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The role of intangible assets in the regional economic growth *

Jordi Suriñach y Rosina Moreno

ABSTRACT: This paper is the summary of the IAREG (Intangible Assets and Regional Economic Growth) European project, which analyzed the role of intangible assets (IA) on regional economic growth. We focused on some of the most relevant intangible assets, for which statistical information is available and where the consortium had more expertise. Consequently, in this paper we put special attention in four big factors: knowledge capital, human capital, social capital and entrepreneurship capital. Additional to the main characteristics of each of these IA (related with their measurement and their effects on regional economic growth), we also analyzed the ensemble effects of these IA over the location of firms. For each asset, we describe its main characteristics, the indicators for its measuring and its limitations, as well as the main results associated to its impact on regional growth. We must outline that in order to improve the analysis of the effects of the IA in regional economic growth it is necessary to develop more and better databases. We present some thoughts in this respect, based on our research experience. Finally, we give some policy implications and recommendations.

JEL Classification: O1, O3, O4, R1.

Keywords: intangible assets, knowledge capital, human capital, social capital, entrepreneurship capital.

El papel de los activos intangibles en el crecimiento económico regional

RESUMEN: Este artículo es el resumen del proyecto europeo IAREG (Intangible Assets and Regional Economic Growth), en el que se analiza el papel de los activos

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intangibles en el crecimiento económico regional. Nos centramos en algunos de ellos, en concreto los más relevantes, sobre los que se dispone de mejor información estadística y sobre los que el consorcio del proyecto tenía mayor experiencia. Los cuatro activos analizados son: capital de conocimiento, capital humano, capital social y capital emprendedor. Además del efecto sobre el crecimiento económico regional se han analizado sus efectos sobre la localización de las empresas. Para cada activo, se proporciona sus principales características, los indicadores con los cuales cuantificarlos y sus limitaciones, así como los principales resultados de la investigación efectuada. Para mejorar en el análisis de los efectos de estos activos intangibles en el crecimiento regional, se requiere disponer de más y mejores datos. Se presentan algunas reflexiones sobre ello, fruto de la experiencia de la investigación realizada. Finalmente, se ofrecen las principales implicaciones políticas y recomendaciones sugeridas alrededor de este tema.

Clasificación JEL: O1, O3, O4, R1.

Palabras clave: activos intangibles, capital de conocimiento, capital humano, capital Social, capital emprendedor

1. Introduction

Globalization and increased competition are putting new types of pressure on companies and, by extension, on the regions that depend on their success. Flexibility, the ability to immediately adapt to market developments, and pro-activism in creating future markets, are the earmarks of this new era. The relative importance of (physical) resource endowment as drivers of regional growth is decreasing as these factors are now almost ubiquitously available. However, **«soft» production factors**, that is, **those related to personal bounded knowledge, are becoming more important.** This is reflected in the endogenous growth theory, which regards to **human capital and knowledge as driving factors of economic growth in industrialized countries.**

All these «soft» production factors can be generically grouped in what is known «Intangible Assets». There is increasing interest, from the academic, policy and corporate environment on the **impact of Intangible Assets (IA) on economic processes.** These assets can be defined as «non-material factors that contribute to enterprise performance in the production of goods or the provision of services, or that are expected to generate future economic benefits to the entities or individuals that control their deployment» (Eustace 2000: 31) [1]. IA contribute to production and productivity both within the firm (through human and organizational capital, intellectual assets,

[1] Needles to say, there is no consensus on the definition of intangible assets. The one quoted here is considered to be a useful working definition. An interesting extension, for our purposes here, of such a working definition for intangible assets is also reported in Gu and Lev, 2001 (cited in Kaufmann and Schneider, 2004) «Intangible assets are defined by their major drivers: R&D, advertising, IT and human resource practices».

brand name, etc.) and outside it (through local externalities, the legal and institutional framework, the education system, property rights protection, social capital, among others).

This report is the summary of the IAREG project[2], which **has analyzed the role of these intangible assets on regional economic growth**. We have focused on some of them, taking special attention to the more relevant ones, to the assets for which it is possible to have more reliable quantitative statistical information, and finally, to the assets where the consortium has more expertise. Consequently, we have outlined this Report in four big factors: **knowledge capital, human capital, social capital and entrepreneurship capital.** Additionally to the main characteristics of each of these IA (related with their measurement and their effects on regional economic growth), we have also analyzed the ensemble **effects of these IA over the location of firms.**

This report is structured as follows. First, a brief summary about the State of the Art previous to the IAREG project is done. In this sense, we present the main drawbacks about the contents of the project, and the expected breakthroughs. Second, we present the Objectives as well as the main questions we expect to answer. Third, we summarize the main results with respect to each one of the Intangible Assets considered in IAREG. Finally, we present some policy implications related with IA and growth.

2. Previous Background. State of the art

There is an increasing interest in the analysis of the main Intangible Assets that affect regional growth. Several seminal papers already analyze the effects of some IA on growth; for example, there is a profuse literature on Human Capital or Innovation. However, there exist some important drawbacks in the way these topics have been considered in the literature and IAREG wants to contribute to increase the knowledge about them.

The drawbacks to be solved were the followings.

[2] IAREG is a project financed by the European Union under the Seventh Framework Programme for Research and Technological Development in the 'Socio-economic sciences and the humanities' area (FP7-SSH-2007-1. 216813). The IAREG consortium consists of 12 partners from different European countries with the aim of studying the impact of Intangible Assets on Regional Economic Growth. The partners are: Universitat de Barcelona . Regional Quantitative Analysis Group (AQR). Spain; Centre for North and South Economic Research (CRENoS). Italy; Economic research centre of the University of Saint-Etienne (CREUSET). France; German Institute for Economic Research (DIW). Germany; Center for Research in Economic Policy, University of Pécs (GKK). Hungary; Max Planck Institute of Economics (MPIoE). Germany; University of Tampere (UTA). Finland; Institute of Regional and Environmental Economy (WU-WIEN). Austria; Univeristy of Tartu (UTARTU). Estonia; Institute for Economic and Cultural Geography, Leibniz University of Hannover (LUH).; Spanish Council for Scientific Research. Institute of Innovation and Knowledge Management CSIC-INGENIO. Spain; The London School of Economics and Political Science (LSE). UK.

2.1. Lack of an integrated analytical framework to understand and manage the process of creation and development of knowledge at the micro-meso-macro level

The analysis of the mechanisms contributing to the creation and development of IA and innovation potential, such as the role of competition vs cooperation among firms, the role of scientific research and universities and the role of global actors (i.e. MNEs), has been identified and has been so far carried out mainly unconnectedly.

Almost no attempt has been made in the direction of merging the empirical analysis of different innovation agents and their interactions in an integrated analytical framework. In order to solve it, IAREG has developed an integrated analysis model to understand and manage the process of creation and development of knowledge.

2.2. There is not enough information about knowledge flows

In particular:

— It is not obvious why geographical proximity facilitates knowledge flows.
— The concept of knowledge spillover, and how knowledge flows diffuses over space is a black box that remains unsatisfactory and not very useful for public policy.
— We do not know much about other determining factors for knowledge flows such as the absorptive capacity, the sectoral dimension of knowledge flows, the mechanisms and sources of regional knowledge spillovers and the impact of knowledge flows on growth

In order to solve it, IAREG has identified the mechanisms underlying knowledge diffusion and the role of IA in this process, in order to better understand the impact on regional growth.

