain, selected Spanish regions and a group of innovative countries were used to illustrate its application. Various problems persist in linking the ecosystem concept to HGFs not the least of which is the ecological fallacy that exists when an effort is made to apply the findings for the whole to one or more of its subparts, e.g., the region compared to the nation. Research is needed to further develop the ecosystem metaphor when applied to regional entrepreneurship and in particular when it leads to development and growth of HGFs.

The Chapter also recognized that national and regional governance and institutions are particularly critical components of regional entrepreneurship ecosystem performance. Governance systems and institutions were examined and summarized for three settings (U.S., European countries and China) and compared in an effort to illustrate major differences particularly in the role of «government in governance». The U.S. was viewed as having the least government intervention in the promotion of entrepreneurship; European countries tended to provide stronger policy support; and, China as having the strongest commitment to the public sector role. In this context the seemingly inherent contradiction between strong government support and the self-reliance required to execute company startup and growth was recognized. Research that monitors the relationship between entrepreneurial performance and the level of government participation as part of governance systems will be of great value over the near future as it will help researchers and policy makers to understand better where governments can positively support entrepreneurship and where their intervention will likely detract from fruitful outcomes.

The last major part of the paper examines, in brief, entrepreneurship support for special groups and some sub-areas of research that are emerging or have persisted. First, two rationales have been offered for public policy support for specific groups in society. One of these is fairness and equity for the measurably disadvantaged, e.g., youth, aged, women, minorities, migrants, other capped persons, and the poor. The policy and program assistance applied to enable these groups to establish and grow new companies is somewhat similar across the developed countries and includes advisory, training and financial assistance in the building and growth of companies (for the U.S. see *SBA.gov*).

Two other groups or bodies of research were also recognized. First, family businesses and entrepreneurship in the form of spinoffs were considered. Heretofore these businesses and their spinoffs' role in regional economic development were dormant or mostly unrecognized. Recent research has emerged that begins to lay out research issues and questions in this arena which provides some provocative opportunities for future research agendas. Secondly, technology and related innovation driven economic growth is recognized as a highly important regional research area as it has become a major if not dominant policy objective for most regions. The reason for the persistence of interest in this research is examined with references to some literature over the past 10 years provided for the interested reader as the topic is far too extensive for more than cursory mention and examination in this chapter.

Finally, potential topics for researchers in general and more specifically young researchers are summarized here. They appear in more detail at the end of the various analyses in the paper. First, there is much room for research testing and examining the effect of various ecosystem factors on entrepreneurship and in turn regional economic growth and development. Second, research to expand and deepen knowledge about the role of governance and institutions in successful entrepreneurship systems are considered at the end of Part III. The importance of research into these factors lies in the fact that different cultures produce different institutions (defined as rule systems as proposed by the new institutional economics) and thus governance dimensions which,

in turn, make it difficult to measure their relative importance in entrepreneurship systems. A cross national comparative analysis is offered in the paper to help illustrate this issue and its importance across different cultures. Finally, Part IV examines equity issues in entrepreneurship and the related rationale for public policy intervention. Much research is needed to better understand what sort of policies and practices are needed to enhance the success of entrepreneurs in such groups as: male vs. female; seniors and youth; ethnic minorities; migrants; family and technology based entrepreneurship. These and related research opportunities are presented throughout the paper.

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Section ARTICLES

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Dark and Light: Entrepreneurship and Innovation in New Technology Spaces

Philip Cooke *

ABSTRACT: Notable changes to human comfort are underway that add greatly to the complexity of existential processes. These are «inter-ethnic violence» and «economic polarisation». Historically, these have resisted resilience from urban recovery in intractable contexts. Among the «wicked problems» confronting future actors and agents of newly emerging frontiers of research and policy are those addressing the «dark side» of innovation and entrepreneurship. This is seldom studied in economic geography but such are the negativities associated with so many dimensions of not only technology but its deformations and inhuman inversions that there will, for sure, be future growth for a wide range of social, natural, applied sciences and technology fixes for human dilemmas into the foreseeable future. We consider «resilience» in prefatory remarks on two intractable cases. Contrariwise, in this brief paper on «new technological spaces», attention is devoted to two new «cybersecurity» spatial types, each of which consists in an under-explored «dark side». In this, not in the long term, the naturally optimistic research outlook of the academic will be obscured by the demands of a more pessimistic outlook for the short term. Two of our selected sub-fields, in cyber-security and structured finance, reference both the «dark web» for illegal and terroristic communication and «dark pools». The paper reviews the economic geographies of these «apocalypses» and draw conclusions.

JEL Classification: O1; O3; R1; K4.

Keywords: new technological spaces; innovation systems; entrepreneurial ecosystems; resilience.

RESUMEN: Se están produciendo notables cambios en el comportamiento humano actualmente en curso que afectan a la complejidad de los procesos existenciales. Entre ellos están la «violencia inter-racial» y la «polarización económica». Históricamente, estos se han enfrentado con la capacidad de reacción de las áreas urbanas en contextos realmente difíciles. Entre los «problemas perversos» que

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enfrentan a los futuros actores y agentes de las nuevas fronteras emergentes de investigación y de diseño de políticas están los que afectan al «lado negro» de la innovación y el emprendedurismo. Esto raramente se estudia en geografía económica, pero los aspectos negativos asociados a estos procesos tienen muchas dimensiones y no sólo se vinculan a la tecnología sino a sus deformaciones y a los retrocesos humanos, que a buen seguro darán lugar en el futuro a futuros incrementos de un amplio conjunto de impactos sociales, naturales, de ciencias aplicadas y de la tecnología. Nosotros hemos considerado de forma preliminar la «*resilienc*e» (capacidad de reacción) con referencia a dos casos muy relevantes. Por contra, en este breve trabajo sobre nuevos espacios tecnológicos, la atención se centra en dos nuevos tipos espaciales de «*cybersecurity*» (seguridad cibernética), cada uno de los cuales constituye un ámbito muy poco explorado del «lado oscuro». En este caso, aunque no a largo plazo, la visión investigadora naturalmente optimista del académico quedará ocultada por las demandas de una visión a corto plazo más pesimista. Dos de los sub-campos seleccionados, seguridad cibernética y finanzas estructuradas, hacen referencia a cuestiones que se mueven en los ámbitos de la ilegalidad y de la comunicación terrorista y de los «*dark pools*». El artículo revisa las geografías económicas de estas «apocalipsis» y extrae algunas conclusiones.

Clasificación JEL: O1; O3; R1; K4.

Palabras clave: nuevos espacios tecnológicos; sistemas de innovación; ecosistemas de emprendedores; capacidad de reacción (*resilience*).

1. Introduction

We live in unstable times. But a popular theme in contemporary social science is building new bridges with older ecological science; especially the latter's discovery back in the early 1970s of the widespread relevance of and interest in system «resilience» (Gunderson & Holling, 2002). Arising from their and ecology's recognition that system-thinking had opened up a route way into deeper understanding of non-linear, interactive and self-organising relationships among species of flora and fauna, helped understanding of their survival or extinction capabilities. In turn, such a way of thinking became more widespread in the social sciences, including economic geography, as the «Grand Challenges» of climate change, energy deficits, demographic ageing, and failures of «governance» that justified «free market» ideologies confronted all kinds of unanticipated «shocks», «crises» and worse. The litany is endless, including, health disasters (SARS, etc.), food crises (BSE, E-coli, lithium etc.), climatic impacts (storms, hurricanes, floods, droughts and desertification) and terrorism that «thrives on the weakness of states» (Gray, 2007, 75). Such states include especially those imploded internally, invaded illegally or hosting urban communities in exile populated by economic migrants or refugees originating, for example, in the Islamic world.

Despite the optimism of academics, practitioners and others who believe in the long-established values of the Enlightenment and its belief in progress, the scale, complexity and — indeed — «wickedness» — of the crises having to be confronted today are of a combined magnitude that invokes more sober judgement. While it can be argued that sovereign communities have faced worse existential threats during times of global warfare, as in the Second World War, climate change expresses a kind of war against the world in its planetary meaning. In healthcare, many diseases seem to be almost demonically «wicked», notably cancer in its determination to metastasize and kill the patient. Of course therapeutic progress occurs, but often at such cost that society has to «ration» the drugs that may help some if they can benefit from «free market» mechanisms. The Middle East evidences swathes of war-torn desert and urban destruction with implications for hitherto «safe» cities in East Asia, Europe and the Americas. Without labouring the point, some of the conditions just discussed do not seem to be very expressive of a notion of «resilience» where, for example a burnt forest regenerates in a few years. Some of these «wicked problems» (Rittel & Webber, 1973) are, in effect «peak crises» (like transitioning fossil fuel energies) that humans have not had to deal with in historic, or even prehistoric, time.

Accordingly, the technologies and their spatial or non-spatial incidences that are advancing stutteringly into the innovative future, are each relatively new, often quite «informational» and surely «digital» but confronted with thinking and action that is also new. They do not share the old technology dream of «discovering the silver bullet» which, to some extent characterized the era of antibiotics, aeroplanes, communication (ICT) or personal mobility (combustion engines). To be sure, such innovations were real combinations or re-combinations of knowledge and artifacts much as Schumpeter observed innovation. So, it could be argued, were the «policies» that gave them purpose. They contributed to the «resilience» of «creative destruction». But now, such resilience is less clearly purposive because the problems denoted are far greater in scope, more diffuse and generally complex. Accordingly «action» and «policy», much of which has not escaped from its «one-off problem-solving» inheritance, must also become a «never-ending story» of evolutionary management of change (Uyarra & Flanagan, 2013). Some of these technologies allow for such a perspective to seek to respond (not always easily or optimistically) to the «Grand Challenge» of «wicked problems», one of the worst being the failure of «resilience». In what follows the exemplars will point the way to more hopeful indications.

2. From Detroit to Sarajevo: Some Failures of Resilient Cities

Resilience is a wonderful thing. When it is expressed as «hysteresis» it seems to make a metropolis bounce back to square one like a giant rubber band. Where the elasticity is less evident, it may not suffer very deep recessions because it is unaffected by the cause of the recession, or it may experience a modest return to its hitherto moderate performance (Martin, 2012). An alternate but seldom explored condition is expressed in the city (or region) that is neither revitalizing nor returning to a modest

growth-path but continually sliding (like Black Death villages or coastally eroding medieval towns) into oblivion. An emergent critique if «resilience» explores aspects of its «failure» (Gong & Hassink, 2016). Archaeologists alone show any interest in such locations since there are only remains of ruins, bits of ceramics and human or animal bones for them to record the passing of time. Our two cases are not yet in that quiescent state. But they are not especially good examples of resilience either. Why? Because in «resilience theory» they lack two key attributes for recovery, namely «connectivity» to sustain networks and «potential» that gives impetus to innovation (Folke, 2006). Connectivity is a weakness discovered in parallel, if not in derivation from resilience thinking, by complexity thinking. There the developmental weakness of a given topology (absent an economic geography) is a low density of «energy» points across a possibly abstract space. Without such «attractors» among which «interaction» can occur and the exchange of useful or relevant information can ensue, no endogenous interaction can occur. «Potential» is where one or more abstract «energy» points or «clusters» find opportunities and reasons for interaction to occur. Creative energy combinations may ensue, resulting in innovation and ecological or non-ecological growth.

2.1. Detroit in Ruins

If we consider the case of Detroit for a moment, it is almost a text-book case of the unresilient city because it was designed to be so. The key *absence* in Detroit, even in its economic heyday, was variety. It was set up to be, as it became labeled at its peak in the 1960s «Motown» or the classic «Fordist» city. It can be argued that it evolved variety in its music and wider cultural scene but Motown soon migrated to Los Angeles rather like the «Merseybeat» migrated from Liverpool with the Beatles to London. Detroit was heavily (over-) specialised in the automobile industry just as Liverpool was heavily specialised in trans-shipment of goods and people. When the market was strong for both sectors, investment in slum housing but relatively expensive residential real estate and symbolic architecture associated with consumption goods and a consumer culture were marked features. Even today visitors to the bombed-out suburbs of Detroit often remark on the scale and generosity of the housing plots and Art Deco grandeur of the cinemas and other public buildings from the first half of the twentieth century (Apel, 2015).

The lists of famous persons emanating from Detroit is huge for entrepreneurs, greater still for entertainers but greatest of all for successful musicians from Aretha Franklin, Martha Reeves, Madonna, Diana Ross, Alice Cooper, Iggy Pop and Smokey Robinson and many more. But even the Detroit Art Institute's fabulous collection of paintings, threatened with monetization to pay the city's pension debt was trumped by the objection that the city's bond insurers had legal priority over the retirees (Apel, 2015).

But while the car industry contains many differently originating trades and skills ranging from metal and mechanics, through rubber, trim, glass and so on including financial, design and organizational management skills, it is clear that Detroit's main industries were «locked-in» to car production. Moreover, as in a military or govern-

ment bureaucracy, controls were exercised top-down with no significant horizontal knowledge flows. Workers were actively discouraged from taking initiatives and, on top of that, hierarchies were enforced, labour processes were «time-and-motion» regulated and Ford even had an infamous Sociology Department that snooped on workers» extra-curricular, «free-time» activities. Such was the «command-and-control» mentality of the city notables (who resided elsewhere) giving little civic leadership. This was expressed in the person of Henry Ford, who professed to despise his workforce as much as his peers while also being a rabid racist and anti-Semite. The one saving grace was that the automotive workforce was relatively well-paid, meaning once they escaped the clutches of the Sociology Department, workers could enjoy some high-quality musical and artistic popular entertainment epitomized by the likes of blues original John Lee Hooker to film maker Francis Ford Coppola.

However, once as is well-known, the heyday of the mid-century, gas-guzzling American automobile was in decline in the 1970s, signaled by the rise in Middle East fuel prices and the appearance on the US market of higher quality and more reliable Japanese products at an affordable price, Detroit's fate was sealed. Interestingly, Detroit continues to be a city-region in which automobile production remains as one of its major but much weakened specialist manufacturing industries. This legacy is shared with other single-industry survivals, Manchester, UK being a case in point for surviving cotton textiles trade. But it is testimony to the other resilience characteristic, *potential*, which signifies the capability to arise from a negative lock-in condition through innovation which caused the main blow to its evolution. For redundancy, down-sizing and general job-loss multipliers resulted in widespread rioting, especially in ethnic majority residential areas, which have accordingly been torn down (many as crack houses) and in many cases reverted to fields. Despite municipal and government efforts, Detroit has not recovered and continues to display the characteristic absence of revitalization that is associated with the «unresilient city». So, despite its history of cultural and creative innovation, with evident *connectivity* in the entertainment sphere alongside strength in limited kinds of entrepreneurship, this was not carried over to the industrial sphere (Klepper, 2010).

We move shortly to a totally different exemplar of «inhibited development», indeed it may be rare for these cases to be compared; such is the academic preference for «success stories» rather than their obverse. The etymology of each is very different, although both were once success stories. The first was fatally weakened by the geography of economic decline, over-specialisation and the regime shift from Fordism to «Toyotism» (Dohse, Jürgens & Malsch, 1984), the second by the break-up of an east European state system, accompanied in Bosnia and Sarajevo, by religious sectarianism and brutal «ethnic cleansing».

2.2. Sarajevo: Forerunner of Syria's Besieged Cities

Numerous news articles recall how Sarajevo foretells the contemporary plight of Aleppo, Damascus and Homs in Syria's «conflict urbanism». Observers and experts

would say that two historic periods highlight the twin peaks in the fortunes of Sarajevo. The first of these was in the era directly before the First World War when the city was industrialized by the Austro-Hungarian imperial regime that, nevertheless, exploited it as a kind of metropolitan innovation laboratory, for a pioneering streetcar system. Hence, in 1885, Sarajevo was the first city in Europe and the second city in the world, following San Francisco, to have a full-time electric tram network running through the city. Because of its long Ottoman history the city was multi-cultural and labelled the «Jerusalem of Europe» as the only large European city to possess a mosque. After a fire that engulfed the city centre, architects and engineers swiftly arrived in the city to re-plan it in modernist style at this time. Numerous factories (e.g. the landmark Sarajevo brewery) and other significant buildings originated in the 1890s. These included the Cathedral, National Museum, National Theatre, National Library and Academy of Fine Arts, the Central Post Office and City Hall which were built then, and a number of institutions altered (e.g. widespread use of Latin script in place of Cyrillic after centuries of Arabic in the Ottoman era) being both Westernized and modernized. The decline set in following the assassination of the heir to the Habsburg Empire in 1914.

Despite the preceding transition, where rapid urbanisation, industrialisation and modernisation occurred without notable socio-cultural tensions in a multi-ethnic and multilingual context, the aftermath for the urban political economy was shocking. The Austro-Hungarian Empire lost the Great War and the new Slavic country of Yugoslavia was created. Sarajevo became a sub-centre of a small, divided and poor kingdom. Unlike the dominant Serbian centre of Belgrade, it was not treated with the same attention or considered as significant, being at least partly Muslim, being perceived picturesquely as a lethargic rather than vibrant city as it had been in the past. Unlike the late nineteenth and early twentieth century modernisation in Sarajevo, apart from the National Bank of Serbs, Croats and Slovenes (sic), the predecessor of today's Bank of Bosnia and Herzegovina, virtually no significant contributions to the city were made during this period. Accordingly, Sarajevo stagnated under the Kingdom of Yugoslavia.

During World War Two Sarajevo became part of the fascist Independent State of Croatia with many Serbs and Jews being massacred. In that time Bosnia's Muslims signed a resolution seeking security for all citizens, particularly the persecution of Serbs, of whom some 20,000 found refuge in Sarajevo. Secular demographic decline resulted in an inherited city population that had slowly receded from hundreds of thousands to some 80,000 at the end of World War Two. But under Tito it boomed once again, echoing something of the rapid modernisation that characterised its fate at the end of the Austro-Hungarian Empire. Hence, the growth rate subsequently benefited once again from rapid investment after liberation when Sarajevo became the capital of the Socialist Republic of Bosnia and Herzegovina within the new Socialist Federal Republic of Yugoslavia. Tito's federal government spent heavily in Sarajevo, building substantial blocks of social housing in «new town» municipalities nearby. Moreover, Sarajevo experienced a second «modernisation» by state development of the city's industry. Sarajevo's city population was 115,000, by the end the war but by

the end of Yugoslavia, Sarajevo had a city-regional population of 600,000. Its peak of achievement was hosting a successful Winter Olympic Games in 1984 after which international tourism boomed. Thereafter, the Balkan war-era led to the Siege of Sarajevo (1992-6) in what became the horrific Bosnian War. This massively reversed its fortunes compared to its Socialist growth-era development. Planned as a significant regional industrial centre, Sarajevo returned to its former marginalised condition.

After the Bosnian War and Siege of Sarajevo by 13,000 armed Bosnian Serbs of the Republika Srpska, Sarajevo's fluctuating historical demography resulted in a decline from 453,000 before the Siege to a city size by 2013 of some 350,000, a reduced scale which remains after twenty years alongside that of the metropolitan area of 688,000. By the summer of 1996, the city was in ruins, industry was destroyed and there was high unemployment. The massacres by Serbs of Bosnians, especially the «ethnic cleansing» of the Muslim population, still affect Bosnia like a dark, toxic cloud. Although the Bosnian rape camps were well known among international human-rights organizations, there have been attempts to deny their existence or erase that part of history. Abused women have almost no institutional support in a country now rigidly divided into Serb and Bosniak-Croat areas. Surrounded by the Dinaric Alps, in the valley of the Sarajevo (Milijacka) river, the reminders are everywhere: countless bullet holes in buildings and homes that are flanked by recently built apartment blocks and shopping malls selling designer wares that only the wealthy few can afford. International winter sports tourism has revived somewhat with Sarajevo being a destination of choice for wealthy Arab visitors.

Despite the Arab tourism, Bosnia's economy has been developing lethargically. Its GDP per capita is 28 percent of the EU average (compared to the poorest member state, Bulgaria with 45 percent). Unemployment also runs at 28 percent, and the average monthly salary is 425 Euro (NATO Review, 2015). By July 2015, all levels of government adopted a comprehensive economic and social Reform Agenda. Implementation of this agenda has occurred. If it continues, and growth targets are met, the EU has promised to accept a membership application from Bosnia. Making for a dispiriting urban future for Sarajevo (let alone smaller, damaged towns like Tuzla, Srebrenica and Mostar) are the remaining empty and bullet-ridden hulks of the Tito-era residential blocs, disused central train station, children's memorials and the emergency transformation of former parks and stadiums into overflowing cemeteries. Clearly, Bosnians and Sarajevans, more particularly, have experienced a resilience-defying triple shock from war to peace again, from a planned economy to a market economy and from a socialist state to a liberal democracy. Elsewhere in Eastern Europe it is well-reported that many older residents regret the loss of security that transition brought. Similar regrets may be heard in former Yugoslavia, which offered decent living standards, freedom to travel, and secure jobs. Except that unlike elsewhere in Eastern Europe, socialism disappeared in times of war, rather than being dismantled, mostly peacefully.

What are the contrasting and comparative elements of change that such widely differing exemplars reveal of the difficulty of «bouncing back» swiftly from disas-

trous resilience shocks? We may draw attention to the following. The most obvious wide-ranging condition that is recognisable, despite some periodic variations, is the general absence of what is called elsewhere «generative growth» (Cooke, 2016). Increasingly, this occurs in firms, regions and countries coming to terms with new realities, of globalisation, interaction and collaboration. It obviously entails entrepreneurship but not just of a kind of race to the bottom of profit-seeking (as we shall see, below). Generative growth involves intensifying direct and indirect capabilities for knowledge-intensive production, enhanced productivity, innovation and new firm formation that accompany integration of local and global value chains. Generative growth feeds off these interactions rather than being unproductively transplanted, as often occurs with «redistributive growth», the style of incentivised and regulated movement of jobs and capital from locations where they were abundant to those where they were not.

3. Entrepreneurial Ecosystems & Regional Innovation Systems in New Economic Spaces

Moving from the discourse of decline, through a «minefield» of new digital technology applications, to the «new technology spaces» in which article space only allows for two exemplars, we briefly underline the important distinction between entrepreneurial and innovative activity. Accordingly, three key lessons can be learned from the «innovation systems» literature, especially that associated with regional development, for reference to both the contrasting and competing interests of «entrepreneurial ecosystems». These are, in no particular order of preference, the following.

— First, innovation (after Schumpeter, 1934) is inherently recombinant, drawing inspiration from several cognitive and material sources. These «new combinations» are inherently socially interactive in nature,
— Second, while commercial exploitation is the purpose of successful combinations, they may nevertheless be socially useful innovations for the innovator much more than the entrepreneur. There are many cases of altruistic innovation.
— Third, innovation is fundamentally a «learning» procedure involving networks of innovators in «gift exchange» or «studied trust» type interactions. These help to achieve the «adjacent possible» innovative event or aid the crossing of «structural holes» from the known to the unknown.

We have argued that entrepreneurial ecosystems can be capable of generative growth where that is accompanied by a high degree of social cohesion, social stability and low social exclusion. By example, we concluded that these three characteristics were not enjoyed by troubled cities like Detroit and Sarajevo, which clearly express insufficient resilience to decline (Hospers *et al.,* 2012; Polenske, 2014). In our first two «new technologies in new economic spaces» narratives we will draw attention to the «dark side» of entrepreneurship that has become pronounced due to heightened global and urban security conditions in the twenty-first century. The first two of our

new entrepreneurial settings depend heavily upon data encryption, hyper-competitive advantage and intense, defensive security criteria. The first of these is «Cybersecurity Digital Forensics» (CDF) and the second is «High Frequency Trading» (HFT). Both are heavily dependent on complex communication algorithms and highly skilled entrepreneurship but the second is complex yet surprisingly simple and linear. The HFT phenomenon has an economic geography in a single US platform space at present, though it is developed in London and the M4 Corridor and slowly emergent in the EU. The CDF space is more widespread, international, with leading innovative and enterprise edges in Israel and strategic US and UK locations, signifying a broader geography and history of Islamist jihadi violence that has provoked the emergence of specific centres of expertise. We begin with CDF.

3.1. Cybersecurity

Prefiguratively, as a guide, the top 500 cyber-security firms —a broader population than CDF— show a concentration of some 19 small-medium enterprises (SMEs) in Israel, overwhelmingly in Tel Aviv, but with an emergent incubator space housing multinationals, SMEs and incubator start-ups in Be'er Sheva in the Negev Desert. Elsewhere, the bulk of the remaining top 500 are found in or near «Edge City» (Garreau, 1991) locations in the US, such as Reston-McLean-Herndon in Fairfax County on the boundary of north Virginia and Washington DC. McLean hosts the Langley headquarters of the CIA as well as the most luxurious residential location in the Metropolitan Area. Altogether, the Dulles Technology Corridor houses some 38 cybersecurity firms; exactly double the total of Israel. A further 11 cyber-security firms are found over the Maryland state-line which carries the Edge City to satellites such as Bethesda, Columbia and Rockville.

But the 800-pound gorilla of this world is California. Here, mostly in Silicon Valley, in the San Francisco-Santa Clara-San Jose axis, in particular, are found 125 such companies. Clearly, this is not a new economic space for technology companies, rather it expresses another round in the previously documented mutation of varieties of technology from semiconductors to personal computers to cellphones, search engines, biotechnology and clean technologies, now including further varieties of cybersecurity. The third competitor technology space for cyber-security firms is Massachusetts, mainly in the Edge City to the west and north of the Boston Beltway, a once declining computer cluster replaced twenty years ago by the globally most significant biotechnology platform. However, the number of cyber-security companies in the Massachusetts complex reaches only 24 companies, focused mainly on Waltham (6 firms), Burlington (4) and Boston (4).

In Europe, some 20 firms concentrate in London and its technology corridor to the west along the M4 motorway including the former military, now privatised, Malvern signal intelligence (SIGINT) platform. Munich has six such firms. All locations are to some degree exploiting their pre-existing technology strengths in digital communication. The new twist is that while information technology had originally

been subsidized by government defence research budgets, these have shifted to some extent from information and communication hardware to software, systems, algorithms and encryption software technologies. Noteworthy also is the proliferation of SMEs and start-ups in the population of such firms. It is hypothetically the case that, especially where firms concentrate spatially, they form a potential entrepreneurial ecosystem, imitating each other. Foremost this involves applying related or likely differentiated applications of computer science and profiting from government contracts either singly or in «Eco-nets» or ecosystems.

The clearest illustration of the intimate interactions between spatially co-located firms, government contracts, the military, university research, talent formation and specialist infrastructure occurs in Israel whose Unit 8200 is at the epicentre of today's CDF industry. Celebrated by Senor & Singer (2009) —until 2003, Unit 8200 was a secret military department of the Israeli Defence Forces (IDF). Unit 8200 is the SIGINT and code deciphering arm of the IDF being its largest unit, and headquartered at Camp Glilot, north of Tel Aviv. In 2004 a Knesset committee recommended turning the unit into an autonomous entity separate from the Defence Ministry, along the lines of its equivalent, the US National Security Agency (NSA). Unit 8200's most important and powerful SIGINT base is located near the village of Urim in the Negev desert, to which it began re-locating in 2015. Israeli Prime Minister Netanyahu had earlier promised that Be'er Sheva was destined to become «the cybercenter of the Western hemisphere». This decision would transfer army SIGINT bases, start-ups and university expertise from central Israel to the south and act as major boost to Be'er Sheva as «world cybercapital». Land agreements to include bases in Glilot and Ramat Gan that house military SIGINT facilities, including the world-renowned 8200 unit, thus have a planned location at the perimeter of the new technology park in Be'er Sheva beginning in 2020. Tenants of the Advanced Technology Park already include *Deutsche Telekom*, *IBM*, *Oracle*, *Lockheed Martin*, *EMC* and *PayPal* —with Be'er Sheva's Ben-Gurion University and its Cyber Security Research Centre in attendance.

This confirmed a path dependence that began in the 1990s with Unit 8200 start-up successes: *Check Point* (a world-leading IT Firewalls security firm); *Metacafe* (a world-leading video site); *Comverse* («Logger» telecom software, 4,000 employees); and *NICE* (data security) with 3,600 employees and a 2015 NASDAQ valuation of $5bn. Another contemporary Unit 8200 alumnus *New Dimension Software* (enterprise software) was sold (1999) for $675 million to BMC Software of Houston, Texas. This directly led to reinvestments by founder Roni Einav in dozens of Israeli tech start-ups. *Palo Alto Networks* (cybersecurity) was in 2015 NASDAQ valued at $10bn. Meanwhile *ICQ* (instant messaging) was sold in 2010 to *Digital Sky Technologies* (Private Equity: HQ Moscow) for $200 million.

Senor & Singer (2009) showed Israel had more venture capital investment *per person* than anywhere in the world and the largest number of NASDAQ-listed companies (63) after the US and China. So, in 2010, Unit 8200 alumni decided formally to offer their expertise to other young Israeli entrepreneurs. The result was the 8200

entrepreneurship and innovation support program (EISP), a five-month high-tech incubator in which Unit 8200 alumni volunteer to mentor early-stage startups. Between 2010 and 2013, 22 received funding totalling $21m (£13.5m) and employ 200 people, joining the 230,000 employees of Israel's 5,000 tech companies that earn $25bn a year —a quarter of Israel's total exports. This can be judged, on a scaled measurement, as a remarkable achievement, which has become a model for cybersecurity entrepreneurial ecosystems, now including corporate technology investors. All the main elements for generative growth are present: collaborative institutional and pioneering enterprise pursuit of social value, cohesion and solidarity that is driven, not foremost by profit, but collective citizen security. As a model of enterprise ecosystem practice, it is already influential.

Accordingly, in the UK, budding GCHQ spies may become entrepreneurs by exploiting GCHQ «Big Data» intellectual property (IPRs) for Cybersecurity applications or «Apps». The scheme is based on the UK's «Teach First» programme success whereby selected bright graduates work in challenging schools for two years on the promise of a commercial job if they leave teaching. To further this, the UK's Government Communications Headquarters (GCHQ) set up 11 university cyber-research centres & 2 virtual-research institutes. In 2014 its first cryptography «app» was released under National Cyber Security Strategy designed for firms and the public sector to combat cyber-attacks (e.g. N. Korea). Today, it is often overlooked how much *innovation* originates at public initiative (as «collective» or «demand-driven» innovation). Historically the public sector has had traditional conventions and rules against exploiting taxpayer funds for risk-investments. But where funding is strategic (and enormous) as in defence and healthcare, this risk-fear is lower. With the threat of Islamist-inspired jihadi terrorism at home and abroad, the strongest source for public innovation today is from spying. As we note below, this means Big Surveillance Data for Cybersecurity, especially as evolved over time in Unit 8200, NSA & GCHQ.

Derived from the «dark web» skills obtained over decades by SIGINT that USA, UK and Israeli exporters of cyber security products find in demand, are the following. They include algorithms designed to protect companies, banks, governments and —since 9/11, 7/7, Madrid, Mumbai, Paris and Brussels— citizens far away from the Middle East war zones —from the growing «dark web» of hackers, fraudsters, snoopers and terrorists. As noted above, such exports from Israel alone topped $6bn, about 10 per cent of the global cybersecurity market in 2015, exceeding Israeli exports of military hardware for the first time. Today this market is also growing rapidly after high-profile hacks that in some cases —such as at US retailer Target and Sony in 2014, more recently the «Panama Papers»— have cost CEOs and even a Prime Minister their jobs.

As in other spy agencies, a key focus is data mining, and specifically the ability to sift through mountains of information to find the one menacing email, or the recurring patterns that suggest something is suspicious. To get a clearer idea of the tools the unit uses in its work, Reed (2015) visited Tel Aviv University to interview Oded Maimon, a leading expert on data mining and artificial intelligence —teaching

computers to do not just what they have been told but to predict things that have yet to occur. Maimon edited the manual called the definitive *Data Mining and Knowledge Discovery Handbook*. Like other Israeli mathematicians, he has worked for both the intelligence services and the private sector. In the past, he advised *Verint*, an Israeli-founded video-and-audio-monitoring company now based in Melville, New York. The first step is to obtain raw information, where in Israel - «8200 is very important here». Once intelligence is gathered and organised into a database, an analyst needs to seek a common denominator.

«Big data» experts call this *fusion*: the ability, for instance, to interpret an object identified from different angles by different means —possibly a drone in the air, a camera on the ground, or a listening device in a phone. Human senses can do this naturally but computers have to be taught. One intelligence source might have identified someone talking in a car on a phone while another, using a camera on a plane, identifies the same car. «You create a knowledge base», Maimon said. «You now know not only that a person is in a vehicle but you have the information that his phone is interesting to you.» Analysts can then apply data mining algorithms to this «knowledge base» —determining, for example, from a base of several million conversations, which two are relevant. Algorithms also do what Maimon calls «data compression» —for instance, to establish that a target makes calls every day at 7.30 am and 4.00 pm. This can then be matched with other intelligence. «Finding a modus operandi is important,» Maimon said. Only at the end of this process is human intervention needed. Among the options available might be an arrest, a drone strike or another military operation. These are the «regional» even «local» conditions for systemic innovation rooted in pure and applied mathematics and computer science that create the invaluable but purposive, albeit «disinterested» science that creates potentially profitable enterprise ecosystems from trained cadres of entrepreneurs.

3.2. High Frequency Trading: From the «Dark Web» to «Dark Pools»

Much encryption protects information, transactions and criminal acts on the «dark web» and much cyber-security entrepreneurial activity is involved with «hacking» or data espionage into such information flows, especially where they are intended for nefarious practices. As we have seen and can be further understood from analysing cyber-security company prospectuses on websites such as Cybersecurity 500 (2015) their interests are focused upon such activities as: adversary pursuit; cyber threat/attack protection; cloud content security; forensic analytics; file encryption; anti-terrorism and homeland security; mobile forensics; enterprise identity management; cyber security analytics and many more. In contemporary digital finance, decentralisation to competing exchanges and financial facilities has created a new financial communication ecosystem. However, amid the distributed stock exchanges, «matching exchanges» (see below) and data centres we conclude with a brief and relatively straightforward light-speed «new economic space» without such complexities. Indeed it is a single, linear light source targeted directly at massive profitability,

involving much geographic proximity, a singular business, involving questionable legality, which has, even so, out-performed the regulators in its application of hyper-advanced technology. The subject, in brief, is High Frequency Trading (HFT).

The «Dark Pools» in the sub-title here, are hidden deposits of enormous investments by global investment banks, pension funds and hedge funds, also occupying parts of the «dark web». Such dark *pools* are inaccessible even to investors whose investments are directed to «dark pools» by their chosen financial institution. Like pilot fish accompanying the bow-wave of the shark swimming in the ocean, the ecosystem of broker intermediaries is large in number but small in scale. The obvious reason for «dark pools» is privacy, but for whom? Actually it is especially for the investment banks and what Michael Lewis (2015) calls

> «the hidden passages and trapdoors that riddled the (stock) exchanges (mean)... the world's financial markets were designed to maximize the number of collisions between ordinary investors, and for the benefit of high-frequency traders, exchanges, Wall Street banks, and online brokerage firms. Around these collisions an entire ecosystem had arisen» (Lewis 2015, 179).

An irony of this ecosystem is that it evolved as a low-trust zone of individualism and predatory exploitation of tiny margins, «front-running» property, in effect, stolen from investor accounts. Where these are hidden in «dark pools» obscured from investors, HFTs pay enormous up-front fees to the nine banks responsible for designing the dark pools and controlling 70% of Wall Street stock market orders (Patterson, 2012). These were, by 2011 market share, *Credit Suisse, Morgan Stanley, Bank of America, Merrill Lynch, Goldman Sachs, J.P. Morgan, UBS, Citi*, and *Deutsche Bank*. The banks also have their own HFTs, which are in competition with the rest of the ecosystem. To these can be added a variety of hedge funds with their favoured or captive HFTs. Characteristically, HFTs are populated by engineering and technology doctorates recruited by the «big nine» banks who subsequently move on to found or consult for smaller HFT firms. It is estimated that in Wall Street the technical «kingpin» elite of HFT innovators number no more than twenty-five experts, many of them Russian mathematicians.

