THE FUTURE OF THE CREATIVE ECONOMY IN EUROPE: AN EMPIRICAL ANALYSIS ACROSS THE MAIN EUROPEAN REGIONS

by

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ABSTRACT

Having been enlightened by the popular creative class thesis, this doctoral thesis aims to contribute to the understanding of the emerging creative economy. Using newly derived panel data from NUTS 2 regions in Europe, the role of creative workers is systematically evaluated. This thesis is multi-disciplinary in nature as several different theories are combined in order to understand what the knowledge economy really requires. The thesis first critically and comprehensively reviews previous studies regarding the relationship between city/regional economic development and the presence of the creative class. In the second part, the research of ICT-related theories is summarised before being matched with the issues from the creative class thesis. Three main research directions are listed, including the economic function of workers with creative skills, their specialised preferences and the influence of educational backgrounds in the labour market. A Growth Accounting model is used together with two empirical models for testing the economic impact of creative workers, ICT, as well as the interactions of these two variables across NUTS 2 regions in ten European countries. Three main findings can be summarised: the unbalanced development level of the creative economy across the main European regions, the complementary relationship between ICT and creative skills in explaining output and productivity growth, and finally the difference in the economic function of graduates and creative workers. The thesis then develops an empirical model to investigate how creative workers are distributed across regions in twelve European countries. Together with two different econometric models, the evidence suggests that Florida's (2013) theoretical framework has explanatory power in larger regions in contrast to midsized and smaller regions. However, how well a local government performs has a substantial impact on the influx of creative workers among regions of all sizes, and the overall quality of political institutions appears to enhance this process. This phenomenon is more evident in small-sized regions compared to large-sized regions. The final strand of the thesis briefly discusses the possible factors that could determine the outcome of creative jobs, using the micro-level EU LFS data in seven European counties. The findings imply that education background is generally consistent with creative job outcomes, but it is difficult to identify a clear boundary regarding creative jobs among occupations that require and use higher education. The key findings, contributions and research limitations are summarised in a concluding chapter, which also outlines several promising ideas for future research.

To my dear parents and wife

for all your love and support

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CHAPTER 1

INTRODUCTION

1.1 What really matters for growth?

What factors really do stimulate economic growth? This question has always been at the heart of both economics and geographical economics. Despite an ongoing desire to resolve this, centuries of studies, based on various perspectives, have produced many complementary or competing theories. Earlier studies merely focused on the role played by firms and industries. Marshall (1930) advocated that agglomerations or clusters of firms and industries would achieve considerable advantages in terms of lower labour costs, fewer potential risks or a greater likelihood of shared knowledge bases and markets. Economists started to investigate and catalogue the possible factors lying behind such agglomerations and clusters.

Classic location theory emphasises transportation costs and other trade-offs made by large industries or firms. For example, Weber (1909) formulated a least cost theory of industrial location, which attempted to explain and predict the uneven distribution of industries at the macro level. In common with other similar theories (e.g. Ohlin, 1933; Christaller, 1933), the argument is that firms and industries are always seeking minimum transport and labour costs. In the age of Fordism, the role of firms, or specifically large firms, became even more important as the dominant unit for regional economic development. Many attempts have been made to try to explain the location decisions made by multinational enterprises and later on the location choices of their branch plants. For example, Vernon (1966) proposed a classical model that explained industrial location based on the product lifecycle theory: firms would decentralise production through branch plants when production processes had been standardised. However, these studies did not examine the role of occupations or other types of skills as most jobs were standardised and were only seen as a cost to be minimised.

Changes occurred with a shift from an industrial to a post-industrial economy. As a consequence, non-standardised production resulted in the rise of the knowledge intensive economy and labour divisions seemed to become more important than ever. For example, Bell (1973) depicted a new class structure based on managers, scientists, administrators and engineers, which according to his point view, is the creative force for regional economic development. Andersson (1985) further proposed a concept of a "*C-society*" based on creativity, communication, culture and knowledge.

A very influential body of literature was structured around the human capital theory, drawing on the pioneering work of Becker (1964) on the role of human capital in economic growth. Human capital is embodied within individuals, who in turn produce economic value or increase productivity in economic transactions (Faggian, 2005). For example, Mincer (1997) suggested that the wage level is an equation of hours worked to skills and education – in competitive markets, wage levels should be proportionate to the level of human capital stock for individuals.

The positive relationship between human capital and growth has been confirmed by various literatures at the national level (Barro, 1990; Barro and Jong-Wha, 1993; Simon, 1998). Some studies argue that it may be difficult to explain national growth by human capital because of institutional effects (Glaeser *et al*., 2004). At the sub-level, cities with more skills appear to have stronger power in explaining economic growth in comparison to those less skilled cities. For example, Acemoglu and Dell (2010) examined subnational data from both North and South America to distinguish the roles of education and institutions in accounting for economic development, finding that half of the intra-country variation in levels of income was explained by education.

An alternative approach linking people's skills to economic growth is via entrepreneurship. The discussion of creative entrepreneurship's impact on economic growth can be traced back to the early 20th century. Schumpeter (1934, 1980) defined an entrepreneur as a person who is willing and able to convert a new idea or invention into a successful innovation, and as he advocated, entrepreneurship employs "*a gale of creative destruction*" that partly or entirely replaces inferior innovations across industries or countries and creates new products or introduces new business models. Therefore, entrepreneurship is related to the dynamics of an industry and to long-term economic growth.

The routinised innovation process from giant firms will not replace individual innovators or entrepreneurial partners' positions; independent entrepreneurial inventors are more likely to provide revolutionary breakthroughs and contribute significantly to further economic growth (Baumol, 2002). Furthermore, entrepreneurship concentrates on the creation of economic activities; it is, to a certain extent, asserted to be a good proxy in explaining the contribution of human knowledge and the ability to generate economic growth, particularly in urban regions (Glaeser, 2009). In empirical tests, the measure of such entrepreneurial activities is multifaceted, such as by share of midsized or small-sized firms (Chinitz, 1961), the self-employment rate (Glaeser, 2010) or by numbers of newly formed firms (Kirchoff *et al*., 2002).

At the same time, growth in the availability of microeconomic data led to a further wave of discussion regarding the skills themselves. Corrado *et al*. (2006) defined three subsets of intangible assets that are deemed to be important sources of output and productivity growth: in addition to digitised information (ICT) and innovative property (R&D), economic competencies are largely determined by knowledge capital. With respect to this, Piekkola (2009) measured specific intangible skills such as management-marketing skills, research and development (R&D) skills and information and communication technology (hereafter referred to as ICT) skills. In contrast, Jones and Chiripanhura (2010) distinguished economic competencies by individual human capital and collective human capital; the latter is considered to be more consistent with the notion of intangible assets and has strong explanatory power regarding variations in economic performance among OECD (i.e. Organisation for Economic Co-operation and Development) countries. There are also many other measures of intangible skills within the workplace, for example by workplace practices (Black and Lynch, 2005) or organisational factors (Bloom and Van Reenen, 2007).

Finally, another line of argument highlights creativity, which is mainly referred to within the notion of creative cities/regions (e.g. Florida, 2002, 2008; Landry, 2000, 2007; Glaeser, 2011). Related literature, in a broad sense, focuses on the contribution of different creative skills as a whole in generating economic growth in cities and regions. Florida (2002) defined a set of occupations as "*the creative class*", including science, engineering, arts, culture, entertainment and the knowledge-based professions of management, finance, law, healthcare and education. In this case, creativity is defined as comprehensive creativeness, involving different forms not only of the creativity of discovering technological inventions, but also of the "*soft* *creativity of marking interaction in the city flow*" (Landry, 2007, p.1). Thus the discussion of skills is further linked to the nature of places and their cultural ecology.

1.2 Why place matters: the power of the city and the mega-region

If industrial production was organised around firms and industries, then the creative population would be embodied in cities. Cities have been a location of innovation as creativity is often sparked by the collision of ideas from different disciplines and cultures. The role of cities has received policy markers' attention since the 1960s. Jacobs (1961) was among the first scholars to suggest the importance of innovation to economic growth. As she claimed, innovation does not come from firms or factories, but cities which contain skills and talents.

However, major changes have emerged through the process of globalisation within the economic landscape. As the volume of international trade and capital mobility has rapidly expanded across different countries, globalisation has gradually undermined the previously strong position of national-level economic institutions (Ascani *et al*., 2012). As a result, the world has become increasingly borderless, with national borders being less likely to determine the location of economic activities. Capital flows to where the return is great and people go to where better opportunities lie.

At the same time, many cities that Jacobs once thought of as central cities surrounded by small villages and towns have grown into mega-regions. The mega-city is not only defined by its high population and the large number of inhabitants, it is also a new economic system that results from the outward growth of many urban societies within it. Globalisation exposes modern cities to worldwide competition and when economic activities are globalised, the bigger and more competitive mega-regions replace cities and become the new engines of the global economy (Florida, 2008, p.59).

Some recent studies suggest that technological improvements shorten the distance between places and people. The world is more likely to be "flat" enabling production to be dispersed and people to live everywhere (Friedman, 2005); however, the reality is that the share of the world's population who live in urban areas dramatically increased from 30 percent in the 1980s to around 50 percent today (Florida, 2008 , p.19).

Population may be not the only indicator to show that the world is "spiky". Based on satellite data from NOAA, Florida *et al.* (2007) used the level of light emissions as an indicator to map global economic activities and compared these findings to a map of the global GDP levels. As these two maps largely overlapped, the results suggest that our world is shaped around a couple of dozen mega-regions such as the Boston-New York-Washington D.C corridor, Amsterdam-Antwerp-Brussels or the Greater London region; however, population density or energy usage levels cannot be equated with economic growth. Many of the world's mega-cities remain less developed, such as Mexico City, and are substantially different from those successful ones that have high innovation capacities.

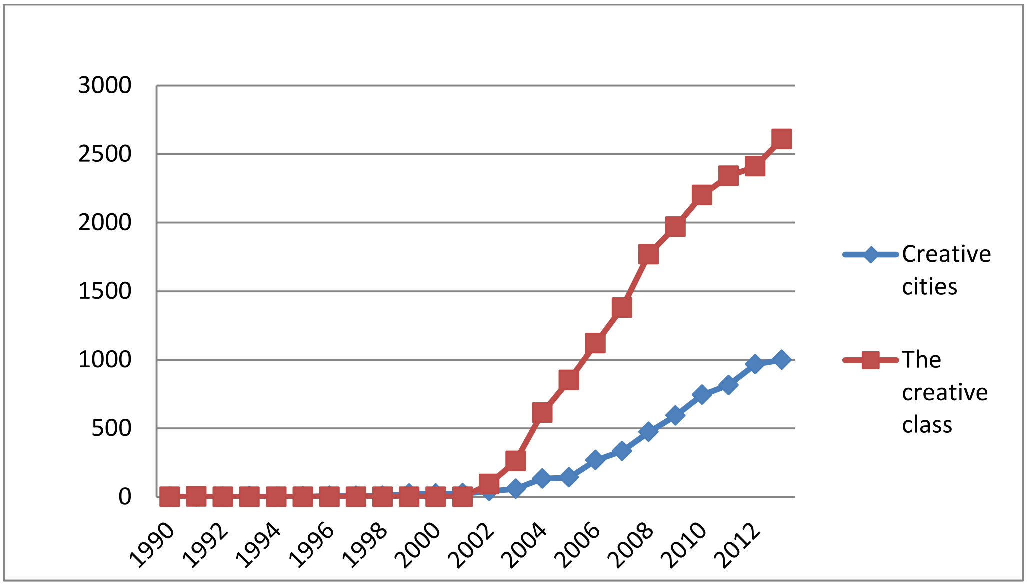
In conclusion, the changing nature of the economic landscape has progressively increased the importance of regions in shaping growth trajectories. Together with the rise of the knowledge economy, we encounter several new difficulties. On one hand, the knowledge-based economy still appears to be sensitive to location. Fordist industries always choose a place where labour and land rent are cheap, and later products can be sent to destinations for consumption. Knowledge production, which is, however, related to service goods too, requires contemporaneous contact from both producers and consumers (Florida and Mellander, 2012). On the other hand, skilled workers do not only contribute to production, but also acts as consumers in cities and regions. Therefore, the new nature of the global economy forces us to rethink how to generate growth, focusing on how we can bring the right people to the right place rather than focusing on skills alone.

1.3 Motivations: the creative class thesis and the European regions

To sum up, in the past urban economists focused on firms and industries as the important area for analysis, but in recent decades there has been an increasing concentration on skills. The skills revolution changed the nature of the global economy, meaning that the role of human capital, occupations or skills, has begun to receive much attention. The notions of creative cities and the creative class thesis have already become very influential (see **Figure 1.1**), leading us to rethink the formation of an economic system. They are new concepts, measuring a combination of supply and demand driven labour rather than the more conventional human capital, and they appear to be solutions that might bring about further economic growth.

Numerous studies had found fault with the logic or empirical claims of Florida's changing prognosis in the North American context in his creative class thesis. Such on-going and intensive debates exerted profound influence on the theoretical development in the domain of urban and regional studies, marking the beginning of a widening stream of academic work on the concept of creativity.