2.3. Returns from human and social capital are taken as homogeneous for all regions

In particular:

— The economic literature tends to consider returns from human capital as homogeneous for all regions
— The impact of human has been analysed in isolation from the impact of social capital
— The relationship between quality in work and productivity has not provided consensual results

— Little attention has been devoted to the regional consequences of over-education
— Studies that explicitly include the role of distinguished individuals and their careers in regional knowledge networks and for the accumulation of intangible assets are still rare
— Deeper evidence on the effect of human capital in explaining heterogeneity in wage distributions across regions is needed

In order to solve it, IAREG has developed a detailed analysis of the influence of human and social capital in regional development with the consideration of the impact of educational mismatch and quality of work.

2.4. Scarce analysis on the relationship between entrepreneurship and regional economic performance.

In particular:

— Micro-geographic analysis as introduced by Duranton and Overman (2005) focus on agglomeration patterns of incumbent firms and do not pay attention to new entrants.
— The upcoming demographic change and its impact on entrepreneurial activities have not yet been studied.
— Akerlof and Kranton (2000) incorporate the concept of identity into a standard individual utility function and present a range of examples where the choice of identity affects individual economic decisions beyond what standard economic theory suggests. This concept has not yet been applied to an individual's decision to become an entrepreneur.
— The idea of regional entrepreneurship capital as introduced by Audretsch et al. (2008) has been tested for German data but has not yet been applied at a supra-national level.
— It's not clear if the positive relationship between entrepreneurial activity and economic growth at regional level (for US and Germany) can be generalized to other European countries.
— Moreover, the relationship between regional innovation activities and entrepreneurship capital is not analyzed in the empirical literature.
— No deep studies have been carried out to benchmark the situation in the EU to US related with entrepreneurship and venture capital financing for start-ups.

In order to solve it, IAREG has identified the factors which drive regional entrepreneurship capital and has developed specific studies to know the relationship among the individual and firms' characteristics that affect entrepreneurship.

2.5. Lack of a systematic and simultaneous assessment of the role of different type of IA on firms location and on the performance of the economy (local, national, European)

There are some seminal papers where firms' location choices are explained by the presence of external effects (Jaffe, 1986; 1989; Audretsch and Feldman, 1996, 2004; Krugman, 1991; Venables, 1996). However, the assessment of the role of IA on local growth has not considered the importance of local spillovers and has not analysed the influence of these externalities in the locational choices of firms.

In order to solve it, IAREG has assessed the concurrent influences of IA on firms and the economy as a whole by using different methods (production functions, spatial models, computable general equilibrium models).

2.6. Lack of data on IA and lack of indicators to measure some IA

Last, but not least, due to the important limitations in the availability of statistical information on these assets (knowledge, human, social and entrepreneurship capital) at the regional level, the IAREG project has tried to highlight this lack of information, and has tried to give a step forward by defining concepts that are necessary to measure certain Intangible Assets at the regional level. Additionally, as far as it has been possible, we have tried to homogenize the information available and the one that has been obtained through the project in a comprehensive database. Unfortunately, too much work still has to be done in relation with IA databases.

3. Objectives of the Project. Questions to be answered

3.1. General Objective

IAREG project aims at analysing **the role played by IA** in the generation of innovation and productivity and growth at a theoretical and especially at an empirical level. In addition to the analysis of the actors generating these IA, the project also considers the linkages among them and the **geographical dimension** in which these processes take place. This has been done in order to give **scientific support to policy activities** in relation to IA and to **identify best practices** for regional innovation systems.

3.2. Specific objectives

— To develop **new indicators** for improving the measuring of the IA considered having the most influence in the generation of economic development.

— To **understand the role that IA play in the processes of innovation and knowledge** accumulation at the **regional level**, which are at the core of uneven territorial development.
— **Identify the mechanisms underlying knowledge diffusion and the role of IA** in this process, in order to better understand **the impact on regional growth.**
— To **analyse the role** that **knowledge, human, social and entrepreneurship capital** have on regional economic growth and productivity.
— **To examine how IA and their interaction** define the environment that **affect the localization choice** of the firms.
— **To measure the role of externalities in the generation of IA** and in determining local economic performances in Europe and **in the diffusion of knowledge**
— To extract **policy guidelines** for public administrations practitioners in order to support them in the future design and implementation of regional innovation strategies
— To **diffuse the project results to policy makers** at European, national and regional level, to promote the efficiency of future policies for the support of innovation activities and regional economic development

4. Results and Conclusions of the IAREG PROJECT

4.1. Knowledge Capital

4.1.1. Rationale behind the topic

IAREG has identified the key contextual elements and suggestions to support policy makers in governing the whole innovative process and enhancing its economic impact. It has done so by analysing the whole spectrum of innovative activity, from the early stages of knowledge generation and accumulation to its diffusion, and answering two sets of questions. The first one, dealing with **knowledge accumulation,** addresses, among others, the following issues:

1. How does innovation and knowledge accumulation occur within firms and how does it impact on economic performance?
2. What is the role of Universities in regional, national and global knowledge accumulation processes?

The second set of questions addresses the way **knowledge diffuses over space** and how this diffusion impacts on economic performances. In particular:

3. To what extent knowledge diffusion is conditioned by spatial proximity?
4. What is the impact of knowledge accumulation and diffusion on economic performance?

To answer these questions, having reliable measures of how the innovation process occurs, of the actors that take part in it and the mechanisms that are in place, is of paramount importance. To this purpose **IAREG has highlighted the weaknesses**

of traditional measures and suggested new ones (quantitative and qualitative) able to grasp both the ongoing transformations of the relationship between science and technology, and the systemic and interactive nature of innovation processes. The theoretical review showed that traditional indicators do not account for the dynamic, structural and connectivity features of innovation processes and therefore are mostly inadequate to capture its spatial dimension. The inventory indicates large inconsistencies across regions in the EU, as for the majority of indicators regional data are not provided or provided unevenly. A special concern regards the Community Innovation Survey, a key milestone for the study of innovation, for which guidelines on regionalization are still not established. We pointed out that **the systemic nature of regional IA demands indicators that grasp two kinds of capabilities: network capabilities (i.e. connectivity), bothintra- and inter-regional, and organizational capabilities, as well as their dynamics.**

These indicators have been applied to the study of linkages and **relationships between firms and between firms and Universities**, highlighting the mechanisms through which those actors contribute to the processes of knowledge accumulation, generation and diffusion. Original approaches have also been developed to assess the spatial nature of such processes and their impact on economic performances. In the IAREG web page (www.iareg.org) you can find a detailed list of proposed indicators related with all these topics.

4.1.2. Results

How does knowledge accumulation occur within firms and how does it impact on economic performance?

IAREG has highlighted the crucial role of research partnership for knowledge accumulation, identifying how different types of collaborations enhance innovation at different stages. It has shown that **whilst collaborations with competitors are most commonly undertaken at early stages of the development projects, those with buyers and suppliers are more likely to result in the introduction of new products and processes.** At the same it has been highlighted that, regardless of the industry, **the most innovative firms**, i.e. those more able to absorb knowledge, are **more likely to participate in collaborative networks**.