The unique HFT selling point is speed. Through the computerisation of stock trading by direct orders to HFTs or through the dark pools, the first HTV to the order (the «front-runner») wins the business in a zero-sum game that rewards the winner. The manner in which market signals travel to and from the now digital public and private exchanges by means of fibre-optic cables creates two new levels of «new technology space». These are found at two types of location, meso and micro, determined the cost of their different geographies. These, in turn, are determined by the ecosystem imperative of destroying historic stock exchange monopoly by the introduction of competition. Thus until the New York Stock Exchange (NYSE) had evolved to become an electronic hybrid market, it was the main US stock exchange. The introduction of exchange competition thereafter had spatial implications at what can be termed the meso level based on the decentralisation of a total of 13 public markets. These are run by the New York Stock Exchange, NASDAQ, BATS (Better Alternative Trading System) and Direct Edge. Between the public stock exchanges

and the dark pools were in 2015 nearly 60 private exchanges, most of them in New Jersey, where an investor could buy any listed stock. Associated with the exchanges were various infrastructural facilities such as data centres, server farms and what are called «matching engines». These match stock market bids to offers.

Now the digital geography can be outlined: hence the NYSE can be accessed through Manhattan and Newark, NJ but it has its matching engine in Mahwah NJ. IEX (the private exchange set up by Royal Bank of Canada with speed-equalising algorithms of 350 microseconds aimed at defeating Wall Street's «rigged» markets) has its «matching engine» in Weehawken NJ and a «point of presence» (POP) in Secaucus, NJ. In 2015 BATS moved its stock exchange, contracted to global «colocation» «services ecosystem» specialist *Equinix*, to its NY5 data centre in Secaucus, NJ from its former Weehawken NJ2 data centre. *Equinix* now also hosts the Direct Edge public exchange, which BATS acquired in 2014, itself moving to NY5 in Secaucus a year later. The BATS and Direct Edge secondary data centres remain in Chicago. NASDAQ's primary data centre is located in Carteret, NJ and its secondary one at Ashburn VA. Its first POP was also located in *Equinix*» NY4 facility in Secaucus NJ and connected by high-speed wireless to Mahwah NJ. Other proprietary data centres in the «service ecosystem» include the likes of *British Telecom's BTRadianz* in Nutley NJ. A similar meso network links the City of London (LSE) to competing exchanges in Docklands (BATS) and along the M4 Corridor to Basildon (NYSE) and Slough (BATS-Chi-X *Equinix*) data centres.

Among NASDAQ's recent announcements was its New Wireless Express offering from Carteret to Aurora, Illinois near Chicago with its specialist stock exchanges. This is the simple part of the complex story of HFT because the demand for ever-increasing millisecond speed advantages using fibre-optic light in as near as possible to uninterrupted space led to the cabling by the *Spread Networks* company of the New York to Chicago exchange system with a private fibre-optic connection. This cost the first two hundred members to invest in the service some $14.0 million for a five year contract. At higher than the meso to the macro-regional level this enhanced relational proximity as follows. It enabled a trader needing to be at both places at once to reduce signal time from Carteret to Aurora and back from some 17 milliseconds to 12. The geographic distance of the return journey is 2,300 km or 1426 miles.

This returns our narrative in this entrepreneurial ecosystem, of little social value compared to individual avarice, back to the micro-local scale because all HFTs want to be in the closest proximity to the public, private, «dark pool» exchanges and POPs. There thus grew a remarkable boom in demand for an HFT firm's terminal to be —in the jargon— «colocated» with or preferably «within» the exchange. This was for the advantage gained through gaming the meso-regional light speeds connecting other public and private exchanges. But now, with the macro-line to the Chicago exchanges, added value to «front-run» and «rig» a further variety of markets had occurred. As hinted, one upshot was that firms demanded colocation presences inside the exchange. The NYSE and other exchanges leased these spaces at a handsome profit, allowing HFTs to be located nearer to the servers than their competitors. Some

demanded shorter or faster fibre-optic cable or better intra-exchange locations. Thus the economic asset of «proximity» (which is a word that has no legal representational status) became legally and economically acceptable if termed «colocation». As an indication of the cost of these milliseconds, Lewis (2015, 64) estimated *BTRadianz* alone paid $80 million between 2005 and 2008. This was purely to allow HFTs to colocate their computers near to the relevant stock exchange matching engines. The *BTRadianz* public relations discourse, legally more flexible, announced in 2015 the launch of «BT Radianz Proximity Solutions» combined with «BT Radianz Ultra Access» allowing customers to have direct market access to global stock exchanges via *Spread Networks*.

4. Conclusions

These two attempts to demonstrate some key nuances of «new technology spaces» reveal some similarities and some differences. The most obvious difference is that privacy, confidentiality and avarice combine in ways that are legal in a neo-liberal ideological era. Regional and global «innovation», if that is an appropriate word for it, has been reduced to dog-race scrabbling for a privileged location for profit-seeking. In the pursuit of zero-sum outcomes that transmutes into a struggle even to «colocate» on the floor of a data centre in proximity to a stock exchange's «point of presence» or in the dusty corners of an actual digital exchange. As we have seen entrepreneurial ecosystems of greater or lesser moral hazard display shared, tightly circumscribed network cultures. Contrariwise, at first compared to finance's «dark pools,» the «dark web» of cybersecurity activities can seem almost honourable. But SIGINT can have an even deeper dimension when it comes to «neutralising» Islamist terrorists, implementing drone attacks or intercepting jihadist signals, all in the name of security.

The technologies that allow for these kinds of entrepreneurial «new frontiers» are ultimately similar. They use the «light» of fibre-optic technology to explore the «dark» side of the evolving digital world of communication. Both are a triumph of an ancient contrast in social science between «community» and «association». Possibly the entrepreneurial ecosystem of HFT finance is more anomic than those forged in the solidarities but also the atrocities of contemporary civil and guerrilla wars. It is always more obvious that entrepreneurship can involve simply the banal pursuit of profit at the expense of innocent participants in stock market speculation. Many of the originators of structured finance were semi-disinterested innovators more animated by their innovation more than pure profit. A comparison of a kind can be drawn with the military service innovations from Unit 8200 that were only later turned towards commercial markets by talented or at least professional entrepreneurs. Finally, the focus has also been on the way resilient places may never revive, while others, blessed with new kinds of knowledge, institutions and resources may thrive. Thus the Negev remains a natural desert but has been stimulated into growth by military research and entrepreneurship. HFT has spread to the Edge Cities of New Jersey and, to a lesser

extent, the M4 Corridor near London. Meanwhile Detroit and Sarajevo, once global innovator cities, remain in ruins, isolated as a consequence of marginalisation, social polarisation and «conflict urbanism» which are exploited elsewhere in today's «new technology spaces».

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Section ARTICLES

Journal of Regional Research Investigaciones Regionales

Towards inclusive and resilient regional labour markets: challenges for research and policy

Jouke van Dijk *, ** , Arjen Edzes *

ABSTRACT: Unemployment and inactivity remain among the largest social and economic problems in society, especially in the context of structural developments, such as sectorial shifts in employment structures and globalization, coupled with robotization and automation, that question future job growth. These employment-related issues vary by region, and between urban and rural areas, due to differences in economic structures and location factors, and in the quantity and quality of the labour force which is to an extent related to aging and processes of spatial sorting. Science and policy, particularly where related to economics and geography, are developing alongside two perspectives that dominate labour market research: the economic investment perspective and the social compensation and activation perspective. This paper discusses specific challenges facing research and policy and offers three recommendations that aim to stimulate inclusiveness in regional labour markets: the necessity of a place-based approach, the need for fundamental changes concerning the concept of labour and enhancing effective regional governance.

JEL Classification: R23; R12; J21; J24; J33.

Keywords: regional labour markets; regional economics; unemployment; social inclusion; labour market policy.

RESUMEN: Una de las principales preocupaciones socio-económicas en la actualidad continua siendo el desempleo y la inactividad laboral. Especialmente en el contexto de cambios estructurales, como los que se derivan de la globalización o de la automatización y robotización de la producción, que pueden poner en tela de juicio la evolución futura del empleo. Sin embargo, existen diferencias a nivel regional, así como entre áreas urbanas y rurales, debido a las diferencias en cuanto a estructura económica y otros factores de localización, así como en la cantidad y calidad de la mano de obra debido a componentes demográficos y otros procesos de distribución espacial. Tanto la Ciencia como la Política, particularmente en lo que concierne a la Economía y la Geografía, se mueve en la actualidad en torno

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a dos corrientes que dominan la investigación sobre los mercados laborales. Por un lado, la que analiza la inversión económica. Y, por el otro, la que lo hace desde el punto de vista de la compensación social. Este trabajo discute aspectos concretos sobre estas corrientes y concluye resaltando tres necesidades que pretenden estimular la inclusividad en los mercados regionales de trabajo: procedimientos basados en la localización; cambios en el concepto de mano de obra; y, finalmente, una política regional efectiva.

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Palabras clave: mercado de trabajo; economía regional; desempleo; inclusión social; políticas de empleo.

1. Setting the scene

In the summer of 1930, at the start of the Great Depression, John Maynard Keynes gave a speech in Madrid entitled «Economic Possibilities for our Grandchildren». He stated that, over time, humankind was solving its economic problems thanks to the process of capital accumulation. He predicted that the standard of living in progressive countries would, in one hundred years, be between four and eight times higher than it was in 1930, and that the standard working week would be fifteen hours. An important societal problem foreseen in Keynes' prediction would be how to spend leisure time (Keynes, 1963).

With hindsight, one cannot deny the fundamental and dramatic changes that modern labour markets have faced over previous decades. In that sense, Keynes was right although maybe the reasons are different. Under the influence of globalization, technological change and information and communication technology, the employment and occupational structure is changing fundamentally. Labour relations are in transition in the sense that lifetime employment is increasingly being replaced by flexible contracts and working hours, employability and entrepreneurship and self-employment. Ageing and demographic transitions mean that most western countries are facing serious challenges in enhancing labour productivity and labour participation. Last but not least, people are on the move, in search of a better life or work opportunities. However, in contrast to Keynes' predictions, current labour market problems are not framed as a luxury of how to spend our leisure time, but rather as a question of inclusiveness: how can we include everyone in today's labour markets, reduce the sharp separation between insiders and outsiders and fight the poverty that results from poor working conditions and labour relations? Social exclusion and increasing immigration challenge the adaptive capabilities of national economies, regional labour markets and educational systems, and also put pressure on societal solidarity.

The global financial crisis that started in 2008 caused unemployment to rise to levels that had not been seen for decades. Today, unemployment remains at unacceptably high levels in a considerable number of European countries. Although labour

market conditions are improving, and the proportion of the working-age population with a job is projected to return to its pre-crisis level in 2017 (OECD, 2016a), the recovery continues to be uneven across regions and countries. Further, vulnerable groups such as low-skilled youths not in employment, education or training (the so-called «NEETs») face the risk of being left behind. The OECD report also signals that, as labour markets continue to recover from the impact of the financial crisis, longer-term weaknesses and structural changes in labour markets will become more visible. So, on the one hand, the financial crisis has led to cyclical developments while, on the other, it has hidden structural reforms and changes to an extent caused by aging and the rapidly increasing robotization, automation and globalization of society.

These general labour market trends influence the position of individuals and households, and also the positions of regions. Not all regions are affected in the same way, partly due to their specific industrial structures in combination with regional location factors, human capital characteristics and institutional, socio-cultural and governance issues. The recent publication Regions at a Glance (OECD, 2016b) clearly shows persistent regional disparities in terms of GDP, unemployment, education and other indicators of wellbeing such as health. It is widely accepted that individual happiness and wellbeing are closely related to having a job and earning an income. It is generally acknowledged that regions matter, and that differences in labour market outcomes illustrate differences in the unique characteristics of people and places (McCann *et al.,* 2013; OECD, 2011). This not only sets the stage for a new framework of place-based policy, it also fundamentally challenges the general labour market theories that offer explanations for regional variations in labour market outcomes. It also challenges the economic geography theorists to integrate general labour market theories into theories that explain spatial variations in labour market outcomes.

The main question we address in this contribution is what are the specific policy challenges in stimulating inclusiveness in regional labour markets? First, in Section 2, we discuss the trends in labour market developments in more detail and discuss their spatial implications. Then, in Section 3, we will argue that these developments set a new framework for regional labour market analysis and place-based policies. We are not aiming to develop a new regional labour market theory, rather we explore new research and methodologies that address regional labour market analysis. In Section 4, we address specific policy challenges from two perspectives: an investment-focussed perspective on regional economic policy to boost employment growth; and a compensation-centred perspective on social security and welfare, including an active labour market policy to re-integrate the unemployed into the labour market. Section 5 discusses governance issues related to bringing regional synergy into the policy domains (regional economic policy, ALMP, education and welfare), stimulating co-operation between stakeholders and enhancing effective and efficient implementation of policy instruments. Finally, in Section 6, we draw conclusions and offer recommendations for research and policy.

2. Trends in the spatial organization of labour

In the traditional, neo-classical, labour market theory, demand for labour is viewed from the firm perspective. The demand for human capital, consisting of a bundle of skills, is seen as a production factor that determines both productivity and its price in the form of wages. In the micro-economic theory of labour supply, an individual is willing to exchange hours of leisure time for hours of work depending on their preference for leisure time versus the desire to earn an income with which to buy goods and services. The labour market is where supply and demand meet, with the result that market forces determine the wage rate where labour supply and demand are in equilibrium.

In reality, the functioning of labour markets is much more complex. Rather than preferring leisure time to work, unemployment makes people unhappy, not only because of a lack of income but also because it lowers self-esteem and may ultimately lead to social exclusion. Labour markets are also segmented by occupation and region due to the heterogeneity of skills and limited job mobility and constraints on spatial mobility. Labour markets sometimes have sharp demarcations between the insiders, i.e. those with stable labour relationships and good working conditions, and the outsiders, those who are unemployed, inactive or disabled, or are in flexible working relationships with poor working conditions (Kahn, 2011). Further, labour markets are embedded in institutional and cultural patterns that are path dependent and not easy to change. This so-called «structuralist» or «balkanized» model of the labour market (Kerr, 1954) can be traced back to John Stuart Mill and Pigou who were dissatisfied with Adam Smith's conception of the competitive labour market.

In a historical setting, Martin (2000: 455) describes different periods in which spatial differences in labour have been conceptualized. From the 1930s to the mid-1970s, labour was viewed as a production factor available at a particular location as input into a firm's or an industry's production process. From the late 1970s, the focus shifted to the spatial division of labour, i.e. the idea that regional development and the distribution of employment are spatial expressions of the technical and social organization of labour in the production process. Labour remains unique because firms, in contrast to physical capital, do not own workers since slavery has been abolished. Another unique feature of human capital is its relative spatial immobility. In contrast to the assumptions underlying neo-classical theory, people are not footloose and this creates spatial mismatches and regional differences in unemployment. The labour market is in essence on a regional scale because commuting distances are limited by time and cost constraints, and more permanent relocations of labour through migration is also costly (Venhorst, 2012). Further, softer factors such as place-attachment and familiarity play a role in the choices made regarding commuting and migration behaviour (Venhorst, 2013). Since the late 1980s, there had been greater emphasis on the geographies of the labour market: on the idea that labour markets have an intrinsically local level of operation and regulation, that «the creation and destruction of jobs, and the processes of unemployment, unemployment, and wage setting, and the institutional and social regulation of the processes, to some extent at least, are locally constituted» (Martin, 2000: 456).

However, in today's global economy, the main drivers of economic growth, i.e. technological and demographic change, globalize the competition for highly skilled talent and production locations as a consequence of digital Taylorism (Brown, Lauder and Ashton, 2011). These developments create problems of social exclusion in local communities and regions, unemployment and skill mismatches (Froy, Giguere and Meghnagi, 2012). As Martin (2000: 457) argued: «The increased spatiality of the labour market poses economic geographers with a series of important empirical and theoretical challenges, not only in making sense of the new patterns that are emerging, but also in terms of understanding how local labour markets function and what form local labour market policy interventions should take».

In achieving a better understanding of the functioning of the modern regional labour market, the following major trends need to be taken into account:

1. *Sectoral shifts*: there is an ongoing trend in that modern economies show major shifts in sectorial employment. Historically, the majority of jobs were in agriculture followed by a period of an increase in manufacturing jobs. Technological progress and economies of scale were the main driving forces. Nowadays, in all modern economies, the vast majority of the jobs are in the service sector but, because of the use of information technology, jobs in the service sector are at risk and some are disappearing. Due to the robotization in manufacturing and automation in services, it is especially jobs matched to lower-medium levels of education that are disappearing, while this has led to more jobs for the higher educated (Arntz *et al.,* 2016; Frey and Osborne, 2013). As a result, there is increasing polarization in the labour market (Goos, Manning and Salomons, 2014). In essence, the number of low-level jobs remains stable, while jobs at the medium level are dropping and the number of jobs requiring high levels of education is increasing.
2. *Knowledge intensity:* technological progress and innovation have meant that the unique added value of human capital is increasingly related to performing complex tasks requiring knowledge-intensive competences gained through high-level education. In addition to specific occupation-related skills, more general «21st century skills» (De Fruyt *et al.,* 2015; Voogt *et al.,* 2012) are also required and competences need to be kept up-to-date by means of lifelong learning.
3. *Education:* as a consequence of the increasing knowledge intensity, the education level of the labour force is increasing, and higher educated people are much more successful than lower educated ones in term of higher wages and lower unemployment, and also in terms of wellbeing. Higher educated people have better health and a higher life expectancy (McMahon, 2009). Investment in education has a good return but, unfortunately, there are a growing number of individuals unable to achieve the level of education needed for a successful career. A substantial number of people have problems in the workplace due to insufficient basic reading and writing skills.
4. *Aging:* demographic transitions are leading to an aging population, declining birth rates and a shrinking labour force. On the one hand, this may mean we

have to produce more with fewer people, requiring an increase in labour productivity that could be facilitated by technological change and social innovation. On the other hand, the hours of labour available may increase if weekly working hours are extended by reducing part-time work, if lifetime working hours are increased by raising the retirement age, if participation rates increase, if new jobs are created, through job carving, that can be filled by low-skilled workers who are presently unemployed, or through immigration. The downside of increasing the retirement age is that it may cause problems in terms of more workers with outdated skills and more health problems that may result in lower productivity. Malmberg *et al.* (2008) observe that the age composition of the working-age population affects productivity in a complex way. In their view, two hypotheses are relevant. The first is based on productivity measurements at the individual level: with most studies indicating that labour productivity peaks somewhere between 30 and 50 years of age. The second hypothesis is based on events at the Horndal steel plant in central Sweden. Between 1927 and 1952, this plant experienced a mean annual growth rate in productivity of 2.5 percent despite the fact that no major investments were undertaken and the proportion of workers aged over 50 increased from one-third in 1930 to almost half in 1950 (Genberg, 1992). This finding suggests that workforce aging is not a problem for productivity growth. On the contrary, an aging workforce seems compatible with rapid increases in labour productivity through a learning-by-doing effect. Later, this formed an important part of Kenneth Arrow's learning-by-doing argument (Arrow, 1962). Malmberg *et al.* (2008) argue that although the two hypotheses appear incompatible (older workers have a lower level of productivity but a higher growth rate), both may be true and conclusions regarding the productivity of an aging workforce may not be as obvious as they may seem, because the aggregate effect is not necessarily a simple sum of the productivity of the age groups.

5. *Flexibilization, changing working relationships:* the proportion of workers with a full-time permanent job is decreasing, and an increasing number have temporary contracts and part-time jobs. The traditional nine-to-five working day is being replaced by flexible working hours. The advantage for the worker might be that they can choose their preferred working hours but, on the other hand, the disadvantage may be that the employer expects workers to be available 24/7. There is also a shift from working in a job-related contract at a specific employer towards working on project-related contracts in which individuals work on specific projects on a self-employed basis.
6. *Increasing spatial mobility:* there is a trend that commuting distances are increasing, especially for the more highly educated. This goes hand-in-hand with a shift from daily commuting journeys during rush hours to a fixed working place to patterns with flexible working hours and locations that require non-daily travel mostly in off-peak hours. With good access to high-speed broadband, workers are able to work partly at home and also while travelling. This working pattern may increase further when the self-driving car becomes an everyday reality.

7. *Increasing urban - rural divide:* historically, there has been a trend for economic activities to be concentrated in cities where agglomeration advantages can be achieved. This is matched by the concentration of higher educated people in cities, which starts when students move to cities to attend institutions of higher education (HEIs) (Venhorst, 2012). After graduation, they may move to another city for a job, or to high quality residential areas in suburban areas in close commuting distance to a large city, but they rarely return to or settle in very remote rural areas. As a consequence, due to this social and spatial sorting process, rural areas can suffer from population decline due to selective outmigration and, as a result, only less educated and elderly people with limited spatial mobility remain in rural areas. An interesting question is whether this pattern will continue in the future. There is evidence that second-tier cities are becoming the high-growth areas, and that the growth of large metropolitan areas is slowing. If the relationship between place of work and residence continues to weaken due to flexible working hours, the use of the internet and the introduction of the self-driving car, what is seen as the most attractive type of residential area might become a larger radius around urban centres because smaller cities can make use of facilities and amenities in large cities through the concept of «borrowed size» (Alonso, 1973).
8. *Decentralization of labour market policy:* since the 1990s, there has been a tendency in several countries to decentralize labour market policy so that it is designed and implemented with efforts from local and regional governments, the private sector, trade unions and community groups (Broersma *et al.,* 2013; OECD, 2003). It is claimed that decentralization enhances the balancing of development strategies for economic development, social inclusion and the quality of life. The OECD (2003) distinguishes two main types of decentralized structures in the design and implementation of labour market policy. The first is when programmes are implemented at the regional level following national guidelines or within a policy framework established at national level. The other form of decentralization is when powers to design and implement policies are also devolved to regional governments. In both models, various arrangements are possible with regard to funding, which may come from the national government, but also partly through local or regional taxes. In this respect, the choice of spatial scale is also important. Ideally, this should be at the scale of the regional labour market but, for practical reasons, policy is sometimes decentralized to local governments on a smaller spatial scale such as municipalities resulting in a need for cooperation.
9. *Globalization:* this increases and enforces an international interdependence of economies, countries, regions, cities and businesses because of the fragmented modes of production in value chains all over the world. Relocations or closures of businesses are increasingly the result of decisions made in foreign head offices. Regions will need to guard against abrupt economic changes, which will make it necessary to invest in resilience.

The latest economic recession has created an unemployment crisis that has obscured the underlying permanent changes in regional labour markets. The recession has created cyclical unemployment, but structural and permanent changes that affect long-term employment and training requirements are needed to solve structural problems such as social exclusion and aging that are fuelled by fundamental changes in our society. The response of resilient regions to these developments will determine the future earning power and employment development of regions.

There is a need to continue to innovate and take maximum advantage of the specific knowledge infrastructure, sectoral specializations and existing business networks that are available in a region. This is sometimes referred to as «smart specialization». For the regional labour market, this means that economic adjustment processes have to go faster, which necessitates more flexible labour relationships and greater dynamism in the labour market. The numbers of temporary contracts and of self-employed have already been increasing for years, and guarantees of a job-for-life are disappearing. The rapid and continuous change in needed skills requires not only life-long learning, but also other skills: the so-called 21st century skills. However, to solve the problem of social exclusion, fundamental changes with regard to the concept of labour and related institutions might also be needed.

3. The case for place-based policies

Although labour market conditions are continuing to improve since the start of the global financial crisis in 2008, and the share of the working-age population in work is projected by the OECD (2016a) to return to its pre-crisis level in 2017, the recovery continues to be unevenly spread between regions and vulnerable groups. Joblessness is highly concentrated in specific regions, and the variation in unemployment rates among the 362 large OECD regions (the so-called TL2 regions), and within countries, exceeds the variation across countries (OECD, 2011). This is somewhat surprising, and shows interesting patterns in what the OECD (2011) calls recession-hit and resilient regions. Resilient regions have managed to sustain employment growth during the recession, and experienced larger increases in qualified human capital and in participation rates than before the crisis and in the productivity of business services, implying that their employment patterns are less vulnerable to cyclical fluctuations. The recession-hit regions experienced faster economic growth and greater decline in unemployment from 1999-2007, suggesting structural fragilities in their economic structures and productivity. Hard-hit regions also had larger inflows of young people who were more vulnerable to job losses later (OECD, 2011: 64-65).

This variation in regional outcomes illustrates that strategies and labour market policies have to deal with regional labour-market variation (Froy *et al.,* 2012; Blien *et al.,* 2010; OECD, 2011, 2012, 2014). Further, it also illustrates the need to gain better insights into specific problems associated with specific groups (such as unemployment, inactivity or mismatches between demand and supply) in relation to economic and institutional characteristics of a region (OECD, 2014). Attempts to classify re-

gions, beyond the above classification by the OECD, have been made by Blien (2010) for Germany and by Baum *et al.* (2007) for Australia. These classifications can help in identifying regions with similar labour market problems and can serve as a starting point to develop strategies for a labour market policy and for the evaluation of policy measures aimed at enhancing the resilience of regions.

In economic geography circles, the debate is between space-neutral theories, where labour is seen as highly mobile, and place-based approaches that emphasize the underdevelopment traps associated with location-specific externalities and the potential market failures that they can also inhibit. «The place based approach explicitly advocates employing appropriately designed local knowledge and learning enhancement tools in regional policy, and the smart specialization argument is one such tool» (McCann *et al.,* 2013: 14). Place-based approaches seem to have become dominant in US and EU regional policies (OECD, 2011). As such, the unique characteristics of a region, in terms of its regional economic structure, its institutions, culture and history, the availability and development of skills in its workforce combined with transitions that embody dynamics and matching processes to societal and economic needs, is at the heart of most regional labour market analyses (Storper, 2013).

From a labour market perspective, regions are seen in two ways. Regions are both the drivers of economic growth and innovation, but also places that will suffer from new poverty and lack of opportunities for those who do not have the right skills for the regular labour market. First, there is the investment and knowledge perspective as the basis for economic and employment growth. Regions compete with each other, nationally and internationally, to recruit highly skilled and high potential employees in a globalized labour market. This perspective does not speak of unemployment, or an active labour market policy, but of a «Human Capital Agenda». This production-oriented perspective on the labour market emphasizes opportunities, although in an economic crisis even highly educated people in less popular disciplines may suffer from a lack of jobs and might be forced to accept jobs below their education level and, in this way, crowd out less educated individuals (OECD, 2016a; Broersma *et al.,* 2015; Edzes *et al.,* 2015).

The second standpoint is the social exclusion perspective: that those with low skills and an unfavourable track record have little access to regular jobs because their productivity is below the level that corresponds with the minimum wage or with social security benefits. In addition, they face competition from medium-skilled workers who have lost their jobs due to automation and robotization. This competition affects mainly the less educated, such as migrant workers and disabled or elderly people who are viewed as outsiders. For this group, rather than opportunities being emphasized, the policy is targeted on poverty, care and reducing claims for compensation through social security legislation.

It is not easy to unite these two perspectives. In theory, targeting an economic agenda for jobs and economic growth may, in the long term, also foster a social agenda for compensation and the re-integration of dropouts, but, more often than not, there are few direct connections between strengthening the regional economy and

providing opportunities for the less privileged in the labour market. However, there is evidence of positive human capital externalities at the level of regions and firms (Moretti, 2011, 2012). Broersma *et al.* (2015) and Venhorst (2016) show that both production and consumption externalities have positive effects on wages. Production externalities are transmitted at the level of firms and not at the regional level. For workers in low-skilled jobs, consumption externalities dominate production externalities. Workers in *low-skilled* jobs earn higher wages when working with workers in high-skilled jobs, whereas, for *low-educated* workers, such cooperation with highly educated workers has a negative relationship with wages. Van Dijk (2016) shows that local multipliers for high-skilled jobs in the tradable sector create significantly more jobs in the non-tradeable sector than jobs for low-skilled people in the tradable sector. Insights into these links are slowly emerging but do not yet offer practical tools for local decision-makers to solve the problems of the less employable.

From the foregoing discussion, it is clear that the labour market is in a very turbulent phase due to the deep and long-lasting economic crisis combined with structural changes. We see processes of economic restructuring, automation and robotization that change the quantity and quality of the labour demand. Labour supply is also changing due to aging and migration, increasing participation rates and part-time working, especially of females. The number of people with higher education qualifications is increasing, and jobs requiring medium skill-levels are disappearing. This leads to polarization in the labour market and a severe risk of social exclusion because of a substantial number of people unable to achieve high levels of education or to use life-long learning to sustain their employability. Working relationships are changing with more flexible contracts and project-based work based on cooperation and self-employment. Sorting processes may result in an increase in spatial disparities in terms of unemployment, income, new firm formation and population decline. All these developments pan out differently in different regions (see e.g. Delfmann, 2014).

In short, there is every reason to focus on the potential of a region to achieve a situation where it has a sustainable resilient regional economy in combination with acceptable levels and distributions of wellbeing for all its inhabitants without social exclusion. In the next section, we will review the implications of this for policy.

4. Challenges for regional economic and labour market policy

In this section, we will review the policy challenges in achieving a sustainable regional economy in combination with acceptable levels and distributions of wellbeing for all inhabitants without social exclusion. First, a careful analysis is needed of a region's economic, social and labour market problems. Here, an important question is whether the structure of the regional economy matches the available human capital stock, both in quantitative and qualitative terms. In terms of the regional labour market, it is necessary to know the nature of the unemployment problem, and here there are three basic possibilities:

1. Demand deficient (Keynesian/cyclical) unemployment, i.e. a lack of jobs that requires the creation of more jobs.
2. Structural unemployment, i.e. a mismatch between supply and demand with regard to skills/occupations and/or regions that can be solved by education/training and/or migration/commuting.
3. Frictional unemployment that requires an improved matching process.

4.1. Employment stimulation - Investment policy

It might very well be the case that all three unemployment types are present in a region. When the problem is a lack of jobs, an employment policy is needed that strengthens the regional economy. Obvious policy directions are to increase the number of jobs by enhancing regional competiveness by stimulating innovation through regional innovation systems. This requires at least a regional innovation strategy (RIS) agenda in combination with a place-based smart specialization strategy. The basic aim is to strengthen the resilience in the region, although there is still considerable ambiguity about what is precisely meant by the notion of regional economic resilience, about how it should be conceptualized and measured, what its determinants are, and how it links to patterns of long-term regional growth (Martin and Sunley, 2014).

One can define resilience as the ability of individuals, employers, industries and regions to adapt to changing and intermittent conditions. For resilience and adaptability, the availability of action strategies is of major importance, and these are not easy to identify and implement (Storper, 2013). Simply put, the more possibilities there are for action, the greater the resilience. For regions, this might mean economic diversification and the ability to respond to increased economic headwinds, but not too much because that would equate with reduced scale efficiencies and a loss of the innovation benefits associated with specialization. As such, the key phrase is «related variety» (McCann *et al.,* 2013; Neffke *et al.,* 2011). A feature of such variety is a regional knowledge base that promotes the cross-fertilization of skills, knowledge, ideas and activities, leading to innovation. The EU has translated this notion into ways for regions to specialize in smart activities that fit the region and the people who live and work there. In short, regional innovation, economic growth and resilience will benefit from inter-sectoral connections (relatedness) and a connection to the knowledge and skills of the local workforce and social capital in the region (embeddedness) (McCann *et al.,* 2013).

Based on the strength of the region, and exploiting its existing potential means, its historical achievements, and the path-dependent socioeconomic infrastructure and its physical and geographical location, regions can develop a so-called RIS3 agenda (Regional Innovation Strategy for Smart Specialization). These RIS3 agendas address innovation and the required human capital, but pay scant attention to combatting unemployment. The focus is on a Human Capital Agenda to ensure that, when new jobs are created, enough workers are available with the right skills. However,

policies targeted at stimulating investments, fostering the creation of new firms (start-ups) or attracting firms to relocate to the region may also lead to the creation of new jobs, especially if these firms operate in tradable sectors. An adequate infrastructure, in terms of roads, harbours etc., but also educational facilities and cultural amenities, and an efficient governance structure may help to achieve this goal.

A labour market policy for the creation of new jobs needs to start from the firm perspective and have, as its main objective, solving the labour market problems of firms. As such, it needs to have a close relationship with the Human Resource Management policies of firms.

4.2. Active Labour Market Policy (ALMP)

When the starting point is the unemployed pool available for work, or the inactive labour stock, and especially when the aim is to increase their chances on getting a job, governments and other stakeholders can use Active Labour Market Policy (ALMP) instruments. ALMPs stimulate entry into paid employment and thereby avoid or prevent social exclusion. ALMPs can increase the competitiveness of regions, and raise output and welfare in a region, if they help to re-allocate labour between sub-markets or contribute to maintaining the size of the effective labour force by preventing long-term unemployment. Bonoli (2010: 440-441) describes various forms of ALMPs based on two dimensions. The first is the extent to which the policy objective enables people to enter demand-driven market employment, provided by either private or public employers. The second dimension is the extent to which programmes are based on investing in jobless people's human capital. This investment can take the form of vocational training or help in developing the kind of soft skills that employers look for when selecting candidates. The intersection of these two dimensions allows us to identify different types of labour market policy and to map the variety that exists under the ALMP heading.

From Table 1 it is easy to see that ALMPs can take different forms, such as training to improve the skills of workers, to increase their labour productivity or to make them suitable for vacancies that require additional skills. This can involve taking part in additional training, or the use of temporary wage subsidies to compensate firms for investing in on-the-job training. ALMPs can also aim to improve the matching process in the form of counselling and vocational guidance or job search courses. Besides improving the quantity and quality of labour supply and the matching process, ALMPs can also be motivated by the desire to alleviate the moral hazard problem of unemployment insurance. Public opinion seems to be that the right to receive social security payments should go together with an obligation to find a job as soon as possible in order to minimize the cost to society of social security. However, when the difference between social security payments and the potential wage from a new job is small, there may be little incentive to put a lot of effort into searching for a job: the so-called unemployment trap or poverty trap. There is also the inactivity trap: when income-related benefits may be lost upon taking paid work. To increase the chances

of someone finding a new job, taking part in ALMP programmes can be obligatory, and people who fail to do so may face sanctions.

Table 1. Four types of Active Labour Market Policy

		Investment in human capital		
		None	*Weak*	*Strong*
Pro-market employment orientation	Weak	(Passive benefits)	Occupation Job creation schemes in the public sector Training programmes unrelated to employment	(Basic education)
	Strong	Incentive reinforcement Tax credits, in work benefits Time limits on benefit receipt Benefit reductions Benefits conditionality	Employment assistance Placement services Job subsidies Counselling Job search programmes	Upskilling Job-related vocational training

Source: Bonoli, 2010.

The use of ALMPs can be justified from an individual perspective because they assist an inactive person to find a job, from a regional economic perspective for improving the quality and quantity of the labour supply and from a societal perspective by responding to the moral hazard problem of unemployment insurance. However, a key question is whether the use of ALMPs is effective and efficient, both for the participants in the programmes and for society as a whole. ALMPs have been in operation for quite some time and there have been a large number of evaluation studies of various kinds. Eichhorst *et al.* (2016) argue that an ideal ALMP evaluation process should involve three steps:

1. Based on clearly defined success criteria, one should analyse whether participation in a measure is causal in improving the situation of the participating individuals;
2. Next, one should assess whether the individual successes justify the cost for the measure, and
3. Finally, one should determine whether the measure has also achieved net positive effects on the aggregate level.

Card *et al.* (2015) have recently published the results of a meta-analysis of impact estimates from more than 200 econometric evaluations from around the world. They find that, on average, ALMPs have relatively small effects on the participants. The average short-term impact on re-employment is close to zero due to a lock-in effect, but the impact does become more positive 2-3 years after completion of the programme.

The overall assessment of the evidence collated by these authors is that the effectiveness and the time profile of impacts depend very much on the type of programme and a participant's characteristics such as their gender, age and period of unemployment.

There has been little attempt to assess whether the impact of a programme justifies its costs. This requires a cost-benefit analysis. The costs of participation in an ALMP programme are relatively easy to calculate and consist of the material and personnel costs of the programme plus the social security payments of the participants or their forgone earnings. The benefits are however less easy to calculate. For the participants, the revenues are that, if they become employed sooner, this leads to gains for the individual and/or the firm in the form of higher wages and higher productivity. The cost of training can then be justified by the reduced expenditure on social security benefits. However, for a proper judgement of the costs and benefits, the third step also needs to be taken because ALMPs not only affect the labour market success of participants. Due to indirect effects (substitution, displacement and deadweight loss), they might also affect the job propects of non-participants. Hence, even if ALMP programmes have a positive effect for the participants, this does not necessarily mean that the ALMP has a positive effect at the aggregate level of the region or the country. If an ALMP leads to the re-employment of a participant from one of its programmes, but at the same time prevents that job being filled by someone else, the net effect is zero at the aggregate level (Crepón *et al.,* 2013). It could even be negative if someone else would have filled that vacancy without any cost against an ALMP.