Figure 1.1: Annual number of citations of the term "the creative class" and "creative cities" by Google Scholar, 1990-2013



The praise and censure of this theory will be systematically evaluated in more detail in the literature review. Here, the motivations of this thesis are briefly demonstrated and the reason why Europe is the primary research target given. Firstly, the majority of studies in Europe duplicated the original theoretical framework proposed by Florida. Also, existing studies for regions in a country or limited countries cannot fully reflect the real function of the creative economy for the whole of Europe. As national borders have become less relevant to economic activities and an increasing number of regions rather than individual cities have turned into new engines for economic growth, Europe's economic geography has become similar to that of the world. With the end of the Cold War and the expansion of the European Union (EU), political boundaries between many European countries have become less important. Despite the remaining heterogeneity in culture, religion, language or historical background, many regions across different countries have become economically connected. When we look at Europe today, it looks more like an integrated economy composed of connected regions or cities. In other words, the new European economy in the 21st century is made up of many important regions or mega-regions that house the bulk of innovation and production (Florida, 2008, p.53).

Secondly, current studies cannot substantially answer the question of how the so-called creative workers contribute to growth. Empirical evidence may support the fact that having more skilled workers co-exists with having higher levels of GDP and productivity or higher employment growth in high-tech industries. However, knowledge, skills and talents are organised around economic systems, and output is determined by a complex interaction between different factors. The powerful synergy of the creative class agglomeration may not be associated with the regional economic growth. Instead, the quite different creative activities in regions could be related to each other, potentially resulting in instability and chaos (Cole, 2012).

Therefore, this thesis attempts to connect the concept of creativity to other desiderata of economic growth, particularly for example, technology. A series of factors could relate to people's talent within the economic system; however, the impact of technology is the most straightforward one as a large body of literature has already discussed the interactive relationship between specific skills and technology. One consensus view is that the increased demand for skilled labour is linked to technological progress (Machin and Van Reenen, 2007). Some empirical studies show this pattern, such as a declining trend regarding the number of medium skilled workers relative to high and low-skilled ones (Autor *et al*.,2006; Goos and Manning, 2007).

A possible explanation of this trend is that ICT complements human capital (Autor *et al*., 1998) and also investment in highly qualified employees with ICT skills is a very important condition for the full exploitation of ICT potential (Van Reenen *et al*., 2010). Nevertheless, academic work on this topic, as with the study of the creative class in Europe, is only at the primary stage. As Boselli (2010) proposed, ICT policies in the future should converge with other policy objectives such as investment in human capital. Therefore, it is quite intriguing to look at this through a high degree of coordination among different institutions, to see how creative workers, in terms of different definitions, could interact with technology in the theoretical context.

Finally, Florida's theory is a grand thesis. According to his "*creative compact*" (Florida, 2013, p.383-398), we should supposedly accept several important principles in order to march forward to the Creative Age, such as innovation expansion, education system reform and promotion of rich amenities. However, many of these propositions, although they have been frequently mentioned, are not empirically tested. At several points, Florida only suggested a vague direction concerning the future development path of his creative economy. Is the concept of the creative class closely associated with economic and social realities? With this question in mind, this thesis aims to put Europe into context to explore these unknown domains, particularly for example, the preferences of the creative class and its relationship with the education system. This perspective, to a great extent, integrates the hot topics of the creative class thesis with various practical effects regarding regional development.

In conclusion, the study of economic development needs to incorporate observations at the regional level. The role of a place in economic systems cannot be simply overlooked in the European context. This dissertation is based on existing urban growth theories, such as the creative class thesis. However, it also disagrees with this thesis as it has an exclusive focus on the agglomeration of one or more specific talents in a place. This thesis is motivated in a broad sense by trying to understand the complex functions of the newly emerged economic systems of the 21^{st} century.

CHAPTER 2

LITERATURE REVIEW

2.1 Creativity

As the creative class theory is fundamental to this study, the six aspects of criticism are reviewed. The introduction summarised the reasons why this research is important; the theoretical framework will not be constrained by Florida's model but instead a comprehensive production function approach is adopted.

2.1.1 Introduction: what is creativity?

According to Scott (2014), creativity is a very difficult word to define as the meaning has frequently been changed by its presumed connection with possessing a great mind and an indefinable genius for the sciences and arts. Nevertheless, there is a generally accepted framework where creativity can be situated between two concrete polarities: one being psychological or internal and the other being sociological or external. With regard to the psychological or internal polarity, creativity could denote outstanding mental capacity and personal talent for a subject, and while some people are gifted others are not. Taking a sociological or external stance, creativity can be embodied in concrete social contexts that shape its character in various ways.

Creativity, in the sociological and economic context, may not be a privilege possessed by a few selected people with superior talents who rarely make mistakes.

Igniting a creative spark could be a step-by-step interconnected process. This includes initial learning, being creative to produce new ideas and a final translation of these new ideas to concrete economic outcomes. Therefore, creativity is modelled by the knowledge and skills of individuals. Amin and Robert (2008) observed that "communities of practice" are driving forces in skills and knowledge generation across various working environments. In other words, individuals may inevitably be constrained by certain factors in their daily environment. They internalise these factors through a further mental process and then reflect back with socially conditioned creative efforts. In the meantime, dense and disruptive communication networks will favour individuals in acquiring a vast range of information and produce greater creative efforts. Taking all these points may lead to one simple fact, that creativity is a social phenomenon. Once again, when defining creativity Scott (2014, p.569) states "*It is in the guise of overlapping physical and social infrastructures and is with dense, polarized and multifaceted transactions*".

Even though Florida has similar thoughts when defining creativity, a greater emphasis is placed on its economic value. Florida added that creativity is not automatically sustained for a long period of time, but requires constant investment in the economic and social forms that feed creative impulse (Florida, 2013, p.23). Creative ideas are economic goods, which can be used on a repeated basis. When used frequently this may lead to growth in values – which is an increasing returns to scale. Unlike physical goods, such as materials which may be depleted, individuals with creative thinking naturally may lead to novel production and useful products. Therefore, it is no longer important who owns patents or physical capital, but is about how to explore the creative efforts of individuals based on specific economic-social forms.

In conclusion, creativity cannot simply be treated as a sovereign emanation from the minds of individuals, but can also be modelled by the complex interweaving of social life, urban amenities and production. In this respect, the purpose of this study is clarified, only focusing on one moment of creativity (external and sociological), whilst exploring its role in the context of social-economic development. This is a meaningful and robust theoretical framework, which will not fall into a protracted debate regarding its definition.

2.1.2 The rise of the creative class

This section reviews how Florida developed the creative class thesis and asks why the so-called creative class or the creative economy is important for us and how the creative class thesis is different from previous theories, such as human capital. Florida provided plausible explanations. He particularly emphasised the relationship between the share of the creative class and employment growth, as well as the factors linked to establishing a sound environment to attract creative workers.

Florida’s first realisation of the creative power was in the age of high Fordism. He was taught a lesson about the possible consequences of management – promoting or squashing creativity – from his father’s working career in the eyeglass-frame business. The factory was originally well operated by experienced workers and self-made managers. However, newly recruited graduates who had considerable knowledge but little real-life experience introduced complicated plans which inevitably failed in practice and brought the whole production to a halt (Florida, 2013, p.64). Furthermore, following a similar observation from a case study conducted in

American and Japanese factories in the 1980s and 1990s, Florida (2013, p.34) emphasised the importance of creative skills. Modern factories no longer only required basic skills such as tightening screws or machining a hem; even entry-level jobs entail problem-solving, quality control or screen-monitoring. Such a complex production process involves not only physical labour but also intellect and creativity. Therefore, workers within a modern economy are coming to be valued according to their contributions to the continuous improvement of products, rather than their performances on routinized tasks.

The theoretical underpinning of the creative class thesis was further complemented by a survey conducted by Florida and his colleagues from 2001 to 2002. Together they constructed a questionnaire survey of information and technology (IT) workers across the U.S., which attempted to answer the following question: “what really matters to your work?”(Florida, 2013, p.69-71). The sample selection was not randomly distributed but the sample size was relatively large: 20,000 in total of which approximately 11,000 identified themselves as staff and 9,000 as management. Even though not all of the creative class which Florida defined later was included, IT workers were certainly part of the conventionally defined creative workers. Unsurprisingly, the results indicated that monetary incentive is indeed important but IT workers were more likely to choose challenge, responsibility, flexibility, peer recognition and location as the primary elements in making them satisfied and happy.

Florida acknowledged that he was not the first one to raise the notion that the modern industrial economy had produced new classes. For example, Fussell (1983) taxonomised many of the attributes that Florida assigned to the creative class, and conceptualised a growing group of the population in the post-industrial society as independent-minded "X" people, who are more likely to devote themselves to "art", "writing" and "creative work". However, he emphasised that the creative class is fundamentally different from these existing class definitions; it is rooted in the changed economic circumstances. The way that connects creative workers together is not only its values and attributes, but also the place it occupies in the economic structure. Therefore, membership to the creative class also follows from an individual's economic functions. Florida (2013, p.38) suggested that *"their social identities, cultural preferences, lifestyles, values and consumptions all flow from this."*

In line with his own studies and other regional development theories, Florida believed we had already reached a "new age", the era of the creative economy. Everything has changed, not only workers but also their workplace, working style, lifestyle, timesheet and how they define themselves. Creative workers are less likely to be free agents and they are reluctant to conform to traditional norms and institutional directives (Florida, 2013, p.56). In this post-materialist society, creative workers work harder and play harder with more flexible working hours. However, they would not define themselves as hedonistic bobos (bourgeoisie-bohemians), who have maverick lifestyles but are less adaptable in the modern workplace (Brook, 2000). They are simply seeing themselves as "*creative people with creative values, working in increasingly creative workplaces, living essentially creative lifestyles and enjoying multidimensional experiences*." (Florida, 2013, p.180)

Florida certainly agreed that skilled and talented people are the driving force for city growth and regional growth. However, what people actually do and their creative occupations are claimed to be a better measure of people's skills than educational attainment and other proxies because they capture utilised abilities rather than potential. In the first edition of *The Rise of the Creative Class*, Florida (2002) classified occupations into the service class, the working class and the creative class.

He further divided the creative class into two components. The first component, which he defined as the super creative core, includes “*scientists, engineers, university professors, poets and novelists, artists, entertainers, actors, designers and architects, as well as the thought leadership of the modern society: notification writers, editors, cultural figures, think-tank researchers, analysts and other opinion makers*” (Florida, 2013, p.38). This is the group of the creative class with the highest order of creative work as they produce new forms and designs that are transferable and widely-applicable. The second component is creative professionals who work in knowledge and technology-intensive industries such as “*high-tech, financial services, the legal and health care professions*” (Florida, 2013, p.39). Although these people are not directly involved in the process of creating new forms or designs, they engage in creative problem solving, based on complex bodies of knowledge to solve particular problems.

In particular, bohemians, comprising poets and novelists, artists, entertainers, actors, designers and architects, are asserted to be quite an important force for the growth of the creative economy too. The bohemian group is the symbol of the creative class as they represent “the geography of cool” and interweave all of the other social and economic factors in economic systems. Mass marketing does not compromise their artistic integrity and they are not only producing values of open-mindedness and self-expression, but also signalling low barriers to entry for other talent and human capital across racial and ethnic lines (Florida, 2013, p.245).

Florida (2013, p.188) suggested that creative workers need to gather into creative cities. It may be deemed true that thanks to technical progress and competition in telecommunications, distance is no longer an issue for us in the modern world as our world indeed becomes flatter. Nevertheless, we have to question if place really is no longer an important aspect for city and regional growth? It appears that many mega-regions drive the world economy such as the Boston-Washington corridor in the United States of America (U.S.) or the Amsterdam-Brussels-Antwerp metropolis in Europe. Such a rapid expansion of cities and urban regions challenges the hypothesis of a flat world. As Jacobs (1961) suggested a long time ago, new types of work and ways of doing things drove economic expansion; however, the city is the motor force behind innovation. In this respect, geography still matters and is an even more important consideration for the creative class

Furthermore, what creative workers appear to want is quite different from our parents' or grandparents' preferences. Rather than preferring traditional physical attractions, creative workers look for quality amenities, openness, diversity and anything else that could be helpful to identify them as creative people. Cities can provide a fertile environment for them as they are containers and mobilisers of creativity, attracting creative workers from surrounding areas while also providing friendly ecosystems and cultural heterogeneity that supports and stimulates creative effort (Florida, 2013, p.201).

Creative people thus need to be located within creative cities. With this in mind, Florida suggested the 3Ts (Talent, Tolerant and Technology) concept for regional economic development. He emphasised that the 3Ts explains well why some cities or regions failed to grow even though they had deep technological or human capital reserves – they had not been open enough and tolerant enough to attract and retain top creative workers in the new era of the creative economy (Florida, 2013, p.229). The promotion of the 3Ts is the core value of the creative class thesis. Florida adopted various indicators to illustrate this concept based on empirical evidence. The first T is technology. In the latest version of the rise of the creative class (10^{th} edition), he extended the original proxy of technology to not only include the tech-pole index (share of workers in high-tech industries), but also patents per capita and average annual patent growth. The second T is talent. The original measure accounted for the combination of both graduates (i.e. human capital) and the creative class (Florida, 2002). However, this received a high number of criticisms (for a detailed discussion see section 2.1.3). Thereafter, Florida excluded the human capital measure (share of college graduates) from the creative class measure (share of creative workers) to solely represent talent. The third T is tolerance, which is illustrated by the bohemian-gay index (share of bohemians and share of a gay population). Florida found a connection between the level of bohemian/gay individuals and the level of economic growth. The bohemian and gay index was positively correlated to regional wealth (house price) in addition to the effect of income change (Florida and Mellander, 2009).