IAREG has also analysed the role of Multinational Enterprises (MNE) for local knowledge accumulation. It has highlighted that **MNEs offer the opportunities for regional firms and research institutions to benefit and contribute to global networks**.

Another important aspect that has been explored, is that of organisational innovation, an issue still largely unexplored both at the theoretical and empirical level. IAREG has shown that those **firms whose structure enables learning by *Doing, Using and Interacting,*** by relying, among other things, on parallel development teams, semi-autonomous work teams and reduced management layers, **are more likely to introduce new products to the market.**

Whilst these mechanisms are likely to operate across European countries, policy makers should be aware of industry and spatial specificities.

What is the role of Universities in regional, national and global knowledge accumulation processes?

Universities can heavily influence regional, national and global knowledge accumulation processes. For instance, when collaborating with multinational enterprises, they may affect simultaneously the three levels. Despite that, this channel is still not fully exploited, partly due to communication challenges between the two types of institutions.

IAREG has highlighted interesting results on the **local impact of Universities**: whilst it has been found that top ranked departments are significantly associated with partnerships involving spatially close industry partners, it has also emerge **geographical proximity, is not *per se*' the main driver of collaboration choices**. These are found to depend largely on firms', networks' and universities' specific characteristics. Among other things, the cultural tradition of academic institution has been shown to influence the ability to collaborate with industry and commercialise research.

Networks characteristics have emerged as crucial in determining academic knowledge transfer: the better the access to international networks, the higher the patenting activity, hence the knowledge transfer to industry. This implies that the set of tools of knowledge based economic development should include not only R&D promotion but also clever ways of supporting academic research networking.

To conclude, although the EU lags behind the US in the ability to commercialise research, IAREG has found that the EU and U.S. academics have quite similar views of what is considered reasonable with regard to the relationship between public and private science.

To what extent does knowledge diffusion arise between agents and how does it impact on economic performances?

IAREG has confirmed that knowledge flows impact on productivity. **Firms' productivity does not only depend on internal features, but also on the knowledge flows available in their regional environment**. Therefore, promoting public and private research activity does not only directly increase the production of knowledge, it also fosters indirectly the creation of subsequent knowledge, thanks to positive spillovers (knowledge spillover effects), improving the global efficiency of the economy.

Moreover, based on EU patent citations, IAREG has shown that **these knowledge flows are spatially bounded.** There is however **a lot of heterogeneity among regional flows and such differences can be related both to diverse geographical, institutional and industrial** settings. Knowledge flows also depend on the **size of the regional economies of origin and destinatio**n (measured by GDP per capita and R&D investments), supporting the idea that **knowledge flows require an absorptive capacity.** Thus, whilst larger places may be able to benefit from knowledge flows due to the agglomeration forces at work, lagging regions may need some help to reach a critical absorptive capacity allowing them to tie down the flows of knowledge produced in the leading ones.

Thirdly, spatial knowledge **spillovers are far from systematic and proximity does not, as such, ensures their existence.** On the one hand, cross-border links for instance have shown to be impeded by institutional, cultural or political factors. On the other, specific mechanisms of knowledge diffusion are at work. **Interpersonal relationships, based on face to face contact and labour mobility, play a crucial role on the local diffusion of knowledge.** In addition, when they occur, **knowledge spillovers are not purely local**, one-dimensional phenomena. They appear to be simultaneously local and global and to emanate from a variety of sources. **Social proximity and the integration within local and global scientific networks is therefore a key determinant of knowledge diffusion**. It is therefore important to favour local interactions and at the same time, to connect the local innovation system to international levels.

Finally, IAREG results on knowledge generation, accumulation and diffusion highlight the great **diversity of the local and sectoral context.** Universal policy recommendations to foster knowledge-based local development can thus hardly be drawn. The definition of **regional policies should be adapted to each regional context**. This requires a good understanding of the local characteristics and point to the need for local monitoring tools. Best practices are therefore specific to each context. IAREG claims for an **easier access to data**, a more systematic collection of this data and an improvement and a diffusion of the indicators in order to adapt them to local needs.

4.2. Human Capital

4.2.1. Rationale behind the topic

Human capital accumulation is a cornerstone in models of endogenous growth. Some authors have treated human capital as an input to the production process like any other factors. Its accumulation leads to increased capital deepening and a period of accelerated growth (Mankiw, Romer and Weil, 1992). Others like Aghion and Howitt (1992) have emphasized the critical role for the discovery and adaption of new ideas and innovations. According to that view, human capital is essential to transform ideas and innovations into new processes and products.

4.2.2. New indicators and limitations

Because human capital is a multidimensional phenomenon, suitable proxies are not easy to find. Many researchers have focused on educational attainment, since this information is readily available. Typical measures include the years of schooling or the percentage of the labour force with secondary or tertiary education or rates of enrolment. However, these variables approximate only particular elements and neglect other aspects of human capital resources, like training on the job, specific knowledge or the previous working experience. To overcome these deficits, we give a step forward and construct new composite indicators. They transform various aspects of human capital into a unique measure. The analysis shows a significant impact of construction techniques on the quality of indicators. While composite indicators and labour income measures point to the same direction of impact, their correlation is not overwhelmingly high.

4.2.3. Methodology, geographical coverage and Results

After the analysis of human capital, a first main objective is to analyze the **influence of human capital on economic growth.** Specifically, in a first step it is aimed to analyse the **existence of spatial variations in regional returns to human capital**, studying to what extent development policies based on stimulating the accumulation of education differ in effectiveness according to issues such as the degree of development of the area as well as the already existing stock of human capital. Among the main results obtained when applying a regression analysis to the Spanish regional case, we found that it is socially justifiable to dedicate resources to the financing of the accumulation of human capital given that it results in increases in productivity and, consequently, in greater economic growth. At regional level, however, our results confirm that the magnitude of the effect of human capital is far from homogenous across economies, even in the case of regions within a country. Relating this effect to the level of development attained by each regional economy as well as the existing endowment of human capital, a trend is observed for the economies with the lowest levels of productivity to benefit most from the accumulation of this factor. Similarly, the negative relationship of the return with the existing stock of human capital suggests that no conflict was caused when using the stimulus for investment in education in the less developed regions as a development policy measure, given that the objectives of efficiency and equity are simultaneously met. Thus, such heterogeneity in the aggregate return and social profitability of human capital should be considered when supporting and financing education as a tool for development policy. At sectorial level, IAREG has obtained that high levels of human capital have strong and substantial effects on the growth rate of value added at the sectoral level in manufacturing, as more skilled and educated workers and regions endowed with larger shares of skilled workers show a faster process of GDP convergence to the most advanced regions due to the reduction in the cost of absorbing technology spillovers.

Finally, also for the Spanish case, we obtain that when human capital matters, **quality in work is a key issue in explaining productivity**. On the contrary, in low human capital sectors productivity has to be achieved at the expense of low levels of quality in work. The results commented are obtained for the Spanish regions in recent decades. The situation in the Spanish regions could be paradigmatic since there has been a spectacular increase in educational attainment which coincided with a virtually uninterrupted process in which the regions have opened up and exposed themselves to competition, leading to the subsequent modernisation of production and institutional structures. This is to a certain extent the situation of some of the Eastern countries that have recently entered the European Union. The results could be therefore used when designing policies for this kind of countries.