Compared to the large body of micro-econometric evaluations, the number of aggregate impact studies taking indirect effects of ALMPs into account is rather small, largely because of methodological problems. Comparing countries is difficult due to large institutional differences. As such, according to Eichhorst and Konle-Seidl (2016), a more promising approach is to use regional variations in ALMPs in a particular country to construct a counterfactual situation. This can be used to test whether an ALMP affects the matching rate in a region since the matching efficiency is often regarded as the primary contribution of an ALMP in reducing the number of unemployed and increasing the number of employed in a region. Eichhorst and Konle-Seidl (2016) report that the results from empirical studies that follow a regional approach are rather mixed. The aggregate impact of ALMPs on the matching process depends on the programme, and often ALMPs have no significant effect. Wapler *et al.* (2014), in a study in Germany, found that a greater proportion of people participating in ALMPs leads to an increase in regional matches, but that this effect varies significantly between different types of programmes. Positive effects stem from long-term vocational training and wage subsidies, as well as from intra-firm training measures. Their results also show that the effect of the different programme types depends to some extent on the regional labour market situation. Broersma *et al.* (2011) applied a different approach, comparing the actual in- and out- flows in activation programmes of 443 municipalities in the Netherlands between 1999 and 2007, and found that control, activation, employment creation and coordination strategies had positive effects on inflow to and outflow from social assistance. This suggests that the activities of

municipalities do make a difference, although the effects are small and vary depending on labour market strategies.

A different approach in the ALMP frameworks is to distinguish target groups. The idea is that a better profiling of the unemployed leads to a better and more directed use of policy instruments. Sol *et al.* (2010) have developed a client typology (see Table 2) based on (a) their «distance» to regular and normal, non-subsidized, jobs and (b) whether this «distance» is bridgeable. This distance is generally measured in terms of the productivity gap. When there is no gap, i.e. no distance to the labour market, the solution lies in generating jobs, stimulating motivation or counselling and motivation. Where the unemployed are at a distance from the labour market, the question becomes whether this distance is bridgeable. Depending on the answer, instruments vary between training, education and wage subsidies, or sheltered employment and benefits when people cannot bridge the distance to regular jobs.

Table 2. Division of instruments by client typology

	Distance to regular jobs					
	No			*Yes*		
				Bridgeable		*Non-bridgeable*
Problems	No jobs	No motivation	No match	Skills shortage / wrong skills Need for re-integration	Able to work but low productivity	Not bridgeable
Instruments	Employment creation Job Carving	Control Incentives and sanctions	Information Counselling Mediation	Training Education	Wage subsidy Workplace adjustment	Sheltered employment Benefits

Source: Sol *et al.,* 2010.

4.3. Education and Welfare policies

ALMPs are the most obvious type of labour market policy measures because they are directly targeted at the unemployed and trying to improve their re-employment chances and reduce the productivity gap. However, other types of policy might also be relevant, such as education and welfare policies. Education policy mainly has an influence on formal education before youngsters enter the labour market. It affects their labour market opportunities because the initial level of education is a very important characteristic for success in the labour market. Therefore, policies aiming to maximize the level of schooling and prevent school dropouts can improve the long-term labour market perspective.

Edzes *et al.* (2015) found that regional factors have a significant impact on the decision whether to continue education and on the likelihood of getting a job. The most striking finding is that a buoyant regional labour market stimulates individuals to accept a job and leave school before achieving the usual starting qualifications. This group prefers the short-term goal of earning money above investing in schooling where the benefits will occur sometime in the future.

Hamersma *et al.* (2014) found that, for low-educated workers, firm and personal characteristics are more important than regional characteristics in explaining under-qualification. By under-qualification we mean that workers have less qualification than the job requires. High regional unemployment rates reduce the likelihood of being underqualified. Working in smaller firms or in firms with many highly skilled jobs has a strong positive effect on the chances of attaining a higher-level job, while working in a firm with many highly educated workers lowers these chances. Women and non-natives are less often underqualified than man and natives, whereas older workers are more often underqualified than youngsters. Gaining a greater insight into the determinants of under- and over-qualification is important when it comes to developing more effective policy measures to improve the labour market position of the most vulnerable groups in the labour market.

In addition, the contents of an education programme can help solve unemployment problems if they match the skill needs of regional employers. Cooperation between schools and companies could help develop programmes such as apprenticeships, the German Meister-Gesel system and life-long learning for later career stages. However, cooperation should not be overly targeted on the needs of one particular firm in the region. Formal education is not the same as company training. Formal education should prepare people not only for their first job after leaving school, but also for a career, and should consist of the right mix of occupational skills and general, including 21st century, skills.

The welfare policy is also relevant in this context, especially in the context of the policy goal of inclusive growth leading to an inclusive labour market. In an inclusive labour market, everyone of working age can participate in paid work, including vulnerable and disadvantaged people. This raises the question of how labour market and social inclusion policies for disadvantaged sections of the population can be implemented at the local level. What can make it easier for people to join (or re-join) the workforce? How can one remove disincentives to work and prevent in-work poverty? Although the main aim of ALMPs is to foster entry into a regular job, and especially in times of economic crisis, full employment might not be a realistic goal. In the longer term, the increasing automation and robotization might lead to structural shortages of jobs, and Keynes' prediction might after all become reality, especially for jobs requiring only low and medium level education. This may lead to fundamental problems in society: if there are not enough regular jobs for a substantial proportion of the labour force, how do we cope with this? Two major questions need answers: how will people without a regular job spend their time, and how do they get an income? Here, the welfare policy comes into play. The government may create sheltered jobs and/or allow individuals to do voluntary work, for example in the care sector or in nature

protection, while receiving an income from the state. This idea has led to a discussion on whether Unconditional Basic Income (UBI) is an option. In effect, a UBI is an amount of money, paid on a regular basis to each individual unconditionally and universally, that is sufficient to ensure a material existence and participation in society. A UBI is seen as a step towards an emancipatory welfare system. This basic income should empower everyone to have an unconditional good and dignified life. Although a UBI might seem utopian, the idea is far from window dressing. Switzerland considered a UBI as a realistic option, but in a referendum on June 4th 2016 a majority voted against its introduction. Finland decided in August 2016 to introduce an experiment in which 2000 Finnish people wound receive a UBI.

5. Governance

One of the biggest policy challenges is to bring regional synergy into the domains described above (regional economic policy, ALMP, education and welfare), through effective co-operation between stakeholders, and to implement policy instruments efficiently.

In that sense, decentralization of national welfare policies to regional and local government levels is one of the main trends in shaping social welfare in the US and in Europe (Edzes *et al.,* 2012). The OECD (2016b) recently calculated that regional and local (i.e. subnational) governments (SNGs) control many policy levels that are responsible for promoting prosperity and wellbeing, and were responsible for around 40% of total public expenditure and 60% of public investment in 2014 in the OECD area. Education, health, general public services, economic affairs and social expenditure represent the bulk (≈ 85%) of SNG expenditure. At the same time, the responsibility for these sectors is often shared, requiring coordination across national and subnational levels of government to ensure effective, efficient and coherent policy-making. Moreover, the lack of such co-ordination was indicated as a major challenge by three-quarters of European SNGs participating in an OECD Committee of the Regions survey in 2015 (OECD, 2016).

Decentralization is often justified by a need to improve efficiency. It prevents agency problems between national and local governments, and local governments are assumed to be better able to adapt policy measures to local needs, priorities and local partnerships (Broersma *et al.,* 2013). The premise is that local officials can address problems more effectively. As such, it is claimed that decentralization has an overall positive impact on the cost of public service delivery. Another claim is that local governments can indeed address and influence local problems more effectively. In terms of the first claim, Broersma *et al.* (2013) show that, for the Netherlands, shifting the budgeting responsibilities for social assistance to local governments did increase the efficiency of public service delivery.

Often regional cooperation is rather informal. Removing this laxity, and creating binding, cross-disciplinary co-operation should be at the core of the gover-

nance approach. Only in this way can meaningful connections be made between the labour market and regional investment agendas, including through the RIS3 approaches, agendas aimed at shrinking regions, regional investment funds for vocational education and urban and regional innovation and investment programmes. In addition to the national funding of labour market policy and regional economic policy, regions need greater freedom to organize their own regional tax regime. Going one step further, one could consider regional collective agreements in which employer and employee organizations, together with regional and local governments and educational institutions, make regional agreements on wages, pensions, quality of the education system, employment guarantees on job mobility and so on. Here, inclusiveness, empowerment and reform become the prime responsibility of the region to ensure regional long-term earning power and the prospects of present and future generations.

6. Conclusions and recommendations for research and policy

We started this contribution with the question as to what are the specific challenges facing policy that aims to stimulate inclusiveness in regional labour markets. We argued that unemployment and inactivity are still one of the biggest social and economic problems, and that structural developments, such as sectoral shifts in employment structures and globalization, coupled with robotization and automation, question future job growth. This scenario is accompanied by trends such as aging populations and an increasing urban-rural divide that result in enormous differences between regions, even within countries. What we also can see is that science and policy, in particular related to economics and geography, are developing alongside two perspectives that dominate labour market research. First, there is the investment perspective that focuses on regional economics, innovation strategies and clustering, entrepreneurship and spillovers. Second, the compensation and activation perspective mainly focuses on solving individual unemployment, active labour market policies, benefits and welfare arrangements. Somewhere between these two perspectives lies the field of (21st century) skills development, human capital, education and lifelong learning. On top of this, the potential to cope with these employment-related issues differs by region, and between urban and rural areas, due to the differences in economic structures and in the quantity and quality of the labour force.

On the basis of the foregoing discussion, we offer three main recommendations. First, we made a case for place-based policies. We argues that labour markets are inherently regional, because people are not as footloose as neo-classical and human capital theories assume. People are bound to regions, culture, families etc., and are sometimes locked into regions because the housing market prevents them moving. This regional orientation is one of the reasons that there are spatial mismatches in the labour market. Place-based policies will require stakeholders to acknowledge that

part of the solution lies in the coordination, at the local or regional level, of employment, skills and economic development policy (OECD, 2014) and will require the integration of the perspectives noted above. A popular theoretical notion nowadays is resilience, as a characteristic of regional economies, and also of individuals who try to establish careers in flexible labour markets. However, labour market research has had little to say on the determinants of resilient careers. What kind of education and skills, and what individual background characteristics, determine individual resilience? How is this influenced by place-based circumstances? How can we incorporate notions of resilience in ALMPs?

Second, fundamental changes with regard to the concept of labour and institutions are needed to solve the problem of social exclusion in reaching a situation of a sustainable resilient regional economy combined with acceptable levels and distributions of wellbeing for all inhabitants. It may have taken almost a century, but Keynes' 1930 prediction that how to spend leisure time would become one of the most important societal problems may now be becoming a reality, especially for those with lower and medium levels of cognitive skills. It is likely that the traditional government goal of full employment will need to be reconsidered. It is widely recognized that modern labour relations and the emphasis on employability causes more frequent switches between socioeconomic statuses such as employed, in education, unemployed or inactive, and caring. Managing these transitions for individuals as well as for employers is key to sustainable employment growth, and also for individual wellbeing and social inclusion. Transitional labour markets would be a complement to the innovation and investment strategy required to create new jobs to replace the jobs lost during the recession in Europe (Schmid, 1998: 3). Transitional labour markets are defined as institutionalized arrangements that allow or support changes in employment status or the combination of labour market work with other socially (and to some extent economically) useful activities. However, little is known about transitional careers, the volatility of these careers and their relationship with specific regional characteristics. To gain more insight in this area, a research agenda is needed that combines theories drawn from economics, sociology, psychology and geography. With the increasing availability of micro-data, it is becoming possible to monitor the long-term careers of individuals in a household and also in a spatial context. To take advantage of this type of data, new methods of analysis will need to be used, such as sequence analysis to detect typical careers patterns (Middeldorp *et al.,* 2016). In addition, the potential of Big Data to enable insight into these processes needs also to be explored.

Third, the governance of policy measures aimed at the labour market still needs attention. As we have already indicated, dismantling the informality of cooperation and creating binding, cross-disciplinary cooperation should be at the core of a governance approach. This co-operation should be closely tailored to the unique locational advantages and infrastructure of a region. A second challenge would be to transfer actual discretionary power to regions, rather than just task them with executing national legislation. Again, tailoring policy measures to the specific regional characteristics

could improve the effectiveness and efficiency of labour market policy and create the right mix of smart place-based specialization policies and of education and welfare policies.

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Section ARTICLES

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The «resourceful region». A new conceptualisation of regional development strategies

Peter Nijkamp *

ABSTRACT: After decades of regional policy experiences in many countries, with varying degrees of success, there is a need for a critical assessment and an exploration of new pathways. This paper provides first an overview of various regional development concepts that have emerged over the course of several decades, like industrial districts, growth centres or regional clusters. We point out similarities and differences in these concepts. The main emphasis of the paper is on the design and relevance of a new conditional framework for regional development, leading to the formulation of a new integrating policy concept, termed «*resourceful region*».
This concept takes for granted that each region has a portfolio of development possibilities and conditions (resources or capabilities) which should be combined and optimized so as to ensure the highest regional economic and social performance.
We offer an illustration of the relevance of this notion on the basis of the Aviation Valley in South-East Poland, and conclude with some policy and research lessons.

JEL Classification: O1; R11; R12; R58.

Keywords: regional development; industrial districts; growth centres; regional clusters; resourceful region; economic and social performance

RESUMEN: Tras décadas de experiencias de políticas regionales en muchos países, con diversos grados de éxito, se platea la necesidad de aproximaciones más críticas y de explorar nuevos caminos. Este artículo proporciona, en primer lugar, una visión de conjunto de varios conceptos de desarrollo regional que han surgido durante las últimas décadas, como los distritos industriales, los centros de crecimiento o los clusters regionales. Nosotros subrayamos algunas coincidencias y diferencias que existen en estos conceptos. El principal énfasis del artículo radica en el diseño y la relevancia de un nuevo marco condicional del desarrollo regional, lo que nos conduce a formular un nuevo concepto de políticas integradoras, que aquí definimos como «*resourceful region*» (región ingeniosa; región inteligente). Este concepto da por hecho que cada región tiene un conjunto de posibilidades

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y condiciones de desarrollo (recursos o capacidades) que deben combinarse y optimizarse con objeto de asegurar los resultados económicos y sociales más altos para una región. Se ofrece como ilustración de la relevancia de esta noción el caso del «Aviation Valley» en el Sud-Este de Polonia, y sea concluye con algunas lecciones tanto desde la óptica de la investigación como de las políticas.

Clasificación JEL: O1; R11; R12; R58.

Palabras clave: desarrollo regional; distritos industriales; centros de crecimiento; clusters regionales; región «*resourceful*» - región inteligente; logros económicos y sociales.

1. Regions as a Work Platform

Since Adam Smith highlighted the importance of geography in creating the «wealth of nations» —as a result of natural conditions, transport accessibility, and geographic location near sea routes or navigable rivers—, much attention has been paid in the economics literature to the creation and distribution of economic wealth. People, groups and countries were apparently unable —as a result of many controllable and uncontrollable factors— to share the available resources —and the income accruing from these resources— in a balanced way. This has led to unequal or unbalanced economic development and in many cases —in particular from a global perspective— to a sharp cleavage between poverty and richness, not only between people but also between nations.

The study of economic inequalities has particularly addressed two strands of socio-economic concern, viz. individual income differences and international income differences, in particular between countries. It is noteworthy that the intermediate layer of *regional* or *urban* inequalities, i.e. the spatial economic level of analysis, has received far less attention. In this context, Isard (2003) claimed: «Most [Anglo-Saxon] (if not all) were living in a world that geographers would say is a wonderland of no dimensions» (p. 25). It ought to be recognized however, that also in the nineteenth century already at least some economists have explicitly addressed the importance of geography in shaping the economic development of nations or regions (see e.g., Van Thünen, Palander, Weber and Marshall). Especially Marshall (1890) in his «Principles of Economics» made an explicit reference to the notion of *industrial district* as a growth vehicle, be it more from the perspective of the causes of spatially concentrated industrial location driven by external economies, and less by the integrated planning conceptualisation of regions as a policy platform for action and progress. Nevertheless, Marshall's concept of industrial district has ever since played a central role in many regional development debates. It has prompted an avalanche of applied studies. A more policy-relevant and integrative conceptualisation of industrial districts can inter alia be found in the later

work of Becattini (1979). See for a critical overview also Markusen (2003) and Sforzi (2015).

From reading the extant literature on regional development and regional inequality, the variety in conceptualisations and definitions of regional entities as spearheads of accelerated regional growth is striking. We will provide in our paper a brief overview of this panorama of concepts. In the present study we will next introduce the notion of a «resourceful region» as an umbrella concept to cover and encapsulate various regional development notions and strategies. A resourceful region is a functionally and spatially demarcated geographical area which combines its assets (skills, physical resources, technology, social capital, institutional support systems, geographical connectivity etc.) in order to maximize its capabilities to achieve accelerated economic progress and a more sustainable socio-economic performance. This concept will be highlighted and advocated against the background of our concise historical literature review, followed by an exposition on smart spatial specialisation, opportunity-seeking innovative regional strategies, spatial-industrial cluster initiatives, social and spatial proximity analysis, and the importance of cognitive and creative abilities. A reference will also be made to an empirical case study —the aviation cluster in Poland— to illustrate the meaning and relevance of the «resourceful region» idea.

2. Regions as Spearheads of Polarisation and Agglomeration

2.1. Preface

More than a nation as a whole, regions tend to be particularly effective, efficient and tailor-made spatial units for coping with socio-economic imbalances in a country. The history of economic development has clearly demonstrated that regional growth and spatial policy are of critical importance for the welfare of a nation and its constituent regions. However, regional development is not a static or deterministic phenomenon, but emerges in a dynamic force field, with emerging new perspectives and many actors and stakeholders. Regional development policy seeks to offer support mechanisms for less developed or less privileged areas, which need an above average, outside stimulus for growth. In the past decades, most regional development efforts have focused the attention on supporting infrastructures that would favour the economic basis of a region, without excluding particular sectors of the industry. Consequently, the emphasis was mostly placed on hard infrastructure (e.g., roads, ports, airports, railways, communication infrastructure, resource infrastructure etc.) which would improve the competitive position of a region by improving the quality of indirectly productive inputs, so that the overall efficiency or productivity of the regional system at hand could be significantly improved. Regional export orientation strategies —through improved transport, communication and trade infrastructure— were receiving prominent attention in these days. More recently, the awareness has grown that in an open, globalizing and networked system of regions particularly the quality

of the knowledge and innovation system is of critical importance. And therefore, we witness nowadays a drastic shift from «hardware» initiatives to «innoware» initiatives, through which public expenditures for regional development are in particular oriented towards those investments that stimulate creative and knowledge-based development in a global competition. Also the «new European regional development policy» has made a turn by more emphasis on knowledge, innovation and social capital, especially in an urban or metropolitan context. These are the effective ingredients for smart regional specialization.

Smart specialization is a pivotal concept for accelerated economic growth. This concept has both an economic and a spatial meaning; the question is: *what* is the economic focus of growth initiatives and *where* this growth should be realized (see Boschma, 2016). Consequently, regional development is an integrated initiative to exploit the benefits of a smart spatial-economic specialization. Smart regional specialization seeks to combine the economic benefits of comparative advantages with the place-specific benefits of agglomeration advantages.

Regional development brings both a challenge and an opportunity to both policymakers and researchers. It originates at the cross-roads of two driving mechanisms for economic progress and productivity rise in a given area. These two major mechanisms may be distinguished into polarization and agglomeration forces. Clearly, these two concepts are often used interchangeably, but essentially they are totally different. Failure to make a clear distinction lies at the heart of many confusing debates on growth centres versus growth poles, or on industrial clusters versus spatial clusters. This issue will first be clarified.

2.2. Polarisation

We will first pay attention to economic polarization effects. The polarisation concept refers to economic advantages as a result of increasing returns caused by economic interactions among specific sectors or agents in an economy. The following classification for these effects can be made (see also an earlier study by Nijkamp, 1972):

a. *Static:*

— *multiplier* effects resulting from intersectoral input-output linkages among incumbent firms.
— *(inter)sectoral response* effects as a consequence of the entrance of a new industrial firm or sector in an interdependent economic system.
— *indirect income multiplier* effects caused by employment and efficiency impacts resulting from the two abovementioned combined effects.
— *factor cost* effects emerging from the abovementioned productivity growth and affecting the allocation of resources in an interlinked economic system.
— *spill-over* effects of a change in sectoral composition caused by an efficiency change in the composition of industries in the economic system concerned.

b. *Dynamic:*

— *investment accelerator* effects emerging from the structure effects described above, which next feedback as growth effects in the final demand sector of a multi-sector input-output system representing an interdependent economy.
— *derived investments* related to (public) overhead investments (e.g., infrastructure) favoring economic growth and fed by economic competitiveness.
— *innovation and market* effects associated with the introduction and acceptance of new knowledge for producing and developing novel products or services.
— *upgrading* effects in the labour force inducing an efficiency rise and emerging from the rise of creative sectors or creative classes.

It is clear that polarization effects take place in a complex web in a multi-level economic system, without any direct geographic linkage connotation. Such effects are mainly meso-economic in nature. The obvious question is now: where do such effects show up? This question addresses the geography of growth.

2.3. Agglomeration

Agglomeration is a typical geographical phenomenon. This concept refers to the presence of spatial-economic advantages related to a geographic (regional or local) concentration of economic activities. These effects manifest themselves within a geographically demarcated territory, whereas the above mentioned polarization effects are in principle a-spatial in nature. The theory of agglomeration effects has already a long history in regional economics, dating back to classical economists like Weber or Hotelling. A wealth of literature has emerged after WW II, in particular by Lösch, Hoover, Alonso and Klaassen. A very brief summary of their contributions will be offered here (see also Nijkamp, 1972). A major milestone was provided by Lösch (1954) who presented a series of industrial agglomeration effects, in particular, external economies, positive demand effects, advantages of site and of source of supply, industrial interconnectivity, availability of industrial services etc. This has prompted a wealth of research on regional development in the post-WW II period.

These various effects were systematically categorized into three classes by Hoover (1968):

— *Large-scale* economies relating to a single firm, as a result of the enlargement of the firm's scale of production at one point.
— *Localization* economies for all firms within a single industry at the same location, as a consequence of the enlargement of total output of the industry settled at that location.
— *Urbanization* economies relating to all firms in all industries, resulting from the enlargement of the social-economic size (population, income, output or wealth) of that location, taken together for all industries.

Another factor reinforcing industrial agglomeration tendencies was introduced by Alonso (1968), who pointed out that better known economic conditions in large agglomerations tend to attract more new investors, if they seek to minimize the risk of new investment decisions. This tendency is further intensified on account of the need for reliable communication systems in a regional or local economy (see also Caragliu *et al.,* 2016).

Alonso's framework forms also a cornerstone for the ideas of Klaassen (1967), who stresses the importance of communication costs as stimulators of industrial concentration. These communication costs are a very broad concept; they include also a risk-element, viz. the costs of a stagnation in communication (e.g., postponement of a machine repair because of the absence of the related service apparatus in the vicinity).

The previous sample of earlier agglomeration theories shows that there is no uniform theoretical conception —and certainly not an operational one— concerning the various causes of agglomerative forces; some of these conceptions are not of a purely economic nature, but also of a social and psychological nature. On the other hand, there is a broad agreement on the very existence of agglomeration forces, which stimulate industrial concentration. Therefore, it seems pertinent that agglomeration economies exert a positive influence on industrial clustering, and that these agglomeration economies give rise to a decrease in communication costs between industries at the same locations. This decrease in costs is supposed to induce industrial bundles or clusters, this effect being greater for industries with higher interconnectivity.

Agglomeration advantages do not only favour city formation, but induce also industrial co-location. This concentration of economic activity benefits from proximity conditions, indivisibilities of large-scale plants, knowledge creation and spill-overs, and geographic image effects. According to standard location analysis, spatial co-location thus tends to generate efficiency increases of various kind, either of a Marshall-Arrow-Romer (MAR) type of externality (related to increasing returns to scale) or of a Jacobs type of externality (related to benefits from local social capital, including communication and knowledge spill-overs). There is a vast amount of literature on these effects and on the driving forces and impacts of socio-territorial proximity in relation to industrial agglomeration (see also Caragliu, 2015).

Many regional development studies focus the attention on the backgrounds of industrial location and concentration. This has had big impacts on regional development policy, as it was often (too) easily accepted that attracting new industries was an effective panacea. However, we will argue that regional development is a conditional strategy; specific location conditions may be necessary, but by no means sufficient conditions for attracting new business. Against this background we will introduce later on the notion of a «resourceful region».

The remainder of the present paper will offer an overview of (several notions of) industrial agglomerations on the basis of various contributions in the literature. They range from concepts of industrial districts (à la Marshall) to creative clusters (à la Florida). We will demonstrate that —despite the great variation in interpretation and

origin— external economies related to size, connectivity and local synergy are the critical factors that favour territorial concentration of firms.

3. Industrial Districts

The notion of an industrial district has already a long history in the development literature and dates mainly back to Marshall (1890), who may be seen as the founding father of the notion of external economies in relation to plant size and indivisibilities. This may lead to vertical integration and increasing firm size. The industrial districts conceptualization by Marshall was mainly instigated by the Industrial Revolution in the 19th century, which laid the foundation for territorially integrated industrial agglomerations (e.g. coal mining, steel production).

Industrial districts have played a pivotal role in engineering sciences and in the industrial organisation literature for decades in the last century. The existence of economies of scale of large plants (including indivisible equipment) has always been a major signpost for a better understanding of spatial concentration of industrial activity. Well-known examples include steel industries and oil refineries. But in the second part of the 20th century adjusted industrial concentration models came into being, not only in manufacturing industries, but also in the service sector (see for an overview also Bellandi and De Propris, 2015).

A contemporaneous illustrative representation of the industrial district notion can be found in the so-called «Third Italy» phenomenon, in which a conglomerate of small and medium size enterprises creates a joint and focused pool of competitive knowledge and innovation resources, while scale advantages could be reached through cultural synergy and geographical proximity (see Bagnosco, 1977; Becattini *et al.,* 2009; Camagni, 1991; Goodman and Bamford, 1989). Spatial networks play an important role in this industrial model, in particular among SMEs.

The clear success of the latter developmental strategies prompted complementary views, as advocated amongst others by the *New Industrial Spaces* literature (see Scott 1988), the *Milieu Innovateur* literature (see Aydalot, 1984), and the *Learning Region* literature (see Storper, 1997). In these classes of contributions, the notions of cultural proximity, spatial innovation and collective learning mechanisms, and institutional support systems, respectively, are seen as a critical flanking suprastructure favouring efficiency and high performance and leading to spatial-economic accumulation effects that induce a geographic concentration of firms in a region or locality.

It should be noted that the industrial districts literature contains also feeble elements: it does not show which type of specialisation is the most favourable; it does not make a convincing case for the geographical emergence and location of competing industrial districts, and it does not provide operational policy guidelines on the creation and management of such districts from a regional development perspective.

Clearly, the industrial district literature has meant a continuous source of inspiration for dedicated regional industrial growth strategies and it has prompted a rich lit-

erature on focussed regional economic policy, not only in Europe, but also elsewhere. Spatial symbiosis turns out to be the major ingredient for the emergence of such districts and has offered many useful handles for effective industrial cluster policy (see also Nijkamp and Ratajczak, 2015). This will be further addressed in our concept of «resourceful regions», but first we will critically review some other regional development concepts.

4. Growth Poles and Growth Centres

The post-war regional development debate in Europe has mainly centred on two complementary —but often competitive— concepts, viz. growth poles and growth centres. These find their genesis in the abovementioned distinction into polarisation and agglomeration forces. The concept of *growth poles* —in the spirit of polarisation effects— relates mainly to abstract topological economic spaces and not to geonomic spaces, i.e. it has a predominantly functional economic meaning. A growth pole is conceived of as existing in a field of centrifugal and centripetal forces with repulsion and attraction effects in an interdependent economic system (see Perroux, 1955).

In general, most literature about growth poles assigns a major role to *interaction* with other industries or bundles of industries. Technical and economic interdependencies are considered as a *conditio sine qua non* for the realization of regional growth; the latter may be conceived of as a process of interdependent transformations which are realized within a certain period. In terms of conventional input-output analysis, one may state that interdependent growth effects become, in a sense, «broader», as the matrix of interindustrial relations becomes less diagonal (or block-diagonal).

Over the course of time the scope of the theory and the concept of a growth pole have been expanded and reoriented, so that a growth pole is often considered as an ensemble of economic forces with high interlinkages, which are able to transmit growth impulses to all economic sectors in an interdependent economy, without much emphasis on spatial dimensions.

When geographical positions are also taken into account, the notion of «growth centres», defined as geographical locations of growth poles and resulting industrial concentrations in geographical space, is often used instead of «growth poles», where the latter is related to an abstract economic space. Clearly, both concepts are interrelated.

The growth centre theory originates from a spatial growth theory that may be viewed as a development theory in a simultaneous sectoral-temporal-spatial context and that is based on a territorial clustering of economic activities. The concept of a growth centre can be considered as a very useful one, particularly since it is an analytical tool for studying accelerated regional growth. A particularly important contribution to growth centre theory in a more elaborated geographical framework has been presented by Boudeville (1961), with his well-known tripartite division into homogeneous, polarized and planning spaces.

Generally speaking, growth centre policy can be considered as a process of decentralized concentration of development activities in order to accelerate the process of regional or local growth. It should take into account industrial interactions, external economies caused by agglomeration effects, and intertemporal locational interrelations. The dynamic effects, resulting from the attraction of new investments, assign a high superiority to sequential development strategies.

The growth pole and growth centre theory have assumed a prominent role in the 1960s and 1970s, as these concepts were regarded as strategic vehicles for accelerated regional economic growth. Interesting examples can be found in Italy, Spain, France and Brasil, and in many other countries.

A related concept has also often been employed, viz. «development axis». This notion regards connectivity and infrastructure as the main key toward economic success of regions. Consequently, location and network mechanisms are interwoven in this concept. The notion of «industrial corridor» is rather akin to the previous concept (see Gibson *et al.,* 2013).

In the course of time, new elements were added to these concepts, in particular, knowledge and innovation infrastructure. This is sometimes reflected in more recently emerging French planning concepts, such as a «*pôle de compétitivité*», in which high-tech knowledge orientation offers the basis for a globally competitive industrial agglomeration. In conclusion, the growth pole literature has created a wealth of policy strategies for regions in less privileged circumstances. Against this background, also the notion of spatial convergence strategies has found an interesting culmination point in the growth pole concept which may be seen as a balanced strategy aiming at a «decentralized concentration».

A modern variant on the growth pole-growth centre discussion can be found in the popular concepts of National Innovation Systems (NIS) vs. Regional Innovation Systems (RIS). NIS refers to innovation specialisation in a national —largely a-spatial— context, while RIS refers to the geographic context of a given innovation strategy (see for more details Asheim and Coenen, 2005, Asheim and Gertler, 2005, Cooke *et al.,* 2000, 2004, Lundvall, 1992, Nelson, 1993, and Tödtling and Trippl, 2005). In a way, these concepts bear some resemblance to the above mentioned distinction into polarization and agglomeration forces, or into growth poles and growth centres, as the focus on innovative ability has also a clear geographical connotation. Open RIS is based on flexible public and private initiatives, regional synergy and symbiosis, a strong knowledge base, and creative and learning actors (see Kourtit, 2015). In this context, a «resourceful region» uses spatial capital and entrepreneurial capital as key constituents, as will be outlined in Section 8.

5. Industrial Complexes

A blend of polarization and agglomeration effects can be found in the *industrial complex* literature. This concept started to flourish in the post WW II re-develop-

ment and re-construction period, when large industrial agglomerations were built. Such geographical concentrations of industries —very often, heavy industries— comprised a collection of industrial activities, settled at given locations, which were inter-connected by mutual technical and/or economic relations. In terms of input-output linkages, an industrial complex is composed of those industrial sectors that have a block-diagonal structure of rows and columns in a national or regional matrix of inter-industrial relations; block-diagonality of a matrix implies a high degree of interlinkages (both forward and backward) between certain sectors. Bundles of industries selected in this way show mutual interrelations, while they possess relatively low interrelations with respect to extra-complex activities. The interrelations are of such a nature and degree that a spatial juxtaposition of industrial units in a given region or country can lead to substantial external economies (scale economies, density economies etc.). Industrial complex analysis deals with spatial schemes of incidence and development of grouped industrial units. It can be considered as a valuable application and extension of traditional input-output analysis at a micro scale of large plants. Additionally, it is a useful instrument for implementing concentrated industrial development in a local setting. It is concerned with the economic feasibility of developing certain types of industrial activities at a given, economically favourable location and with the estimation of the order of magnitude of locational advantages of such combinations compared to other types of locational structures. Industrial complex analysis, is therefore, a functional technique within the framework of a planned regional growth, since it allows one to identify and to evaluate combinations of industrial activities (see Nijkamp, 1972).

A classical example of industrial complex analysis can be found in Isard and Schooler (1957) and Isard *et al.* (1959), who applied a comparative-cost assessment to a large-scale industrial complex in Puerto Rico. The analysis identifies and evaluates desirable bundles of industrial expansion for Puerto Rico. None of the existing selection techniques in regional analysis (general economic development approach, individual comparative-cost analysis, location quotients, labour coefficients, coefficients of localization, analysis of commodity flows and balances of payments, interregional input-output approach, linear programming, and gravity techniques) appeared to be appropriate or conclusive, although most of them were valid in certain respects.

The first stage was the choice of relevant industrial complexes based upon an identification of sets of industrial units which might profitably locate in the region concerned. A criterion might be availability of resources, like various types of labour, natural resources (or proximity of the latter) and an advantageous geographical site. For example, in the case of Puerto Rico, the economic proximity of Venezuela and the availability of cheap labour led to a consideration of production processes related to crude oil and natural gas, thus giving rise to refinery, petrochemical and synthetic fiber activities, so that the actual complexes to be focused on seem to be the latter set of activities. The enormous number of possible combinations of products and by-products in a large-scale plant is reduced by consideration of flow sheets of commodities related to the production processes mentioned above. This allows the identi-

fication of a number of relevant complexes, each of them based on different technical combinations of refinery-petrochemical-synthetic-fiber activities.

The second stage was a technological representation of all individual and inter-industrial production activities (i.e. all physical inputs and outputs of diverse production activities) which are relevant for the general type of complex envisaged, based on an activity matrix and engineering (or technical) functions.

The third and last step centred around the calculation of total inputs and outputs required for each production program and their associated costs and revenues, followed by a differential cost revenue comparison with identical complexes settled on the mainland.

It is clear that geographic co-location in an industrial complex emerges from scale advantages and spatial vicinity advantages. Industrial symbiosis however, has to be embedded in a broader spatial development strategy, and consequently, we have observed in the past decades the rise of other, complementary types of concentrated spatial development policy, one of them being industrial clusters. We will focus on this notion in the next section.

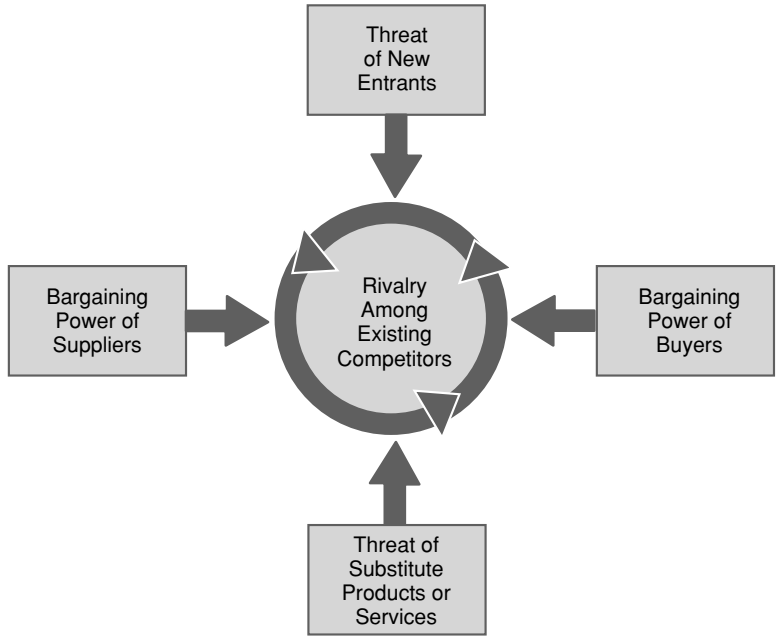
6. Industrial Clusters

In the past decades, the cluster concept has become a fashionable approach in the industrial growth literature. It found its origin in Porter's (1990) cluster concept which aimed to identify and assess the critical success conditions for a coherent portfolio of industrial activities in a given branch of the economy. The horticulture business in the western part of the Netherlands is a good example of a strong, internationally recognized and mutually interwoven sector. The producers in the horticulture sector may partly be each other's competitors, but they share a common infrastructure and suprastructure, and hence reinforce each other on international markets. The geographical dimension was not strongly present in this initial cluster concept, but was added later on. According to a subsequent publication of Porter (1998): «Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (for example, universities, standards agencies, and trade associations) in particular fields that compete but also cooperate» (pp. 197-198). Clearly, the spatial dimension was gradually added to Porter's conceptualization of clusters.