Axtell and Florida (2006) revealed that the population distribution of U.S. cities as well as other advanced industrial countries followed *Zpif's Law*[1], with only a few exceptional cases. While the hierarchical distribution of creative populations also matched this law and the population distribution of U.S. cities, this result supported the law of "*preferential attachment*[2]", in which skilled and productive people attract

[1] *"Zipf's law is a very tight constraint on the class of admissible models of local growth. It says that for most countries the size distribution of cities strikingly fits a power law: the number of cities with populations greater than S is proportional to 1/S"* (Gabaix, 1999, p.739).

[2] In microeconomics, the preferential attachment process is "any of a class of processes, in which some forms of credit or wealth, is distributed among a *number of individuals or objects according to how much they already have, therefore those who are already wealthy receive more than those who are not"* (Surhone *et al*., 2010, p.80).

other skilled and productive people. As the theory suggests, creative people can contribute great skills and talents to regional economic development. Creative individuals prefer an unconventional lifestyle within a diversified community. Therefore, if a place is attractive enough, they will live and work there and thus are more likely to attract additional creative individuals, human capital as well as high-tech based firms and industries, to this place. Finally, more creativity or high-tech based jobs will be created and as they grow, they become the locations for still more creative agents and firms – a virtuous circle.

The original creative class thesis was largely based in the U.S. In the global context, Florida found a similar tendency in the expansion of a creative economy. Although the U.S. has an accumulatively large number of creative workers, its share of the creative class in total employment only ranks twenty-seventh in comparison with the rest of the world. In contract, Singapore, the Netherlands, Switzerland, Australia, Sweden and Finland are countries that have high shares of creative workers. This is generally consistent with other statistics that show that major advanced economies have advantages in technology, innovation and wealth. For example, the overall creativity index is positively correlated with the overall competitiveness index (Florida, 2014).

Finally, we have to consider what the policy implications could be from the creative class thesis. The most important one is that Florida is perceived as wanting more “cool” communities in cities and regions. The presence of the creative class appears to be a crucial magnet and the supply-side foundation upon which creative clusters are built (Peck, 2005). If cities and regions want creative workers to stay, they need to embrace selected amenities to please creative populations (especially young creative workers) and balance their new lifestyles. As a result, we essentially need more authentic historical buildings; walkable streets; many cafes, shops and museums; more arts and live music venues; more indigenous street culture; and other types of self-promotion (Florida and Mellander, 2012). However, spurring creativity should not be to the detriment of the remaining working population who toil in low-skilled and low-wage jobs. Therefore, Florida did not omit to mention the promotion of developing full human potential and creative capacities for every single worker; for example, increasing wages and subsidies for service and manufacturing workers, building more efficient education systems that not only focus on test scores but also on more active learning or encouraging innovation beyond technology and R&D to also include investment in arts, culture and all forms of innovation and creativity (Florida, 2013, p.387-397).

2.1.3 Criticism

This section evaluates the creative class thesis by summarising it into six aspects. Based on the current literature, most arguments mainly focus on the issues of causality, applicability, the definition of the creative class as well as policy implementation. This criticism is linked with the research question and is the reason why the concept of the creative class was adopted but its impact analysed in association with other factors in a different way.

Class, values and assumptions

Since the creative class thesis was put forward in 2002, it has received both praise and censure. Florida proposed a new perspective for us to rethink the contribution of people's skills to economic growth in parallel with existing economic development theories. Nevertheless, its philosophical underpinning, methodology and related policy implementations have received a high number of criticisms.

Firstly, the philosophy that underpins the creative class thesis is questionable. This theory does not involve the use of the Marxian model of class analysis, since it still defines a particular group of people as a "class". Although Florida always advocated the collective values and actions of the creative class, such as the unconventional lifestyles and their common functions in the emerged creative economy, it is not evident that the creative class has a unique position in relation to production and that it is conscious of itself. What are the values of the creative class? Florida's work lacks plausible explanations; rather, these values are pre-assumed through how the creative class makes its consumer preferences (or social and economic impacts) felt, but not in which way they may do this (Pratt, 2008). As a result, the classification of the creative class thesis could be reduced to taxonomy, and we simply jump to accept that cultural assets, such as diversity and tolerance, favour the creative class's presence without any consideration regarding its complex nature in different social forms.

Secondly, many empirical studies draw attention to the causal relationship between economic growth and the creative class. It seems that Florida did not establish an assumption that makes the causality he proposed robust. His simple regression model only indicates a sense of static correlations (Boschma and Fritsch, 2009). Employment growth could be both the cause and effect of the share of the creative class in total employment, while the other indicators strongly correlate with one another and may mark biases that translate poorly in the public realm (Chapple *et al*., 2004). It is possible that what Florida suggested might only be a series of artificial indexes that reflect the creative amenities and economic situations in cities or regions (Montgomery, 2005). If this is the case, these factors of “creative capital” have little explanatory power and are disconnected from economic reality. For example, the U.S. economy far outpaced most of the heavily taxed countries that sit at the top of Florida’s tolerance index, such as Denmark and Sweden, producing new jobs at twice the rate (Malanga, 2005).

Thirdly, the other important assumption of “migration dynamics” was also criticised. Partridge and Rickman (1999) indicated that the relationship between job growth and the number of inhabitants is bi-directional. Recent research has supported this point of view demonstrating the fact that the creative class in Sweden move to places where jobs can be found but not to their bohemian neighbours (Hansen and Niedomysl, 2007, 2009). Manshaden *et al.* (2004) examined the role of creative industries producing luxury goods and services in the Netherlands. He pointed out that creative activities are often involved in this process, so their presence will grow in such environments. This means that creative activities will follow economic growth rather than cause it. Musterd (2006) conducted a European study which also found that the creative class does not avoid cities with a high level of social segregation or lack of tolerance and open amenities. Finally, Scott (2006, 2010) suggested that to a certain extent creative individuals do prefer to move to a place with many amenities, but they are more likely to be motived by greater job opportunities, especially for those who have already invested in developing human capital.

In summary, Florida might have only picked up some suggestive correlations of the relationship between diversity/openness and growth of high-tech/overall employment to confirm his theory. However, as shown earlier, later studies revealed that this highly complex picture cannot simply be reduced to a set of assumptions

(Marcuse, 2003; Clifton, 2008; Markusen, 2006; Borén and Young, 2013; Reese, 2012). In fact, the complexities of the on-going debate over the function of milieu or the creative class itself are much too great to be summarised, with the exception of one consensus, that Florida's model cannot properly explain how the production system of regions/cities and the corresponding stocks of creative capital are frequently specialised (Storper and Scott, 2009; Scott, 2014). If this point of view is true, it implies that even creative cities/regions are still dependent for their growth on their internal productive arrangement.

The creative class and education

Unique characteristics of the creative class concept as Florida asserted are also critically evaluated. Early criticism comes from Glaeser (2005); when using the same database, human capital (i.e. the share of graduates) illustrates similar results to the creative class measure and human capital is in fact the better proxy of knowledge relevant to employment and GDP growth. If the effects of the creative class can outperform human capital, then a positive coefficient should be observed with economic health indicators when both variables are included. However, results from this study rejected this hypothesis. Therefore, it is difficult to gain an understanding of the relationships between the creative class and education, and their impacts on economic growth as they frequently overlap with one another.

Many studies also illustrated similar results. Hansen and Niedomysl (2007) identified a highly correlated relationship between graduates and creative workers in Sweden. Rausch and Negrey (2006) found that the share of the creative class failed to explain changes in gross metropolitan product (GMP) when the education variable was simultaneously involved. Mallender (2009) further investigated the Swedish occupation structure (classified as the creative class, the service class, the manufacturing blue-collar and the fishing-farming category), combined with a human capital measure (educational attainment: low/high) in order to explore whether the creative class is the same group as the highly educated individuals. The results cited a considerable overlap, although not complete, between these two measures.

At the same time, several studies attempted to compare the impact of higher education with the impact of the creative class. In specific contexts, education and other forms of skill development appear to be more important than amenities to economic growth. Based on the datasets from the U.S. Census Bureau and the Bureau of Economic Analysis (BEA), Donegan *et al*. (2008) claimed that traditional measures (e.g. the share of graduates) outperform Florida's 3Ts (e.g. the share of creative class or the location of bohemians) in explaining economic growth (e.g. job change or income change) in 167 American metropolitan areas. However, spending more on schools is not likely to be a direct answer to growth. Public policies should be particularly designed to improve the efficiency of the education system and increase graduation rates in order to achieve long-term growth (Reese and Ye, 2011). Faggian *et al.* (2011) portrayed a complex picture concerning the relationship in the U.S., based on the creative class, human capital and entrepreneurial activities. They believe that the creative class thesis based political implements should be replaced by fostering highly educated workers and the formation of new firms.

In essence, the broad definition of the creative class not only involves occupations that require higher education, but also other technical occupations that have decision-making responsibilities. For this reason, this high level of aggregation causes low construct validity (McGranahan and Wojan, 2007). Should those workers with "little creative thinking" be simply dropped? In the case of bohemian graduates in the United Kingdom (U.K.), Comunian *et al.* (2010) explained that doing so could reduce heterogeneity among occupations. However, this attempt could also lead to misleading results in the empirical analysis, as the creative class as a whole may indeed play a crucial role in local and national economic development.

To conclude, the controversy over how to define the creative class and human capital is still on-going. The main problem is that such a strong overlap between creative workers and graduates, although it has been well discussed in past literature, has not been thoroughly tested based on empirical analysis. Furthermore, it is difficult to ascertain which effects on economic performance are caused by education and which effects are caused by creativity (Boschma and Fritsch, 2009). These overlapping factors may lead to econometric issues; the inclusion of both graduates and creative workers results in multicollinearity. The exclusion of sub-groups leads to omitted variable bias. Either way, human capital effects are inadequately estimated (Marrocu and Paci, 2012). Finally, creative individuals, as the fundamental cause of the development, are only a small part of the creative economy arguments (Sands and Reese, 2013). Either using the concept of the creative class or graduates is in fact only a practical issue that relates to the measure of economic performance. To date, the current debate has not been substantially extended to the role of the education system when shaping new creative workers in the labour market.

Creative subgroups and the creative industry

Florida's (2002) classification of creative occupations conceptualised a suggestive methodology to measure creativity. However, this idea that "*creativity is a* *powerful unifying influence, aligning creative efforts and consumer preferences of very different creative workers*" is questionable (Wojan *et al.*, 2007, p.4). Florida (2002) included a wide range of occupations in the creative class, such as university professors, musicians, artists and scientists, where potentially productive interactions are believed to occur across different creative occupations (Stolarick and Florida, 2006). However, these creative sub-groups were found to be conceptually different based on the Frist Principle Component Analysis in Canada. This indicated that Florida's occupation classification may be deemed as inappropriate (Reese *et al.*, 2010). A definition too broad will result in practical problems, as it is difficult to obtain data based on the level of individuals (Stam *et al.*, 2008). More importantly, the role of bohemians, as the key element in the creative class thesis, appears to be ambiguous. An in-depth case study constructed by Markusen in Minnesota (2006) added that its role in the urban economy is either progressive or problematic. The attractiveness of cities concerning artists is not a result of a response to amenities, but is instead determined by investment decisions that are made by local governments in artistic organisations. Therefore, to define that it has a common cause with other creative occupations, such as scientists, engineers or managers, is not plausible.

With this in mind, it may be suggested that breaking down the creative class into less heterogeneous sub-groups may be ideal when understanding the dynamic process of the knowledge-based economy (Beckstead *et al.*, 2008). Beyond the simplistic evaluation of the whole creative class, many studies have tried to explore the characteristic variations within creative occupations from different perspectives. Asheim and Hansen (2009) divided creative occupations into three groups: analytical occupations i.e. those more scientific climate related, synthetical occupations i.e. those more business climate related and symbolic occupations i.e. those more artistic climate related. Asheim *et al.* (2007) observed the possible differences in preference within the creative class, claiming that suburban areas and smaller cities are more likely to attract engineering based creative occupations rather than those who work in advertising. Krätke (2010) attempted to distinguish creative occupations in terms of their economic functions. He found in Germany that only scientific, technological and artistic creative workers had positive impacts on regional economic performance in the realm of creative innovation-related development paths, unlike the dealer class (e.g. occupations in financial services), the political class (e.g. senior officers in government) and the management class (e.g. general managers).

Other scholars have supported the concept of the creative industry, rather than the concept of the creative class. The theoretical aim of this industry based approach is similar to the occupation based approach, as both are trying to explore and understand the linkage between creative talents and economic growth. However, the definition of the creative industry is considered to be more concise and is more likely to reflect the innovation process of firms, which further effects economic growth (Caves, 2000). There have been several definitions of the creative industries. Generally they can be defined as "*those industries which use individual creativity, skill and talent, creating potential social and economic wealth as well as job opportunity through generation of intellectual property*" (DCMS, 2001). UNCTAD (2010) classified the creative industries into six main categories: (1) advertising and marketing; (2) architecture design and visual arts; (3) film, TV, radio and photography; (4) music and performing arts; (5) publishing; and (6) software, computer games and electronic publishing.