A second main objective related to human capital is to analyse which are the regional consequences of educational mismatch as well as the impact of human capital mobility. Initially, we study the effect of over-education on regional economic growth in the European Union. The results obtained in a regression analysis for several European countries permit us to conclude that **overeducated workers represent an opportunity to take advantage from the generation of more qualified jobs.**

Thirdly, we follow an analysis of mobility patterns of star scientists in Europe, their mobility motives and impacts on (regional) intangible assets as so-called knowledge spillover agents. We observe how Europe suffers from a net loss of star scientists. The highly negative migration balance with the US cannot be compensated by the in-migration of highly skilled especially from Central and Eastern Europe and Asia. Motives for the mobility of star scientists are not limited to direct financial benefits. The research environment, e.g. funding opportunities, material and personnel equipment, is at least of similar importance as revealed by returned German star scientists. Personal factors are often decisive to activate a latent interest to return to the home country. Additionally, the impact of star scientists on intangible assets, i.e. scientific and industrial network capital, human capital, entrepreneurial capital, appears on different spatial levels. **The analysis of the qualitative data on the impact of star scientists on regional intangible assets does not support the expectation that their activities are predominantly regionally embedded.** Very few activities like collaborative research funded by the German Research Foundation or the formation of start-up companies are highly localised. Most industrial collaborations and the long-term impact on human capital development are more likely to affect intangible assets on the national scale.

Finally, we follow the idea that regional differences in human capital endowments are supposed to contribute to wage gaps across regions; but there can also be the case that regions differ in the returns to workers' human capital. Evidence from a comprehensive wage survey for the Spanish regions confirmed the existence of differences not only on average regional wages but also on other important features of the wage distribution. We prove that regional heterogeneity in the returns to human capital (lower in the less developed regions) was the major responsible of wage disparities across regions. **Had workers' human capital in the less developed regions been paid as in the most advanced regions, the bulk of the differences observed in the wage distributions would have vanished.**

4.3. Social capital

4.3.1. Rationale behind the topic

In the course of economic development, the relative importance of traditional growth factors (e.g. physical and natural capital) usually decreases due to decreasing marginal productivity and would be replaced with more intangible resources. Among the latter, human capital is most widely recognized and discussed in the literature. However, individuals and their human capital do not exist in isolation – instead, the value of the abilities and **skills of individuals depend on the social and institutional context** within which they are embedded. Social capital can be understood as a specific characteristic of society's social environment that facilitates people's cooperation. More specifically, social capital consists of different types of networks, norms and trust, being thus embodied in shared values and relationships. Regarding the economic value of social capital as an intangible asset, it is expected to benefit both individual and regional/national welfare through promoting information exchange, reducing transaction costs and hence leading to higher productivity and income levels.

4.3.2. New indicators and limitations

Empirical research on social capital inevitably confronts the **measurement problems** related to the data sources, selection of the indicators, and aggregation. For European comparisons, mostly the publicly available European Values Survey (EVS) and European Social Survey (ESS) databases are used. The main limitation of these data-sources (besides usual shortcomings of cross-national face-to face surveys) is the **lack of longer time series and limited coverage of new EU member states**. As an alternative, more exhaustive national data are collected in some (but only few) European countries, e.g. in Spain and Italy.

Another limitation of social capital measurement relates to construction of appropriate social capital indexes. As social capital is a multidimensional concept, using a set of relevant composite indicators describing different social capital dimensions is preferred instead of highly aggregated single constructs. In the present research, **new composite indicators of social capital dimensions were constructe**d on the basis of both ESS and EVS data, using principal component analysis. These indicators could be divided between two broader dimensions of social capital. The first, **structural dimension** includes indicators that describe formal participation in voluntary organizations, informal socializing with friends and colleagues, social ties with family members and participation in political actions. The second, **cognitive dimension** includes indicators of generalized trust towards unknown others, institutional trust, acceptance of social norms, and interest in political matters. Further, as separate analysis of old and new EU member states gave similar components of social capital in both country groups, it could be suggested that these indicators are robust and thus suitable for cross-national research. However, correlation analysis revealed that theoretically expected strong relationship between different components of social capital cannot be taken for granted – instead, the correlations of social capital components vary by databases, samples and aggregation levels. This result confirms the suggestion that **different components of social capital could both complement as well as substitute each other**. Substitutability is especially important in situations where the evolvement of some types of social capital is restricted or limited due to the social order or development level of the society. Also, as different social capital components could have dissimilar effect on alternative development objectives, it follows that the selection of the concrete indicators and measurement methods depends on the context and purpose of the particular study.

4.3.3. Methodology, geographical coverage and Results

Social capital strongly drives regional convergence. In fact, social capital is a crucial factor in the creation and diffusion of knowledge, both **directly and by improving the effectiveness of other technological inputs**, including R&D efforts and human capital. The social externality embodied in human relationships facilitates the creation, acquisition and diffusion of useful knowledge.

The positive effect of social capital on regional productivity, growth and development is expected to appear directly – through different channels – as well as in interaction with other types of capital, especially human capital. The most general results of our research indicate that social capital components like political engagement, institutional and generalized trust, socializing with friends, acceptance of social norms and helping attitudes are most powerful predictors of economic growth in EU countries. However, the **direct growth effect of social capital was rather small as compared to other growth factors,** indicating that the ongoing convergence process in EU dominates over other effects. Regarding the cross-effects of human and social capital on economic development, the results are somewhat different at national and regional levels. **At national level, human capital works together with institutional trust and political activity, while at regional level the joint effect of human and social capital is related to formal and informal networks, social norms and institutional trust.** It can be generalized that human capital mostly works in conjunction with structural aspects of social capital, while the effect of cognitive aspects of social capital is rather minor.

An important influence channel from higher social capital to better economic performance goes through innovation. Our analysis results suggest the existence of both direct and indirect impact of social capital on regional innovation outcomes. More specifically, **the influence of human capital and R&D efforts on innovation increases with growing levels of social capital**. Also, **the influence of social capital varies with the level of development of each region.** Within high-income regions, the direct impact of social capital on innovation outcomes was strong, while the complementary effect both with human capital and R&D efforts was large and significant.

However, this was not the case for low-income regions, where the direct impact was smaller than that for high-income regions, whilst complementarities between inputs were almost negligible.

This does not mean that we do not need to increase education in less developed countries, as we have mentioned before. In fact, **in countries where social infrastructure and institutional quality is lacking, investing in education obtains a sort of double dividend**: first, it generates important positive returns in technology adoption; second, in the longer term it also helps to improve the local institutions and therefore further improves economic performance.

Just like the presence of social capital could foster economic growth and development, **the lack of it could be a serious impediment for development**. Our research results enable to suggest that the disappointing results obtained in some areas – even after implementing several and richly financed public policies – are partly due to the lower-quality local institutions. This failure of local institutions could be associated to the scarcity of social capital, which tends to be persistent because of the existence of mechanisms of intergenerational transmission of values and norms that change very slowly in time.