The critical conditions of a successful operation of an industrial cluster are summarized by Porter in his so-called *diamond* model which seeks to present the drivers of competitive performance of industries (see Figure 1).

It should be added that strict spatial juxtaposition (or co-location) is not a necessary condition for an industrial cluster, in contrast to an industrial complex. But the existence of synergy relationships is a clear necessary condition for a competitive advantage of firms or industries belonging to —or associated with— a cluster.

Figure 1. Porter's diamond



«The Five Competitive Forces That Shape Strategy»

Source: Michael E. Porter, *Harvard Business Review,* January 2008.

Thus, the «pure» geography —in terms of minimum physical distance friction— plays a less important role here. Synergy among industries can also be achieved by network linkages, e.g. direct connectivity among industrial firms in a cluster, or indirect connectivity through intermediate agents (e.g., information centres, educational support systems etc.). Clearly, the focus of clusters on either generic economic-technological dimensions or on local economic-geographical dimensions is not always very transparent in the prevailing extant literature on clusters (see also Porter and Ketels, 2009)

Cluster policy —with a focus on industrial agglomerations— has become an important strategic handle for regional and industrial policy in many countries and regions, not only in the western world but also in developing countries (see also Asheim *et al.,* 2006, and Gordon and McCann, 2006). It has in recent years also obtained new conceptual orientations, e.g., in the form of creative cluster policy (including a combination of creative industries and of creativity-enhancing urban environments), which are seen as a key stimulus for accelerated and competitive growth of cities or regions. In the course of time, network linkages —both tangible and intangible— have become an increasingly important feature of advanced clusters. This has also prompted new thinking on so-called proximity relations. This will be discussed in the next section.

7. Proximity Centres

Spatial symbiosis lies at the heart of industrial clusters. This symbiosis does not only refer to industrial interdependencies at a given place, but also to indirect linkages to e.g. the labour force, public amenities, social institutions, ecological amenities, and so forth. As mentioned in the previous sections, industrial agglomeration manifests itself at the interface of socio-economic synergy and geographic co-location. These two forces have been the historical dividing lines between national industrial policy and regional growth policy. In the past decades, these two features have received renewed attention as a result of the increasing popularity of proximity patterns among industries. Proximity has both a spatial and a relational dimension in a network configuration of various actors or firms (see also Boschma, 2005).

Proximity is the reverse concept of distance friction, but it is much broader in nature. It does not only refer to Euclidean closeness (or distance), but incorporates also social science oriented interactions related to similarity in culture, values, traditions, technologies, entrepreneurial styles, information handling, and so forth (see for a broad exposition, Torre and Wallet, 2015). In the proximity literature (see e.g. Caragliu and Nijkamp, 2014) the following subdivision of proximity concepts is sometimes made:

— Geographical proximity.
— Social-cultural proximity.
— Technological proximity.
— Cognitive proximity.
— Relational proximity.

An extensive set of contributions to the study of proximity in regional science is contained in Torre and Wallet (2014). We will briefly discuss here two types of proximity that are critical for industrial agglomerations, viz. cognitive and social proximity.

The notion of *cognitive* proximity plays an important role in the present proximity literature. This popularity is largely caused by modern communication technology, in particular digital technology. The share of physical transport costs in the total cost portfolio is rapidly declining and has even led to the «death of distance» hypothesis (see Cairncross, 2002). Knowledge and information have become substantial parts of inter-actor connectivity patterns. They form the blood circulation of spatial networks and are regarded as critical for industrial-spatial symbiosis.

Social capital is another important driver of economic progress. This notion is not necessarily based on altruism, but presupposes deliberate and rational motives to achieve certain personal or business objectives. This also holds for effective clusters in the context of regional development strategies (see e.g. Bochniarz, 2014, and Westlund, 2014).

An example of a study on proximity relations —based on social and cognitive capital in a spatial network— can be found in a case study by Kourtit *et al.* (2014),

where the authors analyse the complementary and mutually reinforcing possibilities of bringing the research and R&D efforts of three university clusters in the Netherlands together in once cooperative model of alliance proximities. The leading sectors in this proximity network —based on the five previous proximity relations— are called «nova stars».

It is clear that proximity conditions are important stimuli for regional development, as they offer competitive conditions through e.g. a decline in transaction costs. Proximity is often used in combination with connectivity, as both concepts are facilitators of learning behaviour.

It goes without saying that the measurement of proximity relations is fraught with many problems. Appropriate network indicators for proximity are rather rare. But recent research efforts have shown a remarkable progress in data analysis and analytical rigour (see for a broad and quantitatively-oriented study Caragliu, 2015).

The next section will be devoted to our new integrative conceptualization of regional development strategy based on the «resourceful region» concept.

8. The Concept of «Resourceful Regions»

The economic fate of nations, cities and regions exhibits an enormous variety across our planet. In various cases, it may be the physical geography (e.g., desert areas, mountainous areas, peripheral areas, etc.) that may explain a poor performance of these areas. In other cases, it may be cultural inertia, religious beliefs or lack of entrepreneurial spirit that drag a region into poverty. The economist's response to such dismal phenomena is rather straightforward: productivity enhancement is the way to a better performance. And salient spatial inequalities can then be coped with through spatial mobility of capital and workers, or other resources. This simple lesson does not provide many useful policy handles. The ratio of output to input is of course a good measure for efficiency of a region, but there are multiple outputs and multiple inputs, so that an unambiguous efficiency indicator is hard to obtain. In addition, some inputs or outputs are not flexible to adjust, so that regional development is a process fraught with inert responses and complex space-time dynamics.

An appropriate tool to measure and rank the efficiency of actors (e.g., regions or cities) can be found in the industrial organization literature known as Data Envelopment Analysis (DEA). This is an increasingly popular tool for benchmarking studies among regions or cities (see e.g., Kourtit, 2015; Suzuki and Nijkamp, 2017).

In the recent past, the notion of «territorial capital» (mainly introduced and popularized by Camagni, 2009) has provided an interesting analytical tool to understand the hurdles and opportunities of regional dynamics. The basic idea is that various types of capital in a region form the conditions that shape regional growth. The clear advantage of this approach is that it widens the regional growth horizon beyond standard neo-classical arguments of capital and labour as inputs to enhance a region's efficiency or productivity. Elements of «territorial capital» are inter alia: technology,

social capital, resources, or human capital . This conceptualization means no doubt a significant enrichment of conventional regional growth theory.

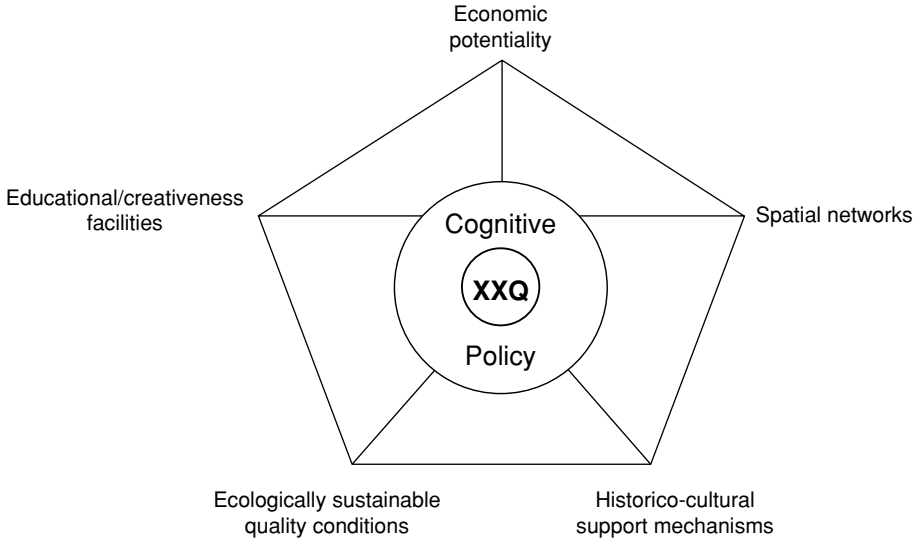
Clearly, the empirical test of this new concept still needs further elaboration. One of the less convincing elements in the «territorial capital» concept is the fact that not all constituents of regional growth may be regarded as a capital or asset (e.g., entrepreneurial spirit, creative attitudes, risk-avoiding behaviour). In addition, the distinction between necessary, sufficient and desirable conditions for a better regional performance is not always conclusive. Our attempt will now address the latter challenges by introducing the «resourceful region» concept.

We take our departure point in an older theoretical framework developed by the French geographer Vidal de la Blache (1903), often called «possibilism». This notion states that any region has a bundle of options or opportunities from which proper ones may have to be selected in order to enhance social economic achievement levels of the region concerned. Different regions may choose different options (depending on their physical-geographical position, cultural backgrounds, or social attitudes). The French historian Lucien Febvre (2000) described the «possibilism» approach as follows: «There are no necessities, but everywhere possibilities; and man as a master of the possibilities, is the judge of their use» (quoted in Johnston *et al.,* 2000, p. 609). Regional economic dynamics becomes thus an evolutionary process influenced by internal and external mechanisms, based on a learning model. The human agency is thus the critical factor in a «possibilistic» regional development strategy. In modern social science, this is sometimes also referred to as the «capabilities» approach (see e.g. Basta, 2015, van Geenhuizen and Nijkamp, 2000, Sen, 1980, and Nussbaum, 2003).

The main idea behind the «resourceful region» concept is that ingenuity and cognitive response to challenges are assets of a region that decide on success or failure of development policy of the region at hand. Every region has a portfolio of growth opportunities, ranging from physical-geographical conditions to human-social abilities. The key mechanism in using these inputs is an intelligent management, exploitation and combination of these scarce assets, a process driven by smart, cognitive and skillful insights and decisions. Consequently, a resourceful region is an area that is pro-actively driven by a smart combination of *economic potentiality* (e.g., capital provision), *spatial networks in terms of accessibility and connectivity* (e.g. locational conditions, cyberspace access), *historico-cultural support mechanisms* (e.g., entrepreneurial spirit), *ecologically sustainable quality conditions*, and *educational and creativeness facilities* (e.g., institutions of higher education). The balanced mix of these supporting conditions for successful regional development can be represented in a so-called «Pentagon» model, sketched in Figure 2. The principles of the Pentagon approach and various modelling applications can be found in Nijkamp *et al.* (1994) and Capello *et al.* (1999). The main idea is that the desired performance conditions of actors or institutions can normally be summarized in five key factors. In the centre of Figure 2, the acronym XXQ stands for the highest posssible quality performance to be achieved for the socio-economic position of the region concerned (see for de-

tails also Nijkamp, 2008). It goes without saying that the notion of a «resourceful region» is strongly akin to the concept of a smart region, the main difference being that resources are a portfolio of options, while smartness refers more to cognitive-technological abilities. This also means that a resourceful region may be high-tech oriented, but this is not a necessary nor sufficient condition. Regional development is based on a multidimensional package of performance facilitators including technology, culture, networks, entrepreneurship and education (see Tubadji *et al.,* 2015).

Figure 2. A Pentagon prism of regional development conditions in a resourceful region



It should be noted that the management of a «resourceful region» presupposes an alert policy driven by competent foresight and innovative skills of all actors involved. The man vision should be that regions are not areas «in troubled water», but sources of unforeseen opportunities, provided all resources are properly exploited. A resourceful region may not be based on a policy of «backing the losers» or even not on «picking the winners», but «optimizing all promising opportunities». Clearly, productivity —interpreted in a broad socio-economic sense— is a key parameter in regional development, as this means a rise in efficient use of scarce resources. Regional development policy does not take place in a «wonderland of no spatial dimensions», but exploits the opportunities provided by agglomeration advantages and density economies in a region, complemented with accessibility conditions, network connectivity, multidimensional proximity, and —last but not least— human capital and entrepreneurial spirit.

Finally, a resourceful region is thus not only based on education, research and creativity, but also on smart learning conditions, stimulated by open creative knowl-

edge, innovative and open interactions and flexible networking, shared consensus building in social capital relations, and strategic and forward-looking knowledge management. A regional system's performance is clearly decisively determined by a creative and cognitive strategy for combining the region's resources in an intelligent way.

9. Flying High: an Illustration

The overview of various strategic regional growth concepts and vehicles in the previous sections has shown a surprising variety of complementary development concepts. In all cases, the existence of external economies as a catalyst for regional growth appears to play an important role. A region is essentially a seedbed of resources, which have to be uncovered, released and exploited. The intelligent combination of such resources is the core challenge of regional development policy.

This «resource» interpretation also applies to the development of the aviation sector. This sector is an advanced multi-product sector with specialized products that need strong network linkages and geographical linkages. From this perspective, modern cluster thinking appears to offer meaningful ingredients for accelerated regional growth strategies. The aviation sector is a complex high-tech sector based on a functional specialization and a geographic —often regional— concentration of activities. This refers to both the physical production of airplanes and particles, as well as to the logistics of the airplane movements (and related transport and hospitality activities), and also to the management and design of airport facilities. In many countries, the aviation sector is a rapidly developing sector, with clear features of a growth centre, an industrial cluster and a proximity hub. And therefore, the operational strategic development of a given aviation activity can best be favoured through the use of operational cluster strategies in the form of a «resourceful region».

Aviation has in the past decades indeed become a major industry in many countries. The aviation industry comprises many elements: airline activities for a broad tourist and business market, cargo transport, logistic management activities for flight scheduling and catering, airport construction and management, and airplane building industries (including airplane parts). In various countries, the development of the aviation sector is also linked to the space industry (e.g., satellites), Consequently, the aviation sector has in recent decades turned into a dynamic industrial cluster of a major strategic importance in many countries.

The aviation industry is thus clearly a high-tech sector, with many linkages to other industrial sectors. And of course, this cluster has strong intra-industry linkages with many specific branches and firms, up to the level of even SMEs. Consequently, such sectors tend to be non-footloose: they enjoy in many cases the benefits of industrial agglomerations. And therefore, the aviation industry is often found in geographic clusters. Such clusters offer the seedbeds for innovation spirit and communication

access for firms participating in such a cluster, leave aside the standard input-output linkages among firms in the same cluster and the overhead advantages offered by the region concerned (e.g., infrastructure, highly-skilled labour).

Clearly, an aviation cluster is also a great example of a Regional Innovation System. This is an organized set of activities at a given place which seeks to enhance efficiency and growth through private and institutional support systems directed towards the development of innovative activities based on synergy. Such innovative activities may include a diverse portfolio of novel technological actions, in particular: radical innovation (an entirely new successful application of new knowledge), creativity (original ways of applying knowledge), inventions (development of new ideas or products without immediate market success), and «standard» innovation (successful commercialization of new products or services). Clearly, despite different categories of innovative activities, a common feature is always that these new activities seek to find a new or better match between market needs and firm solutions. This is in compliance with Schumpeter (1942): «The interaction of technological innovation with the competitive marketplace is the fundamental driving force in capitals» industrial progress».

An aviation cluster in a given region is not the result of coincidental economic or technological forces. It requires a careful orchestration of deliberate and skillful development initiatives, based on cognitive-technological and cognitive-managerial skills and expertise. Consequently, a successful aviation cluster can only be found in a «resourceful region». We will briefly illustrate this on the basis of the aviation cluster in the Podkarpackie region in South-East Poland (see for more details Nijkamp and Kourtit, 2014; Kourtit *et al.,* 2016).

The notion of effective technological cluster in a «resourceful region» is instrumental in the strategic interpretation and the appropriate implementation of the Aviation Valley project in South-East Poland. As said above, an aviation cluster may in principle refer to a broad set of mutually interlinked and regionally concentrated activities in the aviation sector. In general, the sector may comprise the airline sector, the infrastructure sector (in particular, airports), the logistic operations (supporting transport connectivity, such as airport train connections, security operations), the supporting operations (e.g. shops, catering), and the manufacturing sector (products and product development, integrated supply chains, marketing operations). All these components may relate to both civil and military sectors. The Podkarpackie region in Poland has historically been a seedbed for a multiplicity of aviation activities, often international in nature.

The manufacturing part of the Aviation Valley is not an independent part of the aviation sector as a whole. The production of equipment and airplanes is largely influenced by the market of users (passengers, cargo). A significant share of the airline market is determined by the tourist market (at present approx. 9 percent of global GDP). But not only is the size of the demand, but also the organization of the market an important driver for the supply side of the aviation sector. Increasing trends in short-haul holiday visits, the emergence of global tourist flows (e.g., China, emerging

economies), and the fierce competition in the tourism market (both carriers and tour operators) will have a great impact on the future of the airline industry, and hence on the manufacturing side of the aviation industry. The Podkarpackie region is essentially an example of a promising «resourceful region» for the aviation sector, where historical-cultural conditions, environmental quality conditions, innovative seedbed conditions, economic key conditions and connectivity conditions shape a business environment with manifold options and capabilities for a significant performance rise («possibilism»).

In recent years, this region has attracted through the smart use of all its resources a broad portfolio of international aviation activities (aircraft particles, helicopters, small aircraft, and a host of supplementary services and products). This has led to a rapidly growing high-tech cluster, with more than 100 firms. Geographic co-location in such clusters seems to be a realistic strategy for an appropriate regional development strategy, especially for clusters of a medium size. It is based on a blend of spatial capital, human capital, entrepreneurial capital, social capital and technological capital, and is supported by cognitive skills in both the public sector and private sector in the area. This area meets all the conditions incorporated in the resourceful region scheme, as presented in the Pentagon prism in Figure 2. From this perspective, the Aviation Valley in Poland may be regarded as a potentially promising initiative for an upgrading of the regional economy concerned. For more details and a quantitative analysis, the reader is referred to Kourtit *et al.* (2016). Clearly, such a dedicated growth strategy has to be positioned in a broader aviation policy context. Finally, a further and general exposition on the relevance of aviation clusters for regional developments, based on cognitive and proximity principles, can be found in Levy and Talbot (2015).

10. Epilogue

The concept of a «resourceful region» may be instrumental in developing a new perspective on regional policy. Regional development has a long standing history. It has not only become a scientific and policy issue since the political and economic reconstruction strategies after WW II, but it has also played a significant role in the entire economic history of the world. Even the ancient age used already infrastructure as a critical instrument for the development of the space-economy, because of differences in locational conditions (e.g., physical geography), in local attitudes and behaviour (e.g., cultural or political characteristics), and in regulatory systems (e.g., taxation or market entry conditions). The main challenge is of course to favour regional development in a balanced way, so that economic growth (in relation to efficiency and productivity rise) can be stimulated in combination with a desirable or acceptable level of distribution of welfare (the equity motive).In this context, Europe has a long tradition in regional policy, in which the support for less developed or less privileged areas was a central policy objective. Clearly, the success rate of such a policy was often not overwhelming.

As mentioned before, knowledge and cognitive skills are a *sine qua non* for a balanced and operational policy in which advanced regional industrial clusters are the key forces of a «resourceful region» policy concept. Knowledge is increasingly seen as the engine of regional growth. In recent years we have witnessed a heightened interest in the region as a focal point of innovation policy (see van Geenhuizen and Nijkamp, 1998; Ratti *et al.,* 1997). The region is increasingly conceived of as a dynamic, promising and self-organizing spatial unit which is able to achieve a competitive position in an open international networked economy through creative technology design, proper land use policy and management of human resources. The region has become a focal point for the creation of a portfolio of locational opportunities (cf. Cheshire and Gordon, 1995). This is in agreement with our «resourceful region» conceptualization of spatial development.

It is also increasingly recognized that a region will not be able to pave a road towards a promising future through a process of top-down blueprint planning. Rather, we know that a learning process instigated by the effective use of tacit knowledge on uncertainty reduction is a *sine qua non* for competitive survival strategies (cf. Nijkamp and Reggiani, 1998). Thus, the use of the regional knowledge capability is a critical success factor for regional development. The exploitation of this capability presupposes the fulfillment of the following institutional support conditions of a «resourceful region», in particular:

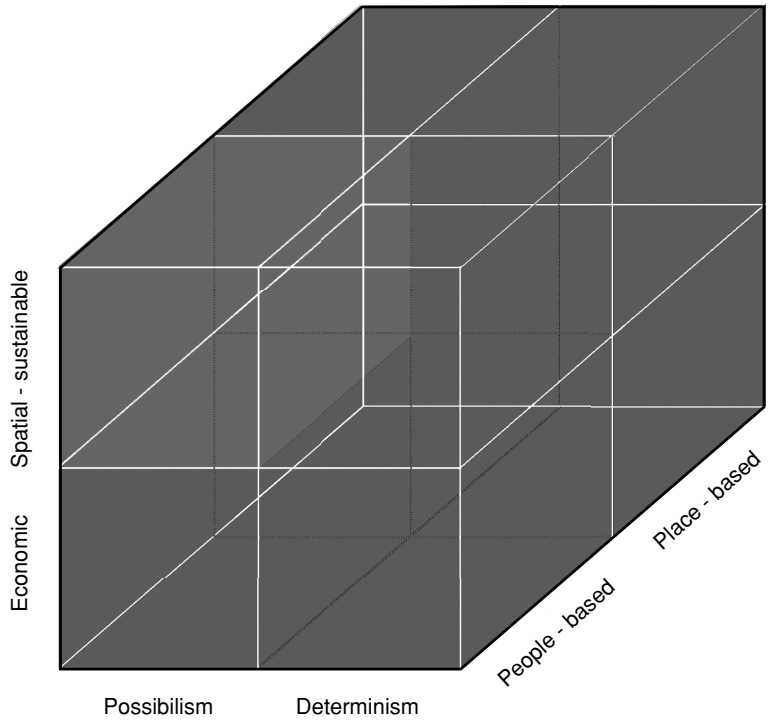
- consensus among regional stakeholders and institutions;
- networking in order to advance information diffusion and knowledge creation;
- appropriate channels for the transformation of knowledge and technology;
- management and development of human capital and of stocks of knowledge.

It may now be helpful to position the new concept of a «resourceful region» against the background of a triple force field of regional policy:

- *determinism* (concepts of makeable society, blueprint planning, command and control measures) versus *possibilism* (emphasis on opportunities, management of capabilities, open-ended planning);
- *place-based* policy (emphasis on geography, such as infrastructure, land use, housing etc.) versus *people-based* policy (emphasis on creativeness, cognitive abilities, entrepreneurship and innovation, etc.);
- *economic objectives* (measured through Gross Value Added, investments, public finance versus *spatial-sustainable* objectives (employment, quality of life and health, welfare programmes, etc.).

From the previous exposition in this paper, it is evident that the focus of a «resourceful region» strategy is on a mix of 3 components: possibilism culture, people-based policy and spatial-sustainable objectives. From the combinational set of 8 possible orientations, we can map out the cornerstones of a «resourceful region» through the following cubic (see Figure 3).

Figure 3. The «Resourceful Region» cubic



Regional development policy is indeed an ambitious cognitive managerial activity. In this context, regional clusters may be regarded as the cornerstones of innovation initiatives and the seedbeds for sustainable regional development. It will be an important challenge to assess the performance of the various clusters that have emerged all over the world, with a particular view to the identification of the strength-weakness factors in these clusters. The Aviation Valley in Poland is a great example of such a promising regional high-tech cluster, and deserves a careful learning evaluation of all important ingredients of this cluster initiative. This cluster takes for granted the importance of social capital in the region in combination with high-tech specialization as a *sine qua non* for a high cluster performance. Such conditions provide the network advantages that are generated by cooperation within or among groups, and they underscore and highlight the relevance of the «resourceful region» concept.

In conclusion, regional development strategies will in the future be critically dependent on the self-organizing capabilities of regions, which through smart combination of their resources will have to develop a sustainable, forward-looking and operational action programme, in which cognitive activities will play a central role. The novel perspective on resources as critical supporting conditions for regional growth will no doubt become a source of new research at the frontiers of regional science.

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Section ARTICLES

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Super-Proximity and Spatial Development

Karima Kourtit *

ABSTRACT: Our world is getting smaller all the time. Connectivity and accessibility in space have improved to an unprecedented degree compared to past centuries, thanks to the enhanced design and effective implementation of transport infrastructure networks and increasingly also as a result of advance cyber infrastructure networks. Our connected and accessible world has indeed become «a small world». Technological innovation has become a buzzword in the past decades. The design, implementation and adoption of digital technology, in particular, have prompted entirely new forms of spatial interaction and communication, with a significant and unprecedented impact on transport, trade, tourism, migration, and social contact networks. In today's increasingly innovation-driven society, almost every activity, action, task, communication, interaction, movement and decision is supported by new technological artifacts and inventions. This paper introduces the notion of «super-proximity» to highlight the force field of physical and virtual infrastructures at various geographical scale and time levels, and to sketch the spatial-economic implications of this universal megatrend towards zero distance-frictions. The paper will be concluded with some prospective observations on the future spatial implications of the e-society and their analysis.

JEL Classification: R1; R4; O3; O18; H54.

Keywords: super-proximity; density; accessibility; connectivity; proximity; infrastructure; innovation; Maslow; digital technology; spatial interaction and communication; transportation; networks; suprastructure.

RESUMEN: Nuestro mundo está siendo cada vez más pequeño. La conectividad y la accesibilidad han aumentado en un grado sin precedentes en relación con los siglos precedentes gracias a las mejoras en el diseño y en la puesta en práctica efectiva de redes de infraestructuras de transporte y, también, como consecuencia del avance de las ciber-infraestructuras. Nuestro mundo conectado y accesible se ha convertido efectivamente en «un pequeño mundo». La innovación tecnológica ya fue una referencia y un factor obligados en las pasadas décadas. El diseño y la implementación y la adopción de la tecnología digital, en particular, han impulsado

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nuevas formas de interacción espacial y de comunicación, con un significado y un impacto sin precedentes en el transporte, el comercio, el turismo, las migraciones y las redes de contactos sociales. En una sociedad como la de hoy, crecientemente liderada por la innovación, casi toda actividad, acción, tarea, comunicación, interacción, movimiento y decisión tienen como base nuevos artefactos tecnológicos y nuevos inventos. Este artículo introduce la noción de «super-proximidad» para subrayar el campo de fuerzas que las infraestructuras físicas y virtuales determinan en los niveles de la escala geográfica y en el factor tiempo, así como para bosquejar las implicaciones económico-espaciales de esta mega-tendencia universal hacia la reducción a cero de las fricciones que supone la distancia. El texto se cierra con algunas observaciones prospectivas sobre las futuras implicaciones espaciales de la e-sociedad y su análisis.

Clasificación JEL: R1; R4; O3; O18; H54.

Palabras clave: super-proximidad; densidad; accesibilidad; conectividad; proximidad; infraestructura; innovación; Maslow; tecnología digital; interacción y comunicación espacial; transportes; redes; supra-estructura.

1. It's a Small World

Our world is getting smaller all the time. While centuries ago, it took months or even years to reach the other end of the globe, nowadays we can reach any point on our planet in a few hours or days. Connectivity and accessibility have improved to an unprecedented degree compared to past centuries, thanks to the enhanced design and implementation of transport infrastructure networks and increasingly also as a result of cyber infrastructure networks. The space and time dimensions of transportation and information have almost collapsed to infinitesimal proportions, with an infinite real space-time proximity as the ultimate representation of the advanced space-economy.

It is noteworthy that nowadays physical and virtual connectivity infrastructures are not developed as independent entities: they act as both substitutes and complements (Batty, 2013; Neal, 2012). For example, the news on the «Arab Spring» took only a few seconds to reach the whole world (in contrast to long-lasting news transmission through postal services in the past); and it took reporters to be physically present on the spot only a few days. Our connected and accessible world has indeed become «a small world».

In this contribution, I will sketch the transition from a physically connected world to a virtually connected global system. This paper will use the notion of «super-proximity» to highlight the force field of physical and virtual infrastructures at various geographical scale and time levels, and to sketch the spatial-economic implications of this universal mega-trend towards zero distance-frictions.

The paper is organized as follows. Section 2 will provide a concise overview of the extant literature on the relationship between transport infrastructure and regional

economic development. Then, in Section 3, the anticipated spatial effects of digital technology will be mapped out, as a result of the large-scale introduction of ICT. Next, Section 4 will conceptualize the above spatial connectivity and accessibility trends by introducing the notion of «super-proximity» in order to provide a broadly based understanding of the various forces involved with the rise of the «small world». Proximity features already for several decades in the geography literature. It may according to an early publication of Hansen (1959) be interpreted as the relative nearness of one place or person to all other relevant places or persons. From this description, it is clear that proximity may have a geographical dimension, but also a social —or any other— dimension.

The relevance of the notion of «super-proximity» in spatial planning will be illustrated by means of a presentation of empirical research on urban transport management through the use of digital information. This example offers an illustration concerning smart e-management of complex transport systems in urban areas. The paper will be concluded with some prospective observations on the future spatial implications of the e-society.

2. Transport Infrastructure and Regional Development

The efficient use of productive resources (e.g., capital, labour, knowledge, technology) is usually regarded as a prominent source of economic progress, in particular in an open and competitive economic system. International or interregional trade —one of the most important contributors to the wealth of nations or regions— is a welfare-enhancing vehicle, not only because of Ricardian comparative-cost advantages, but also because of the productivity-raising effect of reliable and fit-for-purpose infrastructure for a multiplicity of users. Thus, trade, transport and welfare are mutually interwoven phenomena (see also Krugman, 1991).

The role of transport infrastructure in inducing national or regional growth has received major attention in the past decades. This has led to much applied research on the anticipated effects of new infrastructure. Over the past decades a large number of studies has been undertaken to assess the economic impacts of infrastructure, not only roads, but also ports and railways. There is a widely shared belief that new infrastructure generates many benefits for the country or region concerned, as better infrastructure allows a more efficient use of scarce resources in the country or region at hand (Nijkamp, 1988). The focus on transport infrastructure has also led to much policy interest in infrastructure, e.g. in World Bank circles and in the EU. It has promped the development of a wide array of evaluation tools, such as social cost-benefit analysis in transportation planning. But the fundamental question whether transport infrastructure helps to mitigate welfare disparities is still an open question (see e.g. Celbis, 2015).

Since the early writings of Adam Smith, it is an accepted belief in economics that geographical accessibility and network connectivity are essential conditions for welfare improvement through trade and transport. Consequently, infrastructure provision

is usually seen as a critical tool of public policy. There is an extant literature on the assessment of the implications of infrastructure for regional development (see e.g. Banister and Berechman, 2001; Crescenzi and Rodriguez-Pose, 2008; Rodriguez-Pose *et al.,* 2012). One of the first studies in this field has been undertaken by Mera (1973), followed later on by seminal and often quoted studies by Aschauer (1989), Munnell (1990), Duffy-Deno and Eberts (1991) and Lakshmanan (2011). These studies came up with positive welfare outcomes of public infrastructure, although their findings met sometimes criticism due to possible misinterpretations caused by the direction of causality, spurious correlations from non-stationary data, and omitted variables. Some authors recorded also a negative relationship between infrastructure and growth, for instance, Eisner (1991), Tatom (1991), and Evans and Karres (1994). In subsequent studies by Holtz-Eakin and Schwartz (1995) and Boarnet (1998), a more thorough analysis was carried out by investigating also networks and spillover effects. In a comparative meta-analytical study by Nijkamp and Poot (2007), based on many quantitative studies, the authors arrived at the conclusion that —next to public expenditures for education and research— infrastructure investments tend to provide generally positive welfare outcomes for the economy concerned. These findings were in later studies confirmed by Celbis *et al.* (2015) and Elburz *et al.* (2015).

In a review article by Nijkamp (1988), the following caveats were mentioned in scientific impact assessment of transport infrastructure:

— performance measurement in terms of input indicators (e.g. investments, width and length of infrastructure, etc.);
— performance measurement in terms of output indicators (e.g., gross value added, productivity rise, number of jobs, etc.);
— sensitivity of findings for the spatial scale of impact assessment (e.g., local vs. regional);
— definition of infrastructure *per se*, in terms of productive or consumptive contributions to the economy;
— time horizon covered by the investigation period (e.g., one year vs. a few decades);
— distinction between direct effects, indirect effects and long-term generative affects;
— systemic effects on the entire economy concerned (e.g., wage effects, price effects, etc.);
— sensitivity of the results for the initial situation vs. a mature situation of the economy concerned (e.g., incremental or marginal effects vs. integral effects);
— implications of removal of serious bottlenecks in the infrastructure use vs. marginal improvement of existing conditions;
— implications of infrastructure segment improvements vs. comprehensive network adjustments;
— ways of financing new infrastructure provisions (e.g., private vs. public modes of financing);
— presence of positive and negative externalities involved in the building and operation of infrastructure;

— heterogeneity of different types of infrastructure, with varying consequences for regional welfare.

It is noteworthy that over the course of time the interest in infrastructure impact assessment has shifted from a purely physical transport link effect to a broader transport network effect, including various spillover effects on a systemic basis. Recent examples can be found inter alia in Alvarez-Ayuso *et al.* (2016), Cantos *et al.* (2005), Chandra and Thompson (2007), Condeco-Melharado (2011), Delgado and Alvarez (2007), and Gutierrez *et al.* (2011). The final wisdom in transportation planning suggests that physical infrastructure has overall a positive economic impact.

As time passed by, new forms of infrastructure came into being. The most prominent new form of infrastructure originated from the emergence of ICT, and is coined digital infrastructure (sometimes also called «suprastructure») related to information and communication transfer. This new technology has exerted an unprecedented effect on the welfare of nation, regions and cities. This will be discussed in the next section.

3. e-Technology in Space

Technological innovation has become a buzzword in the past decades. It is often seen as the critical vehicle through which economic progress is achieved. There is an avalanche of literature on the concept, origin and impact of technological innovation on the economic performance of regions or nations. Also the regional science literature witnesses a broad interest in the spatial aspects of innovative activities, including its governance aspects. Both evolutionary geography and spatial endogenous growth theory have offered major contributions to a better understanding of the nature and importance of technological progress for the socio-economic profile of cities and regions (see e.g., Boschma, 2005, and Nijkamp, 2008). A major strand of literature addresses the productivity enhancing capability of new technologies and the implications for regional growth and competitiveness (see e.g. Kourtit *et al.,* 2014). A more recent strand of research zooms in on the distance friction reduction of new technologies, especially in the area of ICT (see van Geenhuizen and Nijkamp, 2012).

The design, implementation and adoption of digital technology have prompted entirely new forms of spatial interaction and communication, with a significant and unprecedented impact on transport, trade, tourism, migration, and social contact networks. This development has induced an intense interest from the side of both the research and the policy community.

On the research side, the transition to the digital world has led to the emergence of many fashionable concepts in relation to regions and cities, such as digital regions (or cities), cyber-regions (or -cities), Silicon Valley regions (or cities), and the like. The digital world has even led to the concept of a «global» region or city. Clearly, besides the introduction of a new jargon, the introduction of cyberspace technology has also exerted great impacts on human, business and technological interactions in space. It

has prompted also the rise of a new branch of geography, viz. cyber geography or internet geography (see Malecki, 2001). The emergence of this new field of research was instigated by the proposition of the «death of distance» (see Cairncross, 1997), as the result of the space-friction reducing character of digital technology, such as the internet. Further analysis of this phenomenon has led to a debate on the «world is flat» hypothesis (see Friedman, 2007) versus the «world is spiky» hypothesis (see McCann, 2008). Although both hypotheses are likely to have some validity, it has gradually become clear that cyberspace technology seems to reinforce the economies of density, proximity and connectivity of large cities and mega-cities, with the consequence that digital technology seems to induce more spatial concentration of human and business activity in large agglomerations. Thus, spatial ubiquity does not necessarily imply spatial dispersion. On the contrary, it seems plausible that the «death of distance» will prompt the rise of densely populated urban agglomerations (either in the form of large or mega-cities or in the form of poly-nuclear urban configurations).