A computation of index for cultural activities may miss its natural complexity. Florida's creativity index reduces the interpretations of the cultural economy to a numerical scale and single “recipe”. As Massey (2002, p.646) puts it, “*the complex articulation of intellectual responsibility with political engagement is a far more difficult, multifaceted and dedicate manner*.” However, this normative type of model could be useful, as the cultural economy may be representative of an amalgam of activities that can be defined as a group with common characteristics (i.e. various individuals who produce generally similar creative efforts). According to Gibson and Kong (2005, p.557), “*the multivalence of the cultural economy requires a balance between agendas, focuses on generalization of macroscale trends and interscalar processes.”*

Further studies tend to compare the role of the creative industry with the function of the creative class. Stam *et al*. (2008) used the same method as Florida suggested, showing that the location of creative industries is strongly correlated with employment growth, while the measure of the creative class generally outperformed the creative industry. Higgs *et al*. (2007) adopted a “trident approach” when describing the Australian creative economy, as it is a combined measure that overlaps both creative occupations and creative industries. Nevertheless, their definition of the creative industry is also not exempt from criticism. Pratt (2008) argued that such a definition (as well as Florida’s creative class concept) places a large emphasis on monetary value, but not on cultural value. This makes the classification and study of the creative industries/economy deviate from its original role and mission. Also, it is a grave mistake to characterise creativity only in terms of individualistic values and not social values. A large focus on occupations simply overlooks the necessarily embedded relationships with industries, production and consumption, and individualises the complex and hybrid phenomenon in the whole production chain.

Therefore, the concept of a cultural industry is more adequate when capturing such dynamics.

Overall, these discussions put forward a critical deconstruction or reconstruction of the concept of creative cities. It is difficult to interpret the findings of these studies in a consistent way, given the obvious differences in the definitions of the creative class, econometric models, institutional settings and control variables. However, no matter how creativity is measured, *"what is clear is that the range of potentialities of creativity cannot be achieved in every place at each time."* (Pratt, 2010, p.19) With this in mind, understanding the dynamics of creativity and its effects on mobility is crucial for further studies. In addition, inspired by a series of studies on creative/cultural industries, attention should also be turned to the role of creativity in various social and economic forms: a new consideration of the ways in which creativity could contribute to economic growth (Borén and Young, 2013).

A hierarchical discrimination

Florida (2002) argued that with the exception of a few dismal cities at the bottom of the creative index list, most larger American cities do have a chance to become creative powerhouses. Even for the small-sized city regions, they can at least have "a shot" if they correctly implement local development strategies based on the essentials of the creative class thesis (Florida, 2002). Since creative people prefer to concentrate in urban regions rather than peripheral areas, it is still necessary for those small-sized regions to enhance creative competiveness in a similar way to the larger cities (Florida, 2003a).

This normative and specifically northern economic knowledge based theory appears to be framed as "global", but has been questioned by many later studies (e.g. Gibson and Klocker, 2004). Many empirical tests failed to capture this proposed role of the creative class and its relationship with economic growth in smaller urban and rural areas. Many non-metropolitan regions have also experienced stable economic growth over the last 20 years even without using Florida's remedy. Nelson (2004) found that the cultural capital and the ratio of students within a population showed a stronger correlation than Florida's 3Ts, which represented employment growth in small Canadian cities. Reese *et al.* (2010) also argued that none of Florida's indicators were significantly correlated with economic growth, as they only showed static economic health in the medium-sized Canadian cities. Stam *et al*. (2008) found that the correlation between the share of employees who work in creative industries and employment growth was insignificant when the biggest metropolitan area in the Netherlands (Amsterdam) is removed from the regression. Ström and Nelson (2009) argued that Florida's suggestion will obviously mislead development strategies for comparatively small cities and regions. Rather than developing infrastructures and amenities to attract creative people, those regions and cities should primarily focus on building social, communication and transportation networks to metropolitan areas, and position themselves as affordable and family-oriented alternative places to live.

Florida's policy framework cannot be commonly applied within different American metropolitan areas. Some of the creative cities in the creative index list were observed as acquiring low job growth rates from 1993 to 2003 in comparison with the least creative cities (Malanga, 2004). From another perspective, the creative industry based approach was used to analyse the characteristics of the major America creative cities (Kolenda and Liu, 2012). The results indicated significant regional variations across the larger American cities. Matching growth of creative employees and their relative share of all jobs, the broadly defined metropolitan area has been further decomposed into three categories. The first category contains creative flight cities, where the share and numbers of creative jobs declined, then the second category and the third category include creative sprawl cities and creative engine cities, where numbers of creative jobs increased but the share decreased, and where both the number and the share of creative jobs increased. They pointed out that it is very important to consider cities' unique advantages first on a city-by-city basis before settling upon specific strategies to attract creative workers.

This discussion leads to one point, that such a population based hierarchy of creativity does exist. The reasons for this phenomenon could be summarised according to three aspects: the choice of indicators, the use of synthetic indicators and the reliance of the model on cities with "critical mass" (Lewis and Donald, 2010). In the Northern American context, which may also be applicable to other economies, the choice of indicators ultimately prevents small cities and regions from becoming successful. For example, the adaptation of the high-tech pole index[3] in the creative class thesis only reflects the degree to which the city specialises in high-tech industry agglomeration with a large share of relative employment, thus automatically favouring a few of the biggest cities. While many indicators in Florida's thesis outperformed traditional ones at the level of direct investment or demographical change, it has to be mentioned as many of these that agglomerate with several factors (such as a foreign-born population plus bohemians and a gay population or a first principle component of both human capital and the creative class to represent a general level of "creativity") are only synthetically designed in favour of some

[3] This index shows local employment in technology-intensive manufacturing and service sectors (Clifton, 2008).

particular types of studies. Therefore, these variables with combined effects naturally outperform unitary variables.

In conclusion, the majority of studies still rely on basic analytical models. In the case of either the simple pairwise correlation test or the OLS regression, the different sizes/scales of analysis units and the effect of time trend cannot be controlled for. It may be argued that Florida's creativity indexes or the whole creative class thesis is just synthetically made and may only reflect the facts of static economic situations, in particular regions with "critical mass", but it is too farfetched to make such a conclusion now, given the constraints in databases and analytical techniques.

Old wine in a new bottle?

Even though certain cities already have a high creativity index list, the majority of cities can hope to turn themselves around if they move in the right direction. Florida's index table constitutes a new wave of competition in generating creative advantage among American cities. Furthermore, Florida cannot wait longer to apply his theory globally. Florida and Tinagli (2004) insisted on creating a map of the geography of the European creative economy and, less surprisingly, with similar and alluring recommendations: what is important to economic growth is only partly related to trade or the flow of physical capital, but is mainly about the flow of talent. The U.S still remains the leader in technological development, and continuously benefits from its long-standing ability to attract creative talent from around the world. In comparison, some European countries are successful too (e.g. Sweden, Finland and Demark) while some are still attempting to be (e.g. the U.K.). European economies are one step behind the U.S. in attracting creative talent but this advantage seems to be shifting from the U.S. Thus, a great opportunity is presented to European policy makers: if they are able to attract creative talent, they will be able to enjoy the economic benefits of creativity.

However, Peck (2005) criticised this promotion strategy as being old wine in a new bottle. Improving local amenities, building more cultural facilities or even having more “hippie” neighbours are all similar to the old-fashioned entrepreneurism or consumption-oriented urban development strategies for capital accumulation in the late 1980s, such as a series of competitions for mobile public and private investment among American cities.

The accelerating retreat of the Fordist economy lies in the simple fact that the traditional manufacturing activities had declined in developed economies. Rather than continuing to agglomerate in the industrial cities, industries moved away to look for cheaper labour sources and properties. The problem was that the former manufacturing workers became unemployed and these cities were again experiencing a dramatic re-adjustment of economic structure (Sassen, 2001, p.22-25). Currently, one of the influential arguments is that the comparative advantage cities have is their experience. In the book *The Experience Economy* (Pine and Gilmore, 1999), the discussion about urban/regional economic growth was extended to the promotion of creativity and consumption. With very limited socially political options, more and more policy makers have begun to embrace this framework. As Harvey (1989, p.7) puts it, they started to simply “use *investment and economic development with the speculative construction of place rather than amelioration of conditions within a particular territory as its immediate political and economic goal*.”

In order to attain a competitive position, one of the feasible options for a city region is to emphasise the improvement of consumption, since consumers have more money to spend and have greater opportunity to be discriminating. In this respect, the competition to attract consumer spending becomes frenetic and improving quality of life becomes a routinised process, including turning to post-modernist styles of architecture and urban design, more convention and shopping centres, marinas, exotic eating places and entertainment venues (Harvey,1989, p.9). However, none of these methods substantially increase the aggregate amount of investment, only the rate of capital circulation.

Peck implies this rapid adoption of urban creative strategies is an enduring legacy of entrepreneurial urbanism. Many cities and regions have tried almost everything in the last two decades to retain economic growth, thus there is no harm in embracing this new strategy. It was possible to map it onto the existing policy framework as a complementary plan because it is modest and not revolutionary, as well as being inexpensive to implement (Sands and Reese, 2008). The creative class thesis fits in perfectly with this fast policy market and pleases those successors of urban neoliberalism and entrepreneurialism.

It appears that Florida and his followers advocate pursuing the endless creative advantage. Cultural artefacts are then repackaged as competitive assets and are only evaluated by their economic values. Some gentrifying urban areas were subjectively selected as examples for preferable forms of creative action, hinting that places can be a part of the creative economy and must act now. With respect to this, Peck (2005, p.768) concluded: "*with incredible material pay-offs, the cult of urban creativity is therefore revealed in its true colours, as a form of soft law/lore for a hypercompetitive age*".

Social restrictions, gentrifications and regressive policies

Another line of argument draws attention to the side effects of these creativity-engendering urban development policies, namely, the chain reaction from social restrictions. In the classical Fordist society, the whole workforce is divided into white collar and blue collar types, which is not very subtle but is a well-accepted concept to represent different functions and roles in production. This division of the labour force was projected out into intra-urban spaces where neighbourhood distribution corresponding to this pattern can be observed. According to Florida (2002, 2005, 2008, 2013) or other urbanism advocators (e.g. Landry, 2000; Glaeser, 2011), the creative cities theories brought us to a new stage where the traditional labour force division is being overridden by a new dimension; on one hand, the creative class/human capital and the low-wage services/low-skilled underclass on the other.

No matter how these human capital assets are defined, these urban development theories became extremely popular were to a great extent applied in practice in many countries, leading to a significant rearrangement of urban geography within neighbourhoods. According to Scott (2006, 2014), the top half of the urban labour force is valorised as a privileged group that has the most important technical knowledge, analytical skills and social-cultural know-how to facilitate economic development. In contrast, the rest of the workers are only given a supporting role, as they are deemed to directly and indirectly provide basic services to meet the demand of its upper echelon (e.g. the creative class/high-skilled workers). However, the cultural skills of the service underclass are simply overlooked.

Bolton and Boyd (2003) argued that the traditional skill paradigms fail to provide an accurate understanding of the skills required in service occupations. For a long time proxies of skills such as educational attainment or formal education were treated as skills themselves, thus making a comprehensive discussion about the necessary skills in service occupations difficult. In fact, many of the service occupations have their unique values, which cannot be replaced by technology or easily outsourced since they require service work, emotional labour or caring labour that the worker personally performs (Gatta *et al*., 2009). For example, interactive service work can be successfully completed depending not only on routines and scripts but also additional skills. A waiter in a restaurant needs to welcome customers, place orders using computers, bring food and collect used plates as efficiently as possible at any given time in order to avoid unnecessary trips to the kitchen and provide customer services. Such a process is far from simple, routinised work; it integrates emotional, cognitive, technical and management skills, performed at high speed with various levels of complexity and autonomy within or across different work settings.

As a result, the undervaluation of those socially marginal working groups has, to a great extent, influenced the direction of the urban development agenda over the last decade. Supported by overzealous city councils or urban development planners, the boost for the creative economy seems to deviate from the original goal, becoming a harbinger of gentrification. This phenomenon may be a feature of the post-industrial economy, as more knowledge-intensive workers in financial, media or entertainment sectors gradually replaced the original manufacturing employment. However in many cases, it also reflects the rapid expansion of a new economy. With the renovation of local property and the increase in cultural facilities, the incursion of the bourgeois only leads to more severe social-spatial segmentations around cities. In the meantime, the booming nature of the creative economy seems to have little impact on social inclusion and income redistribution (Scott, 2014).

Such a negative impact of gentrification has been exposed in various contexts such as in the cities of Cape Town (Booyens, 2012), Berlin (Jakob, 2010), New York (Intergaard, 2004), Shanghai (Zheng, 2010) and to some extent Beijing (Ren and Sun, 2012). It is ironic that the development of creative sectors has been stunted largely due to the gentrification process in "creative quarters" in these cities. On one hand, the creative economy advocates the concept of tolerance and diversity, but on the other hand, the majority of the local population is frequently excluded from these developments. Ultimately, the whole plan becomes farcical, which only benefits the already profitable local property market (Jakob, 2010).

Creativity occurs when interdependent processes of learning, creativity and innovation are situated in a concrete social relationship. However, many existing research fails to properly catch this point and leads to regressive policy recommendations. Scott (2014) proposed the concept of cultural-cognitive capitalism, adding that it is only an epiphenomenon that creativity emerges out of complex social and physical infrastructures. As he further noticed, what matters to prosperity and growth is still the intensifying interplay between culture, cognition and economy. Therefore, the challenging task for urban economists is how to harness and regulate urban realities in the interest of a progressive future.