In summary, our results suggest that **social capital benefits economic growth and innovations both directly and in conjunction with human capital. However, economic effects of social capital seem to depend on the average income level and institutional development of a particular region or country**.

4.4. Entrepreneurship capital

4.4.1. Rationale behind the topic

As we have mentioned in previous sections, there are some intangible factors that affect economic development. Some of them are related with human capital and knowledge, as driving factor of economic growth in industrialized countries.

Regional knowledge production is certainly one influence on regional development and growth, but it is no guarantee of it. New ideas are valued differently by different economic agents, including the decision-making hierarchies of incumbent firms and hence entrepreneurial opportunities are not always fully exploited by incumbents. Along this line, the «**knowledge spillover theory of entrepreneurship» introduces regional entrepreneurship capital (REC) as intangible asset that is complementary to knowledge capital and describes the efficiency in the recognition and exploitation of entrepreneurial opportunities**. In particular, REC is defined as the entrepreneurial orientation of all individuals in a region, i.e., their basic willingness to engage in entrepreneurial activities and start new businesses. Across regions, it thus measures the disparities in the exploitation of entrepreneurial opportunity which then **provides an explanation for differences in regional economic growth.**

4.4.2. New indicators and limitations

Regional entrepreneurship capital is a **multidimensional** construct. We define it as the *entrepreneurial orientation* of all individuals in a region, e.g. the personality characteristics conducive to entrepreneurial behavior. Broader definitions of REC do also comprise the *individuals' abilities* that may affect their decision to start new ventures (e.g. skills and network building abilities), and all other regional factors influencing this decision (availability of resources, like venture capital, and regulatory environment). In order to measure REC one would need datasets which provide such information. This would allow us, for instance, to compute regional averages of individual entrepreneurial orientation. **Such data do not exist yet but should be collected in the future.** Hence, we have to rely on *indirect* (outcome) indicators, such as the self-employment rate and the number of startups per region. But even these indirect indicators are not available throughout all European countries at the regional level (NUTS 2).

4.4.3. Methodology and results

Against this background, the IAREG project has done research about two major topics. First, it analyses the connection between **Entrepreneurship Capital and Knowledge Spillovers.** Along this line, the first piece of research aims at separating knowledge externalities from other regional location factors, among others natural advantages that might influence new entrant's location decision. The results for Germany suggest that **incumbent firms of the same industry act as location factor for entrepreneurs.** This finding is in line with the knowledge spillover theory into entrepreneurship, i.e. the idea that new entrants commercialize regional knowledge spillovers.

Taking a closer look at regional knowledge spillovers, we then test the hypothesis that an individual's decision to start a business is influenced by her age *and* by the age distribution in the region where she lives. For West Germany, **we find an inverse u-shaped relationship between the regional age structure and startup activity in a region**. Moreover, our findings suggest that **the age-specific likelihood of becoming an entrepreneur changes with the size of the age cohort**, pointing to the existence of age-specific peer effects. This finding contributes to the literature on the connection between age and entrepreneurship and the literature on older entrepreneurs.

In a third working paper, we switch to the individual perspective and analyze the non-pecuniary motivation to become an entrepreneur. **We argue that an entrepreneurial identity results from an individual's socialization**. This could be parental influence but, as argued in this paper, also school peer influence. Based on PISA 2006 data in which students report their entrepreneurial intentions at the age of 15, we find that **having an entrepreneurial peer group has a positive effect on an individual's entrepreneurial intentions.** The strength of the peer effect in a country is moderated by prevailing values, namely, individualism. The results suggest that **regional entrepreneurship capital can be created within the region**. However, doing so might require more than entrepreneurship courses at universities because **entrepreneurial intentions are predetermined earlier on by the school system and environment**.

One important factor that might explain observed differences in REC is the availability of venture capital. Since the US demonstrated over the past decades that they managed to rejuvenate its industry through this type of financing significantly, a forth working paper takes a closer look at the development of venture capital financing in the US over the time period 1995-2008 and analyzes the structural changes emerging from reallocation of financial resources over time. One key finding is a fairly steady concentration process of US venture capital financing in two key destinations, Silicon Valley and New England. Second, after the burst of the new economy bubble start-up financing lost in importance whereas financing of expansions in later stage financing increased.

The second section related with entrepreneurship focuses on the nexus between **Entrepreneurship Capital and Regional Productivity** and analyzes the relation between productivity, knowledge and entrepreneurship capital on the regional level across Member States of the European Union. Our results suggest **a positive relationship between productivity and entrepreneurship capital, entrepreneurial activity, i.e. the rate of self-employment, and entrepreneurial attitude, and knowledge and productivity**.

4.5. Intangible Assets and regional performance

4.5.1. Introduction and rationale behind this topic

In this section we summarize the **main findings of IAREG project related to the simultaneous effects of various types of Intangible Assets on regional economic performance**.

4.5.2. Methodology, geographical coverage and results

The paper «Assessing agglomeration economies in a spatial framework with endogenous regressors» refers to the NUTS3 regions of Great Britain and examines the effects of IA (knowledge, human capital, and entrepreneurial culture) on regional total factor productivity (TFP). In addition, the role of agglomeration economies, understood as the concentration of production and employment, is assessed. The results emphasize that agglomeration economies matter in explaining differences in economic performance across regions although their importance in quantitative terms and their extension, are somewhat constrained when IA are included in the estimations. Specifically, educational human capital has a significant and positive impact on productivity (in the extended model the coefficient is equal to 0.17 and is statistically robust) while knowledge inputs –that is, R&D and high-tech manufacturing employment- positively affect outcomes as well (coefficients are, respectively, equals to 0.05 and 0.07). The entrepreneurship capital of a region has also a significant and positive effect on productivity. On the other hand, the occupational human capital indicator does not have a significant impact on productivity, although this situation could be partially explained due to social and institutional factors, and to labour market segmentations within high performing regions, since people in those regions may demand low-productivity services to be located inside. Knowledge outputs, that is to say, applied patents according to their inventor region of residence, are not significant either. In short, **agglomeration economies still matter, although their impact (in quantitative terms) and their scope (in terms of distances) are estimated to be lower and shorter respectively when intangible assets are included in the model since these factors play a crucial role in determining regional performances**.

Similar results are found in the paper «Total factor productivity, intangible assets and spatial dependence in the European regions» which examines the effects of IA (human, social and technological capital) on the TFP levels of 199 European regions belonging to the EU15 plus Norway and Switzerland over the period 2004-2006. The results show that **all the intangible assets exhibit positive and significant coefficients**: 0.14 for social capital, 0.16 for human capital and 0.07 for technological capital, thus confirming the crucial role played by this kind of productive factors. It turns out that a **large part of TFP differences across the European regions are explained by the disparities in the endowments of such assets**. Related with the issue of spatial dependence among confirms the existence of external spillovers from other regions. More specifically, the **spatial spillovers seem to generate their strongest impacts in the range 0-300 km** which represents roughly the lower deciles of the distances among the European regions considered. This result confirms previous evidence on the fact that **spatial spillovers are somehow bounded in space and that knowledge diffusion is more effective among closer regions**. In general the outcome of the paper indicates the importance of policy strategies which aim at increasing the level of knowledge and social capital as stressed by the Lisbon agenda.