On the policy side, the wide-spread use of advanced digital technology has exerted an unprecedented influence on the public sector, in the form of a wide variety of e-governance initiatives (e.g., electronic application for building permissions, electronic information supply by public authorities, local public alert systems in case of emergencies, etc.). Local e-governance has seen a booming development in the past years, and it is plausible that this development is still in its infancy. From a strategic perspective, the introduction of digital technology (see Caragliu *et al.,* 2011, Deakin, 2013; Hollands, 2008; Kourtit and Nijkamp, 2015) has also led to a world-wide interest in so-called «smart cities». Smart cities are based on a knowledge-intensive and high-tech orientation so as to achieve the highest socio-economic performance level of the city concerned. It goes without saying that cyber technology is a critical instrument in this field (see e.g., Allwinkle and Cruickshank, 2011; Carter, 2013; Dawes, 2009; Edmiston, 2003; Evans-Cowley and Hollander, 2010; and Musterd and Murie, 2010).

The above concise overview of the significance of digital technology for spatial development is by no means exhaustive or representative. But it highlights the systemic importance of ICT for spatial development, in particular urban areas. This new type of infrastructure —often termed «suprastructure»— will have an unprecedented impact on the evolution of the complex space-economy of our world.

4. Conceptualization of «Super-Proximity»

Infrastructure and suprastructure are broad concepts that are often associated with public overhead capital. In the context of the present study, our focus is on the spatial dimension of both physical infrastructure and virtual suprastructure, so that the issues to be addressed here are particularly zooming in on the geographic linkage aspects of infrastructure and suprastructure.

It is hard to imagine our daily life in the modern world without ICT. In today's increasingly innovation-driven society, almost every activity, action, task, communica-

tion, interaction, movement and decision is supported by new technological artifacts and inventions (e.g., androids, smartphones), with different functionalities at basic levels (Latour, 1992; Waelbers, 2009). In this context, Verbeek (2006, p. 364) argues that a continuous process of renewing and improving the quality of «technological artifacts» and tools, used in business and everyday life at both short and long distances (see Tranos *et al.,* 2013), forms «active mediators» that actively «co-shape people's being» needs and behaviour in our modern way of life (e.g., their perceptions and actions, needs and motives, communications and interactions, and experiences and existence). In other words, these resources create an important action platform to the benefit of urban (sub)systems.

As mentioned above, the specific geographic linkage orientation leads to due emphasis on three geographic space-shaping elements: *density*, *proximity* and *connectivity*. Density economies are related to geographic-economic scale advantages, while proximity economies concern mainly interactions among agents that are subjected to distance frictions of various kind. Finally, connectivity has to do with network links and transportation/communication patterns among network users. These three categories can be described in slightly greater detail as follows:

— economies of *density*: joint advantages of spatial concentration of various actors, actions and activities (see e.g., Nijkamp, 2008; Glaeser *et al.,* 1992; Andersson *et al.,* 2014; Arribas-Bel *et al.,* 2016);
— economies of *proximity*: benefits from physical or socio-psychological access of actors, stakeholders and activities to each other (see Boschma, 2005; Torre and Gilly, 2005; Tranos *et al.,* 2013);
— economies of *connectivity*: joint spatial advantages that emerge from network linkages or social capital —physical or virtual— among a diversity of groups of people, firms and activities (see Kourtit and Nijkamp, 2012, 2013, 2015).

It seems plausible that *proximity* is a central concept in this force field. This will now be further discussed.

There is a recent strand of literature on proximity analysis (see e.g., Torre and Wallet, 2014). A broad and interesting review of the proximity literature is given by Caragliu (2015). The concept of proximity is not only related to (inverse) geographic/physical distances between points or actors in space. Proximity may relate to any gravitational force that creates an above-average attractiveness between these points or agents that supersedes the physical gravity friction between them. According to Caragliu (2015), it makes sense to generalize distance (or inversely, gravitational attractiveness) in terms of *relational* proximity, defined as the intensity of interactions and cooperation among local actors, including firms and individuals. In his study, he makes a distinction into geographic (material or physical) proximity and non-geographic (relational, social or other) proximity.

Geographic proximity (**GP**) is the degree of spatial closeness among actors, measured in material terms (e.g., kilometres, time, etc.). The reverse of geographic proximity is of course the geographic distance often used in transport, mobility and trade models. Next, non-geographic, virtual or *relational proximity* (**RP**) is considered to

be the intensity of non-physical interactions and cooperation among actors in space, including firms and individuals. This can be subdivided into:

- *Social proximity*: similarities of actors in terms of their social capital [shared common culture, behavioural codes, natural trust, and sense of belonging (see e.g. Basile *et al.* 2012)].
- *Institutional proximity*: the degree of homogeneity and compatibility of regional actors or stakeholders in terms of the set of constraints, guidelines, norms, and codes of conduct they voluntarily agree to follow.
- *Organized proximity*: different ways of being close to other agents, regardless of the degree of geographical proximity between agents, the qualifier «organized» referring to the arranged nature of human arrangements or activities (see e.g., Carayannis *et al.,* 2013; Torre and Lourimi, 2013).
- *Technological proximity*: the degree of shared technological experiences and benefits from a common knowledge base, in particular in terms of industry-related knowledge.
- *Cognitive proximity*: similarity of agents in terms of cognitive maps, domains of perception and cognitive programmes.

Comprising the latter five categories of relational proximity under the heading of **RP**, we may thus argue that the total proximity between actors or regions (denoted as **TP**) can be decomposed as follows:

$$\mathbf{TP} = a\mathbf{GP} + b\mathbf{RP},$$

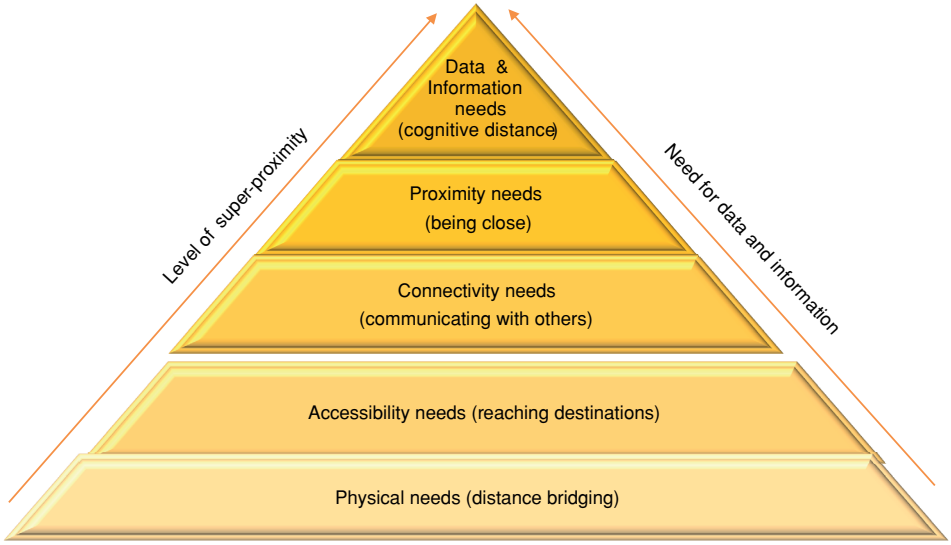
where a and b are distributional parameters indicating the relative strength of **GP** and **RP**.

Now the concept of *super-proximity* will be introduced. Super-proximity is formally defined as both a spatial and a non-spatial intensive degree of interaction and closeness among agents that reaches a maximum total advantage from closeness among relevant actors or agents. Clearly, there may be a trade-off between **GP** and **RP**, in the sense that a relatively low level of **GP** may be compensated by an extremely high level of **RP**. If we assume that the locational socio-economic landscape of agents is (co-) determined by **TP**, we may in principle observe a heterogeneous spatial landscape of agents where geographic concentration and dispersion may both simultaneously take place, depending on the two main constituents of **TP** and the varied preferences of agents for each of these determinants.

The «super-proximity» concept reflects the highest possible long-term added value or utility-enhancing performance of a multifunctional and synergic innovative urban system as a result of strongly interlinked density, proximity and connectivity advantages (physical or virtual) among a heterogeneous set of organizations, people, goods, and services. Proximity may be seen as a societal need that manifests itself in different functions in a hierarchical system of needs. The hierarchical fundamental needs of creative —physical or virtual— «active mediators», with the focus on smart mobility, intense communication, (big) data and information access, and data exchange between different actors in the urban space —as the source of a «buzz

economy» (see Storper and Venables, 2004)— tends to be critical in maximizing the added value from its assets on the basis of «super-proximity». A better understanding and conceptualization of the multiple levels of prioritized quality factors and conditions in a systematic hierarchy of these resources in combination with physical and virtual dimensions can be obtained by employing Maslow's pyramid (1943) on hierarchy of needs as an analytical metaphor for a transition from physical proximity towards modern virtual proximity, leading to a high synergic added value from «super-proximity» (see Figure 1).

Figure 1. Adjusted Maslow's needs pyramid (1943)



Source: Author's own work.

This pyramid consists of different levels of suprastructure related to data, information and communication transfer, while representing needs and requirements set by demand and supply among heterogeneous classes of stakeholders in a globalized digital world. In this context, the interpretation of this transition model suggests that the basic lower-level needs and requirements must be met before shifting from traditional assets and historical data and information systems to more advanced information technologies for which innovation and skills are necessary cognitive conditions.

This simple conceptualisation makes also clear that the «death of distance», the «flat world» and the «spiky world» ideas may be different —though not mutually contradicting— manifestations of the proximity principle in space. The spatial map of interactions and locations is determined by the relative power of **GP** versus **RP**.

The policy implication of the super-proximity principle is far reaching. Spatial development including urban and regional dynamics is not only determined by proximity infrastructure in a traditional sense (roads, (air)ports, railways, etc.), but also

by virtual proximity (e.g., through internet, GPS, GSM, sensors, detection camera's, digital communication networks, etc.). Both deserve to be an integral part of urban and regional policy. Thus, given the combined benefits of **GP** and **RP**, a balanced urban and regional strategy should respect both the real and virtual proximity (in terms of both infrastructure and suprastructure). The next section will be devoted to an illustration of the potential of suprastructure for urban planning.

5. Urban Traffic Management in a Digital City [1]

Super-proximity has both a spatial, a virtual and a time dimension, as it means that human activities can be coincide in almost the same place (physical or virtual) and in almost the same time. This concept plays a critical role in the management of the public urban space, e.g. crowd management, incident control, contingency management, and so forth. In other words, super-proximity has a particular relevance in short-term urban policies that address instantaneous interventions on e.g. demand, behavior or incidences, while it may also play an important role in preventive strategies (e.g., security control). Clearly, digital technology is able to reduce space-time frictions significantly and is the critical vehicle for *super-proximity*.

Digital space-time information is a *sine qua non* for modern effective traffic management in cities. Successful traffic incident management requires a high level of collaboration and coordination of traffic control agencies and relies in particular on flexible communications and information systems for incidence management (IM). «Early and reliable detection and verification of the incident together with integrated traffic management strategies may provide important contributions, which improve the efficiency of the incident response» (Steenbruggen *et al.*, 2014, p. 93). Therefore, it is crucial to have real-time situational interfaces in traffic management systems for monitoring purposes. «Situation awareness for mobility (the ability to understand on the spot the status and consequences of an incident in support of decision making) is essential to reach almost any other objective of IM improvement» (Steenbruggen *et al.*, 2013a, p. 236).

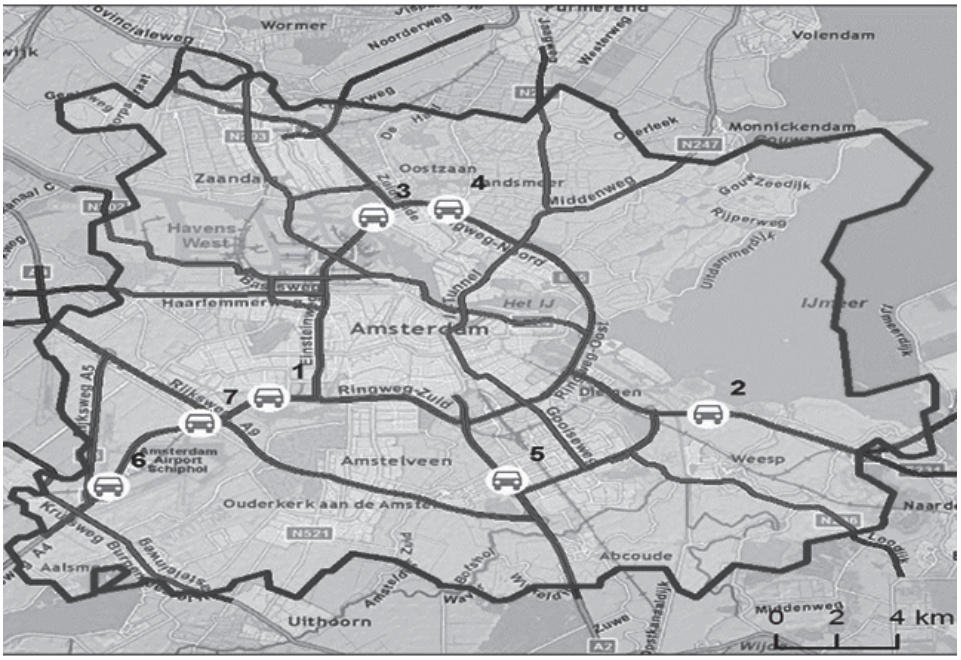
The measurement of mobility dynamics usually relies on established technologies, such as cameras or loop detectors. These are dependable methods, but their costs and installation complexity has prevented so far a full coverage of the road infrastructure, leading to a selective installation on highways and some major urban roads. This limits situation awareness and hampers decision-making ability for transportation in general, and IM in particular. In the last ten years, a number of technologies have been introduced to satisfy the growing demand for timely and accurate spatial-temporal information on mobility flows and their origin-destination patterns. These approaches exploit technology-based mobile devices and sensor networks as a way to collect spatio-temporal data on people and mobility without the need of installing an ad-hoc infrastructure. These super-proximity tools cover

[1] The author wishes to thank John Steenbruggen for his input to this section.

the entire network and all mobility modes, and are thus a perfect complement to existing loop/camera detection in order to provide universal coverage of the entire network, transportation modes and territory at reasonable costs. For an overview of the use of telecom data in the field of transportation, I refer to Steenbruggen *et al.* (2013a, b).

This section will illustrate of the use of mobile phone to improve the situational interface of a traffic management centre. In order to understand how the mobile phone network is geared towards road traffic incidents, occurring on ring roads and immediate highway connections in the metropolitan area of Amsterdam the traffic management centre uses various information sources, including smartphone data in real time. The following criteria were used to select relevant incidents: events had to happen between the period 01-01-2010 and 31-12-2010; events had to fall within a specific area to match the mobile phone operator cells coverage (see Figure 2), and events had to be of a certain critical magnitude. In the analysis four different digital measurements were used. Three of them capture the aggregated use of the mobile phone network: «number of received calls (Terminating Calls - TC), number of executed calls (Originating calls - OC), and number of text messages (SMS), both sent and received» (Steenbruggen *et al.,* 2013b). The fourth measurement contains the sum of these counters (the so-called Index of Human Activities - IHA).

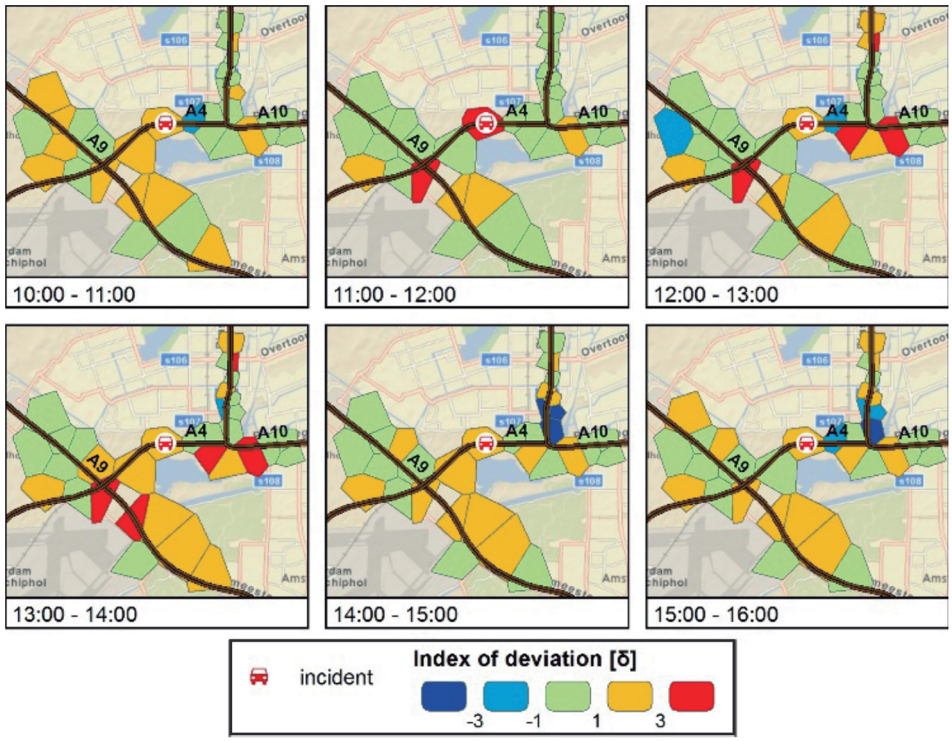
Figure 2. Area for the analysis and the location of selected incidents in Amsterdam



Source: Steenbruggen *et al.* (2010), p. 25.

A more detailed and simple example of a single incident analysis based on digital information management will now be given (see Figure 3). This incident took place on 10-06-2010 (Thursday), on 1.9 km of the A4 highway, between its intersections with highways A10 and A9 of the Amsterdam ringroad. It started at 11:48 and was managed until 13:37. The accident was caused by a previous traffic jam, and thus a relatively high number of travelers affected by the abnormal situation may be expected. The incident can be classified as «major», as it involved this time three cars and a truck. The direction of the flow was «toward the city» (eastern); nevertheless, the lanes on both sides of the highway were blocked. This means that repercussions for the traffic flow should be expected in both directions. To understand and manage the traffic complications caused by this incident, in terms of repercussions on the telecom network, 33 cells within a distance of 3 km from the incident location were considered. A simplified hour-by-hour sequence related to the Index of Deviations for the Index of

Figure 3. Index of deviation of the IHA counter before, during, and after an incident (highway A4 at km 1.9, date 10-06-2010, time period between 11:48-13:37)



Source: Steenbruggen *et al.* (2010), p. 28[2].

[2] Rijkswaterstaat data base «MoniGraph» 3.0 (2016), *https://staticresources.rijkswaterstaat.nl/binaries/MoniGraph%20Handleiding%20versie%203.1.0_tcm21-13729.pdf.*

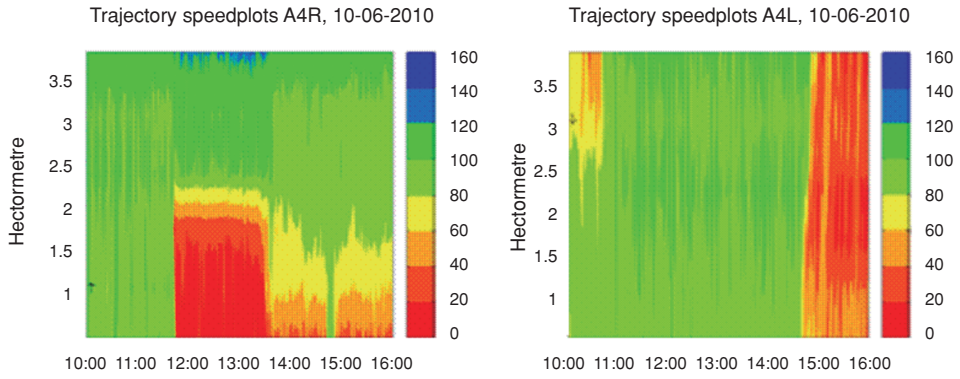
Human Activities (IHA) is presented in Figure 3. This figure shows that for the hour that the incident happened (11:00-12:00), we can observe a high anomaly precisely at the incident location. In the next two hours, the anomalous situation appears to spread out to the nearby intersections of the A4 with the A9 and the A10, which can be interpreted as the activity of people who got stuck while trying to enter the affected segment of the A4. Moreover, serious traffic implications in the further part of the network is also visible, namely at the junction of the A10 with the S106. The road sections around the incident, mainly sections of the A4 and the A9, were also within the class of increased IHA deviations. After 14:00, the situation seemed to slowly come back to normal, as there are more green and orange colours present on the maps.

To validate the IHA on the telecom network, so-called speed plots were used based on detection loop data provided by the traffic management centre (see Figure 4), selected two km before and after the incident location. For the time interval the whole 2 hours» time slot was chosen, before and after the accident occurred. This is between 10:00-16:00 hrs. As clearly indicated on the plot, the right-hand side of the highway was affected by the incident where a large decrease in speed is shown (see red area on plot 4A). It started exactly when the incident was detected on 11:48 and lasted till around 13:30. Also, we can clearly see that after the exact incident location at km 1.9, traffic speed seemed to stabilize back to normal. The left-hand side of the highway was not affected by the incident. Only just before 16:00 hrs, the left-hand side of the highway seemed to be affected by regular traffic jams.

Figure 4. Speed plots related to incident on highway

Figure 4A. Speed plots during and after incident 1 (10-06-2010, 11:48-13:37) on the right-hand (same period) side of the highway

Figure 4B. Speed plots on the left-hand side of the highway (same period)



Source: Rijkswaterstaat data base tool «MoniGraph» 3.0 (2010)[3].

[3] Rijkswaterstaat data base «MoniGraph» 3.0 (2016), *https://staticresources.rijkswaterstaat.nl/binaries/MoniGraph%20Handleiding%20versie%203.1.0_tcm21-13729.pdf.*

The above sketch of the potential of digital information management in traffic planning shows that the digital era has far-reaching effects on urban planning. It enhances the speed of decision-making and provides much better insights into complex decision situations. Consequently, digital suprastructure has two major benefits: it improves the effectiveness and enhances the benefits of public intervention of a smart city in a global sense, and it helps to solve real-time issues in the case of «super-proximity».

6. Prospect

Infrastructure and suprastructure are the cornerstones of urban and regional development. They provide productivity-enhancing opportunities for cities and regions, through economies of density, proximity and connectivity. The present paper has highlighted the importance of proximity as a core concept in understanding and explaining the competitive position of cities and regions. Our study has in particular addressed the emerging importance of suprastructure (virtual infrastructure) in generating a high added value from virtual or relational proximity characterized through various dimensions (e.g., social, technological, etc.). In this context, the notion of *super-proximity* has been introduced to emphasize that spatial dynamics (e.g., urban or regional development) is the result of various gravitational forces —of both a material and a virtual nature— that in combination shape the space economy. Consequently, a given level of economic development of a city or region can be achieved with different combinations of physical and virtual proximity measures.

It should be added that especially large urban agglomerations have turned into big data machines, with an enormously complex system of physical and virtual interactions. The rise of digital technology has provided many new opportunities for efficiency increase and service improvement in the public sector, but at the same time the business sector is also able to reap many benefits from advanced ICT use. And therefore, it is pertinent for public policy to ensure a high degree of relational proximity in cities and regions, in addition to physical accessibility and connectivity provisions. This issue prompts of course the question whether and how virtual infrastructure may become a discriminating part of a specific urban or regional development strategy, given the fact that various suprastructure provisions tend to become ubiquitous and less spatially differentiated. It is clearly a great future challenge to develop novel methods for spatial impact analysis in the context of an overall policy strategy on city-specific or region-specific super-proximity as an overarching principle for improvement of performance and competitiveness of cities and regions.

Finally, digital technology may also diminish the gap between policy-making bodies and citizens. e-Governance is a modern way for cities to provide open access liaisons to people. This may lay the foundation of on interactive and participatory strategy in future urban and regional planning, as citizens and administration are more geared towards each other. In other words, the trend to «super-proximity» may benefit the legitimacy of our democratic systems.

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Section ARTICLES

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Spatial concentration in Latin America and the role of institutions

Patricio Aroca *, Miguel Atienza **

ABSTRACT: Spatial concentration in Latin America, especially in the southern cone, reaches high levels in all dimensions. Despite significant economic growth in the last two decades, trade openness, the return to democratic regimes and reductions in the Gini coefficients the primacy indexes of most Latin American countries remain relatively constant and among the highest in the world. This situation challenges most regional and urban economics theories that predict a reduction in spatial concentration as development proceeds, after an initial period of concentration. Furthermore, Latin American countries could be trapped in processes of agglomeration without growth. The objective of this article is twofold: first, we describe some characteristics of spatial concentration and its persistence in Latin America with special emphasis in the case of Chile; and second, we propose future research lines related to the need of rebalancing Latin American spatial economies focusing on the importance of institutions as an explanation of the persistence of spatial concentration.

JEL Classification: R12; R58; O18; O54.

Keywords: Spatial concentration; Latin America; spatially blind policies; institutions.

RESUMEN: La concentración espacial en Latinoamérica, especialmente en el cono sur, ha alcanzado niveles muy altos en todas sus dimensiones. A pesar del significativo crecimiento económico en las últimas dos décadas, apertura comercial, retorno a la democracia y reducción en el coeficiente de Gini, los índices de primacía de los países latinoamericanos permanecen relativamente constante y entre los más altos del mundo. Esta situación desafía las teorías provenientes de la economía urbana y regional que predicen una reducción en la concentración espacial a medida que avanza el desarrollo, después de un periodo inicial de concentración. Sin embargo, los países latinoamericanos parecieran estar atrapados en un proceso de aglomeración sin crecimiento. En este contexto, el objetivo de este trabajo es doble: por una parte, describe algunas de las características de la con-

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centración espacial y su persistencia en América Latina con especial énfasis en el caso chileno; y por otra, se propone líneas de investigación futura relacionadas con la necesidad de re-balancear las economías espaciales enfocándolas en determinar la importancia de las instituciones como una explicación de la persistencia de la concentración espacial.

Clasificación JEL: R12; R58; O18; O54.

Palabras clave: Concentración especial; América Latina; políticas espaciales ciegas; instituciones.

Introduction

After a very rapid process of urbanization, that took around fifty years during the XX century, Latin American countries are currently the most urbanized in the world, together with the United States, with around 80% of the population living in cities (United Nations, 2014)[1]. One of the main traits of Latin American urbanization is the existence of remarkable spatial inequality in terms of income, access to education, health and other public and private services (ILPES-CEPAL, 2012). Furthermore, despite the natural heterogeneity among the countries of the region, most of them present high levels of spatial concentration among the main city of the urban system. In fact, primacy indexes of Latin American countries are among the highest in the world (United Nations, 2012).

Despite the high level of spatial inequality and concentration, the debate and research about inequality and redistribution in Latin America has been fundamentally considered at a national and individual scale, in a context where distance does not exist, labor and capital are perfectly mobile and territory is homogeneous in terms of factor endowments, production and access to goods and services. Furthermore, most policies have been based on the idea of «non-discrimination», according to which different individual agents should be equally treated across space, assuming that equality will be the result of that policies, at least in terms of the access to opportunities.

During the last two decades, however, individual inequality , measured through the Gini coefficient has significantly diminished in most Latin American countries (López-Calva and Lustig, 2010; Lustig, López-Calva and Ortiz-Juárez, 2013) while spatial inequality and urban concentration persists and it is probably not only a problem for equality but also for efficiency, affecting negatively national growth (Aroca and Atienza, 2012, 2013, Cuadrado-Roura and Gonzalez-Catalan, 2013). In this respect, the problem of rebalancing the spatial economy is one of the main challenges of the region from a policy perspective but also in terms of the theories and models that in urban and regional economics allow us to understand and make decisions

[1] An exception to this trend is the case of many Central American countries, whose urbanization is still in process.

regarding the reduction of inequality and the development of peripheral areas. The objective of this article is to analyze the evolution of spatial concentration in Latin America with special emphasis in the Chilean case, and to propose what are the main frontiers for urban and regional economics research in the region.

The article has three sections. In the first one, we describe the evolution of demographic and economic concentration in Latin America and show how current theories in urban and regional economics are not completely appropriate to explain the persistence of spatial imbalance in the region. Afterwards, we focus on the case of Chile, which despite its level of development and recent political and economic reforms, remains as one of the most concentrated countries in Latin America. For this purpose, we adopt a historical perspective based of the way institutional frameworks could be one of the main causes of the persistence of spatial concentration in that country. Finally, in the conclusions, we analyze the main frontiers for regional and urban analysis in Latin America.

1. The puzzle of rebalancing the spatial economy in Latin America

Martin (2015) has recently stressed how regional and urban economics and regional studies are not able to offer a convincing basis for understanding and devising policies capable of reversing spatial imbalance and persistent levels of geographic concentration of population and economic activity. Although Martin focuses on the experience of the increasing demographic and economic dominance of London and the South East of the United Kingdom, his arguments are particularly relevant for Latin America as it stands out as the continent with the highest urban primacy in the world (United Nations-HABITAT, 2012). Increasing spatial concentration and regional divergence has recently become a trend in some European countries and the United States (Storper, Kemeny, Makarem and Osman, 2016), but it has likely been the main feature of Latin American economic geography since the end of the XIX century (Morse, 1974; Kemper, 2002). It is also doubtful, as Martin states regarding the United Kingdom, whether we have sufficiently adequate theories and policies to achieve a more equitable geography in Latin America. More importantly, it is not clear whether the existing theories, based predominantly on the experiences of Europe and the United States, respond to the specific characteristics of the development and urbanization of Latin American countries, where a process of «agglomeration without growth» may be taking place in countries such as Chile, Argentina, Peru and Uruguay (Polèse, 2005).

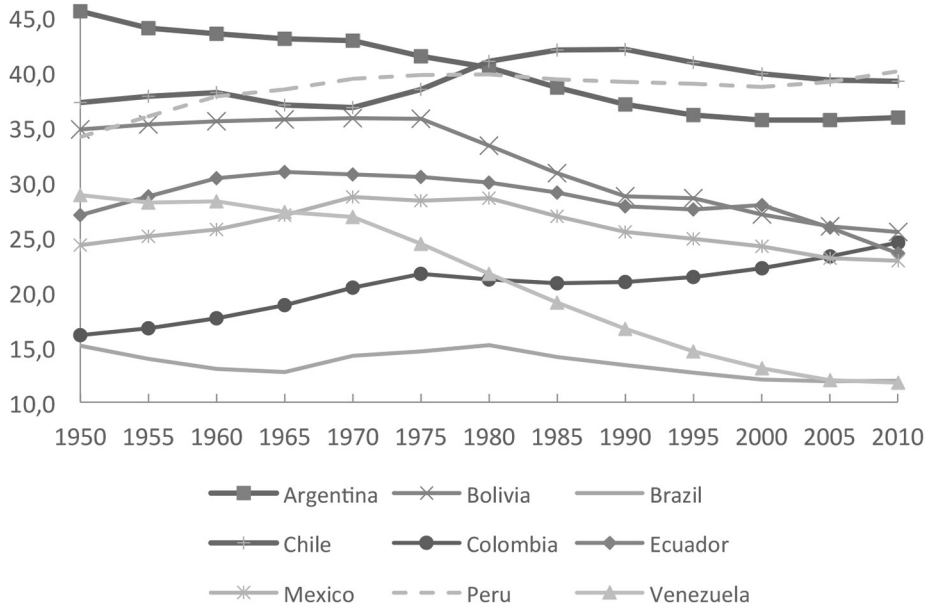
Since 1980, Latin America has experienced significant transformations that should, in theory, have reduced spatial concentration and imbalances. First, the continent has completed the urbanization process and is currently the most urbanized region in the world, together with the United States, with almost 80% of the population living in cities (United Nations, 2014). Second, Latin American countries progressively abandoned Import Substitution Industrialization (ISI) policies that, according

to many authors, was the cause of urban concentration (Krugman and Livas Elizondo, 1996; Rogers, Beall and Kanbur, 2012), and widely opened their trade to the world. Third, the Latin American region has achieved a high level of democratization, following a period of dictatorships and political instability. Furthermore, the region has experienced the greatest reduction worldwide, in terms of states' fragility and warfare (Marshall and Cole, 2014). Fourth, most Latin American countries have shown relatively high economic growth rates over the last two decades and many of them have achieved a medium level of development of GDP per capita (Penn World Tables 9.0). Finally, since the beginning of the XXI century, income inequality, measured through the Gini coefficient, has significantly diminished in most Latin American countries (López-Calva and Lustig, 2010; Lustig, López-Calva and Ortiz-Juárez, 2013).

Increasing levels of urbanization, trade openness, democracy, growth, development and the reduction of individual inequality should reduce spatial inequality and concentration according to the available theories and previous empirical studies (Wheaton and Shishido, 1981; Mutlu, 1989; Ades and Glaeser, 1995; Junius, 1999; Davis and Henderson, 2003; Henderson, 2003; Moomaw and Alwosabi, 2004; Bertinelli and Strobl, 2007; Henderson and Wang, 2007; Barrios and Strobl, 2009; Brülhart and Sbergami, 2009; Pholo Bala, 2009). Latin American spatial concentration, however, is the exception and remains as a puzzle to be solved. Modrego and Berdegué (2015) analyze the changes in per-capita income, monetary poverty and income distribution in 9,045 subnational administrative units of nine Latin American countries between the mid-1990s and mid-2000s. They find a small mean household income convergence and that territorial inequality is persistent and reduces the pro-poor effect of local income growth. Furthermore, despite all of the economic and political transformations previously mentioned, the primacy indexes of the main cities in the urban systems of Latin American countries have remained persistently high since 1950, with the exceptions of Mexico, Bolivia and Venezuela, where the primacy of the main city has diminished and represents less than thirty percent of the urban population (Figure 1). In contrast, among Latin American countries, Peru, Chile and Argentina stand out as the most spatially uneven in terms of population concentration.

The development of Latin American countries does not seem to follow the «Williamson hypothesis» (Williamson, 1965) that predicts and inverted U relationship between GDP per capita and spatial unevenness. In contrast, many countries of the region remain during decades on the top part of this distribution. Furthermore, the role of primate cities in the urban system has significantly changed since the 1990s (Cuervo and Cuervo, 2013). During the application ISI policies, between 1930 and 1980, Latin America experienced a very rapid urbanization, characterized by the concentration of manufacturing in the main cities, according to the hypothesis proposed by Krugman and Livas Elizondo (1996) that relates the lack of trade openness with the formation of giant cities. Since the 1990, the participation of Latin American primate cities in manufacturing output has significantly declined but these cities have increased their role as financial centers and the location of most innovative activities.

Figure 1. Primacy index Latin America (1950-2010)

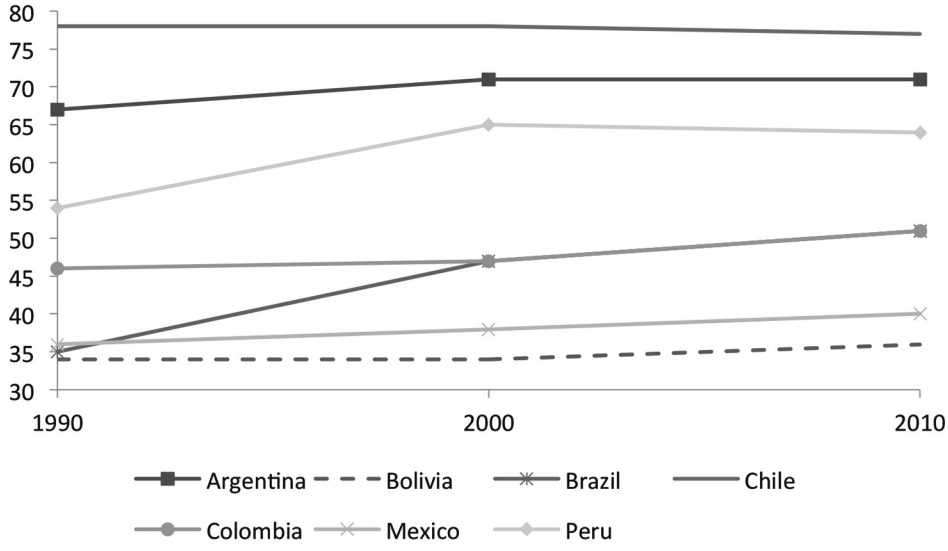


Source: Atienza and Aroca, 2013.

The case of financial activity is a perfect illustration of the current function and revitalization of primate cities in Latin America. The degree of concentration of this activity is significantly higher than the concentration of population, achieving almost 80% of financing services in Santiago (Chile), more that 70% in Buenos Aires (Argentina) and significantly increasing its participation in Lima (Peru) and Sao Paulo (Brazil), that concentrate around 50% of domestic financial services. It is important to mention that, despite the relative spatial dispersion of manufacturing, this activity is still more concentrated than population, and that the majority of peripheral areas in Latin America are still specialized in the primary sector. In this sense, Latin America reflects the idea that the world is becoming increasingly «curve» proposed by McCann (2008), according to which larger cities are increasing their relative importance due their higher connectivity and attractiveness to become the location of more knowledge intensive activities.