2.1.4 Florida and supporter's counterattacks

In a bid to confront criticism and challenges, Florida related some notable studies from the decade following the initialisation of his theory in 2002, to defend his position. In the latest edition of *The Rise of the Creative Class*, Florida upgraded most of the indicators that he used in 2002. He showed that during the period of economic crisis, the creative class enjoyed a significant growth compared to the working class and the agricultural class in the U.S. In the American case, the creative class grew by 2.8 million workers in the period 2001-2010. The working class shrunk over the same period from 32.2 million to 26 million. The creative class was inevitably impacted by the economic crisis between 2008 and 2010, decreasing by 700,000 workers; however, this figure is still less than half that for the working class (Florida, 2013, p.50). In one recent study, Stolarick and Currid-Halket (2013) added that the regional unemployment rate is negatively associated with the size of the creative class in American regions, while graduates have a similar relationship with unemployment but to a lesser extent. In other words, the creative class faces less risk of unemployment during a recession period.

One of the most vocal criticisms is from Edward Glaeser (2005). As mentioned earlier, he used the same dataset as Florida's colleague Stolarick and then concluded that big multicollinearity problems meant that the creative class measure suffered when the human capital measure is included at the same time. Florida (2011) explained there is an inevitable overlap between human capital and the creative class, but these two measures have different perspectives regarding economic and social progress – the measure of the creative class relates to what people do while the measure of graduates (human capital) relates to what people's potential is. He referred to the data from the American Statistics Bureau, saying that 59.3 percent of the creative class in the U.S. have a college degree or above, while 72.2 percent of human capital is in the creative class (Florida, 2013, p.40). Even if the specific group of creative workers who all have university degrees are considered, the analysis angle of the creative class is still quite different from that of human capital. However, whether creativity or human capital would contribute more to skill formation for a worker is unclear (Marrocu and Paci, 2012).

Florida argues that Glaeser should talk to other education experts about how the traditional education scheme hinders creativity because Glaeser misunderstood the functions of the creative class. Other independent studies also support the creative class measure, for example McGranahan and Wojan (2007), based on simultaneous equations, re-evaluated the American regional data in recent years. Their findings verified the significant contribution from the creative class to regional economic growth, an effect which is even more powerful than human capital and is independent. A similar conclusion was also obtained by Marlets and Van Woerkens (2004) in the Netherlands; it indicated that the creative class is a better predictor of a city's growth than traditional educational attainment. Florida finally notes that he never disagreed with the role of people's skills in regional economic growth and that human capital theory is not competing with the creative class concept. They can be complementary and make contributions in different channels. In this case, the presence of human capital is positively correlated with income growth, while the increasing share of the creative class is more likely to be associated with improvement in labour productivity (Florida *et al.*, 2008).

Other critics questioned the possible connection between the existence of the creative class and regional growth. Malanga (2004) in her famous article *The Curse of* *the Creative Class,* stated that it looked like Florida's top ten cities in the U.S. were suffering growth stagnation while some of those cities that he defined as being the least creative continued to look like economic powerhouses, expanding 60 percent faster. Correspondingly, Florida (2004) further refined the sample of American cities to include only those with a population above one million. In a comparison of the top 11 most creative cities and the 11 least creative cities, the most creative cities generated at least three times as many jobs as those with the lowest creativity index ranks. Also, the leading cities added 100 billion dollars to the wage bill, which is five times more than the lowest ranked cities. "*Which city would you like to put your money on*?" Florida asked. Would it be Las Vegas, which enjoyed rapid population and job growth, or the top creative centre of San Francisco? The fact shows that Las Vegas was seriously hit by the economic crisis in 2008, experiencing one of the worst house price crises and a very high unemployment rate; however, the situation in San Francisco was not as bad in comparison (Florida, 2013, p.258).

Florida said that it could be very misleading to take population growth as the primary indicator to measure economic growth. In fact, population growth is quite different from economic growth. A region with a very high expansion rate is not equivalent to a "wealth builder". Real economic growth is not population growth but improvement of productivity. In later research (Florida, 2011), Florida analysed the correlation between productivity measured by economic output per capita and population growth in 350 U.S. cities in the period 2001-2010. The results indicated that there is no association between these two variables.

Responding to criticism about his basic assumption that "jobs follow people" as well as the causality among regional growth, the creative class and other indicators, Florida explained that such a proverbial chicken-and-egg problem is a false dichotomy. Skills and skilled people are mobile factors of production. They flow from one place to another. Therefore, the primary focus of his study is to identify what factors could shape this flow and the level of divergence across regions. For instance, in his article *In the black box of regional economic development* (Florida *et al*., 2008), he adopted the structural equation modelling (SEM) technique to capture both the direct and indirect effects of the creative class to regional economic growth.

However, Florida cannot provide substantial explanations to dispel the doubts related to social inequality, peripheral development or how his concept could be effectively applied to the global context. Even his own research has to accept the fact that there is a positive relationship between creative class agglomeration and the social polarisation in the U.S. (Catalytix and Richard Florida Creativity Group, 2003). Florida's later interpretation of the features of the creative economy indirectly gives answers: firstly, the more creative and innovative a country's economy is, the more of an economic edge it enjoys; secondly, the typical U.S. model shows a high level of socio-economic inequality, which is a somewhat unique case. This phenomenon was mainly caused by poverty concentration in the past and not to improvement of technology and changes in the skills required (Florida, 2013, p.279). Finally, other economies have different features compared to the U.S. It seems that the U.S., along with the U.K., Singapore, New Zealand and Australia, has a problem with social inequality during the creativity-engendering process while the northern European countries do not. Based on a pairwise correlation test between his synthetic creative index and the index of income inequality for the main European countries, Florida (2014) can only draw a reluctant conclusion: "*the Scandinavian case potentially points a way towards the more broadly shared prosperity, one that can draw full* *creative development for every human being while causing far less severe economic-social divides*".

In conclusion, the academic work on the topic of creative cities has been expanded to a very detailed level using more sophisticated analytical models. The follow-up studies, however, are mired in the dichotomy between policy – supportive literature celebrating the advocacy of creativity and critical literature rejecting the roles of creative occupations in the context of urban development (Borén and Young, 2013). It seems that the current academic critiques draw too much attention to the dangers of the ways in which creativity is currently interpreted and adopted by urban policy makers, but this debate overlooks one substantial research question: how creativity could be used in productive ways. Unfortunately, only a few theoretical suggestions can be seen with little empirical evidence supporting these stances.

2.1.5 What are the implications for studies in the future?

In line with the above discussions, the following aspects are summarised as the remaining issues for the research. First and foremost, there is still a lack of evidence to support the series of causal relationships that Florida put forward. This dilemma is not simply caused by the natural deficiencies of the creative class thesis; it is of high probability due to the limited applications of advanced analytical models. For instance, the majority of current research only relies on the cross-sectional frameworks and many practical issues, such as endogeneity or the long-run effect, are not taken into consideration empirically.

Secondly, it is undeniable that the definition of the creative class as including a range of different occupations is a vague concept to represent features that a particular sub-population may have in common; however, the advocacy of excessive subdivision is also challenged. In-depth breakdowns of a list of occupations may result in many practical issues when applying them to survey data. Given too detailed decomposition, very limited observations may inaccurately estimate relative shares or levels, so meaningful results may be difficult to obtain.

Thirdly, the current debate over the role of creativity in the urban/regional economy systems has not been extended to empirical applications. Although many scholars drew attention to its embedded relationship with other factors in the production system or the matter of social inclusion, current empirical analysis does not relate to any economic theories and is not further linked to urban realities. Also, it is not clear what the role of the education system is in producing creative workers whose skills are supposedly commensurate with the needs of the creative economy.

Finally, the creative class thesis is primarily based on North American practices. In Europe or other emerging economies, different institutional settings, methodologies and research perspectives impede us in drawing conclusions in a consistent way. In association with the above three unresolved issues, the study of the creative economy in Europe seems to be only at the primary stage. With respect to this, the discussion will now move to a detailed evaluation of the roles of ICT in the economic system, in an attempt to give reasons why ICT policies can be coordinated with the creative class thesis to give a better understanding of sustainable economic development.

2.2 ICT

In this section, the ICT-related theories are mainly introduced from two perspectives: (1) why ICT is also important (its impact on economic or productivity growth); (2) why its coordination with the creative class is plausible and feasible (its complementary role to skilled workers). The review of literature in this section echoes the previous discussion of the creative economy in this thesis.

2.2.1 Introduction: what is ICT?

As a complementary theory to economic growth, this section will mainly look into the contribution of ICT to productivity growth and its interactive effects with people's skills. Later, ICT will be related to the creative class thesis. The definition of ICT is also difficult, although a greater consensus now exists on how it should be measured than is the case for creativity. The term ICT initially appeared for research purposes in the 1980s and then became a more popular research field in the late 1990s. Generally speaking, Information and Communication Technology (ICT) can be defined in various ways based on different applications. For example, the World Bank defined it as "*the set of activities which facilitate by electronic means the processing, transmission and display of information*" (Rodriguez and Wilson, 2000, p.5), or "*various set of goods, applications or services used for producing and transmitting information, including telecoms, TV and radio broadcasting, hardware and software and electronic media*" (Marcelle, 2000). ICT also may

> *…reshape, reorganize and fundamentally restructure working methods, and ultimately the sectors in which they are used and they offer generic advantages of efficiency gains, information-sharing, communication and faster knowledge accumulation, dissemination and application, in support of the specific purposes for which they are used.* (UNCTAD, 2002, p.3)

Therefore the application of ICT can be seen as a complementary way to improve economic efficiency.

The impacts of ICT were evaluated in various research fields such as IT development, education, commercial science or economics. Using national accounts, ICT capital stock or ICT capital service flows are widely accepted as a benchmark for analysing its possible impacts in the field of economics. According to the report from the United Nations (2002), the diffusion of ICT and growth in the OECD countries has been notable since the mid-1990s. After 1995, the growth rate of ICT capital per worker entered double digits in the G7 nations (Jorgensen, 2005). This upward growth trend can be also captured in other less industrialised European countries and newly emerging economies in Asia. For instance, the contribution from ICT investment in China is significantly increasing, with 0.17 percent in total output growth before 1995 and 0.63 percent afterwards (Jorgensen and Vu, 2005).

2.2.2 Growth accounting: from Solow's paradox to ICT-driven productivity growth

The economic impacts of ICT have been systematically examined by a growing body of literature. Many of the early studies found no or a negative impact of ICT on productivity (Baily, 1986; Roach, 1989; Panko, 1991), a situation which leads to a temporary conclusion that *"computers were everywhere but in the productivity statistics"* (Solow, 1987). According to Bertschek and Kaiser (2003), the reasons for such a paradox can be summarised as follows. Firstly, most of these studies only focused on labour productivity but not multifactor productivity and were mainly based on private databases. Secondly, the measure based on productivity statistics failed to capture high returns to ICT capital. Finally, the impact of ICT takes time to emerge; a diffusion of technology is always slow. Firms often take a long time to absorb technology and combine it with other complementary changes in production methods, such as employee training or organisational change.

Shortly afterwards, the positive role of ICT for economic development came to the fore in the U.S. in the mid-1990s. The economic growth resurgence in the U.S. after the mid-1990s received considerable press attention, particularly compared to the first half of that decade. Sceptics, such as Gordon (1999; 2000), argued that this success only reflected a series of favourable but temporary shocks, while other studies took a keen interest in the diffusion of ICT. The dramatic price decrease in computers, semiconductors and communication equipment in the U.S. significantly stimulated the demand and usage of ICT from both firms and households.

The transformation in the structural change of the U.S. economy is obvious. In the period 1959-1973, the contribution of computer and related services was less than 0.1 percentage point in total output growth in the U.S. Since 1973, prices of computers dropped at a historically unprecedented rate so that intensive use was more realistic for households and firms. After 1995, the decline in prices for computers and other software and communication equipment accelerated and correspondingly, its contribution to output jumped to 0.46 percentage point in total output growth (Jorgensen and Stiroh, 2000, p.126). Despite different methodologies, databases and research perspectives, many studies of ICT reached a similar conclusion (Oliner, 1993; Oliner and Daniel, 1994) that exceptionally rapid technological progress in ICT had a significant impact throughout the U.S. economy and also contributed to Total Factors Productivity (TFP) improvement. Jorgensen and Stiroh (2000) further added that faster and low-priced computers with semiconductors also improved labour productivity elsewhere during the capital deepening process as firms and households used them more frequently. Nevertheless, a further refinement of ICT measure was necessary, especially in connection to constant-quality price, industrial and across country analysis. Although productivity growth in ICT production in the U.S. after the mid-1990s is responsible for a sizeable part of the overall productivity growth, the industry-level productivity growth from IT sector production was not identified.

Based on continuous data improvement in terms of an internationally harmonised price index and an improved constant-quality price of ICT capital, the follow-up studies were no longer constrained to the U.S. and had been extended to a global context. Research findings reveal that not only in the U.S. but also in other developed countries, both high investment in ICT after 1995 and productivity growth in the IT-producing industry accounted for a large portion of economic growth in the late 1990s (Gust and Marquez, 2004; Jorgenson, 2005).