The same methodological framework and territorial coverage is employed in the paper «They arrive with new information. Tourism flows and production efficiency in the European regions» where IA are included as control variables in an estimated equation where the level of regional efficiency (measured by TFP) is explained by tourism flows. The idea is that **tourists represent external consumers which arrive directly to the destination region and therefore local firms can extract relevant information on consumer preferences enhancing the efficiency of the entire region**. The econometric results show the positive impact of tourism flows on regional efficiency levels together with the positive role played by intangible assets, infrastructures and spatial spillovers. The most interesting result is that tourism flows have an estimated impact of 0.09, which is 60% higher than the impact associated with technology, thus confirming the important role played by tourist-transmitted information in determining total factor productivity in the European local economies. All intangible assets display a positive and significant effect on total factor productivity: 0.19 for human capital, 0.13 for social capital and 0.05 for technological capital.

A more general macro approach is used in the paper «Geographic Macro and Regional Model for EU Policy Impact Analysis of Intangible Assets on Growth» which estimates the impacts on GDP of FP6 EU R&D contributions and intangible assets in the Euro-zone over the period of 2003-2007 within a Geographic Macro and Regional (GMR) model. We cannot expect large impacts from EU R&D contributions which account only for about 4% of regional R&D expenditures on average. More than 60% of the funds are won by regions belonging to areas characterized by the highest level of agglomeration; thus, it would not be a surprise if the largest impacts are found in these regions. In the long run, there is accordance with what is expected from temporally positive TFP shocks: they increase GDP levels but not the GDP growth rate. The simulation clearly indicates that **not every region is equally well-prepared for R&D-based development policies**. **The impact on GDP in the Euro-zone is about 10% higher when the policy mix of FP6 and regional quality distribution of R&D is extended by human capital development**. For what concerns **social capital, similar to the findings of the previous scenario the impact on GDP in the Euro-zone is about 10% higher when the policy mix of FP6 and regional quality distribution of R&D is extended by social capital development**.

Finally, the role of IA at firm level is examined in the paper «Intangible capital and firms productivity». This paper evaluates the role of firms internal intangible capital and regional external intangible assets (human, technological and social capital) on firms productivity within a Cobb Douglas production function model for a large panel of European companies belonging to 116 regions of six countries (UK, FR, IT, SP, NL, SWE) over the period 2002-2006. The first important result is that **all countries considered show a clear tendency to increase the share of intangibles over tangibles, confirming the growing role of knowledge capital in the competitive behavior of the firms.** On average the ratio raises from 34% in 2002 to 42% in 2006. The econometric analysis employs different estimation methods: instrumental variables (IV), Olley and Pakes (OP) and Levisohn and Petrin (LP) methodologies. The main findings are that both firms internal and regional intangible factors contribute positively to the production process. More specifically, human capital exhibits an estimated elasticity between 0.19-0.33 signaling that the availability in the local economy of highly educated labour forces represents an advantage for firms performance and for their innovative activities. The effect of regional endowments of technological capital on firms' productivity is positive and significant in all estimations with an elasticity of roughly 0.07. Social capital seems to have a lower impact, estimated in around 0.02; these results are probably due to the weakness of the proxy for social capital. Public capital turns out to be highly significant in all the regression models with an estimated elasticity of around 0.05. Firms' internal intangible capital turns out to be highly significant in the aggregate estimates and also considering each country alone. The estimated elasticity exhibits its lowest value for Spain and France (0.023 and 0.03), Sweden follows with an impact estimated in 0.04, while Italy and the Netherlands have both higher values (0.05) and UK exhibits the highest value (0.09).

All in all, a general conclusion that can be drown by these research lines is a support to the hypothesis of the key and concurrent role played by intangible assets in explaining firms behavior and the economic growth path at the regional level in Europe. The estimated impacts of the IA considered (human capital, social capital, technological capital, entrepreneurship capital, knowledge capital) varies given the heterogeneity in the methodology, time period, territorial coverage and statistical measures employed in the various studies. This fact implies that the **local economic environment should be carefully taken into account when designing and implementing economic policy because the specific regional features strongly influences firms localization choice and consequently the economic performance of territories**. However, all the empirical analyses show the **capability of intangible assets to foster regional productivity and to create a virtuous framework for competitiveness**. Moreover, it has been remarked the **role of spatial knowledge flows and the linkage between social capital and the innovation transmission mechanism**. This analysis is useful to understand what has happened in Europe in the past decades, but it also represents a contribution to identify specific European policies within the framework of the Lisbon Agenda.

5. Final thoughts, about databases

Along the IAREG project and all the Reports and working papers done, it has been made clear that **homogeneous databases at the regional level for most EU countries are not available for most intangible assets**. Homogeneity is indispensable in order to get comparable analysis. It is also important for getting more observations so as to get more consistent results in econometric analysis. It is therefore necessary to make more data available to allow for more detailed research. The analyses on the impact of intangible assets, as the ones carried out within the IAREG, would certainly benefit from higher data quality.

Several aspects should be improved in relation to regional databases.

Firstly, strong effort is indispensable to fill the gaps in the existing Intangible Assets databases. More specifically, a direct involvement by Eurostat is required. Additionally, **data should be available with a sub-national disaggregation and also with a sectoral specification given the high heterogeneity among regions and sectors**. This is particularly true for certain variables such as, for example, the «self employment» used to proxy the entrepreneurship capital, available with a depth sectoral disaggregation only at a national level. In order to overcome the limitations on the existing databases on Intangible Assets, accurate procedures should be indicated for the regular collection of data in the European countries, in particular in the new accession and candidate countries.

Secondly, a higher degree of coordination between EU institutions (e.g. Commission, Eurostat) **and national ones** (particularly national institutes of statistics and other statistical systems) is needed in order to:

— Increase/extend the release of micro-data for policy and research.
— develop a benchmarking for policy learning across the EU, at national, regional and local level with respect to knowledge creation, accumulation and diffusion.

Thirdly, it could also be interesting to develop a specific project to create a homogeneous database of IA at a regional European level. Specifically,

— Due to the great diversity of regional and sectorial contexts, general recommendations can hardly be drawn. A European structure should be set up to provide **a specific place where data would be centralized and homogenized, where relevant indicators could be discussed and made available, and information could be diffused, both to the scientific community and to the policy makers.**
— Such a structure is already experimented in France. The European Localized Innovation Observatory (EuroLIO, www.eurolio.eu) takes on the form of a network that gathers research labs specialized on localized innovation dynamics, all the innovation data producer offices and representatives of the national and regional technological policy makers.

6. Policy issues

Based on all the research done in the IAREG project, some policy implications and recommendations can be suggested. Although in the Final IAREG Policy Guide (2010) we deeply explain them, we consider interesting to summarize here some of them.

— A first question we have answered is **How can knowledge be generated within the ERA?**

As we have seen before, one first agent that can generate knowledge are Universities. However, in few occasions the research carried out by Universities is commercialised. Hence, University policies should **try to stimulate the commercialization efforts of academics**. In that sense, they should:

a) aim toward **engagement with local industries**;
b) to develop policies **to support commercialisation** (facility in English is closely related to chances that academics commercialise);
c) Universities should consider **rewarding engagement with non-university organizations** (appears to stimulate commercialization, perhaps due to network effects of multiple contacts);
d) Universities and Research public agencies should adopt policies to promote **collaborative research projects** between academics and industry (and funds should be provided in a less bureaucratic manner).