Explaining the persistence of spatial concentration and the way of promoting the development of peripheral areas are perhaps the main frontiers in regional and urban analysis in Latin America. Solving this puzzle is not only important in order to achieve more equality as a political and social goal. The trade-off between spatial concentration and national economic growth, mainly proposed by New Economic Geography models (Baldwin and Forslid, 2000; Baldwin and Martin, 2004), has been challenged both theoretically and empirically and particularly affects future studies on Africa and Latin America that according to Pholo Bala (2009) might

Figure 2. Primate city participation in financial product (1990-2010)



Source: Authors based on Cuervo and Cuervo, 2013.

currently be in a «concentration trap» that reduces efficiency and growth. In fact, most empirical works on the relationship between spatial concentration and national growth (Henderson, 2003; Bertinelly and Strobl, 2007; Brulhart and Sbergami, 2009; Pholo Bala, 2009, Atienza and Aroca, 2012) show that in countries such as Chile, Argentina, Peru, Uruguay as well as most Central American countries, spatial concentration is negatively affecting national growth. These results, however, are fundamentally empirical and we lack theories to explain how the spatial dispersion of economic activity and population occurs and can be promoted, taking into account the particular characteristics of the development and urbanization processes of Latin American countries.

Regional and urban economics models that try to explain agglomeration and concentration processes have been predominantly based on the interaction of market mechanisms related to the allocation of resources and the mobility of factors in a context of increasing returns to scale. From this perspective, consequently, there has been a tendency to consider spatial concentration as a market equilibrium. This view, however, has also been challenged and history, institutions and policy have increasingly gained importance in explaining spatial concentration and its potential persistence. Davis and Henderson (2003) and Henderson and Wang (2007) emphasize the role of the institutional framework in the persistence of high levels of concentration. These works highlight the concept of favoritism, understood as an institutional framework that favors the persistence of concentration, due to an asymmetric regional distribution of public investment and an assignment of export licenses and restrictions on capital markets that favor the main city (Davis and Henderson, 2003). Vargas

and Atienza (2016) propose that the existence of historical and current institutional frameworks can also organize territories in an extractive way, ensuring the predominance of some places over others. In this sense, the concentration of political and economic power in an elite that is habitually located in the most important urban centers, can reinforce an institutional framework characterized by favoritism and accentuate spatial inequality. From this perspective, they find that having been a Spanish colony increases primacy.

Martin (2015) stressed the need for an historical and institutional approach to understand the forces that shape the economic geography of a country, particularly in regards to the persistence of concentration. From this perspective, in the next section we will analyze the case of Chile, which possesses one of the highest levels of primacy in the continent. This case is of particular relevance, because spatial concentration has remained constant over the last two decades, despite significant economic growth and development, the return to democracy and a clear policy of trade openness. Furthermore, all empirical studies on the relationship between concentration and growth show that Chile might be in a «concentration trap», a process of agglomeration without growth, or growing under its potential.

2. The Chilean laboratory of spatial imbalanced growth

Chile has been taken by many scholars and practitioners as a successful experience of development from a macroeconomic perspective. Most attention on the so called «Chilean miracle» has been paid to structural stability, growth and reduction in poverty rates. In contrast, inequality both at an individual and spatial level has received until recently scant consideration, despite its high levels, among the highest in the world, perhaps because the lack of success in these aspects. In fact, Chile stands as a classic instance of spatial inequality and persistence of concentration despite economic growth and development. Curiously, current urban system closely resembles late XIX century Chilean spatial organization of the economy when natural resources export dependency inhibited the growth of peripheral regions, in many cases organized as small size enclave towns, while Santiago, the capital, concentrated most economic, political and cultural power (Morse, 1974). Regional and urban economics theories predominantly based on the idea of spatial market equilibrium are not able to explain why the economic geography of Chile is not more balanced nowadays, probably because that geography is not a market result. In this respect, it is more plausible to think of a path dependent process, that started at the end of XIX century, reinforced by an extremely centralist institutional framework and a set of spatially blind national policies that, based on the idea of non-discrimination among individuals, have reduced the opportunities and capabilities of people living in peripheral regions and can also be reducing efficiency and national growth. In this section we will analyze the historical roots and evolution of spatial concentration and some institutional mechanism that can be currently contributing to the persistence of this concentration.

2.1. Evolution of spatial concentration in Chile

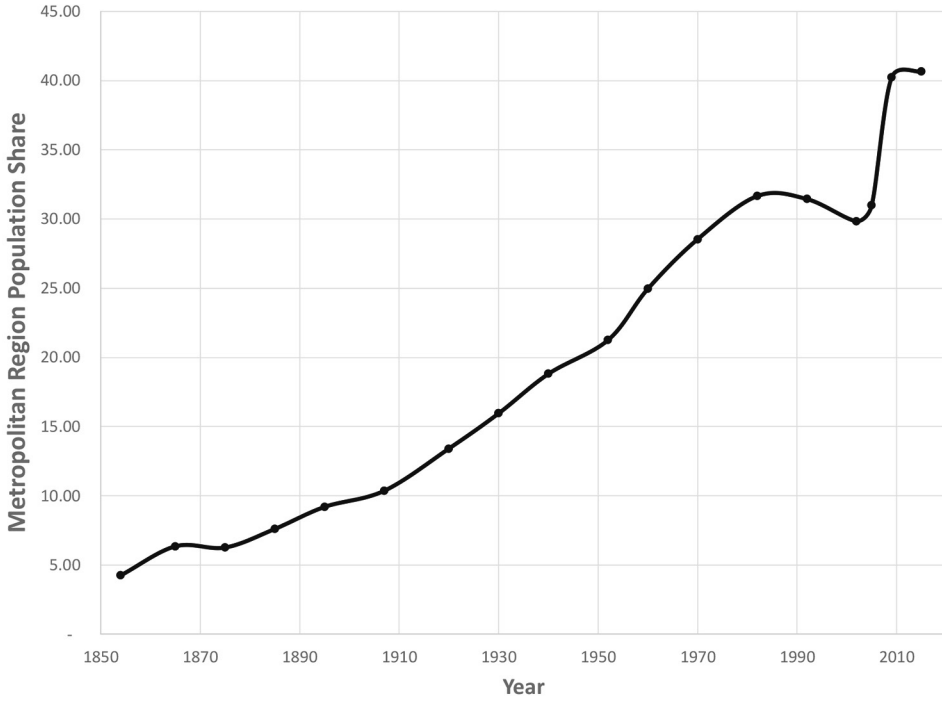
From a historical perspective, Spanish colonial rules created a form of territorial dominion based on administrative cities of the viceroys that acted as units of power and surplus extraction from the periphery (Chase-Dunn, 1984). Colonial urban systems ensured the flow of goods to the main ports and navigable rivers while little effort was made to create cities in the areas of exploitation, which were organized as plantation and enclave economies (Kemper, 2002). After the independence, Latin American countries needed several decades to achieve the unification of the majority of states due to the absence of institutional mechanisms of agreement among rival groups (North, Summerhill, and Weingast, 2000). Chile was one of the first Latin American states to achieve unification thanks to Diego Portales that established an authoritarian and strongly centralized Constitution in 1833 (Boisier, 2000). Portales Constitution, whose influence extends to the XX century, reinforces the colonial territorial model based on a core-periphery pattern where the main city was a center of political and economic clientelism where commercial and financial intermediaries prospered and landowning elites enjoyed urban amenities while peripheral cities remained as primary export oriented economies (Morse, 1974).

At the beginning of the XX century, Chilean was predominantly a rural country and the level of demographic concentration in Santiago was relatively low, around 11% of total population (Figure 3). A process of path dependence, however, had already started, that would be evident during the next decades as the rapid urbanization of Chile proceeded. During the first four decades of the XX century the participation of Santiago in total population consistently increased, but the Chilean urban system was not very asymmetrical and followed the Zipf law[2] (Figure 4). The asymmetry of the Chilean urban system started to grow sharply from 1940s[3] when the urbanization process accelerated, ISI policies were applied and manufacturing activity significantly increased. At the beginning of the 1970s, Chile had already finished it process of urbanization and the demographic concentration in the Metropolitan Region was over 30% of total population (Figure 3). This process of agglomeration followed in general the predictions of standard theories of urban and regional economics. During the Pinochet's dictatorship, between 1973 and 1990, the spatial concentration continued to grow but at a slow pace, mainly because economic crisis in the seventies and especially in 1982 principally affected the economy of the Metropolitan Region. Paradoxically the return to democracy brought a significant rise in primacy rates that increased from 32% of total population to 40% in just a decade, between 1992 and 2002 (Figure 3). At that point, the Chilean urban system did not follow the Zipf law due to the high level of asymmetry (Figure 4). It is interesting that during this period Chile was highly urbanized, had returned to democracy, was a broadly open economy and experienced significant GDP growth. Despite this last period is still relatively short, it seems that there is no sign that concentration is significantly di-

[2] Zipf coefficient was close to 1, which means that the first city in the system is twice the second in terms of population, three times the third city and so on.

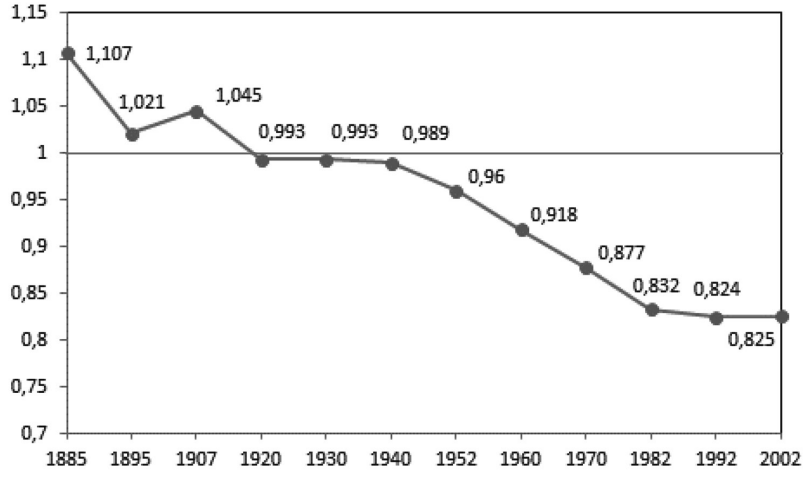
[3] This is manifested in the reduction of the Zipf coefficient below 1.

Figure 3. Concentration of total population in the Metropolitan Region (1865-2009)



Source: Authors elaboration based on Chilean Census and CASEN 2009 and 2015.

Figure 4. Evolution of the Zipf coefficient (1885-2002)



Source: Vallone y Atienza, 2012.

minishing. Why does spatial concentration remain so persistent in this context? In this case, standard urban and regional theories do not offer convincing answers and institutional and political factors, normally absent in those theories, seem to be the most appropriate explanation.

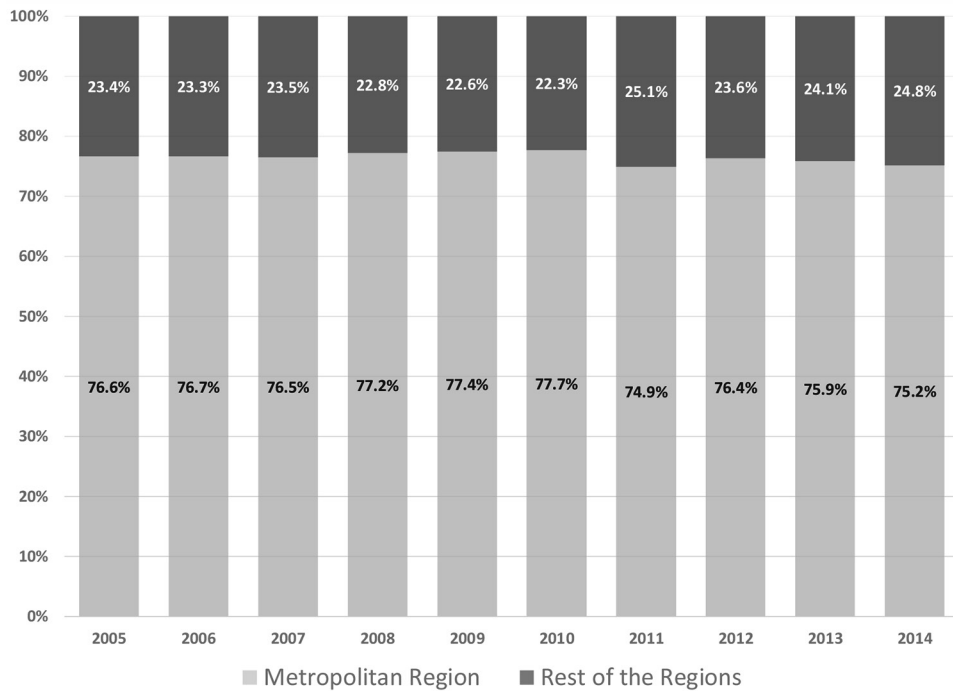
2.2. The role of institutions in the persistence of spatial concentration in Chile

In September 1973, the same month of Pinochet's coup d'état, John Friedmann analyzed the spatial organization of power in Chile and its effects on the development of urban systems. His analysis reinforced the idea of spatial path dependence related to the institutional framework: «the spatial distribution of governmental power influences the location decisions during the early phases of industrialization and the growing interpenetration of governmental and private economic institutions channels the subsequent location decisions of individuals and households to locations of central power in excess of objective opportunities for productive employment». This type of argument has been defended by many authors regarding the strong influence of the centralist Constitution promulgated by Diego Portales in 1833 in the current economic geography of Chile (Boisier, 2000). In fact, Chile still has an extremely centralized state organization especially in terms of political and fiscal decentralization. Surprisingly, despite the importance of institutions in economic geography we lack theories explaining the channels and mechanisms through which institutions can affect the spatial organization of an economy and can perpetuate high levels of concentration. In this section we will briefly analyze four aspects of the economic geography of Chile (the property of capital, the location of qualified human capital, the innovation expenditure, and the central government purchasing system) and how the institutional design could be promoting concentration.

2.2.1. Ownership and concentration of capital

In Chile, it is difficult to find information on the ownership of capital and even more so regarding its territorial distribution. Nonetheless, there is a suitable proxy that can be obtained via a database created by the Internal Taxes Service (SII for its abbreviation in Spanish) and that is available from the year 2005 to 2014. This database contains the sales levels for all Chilean firms that are subject to paying the value added tax (IVA). The information is disaggregated at a regional level, assigning to each region not the sales realized there, but rather the sales conducted by the firms that were started in that region. As in Chile the initiation of activities is generally done in the region where the owner lives, the distribution of regional sales in the territory provides a good approximation of how the ownership of capital is distributed throughout the territory and probably even more importantly, the revenue derived from it. Figure 5 shows the spatial distribution of the ownership of the sales from the Metropolitan Region and the rest of the country's 14 regions, clearly indicating two

Figure 5. Evolution of the Ownership of Sales per Region



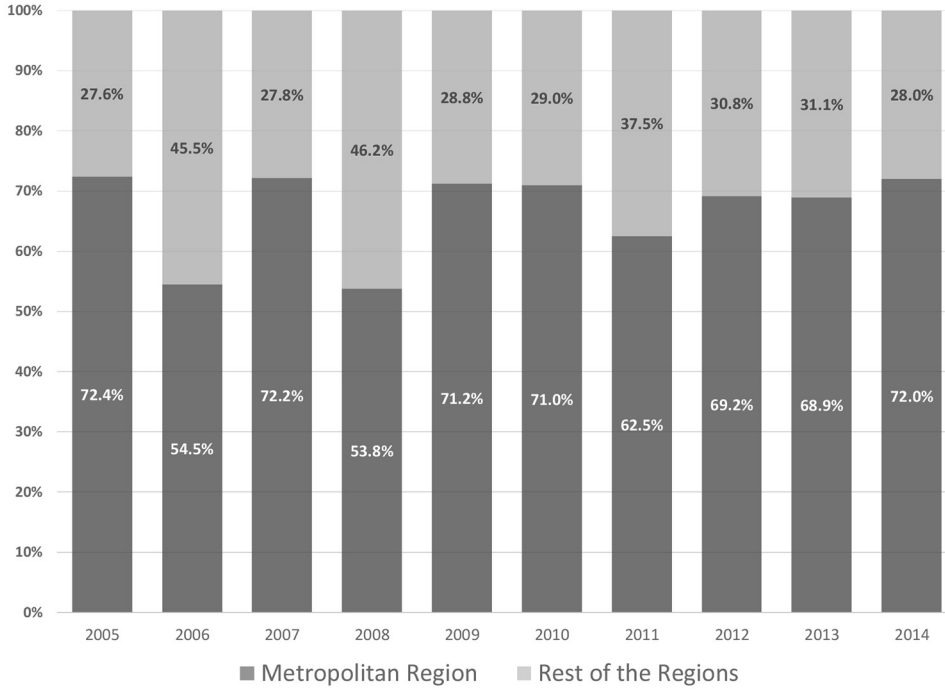
Source: Authors based on SII.

characteristics. The first, the level of ownership of sales on the part of firms that live in Santiago exceeds 75% for every year, and it is relatively constant since 2005. Second, this is a percentage that far exceeds the concentration of the population that lives in the capital and which, additionally, tends to be strongly underestimated by household income surveys. Proximity to political and economic power plays a major role in the extreme concentration of capital in Santiago. Furthermore, due to the centralization of the Chilean state, most decisions, such as access to credit and to public projects, are taken in Santiago and require face to face contacts. From this perspective, concentration of capital has a strong effect on demographic and economic concentration.

Additionally, the strong spatial concentration of capital has another important implication in reference to local taxes that should be paid by the firms in order to function, known as patents or permits for commercial or production activities. While the VAT is collected nationally and goes entirely to finance the nation's fiscal budget, the municipalities or regions where the declaration of the activity was made, are the exclusive beneficiaries of patents and permits paid by the firms. As previously shown, a large majority of these firms pays these taxes in the Metropolitan Region, even though their activity or sales have been carried out in other regions, which favors the municipalities of Greater Santiago over the municipalities where the sales were generated. From this perspective, Santiago enjoys a sort of «fiscal favoritism» against

the interests of the rest of the regions. A dramatic example of this process occurs in the mining sector (see Figure 6), where the Metropolitan Region registers, for many years, more than 70% of the total sales of the sector, while it produces less than 5% of national mining production.

Figure 6. Evolution of the Ownership of Sales in the mining activity



Source: Authors base on SII database.

The ownership of the sales also implies ownership of the surpluses or utilities generated by them, which produces an income distribution of capital gains highly concentrated in the Metropolitan Region, in regards to the rest of the country's regions. This process seems to have converged, as the total percentage of capital concentrated in Santiago has been very stable over time, which would be causing an accumulation of increasing inequality in the territory.

2.2.2. Higher education system and regional «brain drain»

Chacón and Paredes (2015) show that between 1992 and 2011 at least 50% of spatial income inequality was explained by spatial labor sorting, that is the attraction of qualified human capital from the peripheral regions to the Metropolitan Region. This process starts at the moment of deciding where to do the undergraduate studies

and has its roots in the historical concentration of the most prestigious schools and universities of the country in the city of Santiago. Furthermore, current higher education system reinforces the position of the Metropolitan Region because a significant part of the public funds received by the universities depends of the quality of their students.

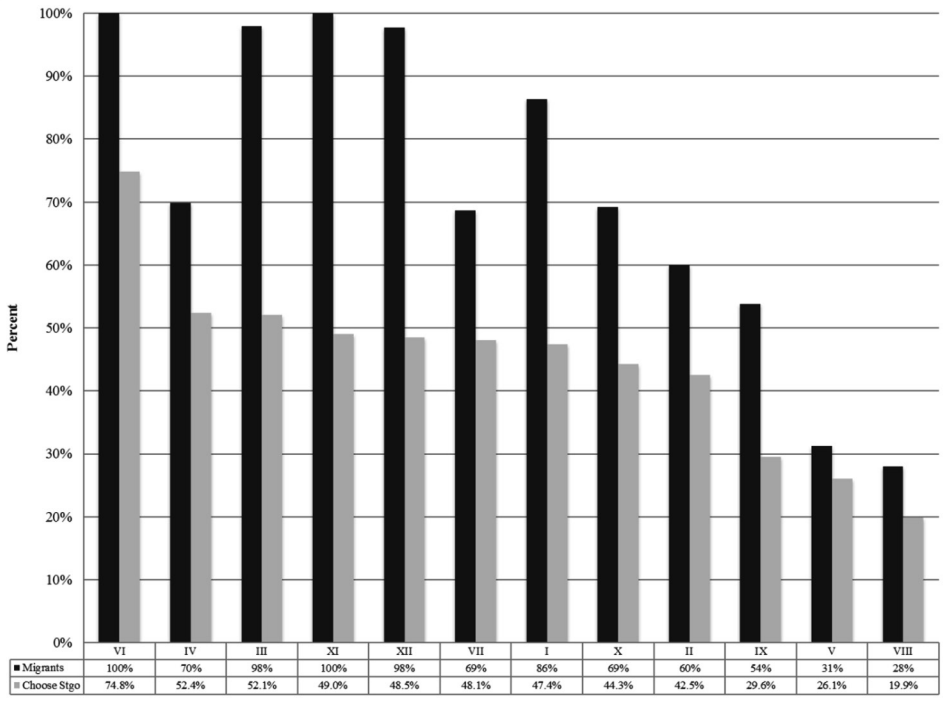
Chile has a higher education system comprised of state universities, traditional private universities and non-traditional private universities. While the first two categories correspond to the long established Chilean universities, the latter includes universities created principally during the Pinochet's dictatorship. The system of student selection is primarily based on the National Placement Test (PSU) that is unified and in which participate the state universities, the traditional private universities and around 5 of the approximate 50 created during the military government. The students that complete secondary education take this exam, that together with their course grades earned throughout high school, currently 9th-12th grades, comprise their application score for the university and degree program that they wish to study. The application score fluctuates between 450 to 850 points. The students that earn more than 700 have a very high likelihood of being accepted by the universities and programs that they desire, while those that earn less than 550 points have far fewer options.

The attraction of students with the highest scores in the PSU by the main universities from Santiago is at the heart of the spatial labor sorting process. In this respect, international evidence (Ishitani, 2011, Kodrzycki, 2001) shows that an important proportion of students find work in the area where their university is located, given that in the education process, especially in professional training, many of the student jobs and internships are developed in the area where the university is located. Consequently, the migration of a student to enter a university can be considered as a movement of potential human capital to this territory. From this perspective, in Chile, there is an intense «brain drain» from the regions to the Metropolitan Region through a process of university selection, creating a replacement of specialized human potential that negatively affects the rest of the territory and that is concentrated in Santiago. Between 2006 and 2008, more than 100.000 students per year entered traditional Chilean universities. In the selection process, 97% of the students from the Metropolitan Region that earned more than 700 points in the PSU stayed in Santiago to study, while more than 50% percent of the students that earned this score from the rest of the regions, migrated to the capital (Figure 7 and 8). Conversely, 87% of students from Santiago that scored less than 550 migrated to study in a regional university and virtually no one from the regions that earned less than 550 left to study in the Metropolitan Region (Figure 7 and 8). It can be said, therefore, that the Metropolitan Region imports good students and exports bad ones. This process, repeated year after year, has created a spatial division of labor among regions (Lufin and Atienza, 2010) and a high concentration of professionals in the Metropolitan Region and reduced the possibilities that the peripheral regions have high quality professionals. An activity where this result is striking is the healthcare. While in Santiago it is possible to find any specialty in different hospitals and private practices, the regions are constantly manifesting frustration about the lack of specialists in different areas of medicine. At

Figure 7. Migration Behavior of the Metropolitan Region Students by Scores

Source: Aroca, Eberhard and Pereira (2015).

Figure 8. Students Migration Behavior with scores > 700 points from Rest of the Country



	VI	IV	III	XI	XII	VII	I	X	II	IX	V	VIII
Migrants	100%	70%	98%	100%	98%	69%	86%	69%	60%	54%	31%	28%
Choose Stgo	74.8%	52.4%	52.1%	49.0%	48.5%	48.1%	47.4%	44.3%	42.5%	29.6%	26.1%	19.9%

Source: Aroca, Eberhard and Pereira (2015).

the same time, as the universities receive more public funds according to the entry scores of their students, the institutional framework of the higher education system itself reinforces the dominant position of the universities from the Metropolitan Region that have the opportunity to invest in better infrastructures and to contract the most qualified scholars.

2.2.3. Innovation

At the end of the 90s and at the beginning of the XXI century, research on total factor productivity (TFP) showed that it had stagnated or even had negative growth for a few years. In 2005, Congress agreed to apply a special tax on the mining industry, whose declared objective was to create a series of efforts to increase the economy's TFP. Since then, incentives were created for firms to spend more in innovative activities, while simultaneously the government created a program to send students to participate in postgraduate programs at first-class foreign universities and many programs to send businessmen to learn about innovative environments abroad. At the same time, a process to accurately measure innovation in the country was started via a national survey that required various attempts before converging on a survey that is reliable and has useful information for the analysis of innovation in Chile.

The sixth through ninth innovation surveys allow for the construction of an annual panel for the years 2007-2014. Using part of the information offered by these surveys, it is possible to construct a regional double-entry table that shows where the firms that decide to spend on innovation are located and in which region this investment takes place. The results show, first, that the vast majority of these expenditures are decided and spent in the Metropolitan Region (region 13). Second and more remarkable, a significant part of the expenditure on innovation that is decided in other regions is carried out in Santiago (Table 1). Furthermore, the distribution of these investments is increasingly growing in the Metropolitan Region over time. These results make it possible to anticipate that the positive results from innovation expenditure will highly concentrate the revenues from innovation in the Metropolitan Region and increase the already high spatial concentration of all of the capital gains. At the same time, the economic geography emerging from this pattern of investment reproduces the core-periphery structure that come from the colonial times, where the core was specialized in more advanced activities and the periphery remained highly specialized in natural resources intensive and extractive activities. In this respect, the lack of industrial policies to develop innovative activities in peripheral regions has been a constant since the return to democracy in Chile. Despite cluster policies were broadly adopted in 2007 by the Bachelet government, these clusters were considered as part of a national competitive strategy becoming, in fact, national industrial policies with scarce territorial content. In any case, the strategy of promoting clusters was completely abandoned four years later during Piñera's government and most investment decisions have been left to the market since then.

In addition, Region of Valparaiso (Region 5), in 2007 used to receive a share from the rest of the country that has a significant reduction in 2014. This region has several good universities and is the second most populated of the country. However, Santiago tend to keep concentrating the main share of the expenditure doing to investment and technology (see Table 1). If this happened with the second most populated and with more universities region of the country, there is not much chance that the rest of the regions do any better.

Table 1. Origen and Destination of Innovation Expenditure in Chile: 2007 and 2014

		Destination														
2014	Regions	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Origin	1	40%	14%	0%	0%	1%	3%	0%	0%	0%	0%	0%	0%	42%	0%	0%
	2	0%	10%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%	87%	0%	0%
	3	0%	0%	18%	0%	1%	6%	0%	0%	0%	0%	0%	0%	74%	0%	0%
	4	0%	15%	7%	40%	11%	0%	0%	0%	0%	0%	0%	0%	27%	0%	0%
	5	0%	0%	0%	0%	84%	0%	0%	0%	0%	0%	0%	0%	16%	0%	0%
	6	0%	0%	0%	0%	4%	19%	0%	0%	0%	0%	0%	0%	76%	0%	0%
	7	0%	0%	0%	0%	2%	1%	48%	1%	0%	0%	0%	0%	49%	0%	0%
	8	0%	0%	0%	0%	0%	0%	1%	52%	0%	0%	0%	0%	46%	0%	0%
	9	0%	0%	0%	0%	0%	3%	0%	1%	81%	0%	0%	0%	15%	0%	0%
	10	0%	0%	0%	0%	0%	0%	0%	6%	0%	70%	0%	0%	22%	0%	0%
	11	0%	0%	0%	0%	0%	0%	0%	0%	3%	0%	41%	0%	55%	0%	0%
	12	0%	0%	0%	0%	17%	0%	0%	0%	0%	0%	0%	69%	14%	0%	0%
	13	0%	0%	0%	0%	5%	1%	1%	0%	0%	0%	0%	0%	91%	2%	0%
	14	0%	0%	0%	0%	0%	0%	0%	1%	0%	5%	0%	0%	58%	37%	0%
	15	0%	0%	0%	0%	12%	24%	0%	0%	0%	0%	0%	0%	54%	0%	9%
2007	Regions	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Origin	1	9%	0%	0%	0%	16%	0%	0%	2%	3%	0%	0%	0%	71%	0%	0%
	2	0%	17%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	82%	0%	0%
	3	0%	1%	36%	0%	6%	0%	0%	0%	0%	0%	0%	0%	57%	0%	0%
	4	0%	0%	0%	16%	2%	1%	1%	0%	0%	0%	0%	0%	81%	0%	0%
	5	0%	0%	0%	0%	58%	0%	0%	0%	1%	0%	0%	0%	41%	0%	0%
	6	0%	0%	0%	0%	8%	59%	2%	0%	0%	0%	0%	0%	32%	0%	0%
	7	0%	0%	0%	0%	2%	1%	64%	1%	0%	0%	0%	0%	33%	0%	0%
	8	0%	0%	0%	0%	3%	0%	0%	29%	1%	0%	0%	0%	67%	0%	0%
	9	0%	0%	0%	0%	12%	1%	0%	0%	68%	0%	0%	0%	18%	0%	0%
	10	0%	0%	0%	0%	4%	0%	0%	0%	2%	65%	0%	0%	29%	0%	0%
	11	0%	0%	0%	0%	24%	0%	0%	0%	0%	12%	5%	0%	59%	0%	0%
	12	0%	0%	0%	0%	11%	2%	0%	0%	0%	3%	0%	45%	38%	0%	0%
	13	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	98%	0%	0%
	14	0%	0%	0%	0%	6%	0%	0%	5%	0%	9%	0%	0%	9%	72%	0%
	15	0%	0%	0%	0%	56%	0%	0%	0%	4%	0%	0%	0%	35%	0%	5%

Source: Aroca and Stough (2016).

2.2.4. The government

Over more than a decade ago, the Chilean Government implemented a purchasing system that is virtual, transparent and by bidding. Every public institution should

post their demands to the site where the providers compete to be selected. The information gathered by the database indicates the region where the firm makes the offer and the region where the public institution makes the purchase.

The Table 2 shows the origin region of the seller in the rows and the destination region of the buyer institution for the years 2007 and 2014. Looking at both matrices, it can be clearly observed that the concentration has been increasing, as every year the Metropolitan Region serves a greater proportion of the regional demands. Additionally, when the purchases are separated according to the size of the businesses, one notes that the large businesses are those that make the difference, since the micro and small businesses in general tend to be local, for which the demands served by these businesses tend to have a similar distribution to the demands of the regions for them, but the large businesses are those that have a high concentration in Santiago.

Table 2. Purchases of Regional Institutions (column) from regional businesses (row) 2007

2014		Buyers														
		15	**1**	**2**	**3**	**4**	**5**	**RM**	**6**	**7**	**8**	**9**	**14**	**10**	**11**	**12**
Sellers	**15**	55.6%	0.4%	1.3%	0.0%	0.6%	0.8%	0.7%	0.3%	1.1%	0.2%	0.8%	1.1%	0.1%	7.1%	0.8%
	1	7.0%	11.8%	9.5%	4.5%	1.2%	0.9%	0.9%	1.9%	0.5%	0.4%	0.7%	0.7%	0.7%	0.3%	2.4%
	2	4.7%	1.8%	17.4%	0.0%	0.7%	1.9%	1.2%	1.3%	11.5%	0.6%	0.9%	0.7%	1.0%	0.1%	0.0%
	3	1.3%	0.2%	1.7%	18.7%	27.8%	1.0%	0.8%	1.1%	1.0%	0.1%	3.1%	1.0%	1.1%	2.1%	0.0%
	4	2.3%	60.8%	2.6%	13.2%	13.8%	2.3%	1.5%	1.2%	2.8%	0.5%	0.9%	2.1%	0.3%	0.0%	0.1%
	5	4.5%	1.0%	5.9%	0.0%	1.7%	17.8%	5.5%	2.2%	5.1%	1.7%	6.6%	5.8%	3.7%	0.0%	0.2%
	RM	6.8%	1.6%	28.3%	0.2%	46.2%	50.1%	68.7%	51.5%	35.4%	15.7%	39.2%	33.9%	14.6%	19.0%	1.5%
	6	2.0%	0.2%	2.4%	7.0%	1.4%	2.5%	2.3%	15.4%	5.2%	0.8%	2.0%	1.6%	5.9%	0.1%	0.1%
	7	3.8%	0.2%	4.1%	1.4%	3.4%	4.9%	3.2%	4.2%	15.9%	2.2%	2.8%	10.6%	7.9%	0.8%	0.0%
	8	3.3%	19.8%	13.2%	32.1%	1.2%	9.4%	6.8%	6.7%	11.6%	48.5%	14.2%	21.7%	7.6%	1.8%	0.7%
	9	2.4%	0.3%	5.3%	0.0%	0.2%	3.0%	2.3%	2.7%	3.7%	3.3%	14.0%	7.0%	12.5%	16.7%	0.2%
	14	0.3%	0.1%	1.5%	0.6%	0.5%	1.1%	1.2%	0.0%	1.0%	21.6%	6.2%	5.2%	1.0%	0.0%	0.1%
	10	2.5%	1.5%	3.0%	9.8%	1.1%	2.6%	2.5%	10.6%	3.4%	2.7%	7.4%	6.8%	42.2%	10.5%	0.6%
	11	1.4%	0.0%	2.4%	11.4%	0.0%	0.7%	0.7%	0.1%	0.2%	1.2%	0.7%	0.7%	0.7%	40.6%	0.2%
	12	2.0%	0.4%	1.4%	1.1%	0.3%	0.9%	1.7%	0.7%	1.6%	0.5%	0.5%	1.1%	0.8%	0.9%	93.0%
2007		Buyers														
		15	**1**	**2**	**3**	**4**	**5**	**RM**	**6**	**7**	**8**	**9**	**14**	**10**	**11**	**12**
Sellers	**15**	28.0%	11.6%	0.6%	0.0%	0.1%	0.6%	0.4%	0.2%	1.0%	0.2%	1.1%	0.5%	0.1%	0.0%	0.0%
	1	17.1%	44.2%	9.3%	8.0%	0.0%	0.8%	0.5%	0.1%	0.7%	0.0%	1.1%	0.3%	0.0%	0.0%	1.0%
	2	29.1%	16.7%	66.8%	0.6%	1.3%	3.4%	2.1%	2.1%	0.7%	0.1%	1.4%	0.7%	0.9%	0.2%	0.0%
	3	0.4%	2.9%	0.4%	40.3%	2.8%	0.7%	0.7%	1.7%	1.2%	0.1%	1.9%	0.8%	0.3%	0.0%	0.0%
	4	2.0%	0.1%	1.0%	3.1%	46.9%	1.8%	1.3%	1.2%	2.7%	0.1%	1.4%	1.2%	0.6%	0.0%	0.0%
	5	4.9%	2.7%	1.0%	0.1%	2.8%	31.8%	3.4%	0.9%	3.1%	0.7%	3.8%	3.1%	1.0%	0.0%	0.2%
	RM	9.5%	9.4%	13.6%	8.7%	41.3%	45.2%	76.9%	33.6%	49.4%	57.4%	52.5%	54.3%	63.9%	4.6%	2.4%
	6	0.7%	5.9%	0.5%	0.5%	0.3%	1.6%	2.0%	29.6%	3.8%	0.1%	2.8%	2.4%	0.4%	0.4%	0.0%
	7	1.9%	2.0%	2.4%	4.2%	0.6%	3.5%	1.9%	2.0%	25.2%	0.5%	7.1%	4.7%	0.4%	0.3%	0.0%
	8	2.1%	0.9%	0.7%	0.5%	1.9%	3.9%	5.2%	25.8%	4.4%	8.9%	7.7%	5.7%	1.3%	0.7%	0.1%
	9	1.7%	1.3%	0.7%	0.4%	0.9%	2.7%	2.7%	1.1%	2.4%	1.8%	12.7%	12.2%	1.1%	0.5%	0.3%
	14	0.5%	0.6%	0.1%	0.0%	0.4%	1.1%	0.5%	0.0%	1.2%	0.3%	2.0%	8.8%	1.2%	0.6%	0.0%
	10	0.9%	0.3%	0.9%	22.6%	0.4%	2.2%	1.6%	1.4%	3.0%	29.6%	2.7%	4.8%	27.3%	19.6%	0.3%
	11	0.3%	0.0%	0.5%	3.9%	0.0%	0.1%	0.2%	0.1%	0.0%	0.2%	1.0%	0.1%	1.0%	67.3%	0.4%
	12	0.9%	1.3%	1.4%	7.0%	0.1%	0.8%	0.6%	0.1%	1.0%	0.2%	0.8%	0.5%	0.4%	5.7%	95.2%

Source: Aroca and Contreras (2016).