Similar results can be also obtained for a particular country or group of countries at different levels. For example, Oulton (2002) adopted Jorgensen's Growth Accounting method to evaluate the whole U.K. economy in the period 1979-1998. He found that the contribution of ICT to GDP growth increased from 13.5 percent (i.e. contribution points of ICT divided by total output growth rate) in the period 1979-1989 to 20.7 percent in the period 1989-1998. Biscourp *et al.* (2002) used company based data, aggregated at industry-level in France, to complement the insufficient evidence regarding the ICT contribution from a microeconomic approach. Their findings are also clear: the use of ICT and ICT production made a substantial contribution to value added output growth, showing a 0.7 percentage point on average in the period 1987-1998 out of total GDP growth of 2.6 percentage points.

However, on average the slowdown of productivity in Europe contradicts the situation in American since 1995. Van Ark *et al*. (2003) found the decrease in TFP growth occurred in all sectors as well as services, while the particular services sectors with a high level of ICT application still kept increasing their TFP. This finding suggests that the investment in ICT may not be the only reason explaining the differences of TFP between Europe and the U.S. In follow-up studies, Inklaar *et al*. (2008) and Van Ark *et al*. (2008) used the EU KLEMS data, showing similar patterns as the slowdown of productivity in European countries is largely due to the slower growth of TFP in market services. Thus, Europe needs to find new mechanisms to stimulate service innovations for a greater TFP growth, such as development of human resources, more efficient change of organisational structure or high investment in other intangible assets (Timmer *et al*., 2010).

In conclusion, the resurgence of productivity in the U.S. since the mid-1990s draws our attention to the role of ICT. Mainly based on the growth accounting approaches, the contribution from ICT capital deepening to labour productivity growth is globally evident, but it seems that such a relationship between technology and productivity is not that straightforward. In many cases, increasing investment in ICT is not the major source of productivity growth. Therefore, many studies shifted attention to the importance of the complementary investments, such as improvements in organisational structure, human resources or other intangible assets development, as these perspectives could be meaningful in understanding such a discrepancy.

Moreover, there are many well-known issues regarding the growth accounting approach. According to Boselli (2010) and Fernald and Neiman (2010), it describes but it does not explain; in fact, analysis based on this technique does not obtain the causal relationships between different factors in the production system. Also, assumptions such as constant returns to scale or constant wage rate of labour and rental rate of capital is argued to be too strong. Finally, the externalities of ICT, which are possibly hidden in the TFP, cannot be measured by this theoretical framework.

2.2.3 Econometric analysis: a future discussion outside the production of ICT goods

In response to the above discussions, econometric analysis is an alternative approach to growth accounting and has been more frequently applied in recent empirical analysis. Given that many of the measurements of TFP acceleration occurred outside of the production of ICT goods (Basu *et al*., 2004), another stream of studies started to focus on its possible GPT (General Purpose Technology)-like features; if this hypothesis holds, ICT investment in one sector should cast positive spillovers into other sectors, but with some time lags.

On one hand, such a hypothesis can hardly hold. Acharya and Basu (2010) constructed a comprehensive dataset for 16 OECD countries, involving 16 industries over a period of 32 years. They found evidence of intangible capital accumulation but no evidence of positive spillovers from ICT. In the context of the European Union, Van Reenen *et al*. (2010) identified a spillover effect of ICT in terms of technology adoption. It implied that “neighbourhood” firms could induce more ICT adoption through the learning process or network effects, but the direct externalities that lead the market to under-supply ICT are not clearly captured. Moshiri and Simpson (2011) adopted the multi-level model to analyse firm-level data in Canada. Their results indicated that the usage of computers has significant influence on productivity improvement at the firm level but again, spillover effects are not significant.

On the other hand, a whole stream of literature confirmed the existence of spillovers to ICT. Van Leeuwen and Van der Wie (2003) provided a contrasting conclusion against the growth accounting approach. They said that in the case of the Netherlands, the spillovers of ICT were an important source of TFP growth. Severgnini (2010), based on the data of manufacturing firms in Italy, found positive externalities of ICT and that the most productive firms are the recipients of ICT spillovers. Rincon *et al.* (2012) further added that based on firm-level data in the U.S., the intra-industry ICT spillovers are contemporaneously negative to productivity growth; however, these spillovers become positive after a five-year lag and the inter-industry ICT spillover is significant both in the short and the long run. Basu and Fernald (2007) also confirmed the lagged spillover of ICT. Based on BLS data on capital by industry, those industries with high ICT capital growth in the 1980s or early 1990s did not have contemporaneous TFP growth but instead had a lagged one in the late 1990s.

In conclusion, although the crucial role of ICT in the formation of the new technology based economy can be identified, problems from an aggregated dataset, such as model misspecification, incorrect measure or other econometric issues, result in quite inconsistent conclusions (Van Reenen *et al*., 2010). In general, ICT spillovers are insignificant and unstable across time and countries at aggregate levels. Again, according to Boselli (2010), one of the plausible explanations is that firm-level data can reflect the reality of the increase in market share of more productive firms. Even if two firms invest in the same level of ICT capital, their productivity growth could be different depending on their capacity to introduce complementary organisational changes. Eventually, lagging firms will either leave the market or catch-up with leaders due to market competition. In contrast, analysis at the industry level inevitably integrates both lagging and leading firms so the contribution of ICT could be underestimated.

Further research is still necessary to understand these controversies. While labour inputs at this stage are still treated as homogenous, considering the differences in occupations and levels of qualification will bring more complexity to understanding the productivity potentials of ICT.

2.2.4 ICT: job polarisation and complementary investments

While many studies focus on the effects of ICT on labour market structure changes and associated productivity gains to ICT use, the idea of skill-biased technological change (SBTC) has been used to understand the employment shift towards more educated and skilled workers. SBTC was initially described as a growth in demand for high-skilled workers and a decrease in demand for low-skilled workers. However recent studies show a different pattern where demand for both high-skilled and low-skilled workers increased and only demand for medium-skilled workers decreased in the different contexts such as the U.S. (Autor *et al.*, 2006) or the U.K. (Goos and Manning, 2007).

The reasons for such job polarisation in the developed countries can be summarised in three aspects. Firstly, it is led by the trend of globalisation, and in particular, the offshoring of services is an important source of employment structure change (Crin`o, 2010). Secondly, job polarisation could be related to income inequality. For example, Mazzolari and Ragusa (2007) found that at the city level, a higher share of high-skilled workers is associated with a higher fraction of low-skilled workers in non-tradable time-intensive services. This finding suggests strong spillovers from high-skill consumption to the low-skilled labour market in the U.S. since 1980. Finally, and most relevant to ICT use, is the use of technology, which is becoming more intense in non-routinised tasks concentrated in high-paid and low-paid service jobs, at the expense of routinised tasks concentrated in middle-skilled based jobs (Goos *et al.*, 2009).

In an influential paper, Autor *et al.* (1998) proposed an interesting research question. Although the relationship between ICT and skilled workers is well-documented, what is it that computers do, or what is it that people do with computers? Correspondingly, an experiment was designed to compare the routine tasks and non-routine tasks of workers in industries that had previously been labour-intensive but had adopted ICT wholesale since the quantity-adjusted price of ICT was decreased. With a theoretical dedication based on a revised production function model, a marginal worker reallocates their labour input from routine to non-routine tasks and the increase in demand in routine tasks is only met by an influx of computer capital. Although the supply of routine tasks decreases, inflow of computer capital compensates for this and consequently there is a net increase in the intensity of routine tasks input in production.

The following empirical tests in this study proved this theoretical demonstration. It revealed that since the 1970s, the labour input of routine or manual tasks was declining while the labour input of non-routine tasks rose in the U.S., and changes in the employment structure favoured non-routine tasks to routine tasks. Therefore, ICT is, to a certain extent, complementary to non-routine tasks but a substitute for routine tasks. Many of the routine tasks were traditionally undertaken by low-skilled workers while many of the non-routine tasks involved highly-skilled ones, such as financial institute managers or university professionals. However, for many of the middle-skilled workers, such as bank clerks, who also participate in routine tasks, the difference is that demand for these occupations appears to be replaceable during the computerisation process. In comparison, low-skilled workers are hardly influenced by technological progress, for example taxi drivers or manufacturing workers.

The hypothesis of SBTC was also tested by other studies from different perspectives. Michaels *et al.* (2010) generated data not only for the U.S. but also for Japan and nine European countries over 25 years. They found that industries with high growth in ICT also had high demands for higher education, but a fall in demand for middle education. O’Mahony *et al.* (2008) focused on whether the SBTC is transitory or permanent over time. In the case of the U.K., the U.S. and France when comparing different skill categories in the 1980s and 1990s, they found, at least in the U.S., that the demand for highly-skilled workers caused by ICT growth is slowing down. This is consistent with the transitory interpretation of the technological progress process.

Most studies do not substantially link ICT use with the increasing demand in skilled labour when explaining output growth or productivity, while some recent contributions have been looking at this issue. Murphy and Traistaru-Siedschlag (2007) used a dataset of 20 OECD countries over the period 1980-2002. By a system of simultaneous equations, they found that countries with higher human capital stock/improvement experienced a faster growth in ICT-producing manufacturing and ICT-using services. Forth and Mason (2006) used survey data in the U.K., which shows that a shortage of ICT skills indirectly and negatively impacts firms' performance, namely the level of ICT adoption and utilisation. Van Reenen *et al.* (2010) ran a series of regressions in different perspectives, showing that complementary intangible assets significantly impact the effect of ICT, such as management practices, firm decentralisation and stock of highly qualified employees. Finally, Hempell and Zwick (2008) measured the linkage between firm performance and ICT use. They found that ICT applications facilitate the organisational flexibility and then this increasing flexibility stimulates the innovation capacity of a firm.

In conclusion, the discrepancy between ICT investment and productivity/ output growth leads to a further wave of discussions of ICT down to the micro level. With the evident phenomenon of SBTC, the increasing complexity of ICT applications increased the necessity for complementary assets. Recent studies had already paid attention to this topic and believed that policy interventions in human capital development will increase the return on ICT investment. Nevertheless, findings at the micro level vary significantly depending on the econometric model, model specifications and sample selections used. How could we better connect the findings at the macro level and at the micro level? Finally, the job polarisation literature needs to be connected to the creative class thesis. Creative workers by definition are undertaking the most non-routine tasks and so computers cannot act as a substitute. However, the current debate over ICT policies has not coordinated these two policy areas, thus demonstrating the need for further research.

2.2.5 What are the implications for further studies?

The following aspects are summarised as the remaining issues requiring further study into ICT. Firstly, over the last two decades, ICT has been one of the important sources for output and productivity growth. However, various analyses based on country, industry and firm levels showed largely different findings in their contributions. Is ICT-driven productivity/GVA growth temporary or permanent?

Secondly, the growth accounting approach showed us that since 2004, ICT productivity/GVA growth slowed down in many contexts. Is this mainly caused by the limited capacity of current models in measuring intangible assets such as human capital, management or organisational practices? How can we efficiently develop the potential of ICT?

Finally, firm-level estimations generally suggest greater impacts of ICT on output/productivity growth, whereas discussions at the micro level only tell us part of the story. How can we better connect evidence at both the macro and the micro level to discover possible channels which the application of ICT could more efficiently impact on aggregate economic growth? Therefore, referring back to the suggestion at the beginning of this thesis, to capture the externalities and complementarities between ICT policies and other policy areas, more evidence is needed which may require going beyond the scope of the current debate.

2.3 Hypothesis

From different perspectives, the thesis incorporates the hot topics regarding the creative class arguments, trying to answer that (1) what the creative class can do (2) what the creative class likes and (3) where the creative class comes from. Following this theoretical framework, the thesis analyses these three research questions in Chapter 4, 5 and 6 respectively and the related hypotheses have been constructed as below.

2.3.1 Theoretical framework

These challenges are addressed head-on, helping to shift the dialogues from the narrow focus on competitive advantages and economic growth to a broader focus on urban/regional realities. **Figure 2.1** shows the evident potential linkages between the creative class thesis and ICT-related theories. The notion of the creative economy requires a more robust theoretical framework, while the role of ICT has to be understood beyond the scope of current studies.