Another relevant agent for the generation of knowledge are multinationals (MNEs). It is therefore of vital importance for policymakers to strengthen cooperations between multinationals and the regional economic environment, including universities. Thus, regional governance boards should be established and existing boards professionalised if needed. To exploit their benefits, the boards have to be easily visible for potential participants. In order to increase their role, it will be useful to:

a) Improve **channels of communication** of MNEs with other regional actors (awareness of local R&D / knowledge transfer initiatives);
b) Do public support of **temporary institutional moves** from academia to industry (feed-back);
c) Create **regional partnering organizations** (as for example what has been done in the pharmaceutical industry);
d) Increase the scope of early-stage face-to-face interaction through **Publicly funded research consortia**

— A second question answered in the IAREG project is: **How can Europe promote human capital in order to impact on innovation and economic growth?**

In any case, **IAREG supports to apply policies stimulating** accumulation of human and social capital, due to the positive effects presented in the empirical results. If not there will be underinvestment in human capital. Our recommendations are:

a) The **national level** should be the major policy level for higher education and research policy, due to the national peculiarities of university systems;
b) It is necessary to give more autonomy to **universities** to enable them to internally strengthen certain strategic fields;
c) The **Regional governments** should complement initiatives to strengthen research fields identified by the respective universities;
d) Governments should try to increase the **Trust on public institutions** and on people's perception of it (Social capital), as this fosters the effect of human capital; and
e) Reinforce quality in work in industries with an intensive use of human capital, because this **implies productivity gains.**
f) **Flexicurity** arises as a good opportunity to embrace the welfare state together with productivity gains in regions with low endowments in human capital.

However, it is also required to transfer new knowledge into marketable innovations. Thus, the creation of an entrepreneurial culture is a central aim in the EU innovation policy. Classes to train entrepreneurial spirit should be offered, if possible, in close cooperation with relevant actors. For example, universities should establish contacts with venture capital firms, law experts for business formation, business angels, and government funding agencies to actively transfer knowledge on how entrepreneurship works. The formation of a business angel community would be helpful to support the novices. The decision to become an entrepreneur should be facilitated by developing the market for diversified sources of financing, such as venture capital and private equity, as banks might not be effective if innovative products and technologies are involved.

— A third question is **How to increase knowledge flows within the EU?** We suggest different strategies:

a) **Continuing the current actions in favour of the innovative activities and their diffusion,** through supporting local academic research and publications**, s**upporting patenting by the local firms and universities, facilitating access by local firms to the information contained in local, national and international patents, transferring the results of public research to SMEs in an understandable form

b) **Promoting science-industry knowledge flows.** In that sense, first, it is necessary to address "Education for entrepreneurship" not only to students, but also researchers. Second, to do financial, technical and informational support to diverse and complementary forms of interaction, from simple transfer to complete cooperation (Informal and formal relationships)

c) **Supporting access for businesses (mainly SME's) to the latest methods of knowledge management:** seminars and financing specialized technical consultants**.**

d) **Helping lagging areas to reach a critical mass allowing them to benefit from knowledge flows within and across the region.** We suggest to focus primarily on the medium size regions that need an initial help to access to global knowledge flows, instead of devoting too much attention to the largest areas (already agglomeration forces)

e) We have observed than spatial proximity is not sufficient for knowledge to flow: Knowledge flows may arise at a distance and conversely, knowledge does not always flow locally. In that sense, we suggest to **increase interpersonal relationships,** because they play a crucial role (face to face contacts and labour mobility), and also to stress the s**ocial proximity and the integration within local and global scientific networks**

f) **Policy tools should be specific to the local context.** The definition of regional policies adapted to each regional context requires a good understanding of the local characteristics. No general recommendations can be done. However, trans-national policy learning is also important to identify best practices

— Finally, although intangible assets affect differently economic growth depending on the regional characteristics of the territory, after the analysis of the effects of IA on growth, we suggest the next **policies:**

Trade policies:

a) Dismantle residual trade barriers, especially between countries with strong income differences, to have relevant welfare gains

b) Support the peripheral territories to avoid regional inequalities deriving from a deeper European integration

Financial Market policies:

a) Promote financial markets with diversified sources of financing, such as Venture Capital and Private Equity,
b) Support greater efficiency in the stock markets since they perform a key role in the evaluation of the introduction and successful exploitation of technological innovations
c) Promote a more liquid market for corporate control to facilitate the transfer of firms' control and to make entrepreneurs less subject to idiosyncratic risk

Labour market policies:

a) Promote education of the workforce (i.e. training programs) and facilitate the matching of newly/more educated workers to firms in more productive sectors to favour a virtuous structural change towards more dynamic sectors of the economy
b) Provide safety nets for those industries more directly hit by the process of euro adoption and facilitate the transition of low-skilled workers into jobs with a higher human capital content
d) Sustain attraction of more educated workers from abroad so that their competences can be used by local firms in the technology adoption mechanism

Industrial policies:

a) Promote **financial incentives and fiscal policies** designed to stimulate the firms accumulation of internal IA (software, R&D, patents, economic competencies and employee training)
b) Improve infrastructures and allow differentiated fiscal regimes among richer and poorer regions in order to **attract firms in the poor region** and favour spatial dispersion of industrial activities
c) Promote the **localization of enterprises** (through fiscal and financial incentives, public infrastructures) in places **where agglomeration economies** are taking place to improve innovation output and support the emergence of industrial districts
d) Promote **tourist flows** since they convey new ideas and information to the destination regions enhancing their efficiency levels
e) Improve **local transportation system** to reduce the length of business and commuting journeys and to boost labour productivity

Accumulation of IA

a) Stimulate and support the accumulation and improvement of all Intangible Assets (human capital, technological capital, social capital and institutions, entrepreneurial) in the system since their complementary action enhances the economic performance at the firm and regional levels. This policy will also create beneficial effects to neighbouring regions due to the presence of spatial spillovers.

b) Impose, through centrally designed national policies, adequate standards in the provision of public good at the local level to facilitate collective learning and relational development

c) Provide incentives to invest in R&D (also through FP programmes) and facilitate the creation of externalities especially for small firms, for instance, sharing the costs of R&D among several SMEs

d) Invest more resources on education; more specifically: in lagging economies invest in lower levels of education to favour imitation, for more advanced economies invest in tertiary education linked to own-innovation

e) Support the higher education in business schools to stimulate the accumulation of entrepreneurial capital

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Annex I: List of IAREG working papers