This is another example of the spatial blind policy of the Chilean government. In general, when the regions compete for getting a share of the market, the ones that will win that competition will be the most developed, increasing the inequalities with those less developed regions. It means, if for more than two hundred years, sys-

tematically concentration have been growing around the Metropolitan Region (RM), there is no way that the lagged regions catch up the developed ones, in a competitive framework. The government will have to design some affirmative action or positive discrimination focus on the lagged regions in order to improve the access to opportunities and promote a more balanced territorial development.

Conclusions

When the institutional framework is biased to promote the concentration of people and economic activity in one city, normally the capital, it is plausible to expect that the excess of agglomeration will constraint economic growth reducing, at the same time, potential opportunities in the peripheral cities. This seems to be case in many Latin American countries, and particularly in Chile. Furthermore, one of the characteristics of Latin American institutional frameworks have been historically the existence of favoritism in support of the main cities and the predominance of spatially blind policies that are only apparently neutral and, in many cases, are perpetuating spatial inequalities. In this sense, it is not clear whether traditional models based on the experience of developed countries are appropriate for the Latin American experience. The Chilean case shows how historical patterns of location and an extremely centralist institutional framework maintain primacy indexes among the highest in the world despite economic development.

One of the main lines of research where regional and urban economics should deepen in Latin America is the relationship between concentration and growth and particularly the processes of agglomeration without growth that seem to characterize not only this continent but also African countries. In this respect, it is necessary to analyze and measure the negative effects and congestion externalities in large agglomerations, an aspect where both theoretical and empirical studies are scarce both in Latin America and other regions. Research is also scarce on the explanation of the process of dispersion of population, activity and investment from the main cities to the peripheral regions. What are the forces that lead this process? Which regions will be benefited from this process? To what extent and what kind of public policies are able to rebalance the spatial economy of Latin American countries? Are models developed for Europe and United States, based on shorter distances and highly developed transport infrastructure valid to explain the evolution of Latin American urban systems? In this respect, an institutional approach that takes into account the origins and evolution of regional inequality can be very useful to understand some of the causes that underlie the processes of persistent spatial concentration in Latin America, processes that in many cases are not governed by the logic of market forces. Rebalancing the spatial economy of a country in favor of peripheral regions often implies a territorial redistribution of power and conflicts. This opens another line of development for regional and urban economics research in terms of the need for a more pluralistic approach open to multidisciplinary research taking into account the contributions of the whole set of social sciences.

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Section ARTICLES

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How institutions moderate the effectiveness of regional policy: A framework and research agenda

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ABSTRACT: This paper develops a research agenda toward the systematic inclusion of institutions into the analysis of regional policy effectiveness. Departing from the commonly shared observation that formal rules of regulation and policies not always lead to the intended outcomes, we argue that institutions are crucial mediators of the workings of regulation and regional policies in specific geographical contexts. By defining institutions as stable patterns of interactions based on legitimate mutual expectations (Bathelt and Glückler, 2014), we open analytical scope for analyzing the multiple relations between regulated rules and regular social practice. Hence, we build on Helmke and Levitsky's (2004) conception of the interdependencies between regulation and institutions, and extend their heuristic into a dynamic framework at the regional scale on how to pursue what we call institutional policy-making.

JEL Classification: O17; P48; R58; Z18.

Keywords: Institutions; regional development; institutional policy-making; relational economic geography; policy-effectiveness.

RESUMEN: El artículo desarrolla una agenda de investigación orientada a la inclusión sistemática de las instituciones en el análisis de la efectividad de la política regional. A partir de una observación comúnmente compartida de que las reglas formales de regulación y las políticas no siempre conducen a lograr los resultados perseguidos, se argumenta que las instituciones constituyen mediadores cruciales de los trabajos de regulación y de política regional en contextos geográficos específicos. A partir de definir las instituciones como estructuras estables de interacciones basadas en las mutuas expectativas legitimizadas (Bathelt y Gluckler, 2014), se abre un campo analítico para analizar las múltiples relaciones entre reglas reguladas y prácticas sociales regulares. A partir de ello y sobre la concepción de Helmke y Levitsky (2004) sobre las interdependencias entre

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regulación e instituciones se extiende su contenido en un marco dinámico a escala regional sobre cómo llevar a cabo lo que nosotros llamamos *policy-making* institucional.

Clasificación JEL: O17; P48; R58; Z18.

Palabras clave: instituciones; desarrollo regional; *policy-making* institucional; geografía económica relacional; eficiencia de las políticas.

1. Introduction

The persistence of regional disparities in the structure and dynamics of economic development, as well as the limited transferability of allegedly successful growth models have been central challenges for theories of regional economic development. One major finding has been the realization that regional disparities in growth can neither be fully explained by external incentives nor by endogenous, knowledge-based approaches, exclusively (Rodríguez-Pose, 2013). Instead, more and more significance is being attributed to the impact of social institutions on economic development. This insight has been encouraging extensive research over the last 20 years, analyzing the conditions for institutions, as well as their effects. A veritable *institutional turn* (Martin, 2000) has become preeminent in many disciplines of the social sciences, such as in economic geography (Storper, 1997; Gertler, 2010; Storper, 2011; Rodríguez-Pose, 2013), economics (Williamson, 1985; Hall and Jones, 1999; Rodrik *et al.,* 2004; Acemoglu *et al.,* 2014), organization science (Barley, 1990; Whitley, 1992; Zilber, 2011) and political science (March and Olsen, 1984; Helmke and Levitsky, 2004; Farrell, forth.).

The proliferation of research on institutions across these and other disciplines has led to a considerable polysemy of the meaning of the term «institution». This diversity implies several challenges for institutional research more generally, and for regional research, in particular (Colyvas and Powell, 2006; Bathelt and Glückler, 2014). On the one hand, advances in our understanding of the empirical antecedents and consequences of institutions are closely tight to the very concept of institution and thus tend to be conflated when associated with only either implicit or all-encompassing concepts of institutions. The heterogeneous use of the concept, in turn, has made it arduously difficult to integrate the findings into a coherent institutional framework. On the other hand, the precise roles of institutions in regional development are still little understood. Though often celebrated as the sine-qua-non factors making a difference for regional trajectories, institutions have hardly been unpacked from the black box of regional analysis. Instead, their importance is often inferred from an increasing inappropriateness of traditional explanations for regional development. As long as institutions are hidden in the residual factor of regional growth equations (Rodríguez-Pose, 2013), we have not yet understood how institutions are actually related to both the effects on regional development and to the effectiveness of regulation and regional policy.

This paper both proposes a framework and a research agenda that include institutions and institutional dynamics into the analysis of regional policy effectiveness. We argue that institutions are crucial mediators of the workings of regulation and regional policies in specific regional contexts. Thus, institutions can be the answer to the question, why the formal rules of regulation and policies not always lead to the intended outcomes. Building on a relational perspective (Bathelt and Glückler, 2011), we first give a short review of institutional research in various disciplines. We then briefly review the predominant concepts of institutions and define institutions as stable patterns of interaction based on legitimate mutual expectations (Bathelt and Glückler, 2014). This conception opens analytical scope for studying the interdependencies between regulation and institutions for which we draw on the framework by Helmke and Levistky (2004). In extension of their approach, we adopt a dynamic and territorial perspective to develop a framework of how to elaborate on what we call institutional policy-making.

2. Taking stock of institutional research

There is neither place nor is it the purpose of this paper to offer a comprehensive appraisal of the vast body of research on the relation between institutions and economic development. Instead, we would like to offer a perspective of major commonalities within and differences between two broad approaches, which we distinguish according to whether research focuses on the antecedents or outcomes of institutions. Research that focuses on the social and economic effects of institutions contributes to what we call institutional theories, whereas research focusing on how institutions emerge, change and are sustained adds to what we define as theories of institutions (Table 1):

Table 1. Analytic approaches in institutional research

Antecedent	*Outcome*	
	Non-institutional	*Institutional*
Non-institutional	Non-institutional theory	Theory of institutions (2.2)
Institutional	Institutional theory (2.1)	Institutional theory of institutions (2.2)

2.1. Institutional Theories

Institutional theories focus on the social and economic effects of institutions which are seen as conditioning frames for social actions, thereby potentially contributing to regional path dependencies (Martin and Sunley, 2006). Economics, political science and economic geography are prominent disciplines within this approach, seeing institutions mostly as either the rules or players of the game (North, 1990). A key interest is to determine «good institutions» that facilitate socio-economic development in order to generalize them into action models. While facing the difficulty of op-

erationalizing and measuring institutions adequately (Robinson, 2013; Shirley, 2013; Voigt, 2013), such studies are often based on quantitative and comparative research designs (Farole *et al.,* 2011) that analyze the enabling or constraining effects of differences in rules and regulations. They suggest, for instance, that a country's growth and development depend on the existence of property rights (Galiani and Schargrodsky, 2010; Acemoglu *et al.,* 2014), rule of law (Duquet *et al.,* 2014), or specific mechanisms of allocation and distribution (Di Tella *et al.,* 2007), labor market conditions and political systems (Glaeser *et al.,* 2004). Research on varieties of capitalism (Hall and Soskice, 2001; Streeck and Thelen, 2005; Hall and Thelen, 2009), on national innovation systems (Cooke *et al.,* 1997; Morgan, 2004; Asheim and Gertler, 2006), and on social systems of production (Hollingsworth and Boyer, 1997; Hollingsworth and Müller, 2002) is equally concerned with the effects of institutional conditions on economic outcomes. Assuming a systemic character, these approaches try to include "all parts and aspects of the economic structure and the institutional set-up affecting learning, searching, exploring" (Lundvall, 1992: 12).

Not only on the national, but also on the regional and urban levels, this stream of research investigates into what kinds of institutional arrangements facilitate economic development (Amin, 1999; Huggins, 2016), i.e. the «institutional quality» needed (Revilla Diez *et al.,* 2016). Apparently objective measures such as the European Quality of Government Index are used, for instance, to quantify and compare the perceived quality of government at the regional level within the European Union, to map its interregional variation (Nifo and Vecchione, 2013; Charron *et al.,* 2014, 2015), and its effects on economic prosperity.

Given its particular research motivation, institutional theory is inherently teleological: it focuses predominantly on the effects of institutional variables on social and economic outcomes and seeks to identify «good» institutions that are conducive for economic prosperity. This is not a problem per se, but it involves at least two challenges. First, due to the instrumental logic underlying the analysis of institutional effects on economic growth, the meaningful conceptualization of institutions is sometimes sacrificed in favor of «stylized facts» (Clark, 1998) and tangible quantitative assessments. Examples are abundant: surveys on trust in strangers and the strength of norms of civic cooperation (Knack and Keefer, 1997), ratings of perceived quality of government (Nifo and Vecchione, 2013), reported fear of failure in entrepreneurship (Vaillant and Lafuente, 2007), or the number of voluntary organizations per inhabitant (Laursen *et al.,* 2012). Second, even once seemingly «good institutions» are identified, institutional theories have not much to say about how institutions are actually built or reproduced in other contexts. This theoretical limitation, requires an additional body of research which explores the processes of emergence, creation, maintenance and change of institutions.

2.2. Theories of Institutions

Instead of focusing on their effects, theories of institutions treat institutions as the dependent variable themselves. They seek to understand the conditions and processes

of their emergence, change or maintenance. In contrast to earlier studies on the diffusion of institutions (Meyer and Rowan, 1977; Tolbert and Zucker, 1983) and on external shocks as triggers of institutional change —such as environmental changes, the introduction of new laws, incentives or technologies (Barley, 1990; D'Aunno *et al.,* 2000; Ahmadjian and Robinson, 2001)— more recent studies focus on the endogenous quality of institutional change by attributing greater influence to actors, like the ability to either reproduce or modify the institutional bases that at the same time condition their actions (Seo and Creed, 2002; Lounsbury and Crumley, 2007). This mutual influence of structure and individual or collective, as well as intended or unintended agency is expressed and analyzed, for example, by the institutional work and institutional logics approaches (Thornton *et al.,* 2012; Lawrence *et al.,* 2013; Zilber, 2013).

Research in the fields of organization studies (Munir and Phillips, 2005; Suddaby and Greenwood, 2009), economic history (Greif, 1993), and some approaches to game theory (Greif and Laitin, 2004; Aoki, 2007) have shown that institutional change can happen unintentionally (Smets *et al.,* 2012) or be the result of the purposeful action of «institutional entrepreneurs» (DiMaggio, 1988; Maguire, *et al.,* 2004; Crouch, 2005; Munir and Phillips, 2005). Depending on the context, the key actors of institutional change can be located in the center (Phillips and Zuckerman, 2001; Greenwood and Suddaby, 2006) or in the periphery of an organizational field (Leblebici *et al.,* 1991; Haveman and Rao, 1997; Kraatz and Moore, 2002; Maguire *et al.,* 2004; Glückler, 2014) which can itself be either emerging or already established (Greenwood and Suddaby, 2006).

Theories of institutions are often non-teleological, and instead put much emphasis on theorizing the quality of institutions and the manifold processes of institutionalization in carefully observed contexts of micro-social practice. Sometimes, however, the often qualitative and case study-based research leads to rather fuzzy and all-inclusive definitions of institutions. At least two challenges emerge from this stream of research: First, although the advances in understanding processes of institutional change have been substantial, there is still much to be learned about the mechanisms conducing this change, the role that stakeholders take in it and the contingent conditions that enable or constrain the operation of these mechanisms. Secondly, since the majority of research on theories of institutions has been conducted outside geography, the geographical dimension of institutionalization has been overly neglected: To what extent are institutions spatially bound and, if so, what are the mechanisms that lead to regionally specific institutions as well as to interregional differences in institutional practices?

A preliminary conclusion of these two lines of research points to some research gaps and the need for research in at least three directions: First, as has been shown in the brief review above, institutional theories as well as theories of institutions are incomplete with regard to an endogenous understanding of how institutions emerge, sustain and change as well as how they affect related institutional and economic outcomes. An inclusive and endogenous theory of institutional change will thus have to integrate knowledge about the antecedents and consequences of institutions into what we define as «institutional theories of institutions» (Table 1). This task, however, is not at the focus of this article and must be left to future research.

Secondly, and as a prerequisite for such a theoretical endeavor, any institutional approach needs to be explicit and sufficiently precise about its very concept of institution to make meaningful contributions to empirical analysis and normative practice. Only when clearly defined and conceptually operated for empirical observation can diverse institutional approaches compare and connect their findings with a larger institutional framework (Bathelt and Glückler, 2014). In the next section, we first appraise two well-established uses of the term institution before we turn to an alternative, relational understanding of institutions. We endorse a relational perspective to adopt an understanding of institutions as legitimate mutual expectations enacted in stable patterns of social interactions.

Thirdly, and at the heart of the research agenda outlined in this article, a relational perspective distinguishes between institutions on the one hand and the realm of prescriptive rules and regulation on the other. This invites for a more explicit theorization of the moderating role of institutions on the effectiveness of regulation and also regional policy-making. The framework that we develop hereafter is dedicated to the systematic analysis of the manifold interdependencies between regulation and institutions in search of unpacking the contextual nature of policy fit and failure (Bathelt, 2006; Bathelt and Glückler, 2011; Glückler and Bathelt, 2017). Our research agenda, then, aims to offer a framework for analyzing the interaction of regulation (and policy-effectiveness) and institutions that invites and inspires future research toward concepts of institutional policy-making.

3. Institutions characterize how the game is actually played

3.1. Organizations: Players of the game

Many studies have employed institutions to denote the particular role of *organizations* in economic development, for example trade associations, public bodies, research facilities, or political organizations (Evans, 1985; Keating, 2001; Greco, 2004; Jones and Gordon, 2004; Goodwin *et al.,* 2005). This perspective has been helpful to recognize the important role that organizations play in procuring services which would otherwise be absent and which may be useful in facilitating cooperation, compliant behavior, rule of law, charity, solidarity, etc. The perspective of institutions as organizations can be found in studies of development and international relations, as well as at the regional level. Approaches such as «institutional thickness» (Amin and Thrift, 1995) and the «associational economy» (Cooke and Morgan, 1998) have elaborated on the beneficial effects of connectedness, close collaboration and on the support facilitated by intermediary organizations such as business associations, public research organizations, vocational schools, chambers of commerce, and public authorities. However, an excessive creation of intermediary organizational entities may raise the necessary effort to coordinate them appropriately, and to try to avoid parallel structures, and unhealthy competition among them (Magro *et al.,* 2014; Morgan, 2016). We argue

that organizations should not be conflated with institutions (Bathelt and Glückler, 2014) because the very decisions and actions of organizations are grounded on institutions themselves. In line with North (1990), we argue that organizations are collective actors or players of the game whose action is itself structured by institutions.

3.2. Regulation: Rules of the game

Much of the empirical work done in institutional theory refers to institutions as the rules of the game (North, 1990), i.e. in the sense of consciously built formal or *prescriptive rules*, e.g. property rights, contracts, or patent laws (Acemoglu *et al.,* 2006; Huggins, 2016). However, as decades of development cooperation and well-intended reforms can tell, bringing different regions to the same level of development cannot simply be done by introducing «good» institutions, i.e. supposedly beneficial laws and regulations. Research in regional governance, for instance, laments the lack of enterprise cooperation despite of years of incentivizing this kind of networking (Cooke and Morgan, 1998; Parrilli *et al.,* 2010). Regulatory incentives to cooperate need not lead to the institutionalization of cooperation in real innovation behavior. In fact, a rule that is introduced on the national level can lead to very different outcomes at sub-national levels, depending on what kinds of regional institutions it interacts with. Hence, regulation and institutionalized interaction are two different analytical concepts. Therefore, we distinguish between prescriptive rules and institutions. Often, the perspective of institutions as regulation includes both formal and informal components (North, 1990; Rodríguez-Pose and Storper, 2006; Gertler, 2010). In doing so, this literature explicitly refers to habits, norms and conventions as informal institutions because they are unwritten, socially shared regularities in social realms, and deviance implies sanctions outside the «official» channels, for example through social ostracism and disapproval (Salais and Storper 1992; Farrell and Knight, 2003; Helmke and Levitsky, 2004). While we agree that the latter are institutions, we find it inconsistent to treat prescriptive rules (regulation) as enacted institutions. The actions of individual or collective actors may or may not follow prescriptive rules, despite the risk of sanctions. Instead, practices are said to be institutionalized if they are widely accepted and enacted by actors in specific situations. Formal rules and regulation may influence the institutionalization of such practices, but they leave scope of action, and may even be meaningless with regard to daily practice. Hence, studying the codified, formal regulation to us means studying «not-yet institutions» (Bathelt and Glückler, 2014).

3.3. Stable interaction orders: How the game is actually played

In contrast to the players (organizations) and the rules (regulation) of the game, we view institutions as how the game is actually played differently in different con-

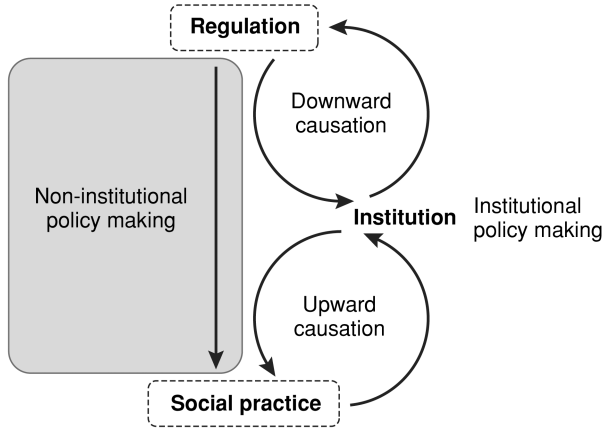
texts, but consistently across recurring situations. Rather than being the prescriptive rules which may or may not be put into practice, institutions are the *relatively stable patterns of interaction which are based on legitimate and mutual expectations* across similar social contexts (Bathelt and Glückler, 2014). Hence, rather than being regulated prescriptions codified on paper, institutions are regular patterns of real interaction. The defining prerequisites of an institution —namely the mutually shared expectations about legitimate alternatives for interaction which are guaranteed by sanctions in case of deviance— resonate, among others, with the French approach of the économie des conventions, where conventions are defined as practices that are bound together through mutual expectations (Storper and Salais, 1997; Sánchez *et al.,* 2010).

With regard to economic development, institutions can be understood as untraded interdependencies (Storper, 1997). Due to their contextual emergence they are not tradable, they can neither be bought nor licensed —as opposed to tangible assets, financial capital or codified knowledge. Despite their crucial role in hindering or facilitating innovation and regional growth, institutions are not imitable (Asheim and Gertler, 2006) and therefore difficult to transfer into other contexts (Dunford *et al.,* 2016). Institutions, thus, are of priceless value or a great burden for social and regional contexts.

This also shows that institutions are context-specific, and one general institutional blueprint, for example cooperation, can become manifest in rather different legitimate interaction orders in different contexts (Barley, 1990), or in different regions within the same national context. Actors have an implicit knowledge about these behavioral expectations, even when not currently exerting them (Hodgson, 2006). However, institutions can only be observed either in their transformation into action in specific situations (Jones and Murphy, 2010) or in the explicit omission of observable practice. For example, the agreement not to attract qualified staff from competitors or other firms in spatial vicinity is characterized by the deliberate absence of action.

Now that institutions are defined as stable patterns of interaction in real social contexts, the concept serves as a moderator between the micro level of social interaction and the macro level of normative orders (Jessop, 2001). Both levels affect the formation and change of institutions while at the same time being affected by them. Institutions are continuously transformed in simultaneous processes of downward and upward causation (Bathelt and Glückler, 2014): At the micro level, continuous social interaction reproduces existing institutional patterns. At the same time, this everyday practice is itself a source of deviant behavior that may transform into legitimate new institutions when repeated in similar situations and becoming increasingly accepted (Hall and Thelen, 2009). This recursive loop of practices reproducing existing institutions while at the same time challenging them through deviant practices is a source of upward causation. At the macro level, in turn, the imposition of prescriptive rules in the form of codified laws, directives, norms, codes of conduct etc. affects institutions in a contingent process of downward causation (Figure 1).

Figure 1. The intermediate role of institutions in policy-making



Although policies are developed on purpose either to protect or change existing behavior, their effect on actual social practices is moderated by existing institutional patterns in each social context. Rules and regulations, thus, come to be used in ways other than intended or designed originally (Thelen, 2004; Streeck and Thelen, 2005). This line of argument is supported by comparative empirical research that illustrates how the convergence of formal policies, such as the regulation of money laundry in the U.S. and the Netherlands, leads to very different and even opposite effects in observed social practice (Unger and van Waarden, 2009). While both regulation and the practice of organizations or individual actors can be empirically observed (Figure 1, dotted boxes), institutions remain an abstract phenomenon. Institutions can only be known through the observation of repeated patterns of interaction in similar situations and are thus read out of practice. Just as a grammar explicates the regularities of speech do institutions describe the legitimate patterns of social interaction (Giddens, 1984).

As long as the inimitability of institutions and the contingency of their effects in other contexts holds true, researchers in regional development will need to understand the processes of evolving, creating, maintaining, and transforming institutions in regional context. Moreover, it will be necessary to theorize the relation between institutions and new, exogenous rules introduced into institutional contexts by means of regulation and regional policies. It is here where we identify a major research gap: Since policies do not always have the intended social outcomes (e.g. Morgan, 2016), we argue that institutions moderate the effects of regulation on social practice and economic outcomes, and that any policy-making will be contingent on its institutional fitness in a specific regional context (Bathelt, 2006; Glückler and Bathelt, 2017). In what follows, we will outline an analytical framework on how to unpack the mutual effects and interrelatedness of institutions and regulation. This framework is meant to open a research agenda that includes institutions into the analysis of regional policy-

making and policy-effectiveness in order to be able to develop an «institutional» policy making that aims at either building on or changing not only behavioral practices, but their underlying institutional foundation (see Figure 1).

4. The relation between institutions and regulation

Now that regulation and institutions have been conceptually distinguished, there is analytical scope for the analysis of the ways in which they mutually affect each other. The theoretical variety of interactive effects between regulation and institutions ranges between convergent and divergent effects on social practice, and offers an important starting point for the conception of institutional policy-making. In what follows, we build on the basic idea of Helmke and Levitsky (2004) to systematically consider the ways in which regulation and institutions affect each other. In their article, Helmke and Levitsky (2004) explore the relationship between formal institutions (i.e. formal rules) on the one hand, and informal institutions on the other, which they define as "socially shared rules, usually unwritten, that are created, communicated, and enforced outside of officially sanctioned channels" (Helmke and Levitsky, 2004: 727). Their typology defines four kinds of informal institutions depending on whether formal institutions are enforced effectively or ineffectively and whether their interactions with informal institutions produce convergent or divergent social outcomes. Hence, they distinguish complementary, accommodating, substitutive and, finally, competing informal institutions (Table 2) and illustrate corresponding empirical cases at the level of national politics such as electoral regulations and practices.

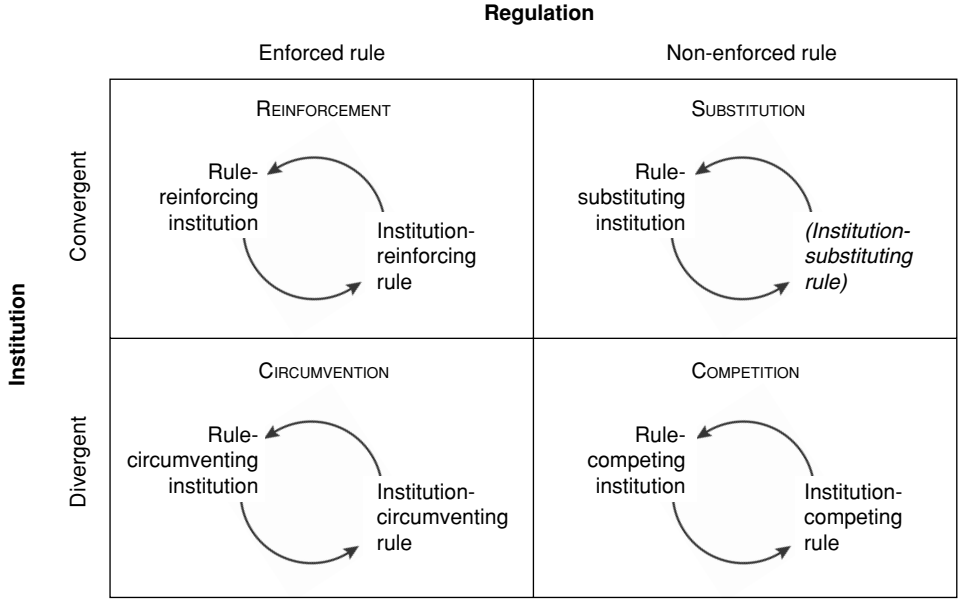
Table 2. Typology of informal institutions (Helmke and Levitsky, 2004: 728)

Outcomes	*Effective formal institutions*	*Ineffective formal institutions*
Convergent	Complementary	Substitutive
Divergent	Accommodating	Competing

Though being helpful for the original distinction between informal and formal institutions and the outcomes of their various interactions, this typology needs to be revised and extended to serve as an appropriate framework for the regional analysis of institutional policy-making (Figure 2). According to the relational approach and the concept of institution as a stable pattern of interactions adopted here, we first revise the terminology and replace informal institutions with the term institution and formal institution with the term regulation. The effectiveness of rule-making (regulation) is linked to its degree of enforcement, i.e. the resources and efforts involved in monitoring and sanctioning rule infringement. As one aspect of incentivizing and supporting economic development by public bodies, we include policies in the concept of regulation. Second, we extend Helmke and Levitsky's (2004) typology by adding an explicitly dynamic perspective. As we have argued already above (Figure 1), not only

prescriptive rules have an effect on people's behavior, but, vice versa, institutions also shape the performance of regulation and may thus limit, strengthen or mediate its effects to various degrees (Simmie *et al.,* 2014). For designing and evaluating policies and regulations, it is crucially important to distinguish whether policy interventions (new rules) are made in response to given institutions or whether and how institutions change or emerge in response to incumbent regulations. Consequently, our framework distinguishes two dynamic sequences for each of the four interactions between institutions and regulation, depending on whether (effective or ineffective) regulation responds to an existing set of (convergent or divergent) institutions or, vice versa, whether an institution emerges in response to a given regulation. In sum, we define four types of interactions between institutions and regulation, where for each interaction we further distinguish the temporal sequence of interaction (Figure 2). In what follows we empirically seek to scale the framework down to the level of regions as a subnational territorial scale, and present illustrative case examples for each of the subtypes of our extended framework.

Figure 2. A dynamic perspective on the interactions of regulation and institution



4.1. Reinforcement

The first relation is one of mutual reinforcement. In this case, effectively enforced regulation is supported by institutions which help reproduce formal rules in real social practice. Working toward the same goals, institutions do not only exist in parallel to regulation, but can fill in gaps or loopholes left by regulation or not covered by

policies without violating their overall goal (Helmke and Levitsky, 2004). Depending on the direction of the influence, we distinguish between two cases: Rule-reinforcing institutions and institution-reinforcing rules.

An *institution-reinforcing rule* means that an effective rule is introduced to an already existing set of institutions aiming for the same results, thus «formalizing» the institutions. This can be seen, for example, in the comparison between the willingness of Dutch and US American firms to take the risk of innovating (van Waarden 2001). Despite the fact that the legal system in the Netherlands is more effective in reducing uncertainty for entrepreneurs, US firms are more likely to take risks. Van Waarden (2001) concludes that this can only be explained if one acknowledges that risk-averse cultures also produce more risk-averse entrepreneurs and give themselves more uncertainty-reducing policies.

Another example of how existing institutions on the regional level can facilitate regulation can be seen with regard to the introduction of the cluster policy in the Spanish Basque Country. Having a legacy of collective organization in cooperatives (OECD, 2007), and being highly specialized in a few main industrial sectors, as well as strongly relying on its endogenous efforts for lack of investment from abroad (Morgan, 2016), the Basque Country was more receptive than other regions to the successful introduction of cluster policies, and more recently, to smart specialization strategies (OECD, 2007; Aranguren *et al.,* 2016).

The reverse, *rule-reinforcing institutions*, can be seen in the case of the changed attitudes toward sexual harassment at the work place since the corresponding anti-discrimination law was passed in Iowa in 1964. Here, introducing and enforcing a rule has changed attitudes and has created new supporting institutions. As Bilz and Nadler (2014) point out, «citizens' expectations» about how they are entitled to be treated at work have clearly changed over the last three decades, ever since courts began recognizing sexual harassment as discrimination" (Bilz and Nadler, 2014: 243). Specifically, their case shows public outcry after a court had approved the dismissal of a female employee because of the jealousy of her boss' wife. While this kind of behavior would have been tolerated or accepted some decades ago, people today are much more sensitive toward this topic and expect to be treated equally and professionally.

By being aware of, and taking into account positive local conditions, policies can strengthen already existing regional competences and cumulatively reinforce path-dependencies. By acting in accordance with already existing legitimate behavioral expectations, a policy becomes an institutional policy (Figure 1).

4.2. Circumvention

A second theoretical interdependence is to be identified if enforced regulation co-exists with divergent institutions. This happens either when an effective rule is made against an existing institution, or when a divergent institution emerges in response to an enforced rule. The latter is a case of *rule-circumventing institutions,* i.e. behavior

that is incentivized by rules but that alters their effects. These institutions are favored and enacted by actors who dislike the outcomes of regulation or policies, but feel unable to change them. They are fostered by lax enforcement of rules and policies, which helps to reconcile different interests. Exceptions are tolerated in order to keep up the intended outcome as a whole. By finding a way to modify their effects, actors might even help to perpetuate given policies (Helmke and Levitsky, 2004).

An example of this can be seen at the level of a single organization in the study of Bensman and Gerver (1963) about the use of a forbidden tool for wing assembly —the tap— at an air plane factory in New York. The tap is a hard steel screw that when inserted into a nut can cut new threads over the original threads of the nut. In the case of the air plane factory, "[t]he use of the tap is the most serious crime of workmanship conceivable in the plant. A worker can be summarily fired for merely possessing a tap" (Bensman and Gerver, 1963: 590). Despite these explicit rules, however, the majority of workers did possess and use the tap in their daily work. If these rule violations were detected, they were not sanctioned; rather, different levels of authorities such as the foremen, the plant quality and Air Force inspectors, knew about the practice of using the tap and unofficially tolerated it for the sake of getting the work done in time and according to the business targets. In addition, the different ranks and positions had institutionalized interaction orders that both purposively helped oversee the use of the tap (what you don't know won't hurt you) and that educated workers on how and when to use the tap appropriately. Such an interaction order included all status groups in the firm and thus enabled mutually legitimate expectations about how to jointly get the job done, irrespective of corporate law. It remains a normative question whether rule-circumventing institutions are evaluated as sources of policy failure or sometimes as acceptable deviance in pursuit of a consistent higher goal, in the case of Bensman and Gerver (1963): to get the job done adequately.

The reverse case, an enforced rule made against a divergent institution, can be seen in the case of sanctioning anti-poaching agreements between competitors of certain industry branches. These *institution-circumventing rules* are characterized by regulation that goes against certain institutions by effectively enforcing the rules when detecting deviant behavior. In 2010, for example, the US Department of Justice opened a case against high-tech companies because of their illegal agreement to not recruit each others' employees (Kirchgaessner and Menn, 2010). Despite violating antitrust laws and going against both free competition and employees' job and salary opportunities (Lindsay and Santon, 2012), these firms had created divergent institutions (illegal, but legitimate between them) trying to circumvent these rules. Contrary to institution-competing rules (see below, 4.4), however, the rules were effectively enforced once the institutions were discovered, and anti-poaching agreements were stopped: Settlement agreements were put in place for five years prohibiting companies "from engaging in anticompetitive no solicitation agreements" and fees had to be paid (U.S. Department of Justice, 2010).

Since regulation often leaves loopholes and is never fully complete, the above cases demonstrate that this does not necessarily have to be a bad thing as long as the

circumventing institutions work toward the same goals and lead to their better accomplishment. Such an understanding resonates with what Unger and van Waarden (2009) advocate as «risk-based regulation»: Deviation from the strict sense of the rule may be seen as breaking codified rules, yet the actual intentions and social outcomes of deviant practice may well comply with the higher common goal. An institutional policy-understanding, thus, would grant some scope for interpretation on how regulated norms are actually achieved in specific contexts.

4.3. Substitution

If regulation is missing or not properly enforced, we can observe institutions developing in response to an ineffective or absent rule, in our terminology *rule-substituting institutions*. Aiming for the same goal, institutions can sometimes achieve what regulation or policies fail to do (Helmke and Levitsky, 2004). In China, for instance, the institution of *guanxi* substitutes for an unstable legal and regulatory support (Xin and Pearce, 1996). Making personal connections and trusting on partners is more important for doing business than open competition; it is not regarded negatively, but rather as a sign of being loyal, especially since governmental support is lacking.

Individual actors or whole industries might even have incentives to regulate themselves in order to preempt governmental regulation, for example in the form of codes of conduct, «voluntary environmental agreements» of industries, or environmental performance standards (Heritier and Eckert, 2008). This kind of legitimate institution-building in a local economy can be seen, for example, in the case of the whale watching industry in Victoria, a city on Vancouver Island off the Canadian west coast (Lawrence and Phillips, 2004). After commercial whale watching had gained momentum and the number of operators had steadily been increasing in the 1980s, concerns about the harassment of the whales came up and «the basic concern was to avoid regulation by instituting a set of voluntary guidelines» (p. 701) covering different aspects from accessing the harbor to limiting the number of boats allowed around whales at the same time. Since there was no regulation (yet), whale watching operators themselves established a pattern of legitimate expectations on how to coordinate and mutually behave in their activities.

The reverse case, *institution-substituting rules*, is not empirically valid because it is unlikely that a rule that is in accordance with existing ways of behaving would be non-enforced. In both cases it is likely that there is no need to create regulation, if only to formalize existing and well-working social institutions in order to maintain the status quo. Self-regulation in various degrees plays an important role here, either voluntarily, because of the threat of governmental regulation, or because of pressures of multinational supplier-client relationships (Christmann and Taylor, 2001). Thus, this field offers a fruitful ground for focusing on institutional dynamics and for the co-working of policy makers and institutional theorists.