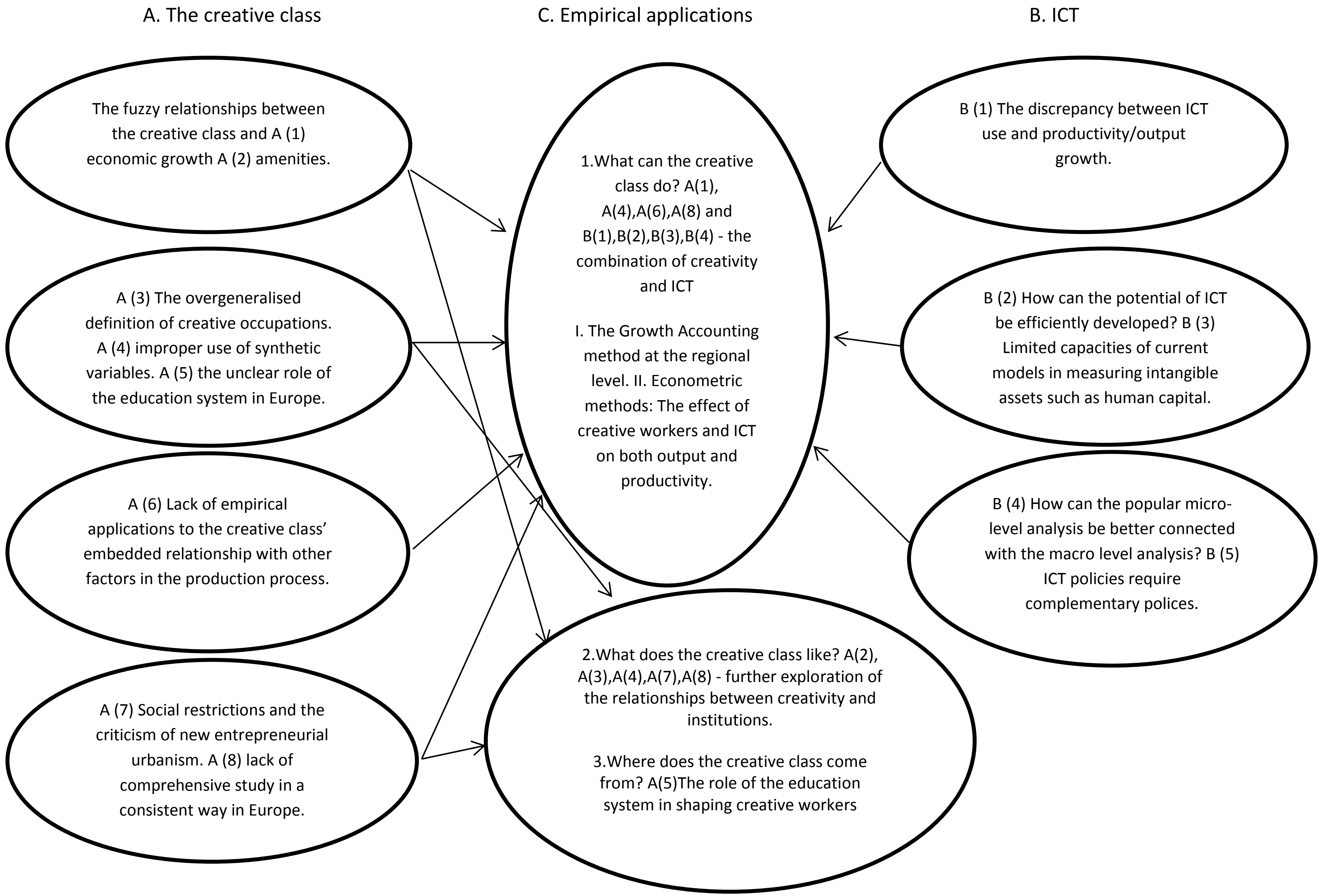
The structural framework for this thesis generally includes two broad aspects, which are related to the specific roles of the creative class in production (i.e. what can they do?) on one hand and its specialised consumption preferences (i.e. what do they like?) on the other. With regard to production, the crucial problems for the creative class are A (1) how to identify the causal relationship with economic growth and A (6) how to empirically evaluate its embedded relationship with other factors in a production system. These issues are to a certain degree responsive to the main issues of ICT-related studies such as B (2) how to efficiently develop the potential of ICT and B (5) the current ICT policies which require complementary policies. With regard to consumption, the specific issues are A (2) how to identify the relationship between the location of the creative class and amenities and A (7) the criticism for social restriction. The rest of the problems can be allocated on both sides, including A (3), A (4), A (5) and A (8). Finally, A (5) is particularly discussed in Chapter 6, concerning the research question “where the creative class comes from”.

In conclusion, a flexible theoretical framework was developed, coordinating different theories that systematically evaluate the functions of the creative economy. It is expected that such integration will help to understand the substantial role of creative workers in an economic system and form a better understanding of creativity. This will in turn enhance our knowledge about the potential of ICT. From another perspective, the separation of production and consumption leads to a particular focus on the behaviours of creative workers; Florida’s hypotheses are difficult to be combined together into one analysis.

2.3.2 Chapter 4: what can the creative class do?

In order to empirically test the theoretical framework, with regard to production, the production function theory is used, based on both growth accounting and econometric exercises. The essential reason is fourfold. Firstly, the production function approach provides a theoretical base to link creative labour inputs, ICT

Figure 2.1: The theoretical framework



capital services and their interactive effects within the production process. Secondly, the measure of labour input is more accurate according to Florida's definition of creative workers as people who dedicate a high proportion of their working hours on creativity-oriented works. This may be observed as the most direct technique used to measure the contribution of creative workers from the production side; the debate over the issues of synthetic variables will not be a distraction here (e.g. the application of creativity index which combines several unitary variables). Thirdly, either the growth accounting approach or panel econometric analysis is a flexible approach. This allows a combined evaluation of both the creative class and other human capital sub-categories. Finally, econometric analysis is, to a great extent, complementary to the discrepancy in measuring inputs contributions based on the growth accounting method. Therefore, it is expected that comparison between these two models will produce robust findings about the creative economy.

"*Gains in Total Factors Productivity (TFP), reflecting more efficient use of inputs, have long been recognised as an important source of improvements in income and welfare* (The World Bank, 2000, p.1)". Therefore, a parallel empirical model was also derived that accounts for the impacts of the creative class, other human capital sub-categories as well as ICT on TFP growth. The regional TFP level in this thesis is obtained from the growth accounting calculation at the first stage. Then, this dependent variable was regressed by the regional share of skilled workers, ICT capital services per worker, their interactive term and other control variables. Even though there is no universal standard to measure or interpret TFP, as differences in assumptions can result in different estimates of TFP growth, a robust theoretical framework that links ICT and creative economic theories together will still be explored within this thesis.

European regions are used as the unit of analysis regarding the increasing awareness of aggregated economies at a local level. A micro-level study may be more accurate in accounting for specific effects of input factors, while it largely overlooks the complex pattern of interactions between a number of components acting together according to common norms, practices and historical inheritance (Ascani *et al*., 2012). In this respect, firm-level or industry-level analysis has its own advantages but it only portrays a partial picture of what is actually going on.

Finally, the empirical applications respond to the arguments about the definition of creative workers, thus each empirical model also involves the evaluation of different sub-categories of skilled workers. The main focus is on (1) the difference/similarity between the creative class and graduates (human capital) and (2) the difference between the creative core and creative professionals. Based on the above, the following hypotheses have been constructed as:

Hypothesis 4.1: Examining main European regions, the level of change of creative labour services (expressed by hours worked) exhibits a positive and significant impact on the level of change in regional economic output (GVA).

Hypothesis 4.2: Examining main European regions, the level of change of ICT capital services is complementary to the level of change in creative labour services or vice versa in measuring the level of change in output. Also this effect is more significant than graduates and other measures of skilled workers.

Hypothesis 4.3: Examining main European regions, the level of change of labour services in terms of creative graduates, non-graduate creatives and non-creative workers will have different impacts on the level of change in regional GVA. A similar pattern can be also captured in measuring the level change of TFP.

2.3.3 Chapter 5: what does the creative class like?

As stated earlier, the analysis regarding consumption also involves the breakdown of skilled workers at the regional level in Europe. Given the increasing awareness of the importance for the complex interweaving of social life, social inclusion and even urban democracy, these concepts are distinguished from Florida's people climate and are grouped as the factors to represent the business climate. When measuring this, not only are well-known variables generated, such as the social provision index and the location of universities, but the regional index of political institution quality is also included. Therefore, this empirical analysis is based on the consumption of creative workers and is also expanded to other essential aspects of economic and social progress.

The controversies of the creative class consumer preferences can be summarised as (1) the unclear relationship between the broad sense of urban amenities including both the people climate and the business climate and the distribution of creative workers and (2) the unclear region-specific preferences of the creative class mirrored by its relatively uneven distribution across different sizes of cities/regions. In response, an empirical model is derived in Chapter 5, which is based on two different econometric exercises including the fixed effects model and the dynamic generalized method of moments model (the dynamic GMM model). The dynamic GMM model is expected to account for more urban realities compared to the simple OLS regression used in many previous studies. Also, the fixed effects model allows us to flexibly analyse the region-specific preferences in different size groups of regions. This leads to the formulation of these hypotheses as:

Hypothesis 5.1: Examining main European regions, the location of migrant workers and bohemians has the significant explanatory power to explain the location of creative workers and such an effect is even stronger in big regions in comparison to small and medium regions.

Hypothesis 5.2: Examining main European regions, the business climate is also important in determining the location of the creative class with the preferences of the business climate varying across regions.

Hypothesis 5.3: Examining main European regions, the sub-categories of creative workers also have different preferences.

2.3.4 Chapter 6: where does the creative class come from?

In addition to the main research questions in Chapter 4 and 5, this thesis also aims to examine if the current education system is efficient to produce creative workers that meet the demand of the rise of the creative economy. Neither Florida nor previous research substantially evaluated the role of education in this direction. The relatively uneven development level between cities or regions could provide a great opportunity to flow talents as Florida suggests. Also, the emergence of creativity is a complex social phenomenon, which requires not only qualifications but also on-the-job experience and re-skilling. However, is the influence of the education system really insignificant in the Creative Age? What is the status of new creative workers in the European labour market? These questions lead to the last hypothesis of Chapter 6:

Hypothesis 6.1: Examining seven European countries, the education system has been specialised in shaping creative workers, but creative job outcomes cannot be simply explained by the attainment of higher education.

Compared to previous sections, the discussion is no longer based on the regional level as limited observations of new workers for each target country prevent further breakdown of the dataset. In order to test the hypothesis, the multinomial logit model are adopted to examine the impact of higher education and the overall education scheme on the probability of getting a creative job in terms of bohemians, the creative core and creative professionals.

CHAPTER 3

DATA MANAGEMENT

3.1 Introduction: definition of the creative class, data availability and reliability

This thesis is different from many previous studies, as many variables in this study do not exist in the accessible datasets. Further generation of new variables based on different surveys may encounter practical issues and requires extra care to be taken regarding data quality. This is why there is particular emphasis on the aspect of data management. In Chapter 3, the details of data construction for Chapter 4, 5 and 6 are demonstrated as below.

For purely pragmatic reasons, Florida's categories must stand in order to produce a comparative analysis of the European regions similar to the studies in the North American context. Given the significant difference in occupation classification standard between the U.S. and Europe, the composition of the creative class is as similar as possible to Florida's construction (2002, 2013). Hence, the definition generally followed is of Boschma and Fritsch (2009) and Andersen *et al.* (2010) for this European study. Further details of the creative class are listed in **Appendix 3.C**.

While the main argument regarding the definition of the creative class centres on whether the dealer class, the economic business class and the political class should be included or how the effect of human capital can be separated from the total effect of the creative class, few arguments have been raised against the inclusion of artistic, scientific and technological workers as creative. In this respect, Florida's idea to distinguish between the creative core and creative professionals is maintained. Also a new dimension is derived to measure the creative class together with human capital where the graduates and the creative class are divided into three sub-categories: creative graduates, creative non-graduates and non-creative workers in model 1 or creative graduates, creative non-graduates and graduate non-creative workers in model 2.

The data was obtainable from various sources. This work relies on the EU LFS, the EU SES, the EU KLEMS, Eurostat and Cambridge econometrics to obtain the required variables. The required data for this study is listed in **Appendix 3.A**. 3-digit ISCO 88 codes and 2-digit NUTS codes are accessible from the EU LFS to estimate the creative/non-creative workers by region and educational level. The U.K. is an exceptional case because only NUTS 1 codes can be obtained. The detailed data for regional capital stock at the NUTS 2 level is not available. In some studies the estimated capital investment and its depreciation rate had been used to calculate regional capital stock at NUTS 2 level in the EU (Derbyshire *et al.*, 2010); however, to obtain enough physical capital investment data by industry and asset type is still quite a difficult task and in this thesis, it is impossible to do so in order to separately calculate ICT and non-ICT capital services.

To estimate ICT and non-ICT capital services at the regional level, a scaling method was applied based on the assumption that the capital-labour ratio in an industry is approximately constant across the different regions in a country. This means that the focus is on the regional distribution of industries rather than differences in the capital labour ratio within industries located in different regions[4]. However, this assumed regional structure could be inaccurate. Capital-labour ratios depend on the relative prices of the inputs and on technical considerations such as scale economies and these influences may vary by region. Still, the assumption is all that is available to make the ICT distinction by region, and it is reasonable.

As the different surveys will not have the same reference period and sampled population, the sampling and non-sampling errors will vary. This issue may be significant when the analysis employs data from a range of sources. The EU LFS survey is based upon private households only i.e. all persons living in the households surveyed during the reference week. If the EU LFS is linked to other sources, variation is inevitable. For instance, the total number of workforce/employment in the EU LFS is generally lower than the corresponding figures from the EU KLEMS. This is mainly caused by the different sampling methods as well as the sample sources. In the EU KLEMS, total workforce is defined as persons engaged in work based on the national accounts, and this can be based on firm census data and other independent statistics, such as social security counts, as well as the LFS. Compared to the EU LFS which is generated from person survey only, such sources might lead to different definitions of employment. Nevertheless, this difference in the number of the total workforce/employees is not significant[5] in most of the selected countries (shown in **Appendix 3.D**). Therefore the figures provided by the EU LFS are believed to be reliable.

[4] In other words, only the number of employees in each industry matters in relative calculation of ICT/non-ICT capital services, given a fixed capital-labour ratio across regions in a country. Therefore an industry with a higher level of workforce will have higher values of ICT/non-ICT capital services compared to the same industry in another region and indicate the pattern of the geographical distribution of labour.