Knowledge Capital

Knowledge accumulation processes and regional growth

- IAREG 1.2a: «Technological capabilities and patterns of cooperation of UK firms: A regional investigation», by Simona Iammarino, Mariacristina Piva, Marco Vivarelli, Nick von Tunzelmann, PDF.
- IAREG 1.2b: «R&D collaboration networks and spatial diffusion of knowledge. A comparison between Telecommunication and Microelectronics», by Corinne Autant-Bernard, Pascal Billand, David Frachisse, Nadine Massard, PDF.
- IAREG 1.2c: «Organizational Capabilities: Some reflections on the Concept», by Gerd Schienstock, PDF.
- IAREG 1.2d: «Organizational innovations and new management practices: Their diffusion and influence on firms'performance. Results from a Finnish firm survey», by Gerd Schienstock, Elisa Rantanen, Päivi Tyni, PDF.
- IAREG 1.3a: «The spatial profile of university-business research Partnerships», by Pablo D'Este, Simona Iammarino, PDF.
- IAREG 1.3b: «Intangible Assets, Multinational Enterprises and Regional Innovation in Europe», by Jan-Philipp Kramer, Javier Revilla Diez, Elisabetta Marinelli, Simona Iammarino, PDF.
- IAREG 1.3c: «One Small State, Two Regions: Are There Differences in Commercialisation of University Research?», by Maaja Vadi, Tõnis Mets, Toomas Haldma, PDF.
- IAREG 1.3d: «Academic Knowledge Transfers and the Structure of International Research Networks», by Attila Vaarga, Andrea Parag, PDF.
- IAREG 1.3e: «Marshall's Dilemma: Intangible Assets and European Universities», by Ed Bergman, PDF.
- IAREG 1.3g: «The Academic Entrepreneur: Myth or Reality for Increased Regional Growth in Europe?», PDF.

Knowledge flows and regional productivity

- IAREG WP 4/01: «Towards cross-border innovation spaces», by Karl-Johan Lundquist, Michaela Trippl, PDF.
- IAREG WP 4/02: «Hirschman Faculties: Brain Circulation and ERA Knowledge Flows of European University Academics», by Edward M. Bergman , PDF.
- IAREG WP 4/03: «Profile of EU University Academics», by Roland Schneider, Edward M. Bergman, PDF.
- IAREG WP 4/04: «Knowledge Management Practices in Low-tech and Medium-tech Industries Findings from a Finnish Business Survey», by Gerd Schienstock, PDF.

- IAREG WP 4/05: «Productivity Changes and Intangible Assets: Evidences from French Plants (2000-2002)», by Corinne Autant-Bernard, Jean-Pascal Guironnet, Nadine Massard, PDF.
- IAREG WP 4/06: «ICT and labour productivity: evidence for the Italian regions», by Simona Iammarino, Cecilia Jona-Lasinio, PDF.
- IAREG WP 4/07: «Underlying mechanisms of knowledge diffusion», by Corinne Autant-Bernard, Nadine Massard, PDF.
- IAREG WP 4/08: «Knowledge Diffusion in European Regions», by Edward Bergman, Stefano Usai, PDF.
- IAREG WP 4/10: «Knowledge flows across European regions», by Raffaele Paci, Stefano Usai, PDF.

Human Capital

- IAREG WP2/01: «Regional measures of human capital», by Christian Dreger, Georg Erber, Daniela Glocker, PDF.
- IAREG WP2/03: «Regional variability in the impact of human capital on regional growth», by Enrique López-Bazo, Rosina Moreno Serrano, PDF.
- IAREG WP2/05: «Quality in work and productivity», by Vicente Royuela and Jordi Suriñach, PDF.
- IAREG WP 2/06: «Regional economic growth and human capital: the role of overeducation», by R. Ramos, Jordi Suriñach, M. Artís, PDF.
- IAREG WP2/07: «Mobile star scientists as regional knowledge spillover agents», by Daniel Schiller, Javier Revilla Díez, PDF.
- IAREG WP 2/08: «Regional heterogeneity in wage distributions. Evidence from Spain», by Elisabet Motellón, Enrique López-Bazo, Mayssun El-Attar, PDF.
- IAREG WP 2/09: «Human capital spillovers and regional economic growth in Spain», by Raul Ramos, Jordi Suriñach, Manuel Artís, PDF.

Social Capital

- IAREG WP2/02: «Indicators of social capital in the European Union», by Eve Parts, PDF.
- IAREG WP2/04: «Human Capital and Social Capital as Interacting Factors of Economic Development: Evidence from Europe», by Anneli Kaasa, Eve Parts, PDF.
- IAREG 5/04: «Persistent regional gaps and the role of social capital: Hints from the Italian Mezzogiorno's case», by Francesco Pigliaru, PDF.
- IAREG 05/10 «Does social capital reinforce technological inputs in the creation of knowledge? Evidence from the Spanish regions», by Ernest Miguélez, Rosina Moreno, Manuel Artís, PDF.

Entrepreneurship capital

— IAREG WP 3/01: «Concept and Measurement of Regional Entrepreneurship Capital», by Werner Bönte, Stephan Heblich, Monika Jarosch, PDF.
— IAREG WP3/02: «The Impact of Regional Age Structure on Entrepreneurship», by Werner Boente, Oliver Falck, Stephan Heblich, PDF.
— IAREG WP3/03: «The Apple Doesn't Fall Far From the Tree: Location of Start-ups Relative to Incumbents», by Oliver Falck, Michael Fritsch, Stephan Heblich, PDF.
— IAREG WP3/04: «Regional Patterns of Venture Capital Financing in the US», by Georg Erber, PDF.
— IAREG WP3/05: «Entrepreneurship Capital, Knowledge Spillovers and Regional Productivity: Some Empirical Evidence from European Regions», by Werner Boente, Stephan Heblich, Monika Jarosch, PDF.
— IAREG WP3/06: «Identity and Entrepreneurship», by Oliver Falck, Stephan Heblich, Elke Lüdemann, PDF.

Intangible Assets, firms location and regional competitiveness

— IAREG 5/01: «Measuring productivity», by Massimo Del Gatto, Adriana Di Liberto, Carmelo Petraglia, PDF.
— IAREG 5/02: «Intangible assets in the European regions: Data homogenization and descriptive analysis», by Marta Foddi, Raffaele Paci, PDF.
— IAREG 5/03: «Total factor productivity, intangible assets and spatial dependence in the European regions», by Barbara Dettori, Emanuela Marrocu, PDF.
— IAREG 5/05: «The euro and firm restructuring», by Matteo Bugamelli, Fabiano Schivardi, PDF.
— IAREG 5/06: «What determines entrepreneurial clusters?», by Luigi Guiso, Fabiano Schivardi, PDF.
— IAREG 5/07: «Does Idiosyncratic Business Risk Matter?», by Claudio Michelacci, Fabiano Schivardi, PDF.
— IAREG 5/08: «Market value and total factor Productivity», by Cristiano Antonelli, Alessandra Colombelli, PDF.
— IAREG 5/09: «Total factor productivity, intangible assets and spatial dependence in the European regions», by Raquel Ortega-Argilés, Rosina Moreno, PDF.
— IAREG 5/11: «Decomposing differences in total factor productivity across firm size. The role of innovation and human capital», by Laia Castany, Enrique López-Bazo, Rosina Moreno, PDF.
— IAREG 5/12: «Intangible capital and firms productivity», by Emanuela Marrocu, Raffaele Paci, Marco Pontis, PDF.
— IAREG 05/13: «Human Capital Composition and Economic Growth at the Regional Level», by Fabio Manca, PDF.

— IAREG 05/14: «Productivity and Firm Selection: Quantifying the “New” Gains from Trade», by Gregory Corcos, Massimo Del Gatto, Giordano Mion, Gianmarco I.P. Ottaviano, PDF.
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