4.4. Competition

In this final case, institutions and ineffective regulation are at odds with each other, i.e. they differ with regard to their incentives and outcomes (Helmke and Levitsky, 2004). Two cases can be distinguished: institution-competing rules (a rule is made against an existing institution and remains ineffective) and rule-competing institutions (institutions emerge in divergence to an ineffective rule).

The first case, the introduction of *institution-competing rules*, can be found in the context of development cooperation, where well-meant policies are designed by donor countries and implemented in developing countries. However, when such policies do not recognize regional specificities and prevailing institutions, policies are doomed to fail. One regional example for this can be seen in the application of the so-called «Nucleus Approach» in a development project in the leather sector of Dhaka, Bangladesh. The Nucleus Approach is based on the idea of cooperation between entrepreneurs, and their willingness to discuss their problems and to jointly look for solutions in working groups. Having had worked successfully in other countries and sectors, this approach could not meet the expected goals in its implementation in Dhaka's leather sector because of the prevailing institutions of non-cooperation. There was mutual distrust between the tanners who were expecting others to make use of their experiences without telling their own. Despite incentives to change their attitude toward this, the tanners sanctioned the project's wrong expectations by not attending the group meetings and by continuing their business as usual after the project had ended (Lenz, 2013).

In comparison, *rule-competing institutions*, i.e. divergent institutions emerging as a response to the introduction of an ineffective rule, can be seen with regard to the introduction of a new anti-corruption regulation in the construction sector of Eastern Indonesia (Tidey, 2013). In 2008, a new regulation was passed that was supposed to fight corruption in bidding competitions and to make the competitive tendering procedure better verifiable by adhering to formalities on paper because «if what is visible and tangible appears to be in line with the rules, then there is no "proof" to support anticorruption investigations» (Tidey, 2013: 186). Until then, there was less administrative documentation and bidders were bribing officials to be awarded the contract. After the new regulation was implemented, public officials made sure to adhere to formalities in every detail. But the adherence to official rules did in fact not erase corruption —it just changed the way it was done: Instead of accepting bribes for giving the project to a particular bidder, public officials were now accepting bribes for making sure the application forms were in order. As a consequence of that, the most competitive offers could be disqualified in case of minor failures to form adherence.

These cases not only show that there is no universal «right» policy, and that a policy working well in one context might be a misfit in another context, but they also serve as a good example for policies that solely aim for changes in isolate practices rather than the institutional patterns of interactions. While succeeding in erasing «direct» bribes, the behavioral practices were changed in the way that bidders and officials were now documenting the process. That is, people complied with the new

rule, yet the rule missed its overall goal. This is because it did not change the underlying mutual behavioral expectations of all actors involved, nor the ultimate goal of winning the bid. One practice got exchanged for another, without touching their underlying institutional base. Thus, policies are incomplete if they only aim at practice change and leave the more substantial institutions untouched.

5. Conclusion and implications for research

We close by inviting scholars of regional research to acknowledge the critical role of institutions for context-specific policy-making, as well as for the analysis of the effectiveness of regional policies with regard to their intended effects (Bathelt, 2006; Lehmann and Benner, 2015; Dunford *et al.,* 2016; Morgan, 2016; Glückler and Bathelt, 2017). Our major argument has been to move from an atomistic perspective of regulating single practices to a relational perspective of institutional policy-making. Institutional policy-making identifies and responds to the underlying patterns of stable interactions in which single practices are embedded. Such a perspective of institutional policy-making is conducive to cumulatively reinforcing existing strengths in a regional economy, such as cluster policies, but also to successfully taking a turn for the better in regions suffering allegedly bad institutions such as nepotism, corruption, non-cooperation etc.

Taking an institutional perspective on policies can also help to overcome the so-called «innovation gap» (Parrilli *et al.,* 2010; Glückler and Bathelt, 2017), as well as the limited compatibility or missing impact of regional development plans and policies (Kitching *et al.,* 2015). As we have argued in this paper, formal rules and regulation may influence the institutionalization of actors' behavior in given situations, but they leave much scope of action, and may even be meaningless with regard to daily practice (Greenwood *et al.,* 2008; Bathelt and Glückler, 2014). In turn, the concept of institutions may answer the question of how regulation and policies that aim to change practices sometimes fail to have their intended effects. To move a step further in our understanding of the intricate relation between regulation and institution, we have built on Helmke and Levitsky (2004) to suggest a more detailed and dynamic framework that systematically characterizes the mutually convergent and divergent effects among regulation and institutions. Moreover, we have detailed a number of examples of how policies may get either reinforced, substituted or circumvented, and even competed by institutions.

Our typology of theoretical linkages is suggested as an analytical framework to detect policy challenges and to promote an understanding of policy-making that is sensitive to institutions and their spatio-temporal contextuality. We should distinguish two types of policies according to what they are aiming for: one, where policies are introduced to change atomistic practice while ignoring their institutional embeddedness, the other where policies are directly implemented to change the underlying institutions (Figure 1). A good example for the latter is the *Tostan* program operating in Senegal, which is trying to abolish the practice of female genital cutting. In 1999,

Senegal introduced a law making it illegal to practice female genital cutting, but rather to please Western values than out of the belief of doing the right thing. While this kind of top-down approach can be seen as too coercive, the *Tostan* program tried to address the issue on a more deep-rooted level (Shell-Duncan *et al.,* 2013). Instead of aiming for a superficial and temporal change in behavioral practice —by imposing the «better» practice of non-cutting— they inform people more generally about health topics and human rights to let them make up their mind on their own. In addition to these «nudges», they acknowledge that rules or policies cannot easily change single practices that are embedded into institutionalized traditions, and therefore aim at the long-term change of these underlying institutions. To achieve this, they need to change each other's behavioral expectations and fear of sanctions: people try to comply with others' expectations and will only change their behavior if they can credibly expect others to do the same, which is why they publicly vow to refrain from genital cutting in the future (Bicchieri and Mercier, 2014). Since 1997, the program has achieved that more than 5,000 communities in Senegal have made such public declarations (Shell-Duncan *et al.,* 2013). This example also illustrates again the potential for regional specificities in the interaction between institutions and regulation. While the introduction of a law on national level did not change people's behavior, the more profound work of *Tostan* was able to achieve some changes in certain regions.

In pursuing a perspective of institutional policy-making, important questions lie ahead of us: To what extent are institutions spatially bound and reproduced? To what extent are institutions interwoven into other institutions, thus raising their hysteresis against change? How can «good» institutions be leveraged for successful support policies of innovation, entrepreneurship, and qualification but also for regional welfare, enduring employment, environmental sustainability and social solidarity? Are some of the relationship types outlined above more prevalent in some territories than others based on the effectiveness of rule enforcement? For example, are substituting and competing relationships more likely to be found in developing economies while reinforcing and circumventing ones are easier to achieve in more advanced economies? How can adverse practices which are based on «bad» institutions be actively transformed into «good» and socially desired institutions? What role do power and hierarchy play in this process, and how can policy-making be adjusted to change institutions rather than isolate practices?

Answers to all these questions presuppose a micro-social and process understanding of social interaction and institutionalization. Recent research criticizes the fact that institutions are left vague when it comes to their specific modes of action (Dellepiane-Avellaneda, 2010). As long as the statement that «institutions matter» is not substantiated by explanations, institutions continue to be treated as «deus ex machina» (Tomaney, 2013) and will remain a truism that explains regional differences solely by the very existence of institutions (Rafiqui, 2009). This is why a greater focus needs to be put on the mechanisms of the process of institutional change. Only by making these mechanisms visible can the effects of institutions be understood, as well as the possibility of their political malleability. An explicitly micro-social process perspective is needed in order to clarify the ambivalence of the relationship

between action and action-restraining or action-enabling structures (Hodgson, 2006; Boxenbaum, 2014).

Concretely, this means to identify local conditions and all stakeholders involved in a given practice and situation. It needs to be clear on which incentives individual behavior is based: is it guided by official rules, or are people following behavioral expectations that deviate from official rules? Only by identifying the underlying guidelines that really influence behavior can we see the starting point for institutional change, and can ultimately contribute to an endogenous «institutional theory of institutions» which explains institutional effects by institutional mechanisms themselves.

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Section ARTICLES

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Smart Specialisation: Insights from the EU Experience and Implications for Other Economies

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ABSTRACT: The paper discusses the origins and emerging ideas of smart specialization, and in particular its translation from a non-spatial concept to an explicitly spatial and regional concept. This discussion is then set in the context of debates regarding the nature, rationale, and role of modern innovation policy, and the governance and institutional issues arising are then examined. We extend this discussion to discuss the experience of these issues in EU regions, and the arguments are then broadened to the potential lessons for other parts of the world which are aiming to enhance their innovation potential.

JEL Classification: L52; O43; R11; R58.

Keywords: innovation; regions; policy; priorities.

RESUMEN: Este artículo analiza los orígenes y las ideas emergentes de las estrategias de especialización inteligente, en particular su adaptación desde un óptica no espacial a una óptica explícitamente espacial y regional. Este análisis se enmarca en el contexto de los debates centrados en la naturaleza, objetivo y papel de las nuevas políticas de innovación, así como aspectos relacionados con su gobernanza y proceso institucional. El trabajo extiende la discusión, introduciendo aspectos basados en la experiencia de la implementación de estos procesos en varias regiones europeas, ofreciendo consejos basados en lecciones aprendidas para otras partes del mundo interesadas en implementar estos procesos con el fin de mejorar su potencial de innovación.

Clasificación JEL: L52; O43; R11; R58.

Palabras clave: innovación; regiones; política; prioridades.

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1. Introduction

Any policies or development-aid agendas which are aimed at fostering local and regional economic development in under-developed or economically weak regions always face various challenges which need to overcome at least in part in order for a development policy to be effective. In terms of the economy, poorer or economically fragile regions tend to display less diverse economies with lower levels of human capital and lower innovation opportunities than stronger regions. In terms of institutions, weaker or more economically fragile regions tend to display more limited institutional coordination and cooperation possibilities, in part due to mis-aligned incentives and in part due to lower level of public trust. In terms of governance, poorer or economically fragile regions tend to display weaker governance systems and lower levels of governance capacity than stronger regions. Finally, in terms of development relationships, weaker regions tend to display greater levels of dependency on development aid and funding than economically more prosperous regions, and stronger co-dependency relationships with the donor agencies. Moreover, each of these features tend to be intertwined with each other (McCann and Ortega-Argilés, 2015), and local and regional development policies are always faced with the challenge of how to best address each of these individual issues in ways that are not compromised or undermined by one of the other interrelated issues.

Smart specialisation has been proposed as a possible approach to tacking these challenges and although the original ideas underpinning smart specialisation initially emerged from non-spatial ways of thinking it became increasingly apparent that they dovetailed neatly with various ideas emerging from other fields including economic geography, science policy, and development studies (McCann and Ortega-Argilés, 2015). Together, these convergent lines of argument have given rise to a broadly-based consensus within Europe regarding a set of policy principles which can be applied to help foster entrepreneurship and innovation in different development contexts, and in particular in regions which are economically fragile (McCann and Ortega-Argilés, 2013a, b). Regarding innovation one of the problems faced by fragile regions is that they appear to display relatively fewer options for innovation-promotion than more prosperous regions and this also implies that the opportunities for entrepreneurially-driven innovation are fewer and the risk associated with entrepreneurship are relatively higher in weaker regions. Weak demand for innovation stifles development and any resulting entrepreneurial activities tend to be necessity-led rather than demand led. In addition, weaker regions typically face more limited institutional capacity for fostering innovation with fewer governance capabilities, less scope for various policy actions and ironically in many cases, weaker incentives for policy-learning. In terms of development policy these types of weaker regions would therefore appear to be principal candidates for policy support aimed at enhancing innovation and development in lagging regions. However, as far as the efficacy of policy interventions are concerned, ironically such weaker regions also tend to display a more limited ability to absorb policy funding effectively and to transform the financial support to workable and successful policies. This is sometimes known as the «innovation paradox»

(Muscio *et al.,* 2015) whereby the economically weaker regions which most need to foster innovation are also less able to absorb policy funds in beneficial ways. The weaknesses arise from the lower institutional capacity and the governance capabilities. These issues are well-known in a wide range of development fields, and they have also been seen repeatedly in the case of the EU, and in particular in many central and eastern European regions. As such, policies aimed at enhancing innovation and entrepreneurially-driven development in weaker countries regions (World Bank, 2010, 2011) need to find ways to address this paradox.

In the specific case of the EU these challenges are well known, and relate in particular to the policy actions and interventions associated with regional policy. The regional and urban policy in the European Union, which is known formally as EU Cohesion Policy (McCann, 2015), faces many of these innovation-related challenges and the smart specialisation approach has been adopted within the recently reformed EU Cohesion Policy architecture in order to help address them. EU Cohesion Policy is one of the western world's largest, if not the largest, local and regional development policy operating under broadly one overall legal and institutional framework. The aims of the policy are to enhance the long term development of Europe's economically weaker regions and this is to be undertaken in a context in which variation in regional per capita incomes is almost identical to the variation across all OECD countries (McCann, 2015). EU regions differ enormously in terms of their levels of development, the extent of urbanisation, their industrial structures, environmental features, their population and demographic characteristics, and their institutional and governance systems (European Union, 2013).

The central issue which is always present in every local, regional or national context is the question of how to best design and implement development policies which are most appropriate for fostering good growth in the local setting. Yet, in such a heterogeneous context as the EU regional system there is unlikely to be any particular «one-size-fits-all» approach which is ideally suited to every regional context. Rather, finding ways to best tailor policy actions and interventions to the heterogeneous local contexts is generally regarded as being the most important issue for policy design and delivery (Rodrik, 2007). However, this tailoring must be undertaken in a manner which is consistent with both the goals and also the overall rubric of the policy architecture. Following widespread consultation and reflection the policy has therefore undergone significant changes in recent years aimed at enhancing its efficiency and effectiveness and these changes have been driven by changes in thinking both within the EU and also well beyond the EU. In particular, various shifts in thinking in many different research and analytical fields have converged on certain key themes which need to be addressed in order for development policy to be successful, and these insights have all been incorporated into the reformed EU Cohesion Policy (McCann, 2015). In order to reconcile the potentially conflicting pressures between local tailoring and consistency with the overall policy logic and architecture the EU has adopted the smart specialization approach to policy prioritisation as one of its key conditionalities or non-negotiable elements in the policy agenda. The smart specialisation approach offers a policy-prioritisation framework for thinking about resource alloca-

tion issues logic and a way forward for regions making policy choices in difficult and challenging budgetary environments. At the same time, the discipline involved in smart specialisation also helps to foster policy learning and institutional capacity building for good governance (Rodrik, 1999).

In order to understand the role which smart specialisation plays in EU Cohesion Policy and the lessons which the EU experience offers to other parts of the world in the following sections we will examine the key insights, motivating factors and messages of smart specialization. We will need to discuss these in the specific context of the EU regional and urban policy but we will also extend these arguments to broader international settings, aimed at deriving lessons for other parts of the world. The rest of the paper is structured as follows. In the next section we outline the key features and insights of the smart specialisation approach as originally constructed in a non-spatial setting and we then outline its application in an explicitly spatial and regional environment. We then discuss various important issues regarding the modern understanding of the nature and role of regional policy and the governance implications which such debates give rise to. We then examine some of the specific challenges facing EU regions in implementing these policies and we also outline the possible lessons and insights which arise from these experiences for regions in other parts of the world aiming to enhance their innovation potential.

2. The Smart Specialisation Principles

One of the key themes which has emerged out of the process of reflection and reconsideration of the role and nature of EU Cohesion Policy, and indeed one of the most novel elements of the resulting reforms, is that of smart specialisation, which provides a way of establishing policy funding priorities aimed at enhancing local development by building on the underlying local opportunities for entrepreneurially-driven innovation. Smart specialisation puts an economic discipline on the policy prioritisation process, the intention of which is to help countries and regions make the most realistic choices regarding policy interventions and actions which are amenable and appropriate for the local context. In the past, the evidence from numerous development policy examples worldwide demonstrates that regions have made many mistakes in terms of their policy choices, and often this was because policies were chosen on the basis of criteria which were not appropriate or relevant for the local context.

As has already been well documented elsewhere, the broad lines of the smart specialisation argument arose initially out of concerns regarding the slow take-up of new technologies in many EU countries and parts of Europe in comparison to North America (Ortega Argilés, 2012). While many European countries and regions were strong in developing new technologies and techniques in leading technology sectors they appeared to be systematically much weaker in adopting and adapting these technologies to a wider range of sectors, activities and locations, beyond the new technology sectors themselves. Expert advice provided to the European Commission policy-makers argued that in the EU case, dislocations between sectors and a lack of

synergies between institutions and actors were often at fault in limiting knowledge and technology flows, and finding ways to partially correct for these mis-alignments offered a possible way forward for policies aimed at enhancing entrepreneurship and innovation at the regional level. There are two reasons why this is so important. Firstly, diversification via technology adoption and adaptation is essential for firms to grow and survive. Secondly, diversification and technological upgrading is also essential for regions and localities to grow and develop. In recent decades many regions were attempting to diversify and upgrade their technological base by attracting inward high-technology investors representing sectors or technologies in which the region had little or no previous expertise. Unsurprisingly, in many cases these inward investments failed to flourish beyond the life of any subsidies provided, and therefore a different way of thinking was called for. This is the departure point for the smart specialisation approach.

The original smart specialisation arguments initially developed in a non-spatial setting and was explicitly construed in a knowledge-ecology ecosystems type of perspective (Foray *et al.,* 2009; David *et al.,* 2009). The concept was based on the idea that in order for innovation policies to be effective they must demonstrate certain key features. Firstly, they must encourage and facilitate entrepreneurship —but not simply in terms of encouraging new firm start-ups —but more importantly helping entrepreneurs and risk-takers to find and build on new sources of knowledge in their entrepreneurial activities— a process which is termed «entrepreneurial search». These processes necessarily involve a certain degree of self-discovery (Haussmann and Rodrik 2003) based on experimentation and trial and error and often experimentation is costly and risky for potential entrepreneurs. These costs and risks often imply that entrepreneurs tend to shy away from attempting innovations or new initiatives which appear to be too distant from their core competences and this limits the ability of firms to successfully diversify. Public policy provides a possible way forward for facilitating firm diversification by assisting with the experimentation processes involved in innovation, and also by acting as a potential bridge between different technological, skills or institutional arenas. Secondly, the smart specialisation approach to economic development also emphasised that any successful entrepreneurial activities will need to develop and build on scale in order to generate sufficiently large impacts that help to transform the system. Multiple small and fragmented entrepreneurial actions are unlikely to lead to any significant step-change in innovation outcomes, and therefore finding ways to leverage scale and connections between entrepreneurial actions and initiatives is essential (Foray, 2015). Thirdly, new entrepreneurial actions must be based largely on existing capabilities, skills-sets or knowledge-bases, such that diversification takes place in an incremental manner using existing knowledge and drawing on local strengths. These general principles highlight the importance of fostering development trajectories which are both connected to the existing knowledge ecology but at the same time attempt to re-orient the existing trajectories. In order to achieve this it is essential to ensure that local connections and synergies between institutions and actors are as strong as possible and policy actions draw on all of the available local resources in order to build both scale and concentration (Foray, 2015).

If we translate these principles into the language of economic geography suitable for the regional and local context (McCann and Ortega-Argilés, 2014a, b; 2015) it becomes clear that fostering entrepreneurial actions which are built on technologies, sectors or activities which exhibit both local scale and embeddedness is essential (McCann and Ortega-Argilés, 2015). A platform for entrepreneurial and innovation promotion is critical in order for small and incremental innovations to display sufficiently large scale effects to help transform the existing system, and it is imperative that the mobilization of activities, technologies or sectors with potential scale are prioritised. At the same time activities aimed at the technological upgrading and diversification of the system must also be built around the system's existing capabilities and skills sets, or rather what is known as «related variety» (Frenken *et al.,* 2007; Frenken and Boschma, 2007), as this maximizes the chances of long run success and learning. Allied to these dimensions, efforts aimed at promoting knowledge connectivity and knowledge spillovers must operate both at fostering greater local intra-regional linkages as well as wider inter-regional and international knowledge linkages. These latter points are especially important in today's economy where global value chains have reconfigured numerous commercial and production relationships. Identifying those technologies, activities or sectors which are able to better leverage off global value chains is also imperative in order to build scale and connectivity.

These smart specialisation principles give rise to an important policy prioritisation framework which helps policy-makers to base their policy decisions on a strong and workable grounding. Policy-makers are always faced with competing interests, conflicting choices, policy trade-offs and constrained resources and budgets, and determining which activities or sectors or technologies to give priority to often involves difficult decisions. Different interest groups and competing constituencies always wish to access policy funding streams and in situations where there are many interested parties it is often observed that funding and resources become scattered and fragmented across numerous actors and initiatives. This tends to undermine the effectiveness of development policies which seek to foster scale and concentration and finding ways to ensure the concentration of resources on key priorities frequently proves to be a difficulty. However, in the end it is policy-makers who still have to make these difficult choices (Stiglitz *et al.,* 2009), and having a clearly articulated logic on which decisions are being made is critical both in terms of ensuring both good policy-design and also public accountability.

Smart specialisation requires that policy makers: undertake detailed ex ante analyses of the regional and local context based on as much data as can be acquired or generated; involve numerous actors and stakeholders in any consultation or engagement processes including the representatives of small firms and actors as well as large institutions: and come to an agreement regarding a set of priorities for the region which not only dovetail with the region's existing capabilities (von Tunzelmann, 2010), but which also offer the potential scale opportunities as well as possibilities for diversification around the region's core competences (Foray *et al.,* 2012). In essence, the smart specialisation approach involves the tailoring of policy actions to the local context, but in a manner which also is cogniscant of the global value-chain

impacts of any policy actions. Given that regions are becoming more heterogeneous in character (OECD, 2009a), as are their global value-chain impacts, the need for such policy tailoring becomes ever greater.

These principles provide the best grounding for entrepreneurial-led innovation policies which are designed to encourage initiatives from the «bottom-up» in which the private sector, education sector and civil society actors are all involved in suggesting, leading or trialing possible entrepreneurial initiatives. At the same time, the policies which are chosen to be implemented should also provide opportunities for learning on the part of all actors involved. Any policies which display something of an experimental nature, as is always the case with innovation-related policies, of necessity require policy learning, if the broader lessons from the policy experience are to be beneficial for society. Policy-learning is an essential feature of institutional capacity building and policy innovation which also involves the public sector sharing some of the risks with the private sector is increasingly understood as being critical for fostering innovation (Osborne and Brown, 2013). Policy-learning is not possible without monitoring and evaluation, both of which are essential features of outcome-oriented policy making, and the need for appropriate indicators to allow for an outcome-oriented approach to smart specialisation policy-making was recognised early on in the development of the concept (David *et al.,* 2009). Indeed, these broader themes relating to the importance of both policy tailoring and policy learning reflect a much broader set of debates regarding the most appropriate form of modern regional and regional innovation policies, and these debates have taken on a particular form in the context of the EU. In order to help better tailor regional entrepreneurship and innovation-related policies the EU has already taken steps to identify the underlying features of entrepreneurship across all EU regions, with a particular focus on identifying those local bottlenecks which inhibit entrepreneurial actions [1]. However, before we discuss in more detail the role that smart specialisation plays in the overall EU Cohesion Policy reforms and also the insights and implications that the EU experience offers policy in other developing or transitioning countries, it is useful to highlight a few key features of these reforms that all heavily impact on the EU's smart specialisation agenda. These key features are the place-based logic, the multi-level governance context, and the results-orientation logic of the policy.

3. The Background Discussions: The Place-Based Policy Debates, Outcome-Oriented Policy-Making and the EU Regional Context

In terms of the place-based logic, local and regional development policy requires a raison d'être and standard textbook models tend to view the rationale for industrial or development policy as being based on market failures. However, within the context

[1] *http://bookshop.europa.eu/en/redi-the-regional-entrepreneurship-and-development-index-pb-KN0214462/?CatalogCategoryID=cKYKABsttvUAAAEjrpAY4e5L.*

of regional policy a new line of thinking has emerged over recent years in a variety of international and institutional settings, which is broadly known as the place-based approach (McCann and Rodriguez-Pose, 2011; Barca *et al.,* 2012; Storper, 2013) and which provides profound twists on the standard development approaches. The place-based approach argues that top-down sectoral approaches to local and regional economic development fail to engage with many of the stakeholders, actors and citizens whose on whose knowledge and networks a successful development policy needs to be built. Top down policies traditionally assume that a «one-size-fits-all» policy model or policy framework is broadly workable and that top tiers of government have sufficient knowledge to design and implement such policies effectively. In contrast, the place-based approach assumes that neither of these conditions are fulfilled in many cases, in that government has neither the knowledge nor the expertise to undertake this (OECD, 2009a, b; OECD, 2011a). Moreover, in the eyes of local citizens, central government and top-down policy architectures also often fail on the grounds of salience, credibility and legitimacy (Cash *et al.,* 2003), and the lack of these underpinnings means that many local actors are unlikely to engage seriously with the policy, thereby limiting its efficacy. In particular, smaller local actors and those which are not in dominant monopoly positions are unlikely to engage with a top-down policy, as their interest are unlikely to be responded to due to lack of lobbying power. As such, in order for local development actions and interventions to be effective, it is precisely the smaller and less noticeable actors and institutions which must be engaged with in order for development benefits to be diffused and distributed throughout the local economic system. Indeed, one of the major problems with top-down centrally-organised policies is that of «policy capture», whereby major players are able to shape and influence the policy design and delivery in their own interests. Finding ways to engage with, and mobilise a wide range of small as well as large local actors is therefore essential for ensuring broadly-based development.

Table 1. Traditional and Modern Approaches to Regional Policy

	Traditional Regional Policy	*Modern Regional Policy*
Objectives	Compensating temporarily for location disadvantages of lagging regions.	Tapping into underutilised potential in all regions to enhance development in all regions.
Unit of Intervention	Administrative units.	Functional economic areas.
Strategies	Sectoral approach.	Integrated development projects.
Tools	Subsidies and state aids.	Mix of hard capital (infrastructure) and «soft» capital (business support, credit availability, networking systems).
Actors	Central government.	Multi-level governance involving different tiers or level of local, regional and national government working in partnership and alongside the private and civil society sectors.

Source: OECD, 2009b; McCann (2015).

Following the place-based logic, the fostering of development is to be achieved by aligning and coordinating the funding and design of policy interventions between the local, regional, national and EU levels of governance in ways which maximises the «bottom-up» engagement and mobilisation of local actors and stakeholders in the policy process. In the place-based approach (Barca *et al.,* 2012; McCann and Rodriguez-Pose, 2011) the engagement of local stakeholders and actors is regarded as being absolutely central to the effectiveness of development policy. The reason is that the engagement such actors is essential for building on local knowledge in order to exploiting underutilised potential. The policy actions and interventions tend to be a mixture of both «hard»; and «soft» support involving business network and credit-related sources as well as capital and infrastructure investments. Given the logic of economic geography it makes sense to implement these policies at the level of functional urban areas or functional regions so as to best capture any externalities and spillovers rather than simply on the basis of administrative units and the need to move away from a sectoral logic to a more integrated cross-sector, cross-technology, cross-activity logic also involves the design of more integrated projects rather than state aids to industries, as had traditionally been the case.

The one additional, but critical aspect of modern regional and regional innovation policies, is that by moving away from top-down and highly centralised policies these modern policy approaches need to operate in a multi-level governance environment (OECD, 2011b), and in the case of EU regional policy this is an explicit legal requirement. Indeed, multi-level governance is a natural part of the EU interrelationships whereby individual national member states of the EU variously interact with, and also act in conjunction with, the European Union institutions in order to achieve common goals. However, such multi-level governance arrangements also pose various additional sets of challenges regarding the definition and allocation of roles for the different governance tiers and jurisdictions along with their interactions with different types of actors and stakeholders. In the case of regional development policies the multi-level governance issues are in many ways more complex than in other EU policies or programmes because local, city and regional governance bodies are almost always also involved in the policies as well as national governments acting in conjunction with the EU institutions. Yet, interestingly, in the EU case, it is worldwide lessons from the development experience of international institutions (World Bank, 2005; Dreher, 2009) working with transition and developing economies which have heavily shaped and re-shaped the EU approach to development. In particular, the need to implement and enforce conditionalities (World Bank, 2005; Dreher, 2009) on the part of all stakeholders has been enshrined in EU policy along with the need for an outcome-oriented approach (McCann, 2015) to be adopted at all stages of the policy design and delivery process. Indeed, the development of a regional innovation strategy for smart specialisation is now one of the conditionalities for receiving EU regional funding, as is the requirement to develop sets of indicators for monitoring the progress of a policy and to permit the evaluation of the policy.

A key feature of smart specialisation is its explicitly outcome-oriented, or in EU terminology its explicitly results-oriented logic (McCann and Ortega-Argilés,

2013a, b, 2014a, b; 2015). Smart specialisation emphasises the need from the outset to consider and make explicit the intended outcomes and results of the policy as part of the whole approach to policy design and delivery. In other words it makes transparent the whole policy cycle whereby policy priorities and choices are based on the best available data and evidence and explicitly linked to intended outcomes, and these data and intended outcomes themselves determine the types of indicators to be chosen for both the ongoing monitoring of the policy and its ex post evaluation. In other words policy interventions and actions must be designed in a way which allows for appropriate outcome indicators to be chosen (Rodrik, 2004; Barca and McCann, 2011) which will facilitate ongoing policy monitoring and subsequent policy evaluation in the light of the policy's intended goals. The resulting policy evaluations can use a mixture of both quantitative and qualitative techniques (European Union, 2015) and there is already a large and well established literature (Davies *et al.,* 2000; Cratwright and Hardie, 2012; Pawson, 2006; Link and Vonortas, 2013) on policy and programme evaluation and also on specially the measurement of innovation programmes (Gault, 2013; Technopolis and MIOIR, 2012) which also facilitates with the programme design at the outset, linking ex ante intentions to ongoing actions and to ex post policy evaluation. Importantly, all policy evaluations will be made public on the EU website in English so that opportunities for mutual exchanges and learning are maximised across Europe (European Union, 2015). Moreover, such transparency also helps to mitigate against policies being designed or shaped largely by local political criteria or vested interests instead of being based on the region's capabilities, assets and potential. Funding is also made available specifically to provide weaker regions whose institutional capacity is low to link up and cooperate with stronger regions whose greater institutional resources, personnel and capabilities can be provided to support the weaker regions» efforts at policy design and delivery. This is also an important forms of technology transfer, again aimed at enhancing the institutional capabilities of the weaker regions and also fostering EU-wide policy learning.

For many European policy makers and decision takers accustomed to the old traditional model of regional policy described above, the requirements of smart specialisation and modern approaches to regional policies, and regional innovation policies in particular, involve quite a new way of working and new lines of thinking. Therefore, in order to help local and regional policy makers in their transitioning to a new approach or more modern approach to regional innovation policy (McCann and Ortega-Argilés, 2013) the EU has set up a «platform»[2] facility to provide a forum for peer-to-peer review, data and policy-learning via debate and engagement. This has proved to be an major success with active participation and engagement from almost every region in the EU, and this is now a crucial feature of institutional capacity building (Rodrik, 1999). Economically weaker regions are able to learn by engaging with more prosperous regions, and sharing ideas and experiences regarding policy design and delivery (Foray and Goenaga, 2013; Foray and Rainaldi, 2013). This aspect of the role of knowledge connectivity and knowledge sharing in building

[2] *www.s3platform.jrc.ec.europa.eu.*

governance capabilities closely reflects one of the key features of the original non-spatial smart specialisation concept (Foray, 2015) which has now been translated into both geographical space and also institutional spaces.

These developments have led to a widespread uptake of the smart specialisation agenda across EU regions and member states and the embodiment of these principles in their EU Cohesion Policy Operational Programmes. At the same time, and as would be expected from the smart specialisation principles, we also see significant variations in priority areas or themes between different regions and regions (McCann and Ortega-Argilés, 2016b). While the uptake in northern European regions has generally been relatively smooth, the policy agenda appears to have been particularly beneficial to many southern European regions in helping improve and enhance the policy settings and their policy design and delivery processes. In contrast, there are still major challenges in central and eastern European regions and member states (McCann and Ortega-Argilés, 2016b), and improving the policy design and delivery in these localities will continue to be an ongoing priority.

4. Lessons for Wider Range of Regions and Countries

The particularities of the EU and its specific experience of reconsidering and re-orienting regional development policies around smart specialisation approaches are also instructive for many other parts of the world. Recently there has been a much greater emphasis on fostering innovation in these development contexts (World Bank, 2010, 2011) and many international organisations have long-lasting experience of the types of challenges which are widely evident in policies aimed enhancing local development. In the case of innovation-related policies, enhancing institutional and governance capabilities and synergies is an imperative, as are the need to limit rent-seeking and to avoid monopoly interests either capturing the lion's share of the policy resources or even undermining the policy. Institutional issues are nowadays regarded as being critical for the success or otherwise of development policies (Acemoglu and Robinson, 2013), and finding ways to overcome institutional logjams and misaligned incentives is essential if policies are to make real headway. Rodrik (2014) argues that new ideas and new narratives can offer a powerful way of breaking institutional logjams and overcoming institutional resistance. In the EU context, smart specialisation plays an important role in shifting debates and providing new perspectives on both the rationale for, and the approach to designing, regional development policies which are based around fostering entrepreneurship and innovation (McCann and Ortega-Argilés, 2014b; 2016a). It has been assessed as being both practicable and workable (OECD, 2013; Fraunhofer ISI, 2013) and highlights the centrality of designing policies aimed at facilitating the bottom-up generation of new ideas, initiatives, trials and experiments by diverse actors, and particularly small actors. In other words, the policy focus moves away from a traditional one dominated by big business and top-down centralised policy logic to one which is more embedded, locally relevant and in many ways also a more democratic way of operating. This is also en-

hanced by the transparency afforded by the requirements for a full public disclosure of all policy and programme evaluations, thereby moving away from a context where policy is derived primarily from a political logic to one which is underpinned by clear intentions and objectives. These features, allied with the possibility for regions to cooperate with each other in their policy design and delivery processes, all contribute to institutional capacity building. Development and governance go hand in hand and smart specialisation provides a way forward for fostering good governance in diverse economic environments in ways which are still entirely consistent with the overall policy logic and architecture (McCann and Ortega-Argilés, 2014b).

Each of these features are highly relevant in a diverse range of environments in many different countries. Many countries face problems of institutional capacity, and contexts where political vested interests and powerful monopoly actors dominate the political and economic landscape. Smart specialisation requires that development policies do engage with such actors, but that the emphasis is very much on the role which newer or smaller entrepreneurial actors can play in revitalising larger incumbents actors and sectors, and not the other way around. For example, in the EU case, large firms are important in as much as they provide important supply-chain possibilities for multiple smaller firms. Finding ways to upgrade the whole regional supply chain across many dimensions rather than simply supporting the investment of the large firm would be an example of a smart specialisation type of logic. As such, the emphasis is very much on smaller and diverse actions and actors and the role which they can play in re-shaping the wider economic and institutional setting. Again, the requirements for using outcome/results indicators along with the transparency requirements for making all policy evaluations public also helps to build trust on the part of the wider public and to foster the engagement of different actors. Finally, the fact that the upgrading of local skills, capabilities and activities via the enhancement of related variety is central to smart specialisation also helps to keep a discipline on the policy design, in that only opportunities which are related to already-existing assets and capabilities are considered. This ensures that policy does not veer too far away from realistic principles and helps to avoid the creation of unrealistic policy expectations, which if unrealized undermine institutional trust. Realistic and appropriate policies for the local context offer the best ways forward for incremental steps toward better development, both in economic and institutional terms. This is true in Europe.

5. Conclusions

Smart specialisation has played an important role in re-shaping EU regional development policies and in forcing a reconsideration of the role which such policies play. This rethinking regarding the links between the policy context, policy design, policy choices and policy intentions has also provided greater clarity regarding the links between policy and governance, between public trust and accountability, and between institutional capabilities, incentives and learning. By adopting a broad sys-

tems-type of understanding of technology which moves beyond a purely scientific perspective to one which includes institutions and policy settings, smart specialisation also provides policy makers with a powerful set of principles to ensure that their policy choices are well-founded and strongly grounded in realistic and appropriate economic fundamentals.

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