[5] We made a comparison of employees and total workforce numbers from both the EU LFS and the EU KLEMS in Austria, Germany, France, Italy and the U.K.

Estimation of working hours is more complicated and indirect. Existing databases such as the EU KLEMS, various methods and sources are employed to estimate the total working hours across the different EU countries. For instance, the U.K. data used sources from the UK LFS survey. Data for Italy used sources from the national census and ISTAT. Adaptation of the multiple sources and methods will make results more accurate due to the different data quality in the targeted countries. The EU LFS is designed to target the person's working status, but census and national statistics focus on surveys or the registries of firms/enterprises. The harmonised data collection technique in the EU LFS can minimise the sampling/non-sampling errors. This approach, however, will lead to a difference of results when comparison is made with the EU KLEMS. This study used the variable "The Actual Working Hours in the Reference Week" (variable "HWACTUAL") to estimate total working hours in the reference year because this variable also includes working hours of paid and unpaid overtime. An assumption was made that the average working hours in a week can be representative for an average week during the survey year. Then the yearly working hours would be close to reality if the "HWACTUAL" is multiplied by 52, which is the total average number of working weeks in a year[6]. In **Appendix 3.E**, the results show that in Austria, Italy, Germany, France, and the U.K., a difference in the total working hours between the EU LFS and the EU KLEMS does exist and such a gap is large in some particular countries such as Italy and the U.K., but is not quite significant in France or Germany. In general, it indicates that the total working hours estimated from the EU LFS are comparatively accurate[7].

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[6] $365/7=52.143\approx52$.

[7] We took figures from the EU KLEMS as the benchmark to evaluate the reliability of the estimation technique, given it is based on national accounts and is a well-accepted database.

Information on real wages is confidential in the EU LFS. The income variable "INCDECIL" only indirectly provides a value range of wages in terms of deciles as a result of privacy protection measures. The EU SILC[8] has very detailed income information from 2004, including gross/net cash earnings and gross/net incomes. However, the sample size of the EU SILC is a problem. Since the principle of minimum effective sample size can be met, there are only 130,750 and 282,900 real observations from household respondents across the main EU countries. This drawback could result in a very serious bias when trying to estimate real average wage/annual income for either the total workforce or creative workers. An alternative option is the EU SES database. Compared to the EU SILC, its micro database includes approximately 7.9 million observations under Council Regulation 530/1999 and Commission Regulation 1916/2000. Such a big sample size makes the estimation of average wage/annual income much more accurate. However, this survey was conducted with an interval of four years and only had two waves in total. So there are only waves from 2002 and 2006 as a reference. The EU SES also has incomplete regional classifications. For instance, most of the variables are only available at NUTS 1 level and the classification of German regions does not follow the NUTS standard[9]. In response, it was assumed that regions at NUTS 2 level in a country share the same labour market with its aggregated regions at NUTS 1 level. Therefore, annual earning in a region will be similar at NUTS 2 level in comparison to its own NUTS 1 level.

The labour market across NUTS 2 regions indeed has different features but such a difference will not be very significant, given most of the targeted regions in this study are territorially small. The number of the creative/non-creative workers by

[8] The European Union statistics on income and living conditions

[9] For estimated annual earnings in German regions, see **Appendix 3.F**.

region was obtained from the variable “REGIONW” in the EU LFS. Annual earnings per worker were collected from the EU SES at NUTS 1 level (variable “A11”) for most of the targeted countries and then applied to the relevant NUTS 2 level. Germany is an exceptional case that requires further manipulation, given regional classification is more aggregated than NUTS 1 in the EU SES. Finally, only two waves of the EU SES data are accessible; therefore, wages for intervening years are interpolated.

Finally, it is worth mentioning that as self-employed people do not receive a regular payment from an employer, the EU SES excludes these workers in firms with less than ten employees. Variables from the EU SILC also only contain cash/non-cash income for employees. Therefore, the income for self-employed creative workers is quite difficult to measure and it was assumed that it is equal to the income of creative employees in each occupation category.

3.2 Chapter 4: estimates for labour and capital services inputs at the regional level

This section focuses on how to define creative workers and how to realistically estimate the labour and capital service flows at the regional level. Due to practical issues, such as lack of data and data inconsistency between private surveys and the EU KLEMS, further estimation techniques are necessary as is explained below.

Estimates for ICT/non-ICT capital service flows at the regional level

The challenge in measuring capital services for growth accounting is related to the nature of the capital services; the quantity of capital services is normally not observable in practice. Therefore, the empirical researcher has to rely on theoretical assumptions to approximate the capital services. The most well-known approach was developed by Jorgenson (1963), Hall and Jorgenson (1967) and Jorgenson and Griliches (1967). The crucial assumption in this theory is that the flows of capital services are proportional to the stocks *at individual asset level* (Erumban, 2008). In other words, if it is assumed that the proportionality between capital stock and capital services for each asset type, the proportionality factor varies across different asset types and over time depending on their marginal productivities. Therefore, at the aggregate level, the capital service flows could reflect this difference in the service delivered by different asset types as it is estimated by summing the growth rate for each individual asset stock weighed by the relevant marginal productivity (OECD, 2001).

The variables of ICT and non-ICT capital services are defined as per hour term in the EU KLEMS (i.e. variable “CAPIT_QPH” and “CAPNIT_QPH”). The currency unit was also converted to 1995 euros (i.e. European Currency Unit (ECU)) using capital compensation and exchange rates for countries outside the euro area (e.g. Sweden, Hungary and the Czech Republic). However, there are no existing estimates of investment at the regional level to enable calculation of capital services. Instead data on capital by industry by shares of employment in each industry was combined to calculate a proxy measure. If the capital-labour ratio by industry is assumed to be constant across regions in a country then we can have:

$$K_{ICT,j,t} = V_{ICT,j,t} * H_{j,t} \quad (3.1)$$

$$K_{NICT,j,t} = V_{NICT,j,t} * H_{j,t}$$

$$ICT_{i,t} = \sum_{j=1}^{j=17} K_{ICT,j,t}/L_{j,t} * L_{i,j,t} \quad (3.2)$$

$$NICT_{i,t} = \sum_{j=1}^{j=17} K_{NICT,j,t}/L_{j,t} * L_{i,j,t}$$

$K_{ICT,j,t}$, $K_{NICT,j,t}$ and $L_{j,t}$ are ICT, non-ICT capital services and number of labour by industry j at a national level at time t respectively. $K_{ICT,j,t}$ is calculated by multiplying ICT capital services per hour worked ($V_{ICT,j,t}$) by the total hours worked ($H_{j,t}$) in industry j and similarly for non-ICT.

Because the capital-labour ratio is constant across regions in a country, for any particular region i at time t, the total regional ICT_{it} or $NICT_{it}$ capital services is the sum of the arithmetic product of the national capital-labour ratio $K_{ICT,j,t}/L_{j,t}$ or $K_{NICT,j,t}/L_{j,t}$ and the regional labour input $L_{i,j,t}$ by all industry . There are 17 industries in total according to the NACE 1.1 standard, and the EU KLEMS database has enough information to calculate the ICT/non-ICT capital-labour ratio at the national level since 1975. The remaining problem is that the EU LFS exhibits different time series across countries and the regional labour data in countries such as Germany, Sweden or the Czech Republic is not consistent over years due to the frequent upgrade of NUTS codes. Hence, the regional labour data for the selected 11 countries cannot be balanced to the same basic year. However, for most of the targeted countries in this study, this problem is not serious.[10]

The U.K. in the years 2000, 2005 and 2008 was taken as a set of examples to examine if the capital estimation method this study adopted was unbiased. In doing so,

[10] The time series is not confined to a basic year, given German data is only available since 2002.

distribution of the total regional capital services[11] would truly reflect reality in a target country. As shown in **Appendix 3.G**, the technique used to estimate regional capital services is acceptable as the capital-labour ratio in most regions of the U.K. appears plausible. For instance, metropolitan areas are likely to be dominated by services; for example, Greater London has a lower capital-labour ratio compared to Scotland, which is heavily dependent on capital intensive oil production. The capital-labour ratio in the majority of regions is also increasing due to general technological progress.

Estimation of regional labour and capital revenue shares

As information regarding creative/non-creative labour compensation and ICT/non-ICT capital compensation is not obtainable at the regional level, the scaling method was again accepted to indirectly estimate revenue shares of both capital and labour services. In doing so, a further assumption was made that revenue shares of labour and capital services over value added output by industry is constant across regions in a country, and similarly compensation shares of creative/non-creative labour and ICT/non-ICT capital assets over their total compensation by industry too. To account for the differences in economic scale across industries in a region, relative revenue and compensation shares of each input by industry on a national level were weighted by their labour shares in terms of workforce numbers. The relevant equations are given by:

$$V_{L,j,t} = L_{j,t}/Y_{j,t} \quad (3.3)$$

[11] The estimation of total capital services is similar to ICT/non-ICT capital services. Total capital services per hour equals the sum of ICT and non-ICT capital services, weighted by the relevant capital compensation shares.

$$V_{L,i,t} = \sum_{j=1}^{i=17} V_{L,j,t} * S_{L,i,j,t} \text{ (3.4)}$$

$$V_{K,i,t} = 1 - V_{L,i,t}$$

$$V_{CR,i,t} = V_{L,i,t} * W_{CR,i,t} \text{ (3.5)}$$

$$V_{NCR,i,t} = V_{L,i,t} * (1 - W_{CR,i,t})$$

$$W_{ICT,i,t} = \sum_{j=1}^{i=17} W_{ICT,j,t} * S_{L,i,j,t} \text{ (3.6)}$$

$$W_{NICT,i,t} = 1 - W_{ICT,i,t}$$

$$V_{ICT,i,t} = V_{K,i,t} * W_{ICT,i,t} \text{ (3.7)}$$

$$V_{NICT,i,t} = V_{K,i,t} * W_{NICT,i,t}$$

All necessary information at the national level can be retrieved from the EU KLEMS, the EU SES and the EU LFS. Here $V_{L,j,t}$ is the share of labour compensation over value added output by industry j on the national level at time t and $L_{j,t}$ and $Y_{j,t}$ are labour compensation and value of GVA respectively. With a fixed labour compensation-output ratio $V_{L,j,t}$ by industry, share of labour compensation over value added output in region i at time t is $V_{L,i,t}$, which is equal to the sum of the arithmetic product of $V_{L,j,t}$ and $S_{L,i,j,t}$. $S_{L,i.j,t}$ is the share of the relevant labour over total number of regional labour force by industry. Then revenue share of capital services $V_{K,i,t}$ is equal to $1 - V_{L,i,t}$, under the conditions of the constant return scale and full utilisation. In equation 3.5, $W_{CR,i,t}$ and $1 - W_{CR,i,t}$ are shares of labour compensation of creative/non-creative workers over total labour compensation, based on the calculation from the EU SES. Finally, revenue shares of the creative workers and non-creative workers by regions at time t are equal to the relative share of total labour compensation $V_{L,i,t}$ multiplied by separate labour compensation shares $W_{CR,i,t}$ and $1 - W_{CR,i,t}$ respectively.

To estimate revenue shares of ICT/non-ICT capital assets, a similar process as used for the estimation of the regional share of labour compensation is followed. In equation 3.6, $W_{ICT,j,t}$ is the compensation share of ICT capital assets by industry at a national level at time t. The compensation share of ICT capital assets over total capital compensation in region i at time t is $W_{ICT,i,t}$, which is equal to the sum of the arithmetic product of $W_{ICT,j,t}$ and the relevant regional labour share $S_{L,i,j,t}$ by industry. Therefore, revenue shares of ICT and non-ICT capital assets over value of GVA by regions is equal to the total revenue share of capital services $V_{K,i,t}$ multiplied by $W_{ICT,i,t}$ and $W_{NICT,i,t}$ respectively.

In conclusion, although bias cannot be completely eliminated, the contribution of each input can be realistically estimated according to this perspective; the focus here is on how industries distribute across regions rather than accounting for the difference in the capital-labour ratio for an industry across different regions. One of contribution this study is that the levels of creative labour and capital services are estimated for the first time in the main European regions.

3.3 Chapter 5: estimates for locational quotients and other relevant variables at the regional level.

In Chapter 5, the locational quotient is used to describe the pattern of geographical distribution for creative workers across regions in a country. It is calculated by dividing the regional share of creative workers by the national share of creative workers. The variable description details are listed in **Table 3.1**.

Creative population. The composition of the creative class is as similar to Florida's (2002, 2013) as possible, given variations in occupational definitions between the U.S. and Europe. In addition to the traditional measures for the creative core and creative professionals, new definitions were constructed (as in the last chapter) for creative graduates and creative non-graduates. These were intended to capture the overall impact of both the creative class and human capital (i.e. graduates).

Tolerance. Given that data for the gay and lesbian population is not obtainable in the European context, this factor is measured by the locational quotient of "bohemians". These are defined as workers performing artistic jobs.

Openness. To measure "openness", the labour participation rate of migrants is used. A high participation rate of migrants in a region is argued by Florida to be a clear sign of attracting highly skilled workers. Here, the locational quotient of migrant workers is defined in the usual way as the regional percentage of employees born abroad divided by the national percentage.

The location of universities. For this variable, it is assumed that the number of university teachers proxies the quality of local universities. Since a high share of creative workers are graduates and many of them are working in actual research and in academic jobs, there is a clear link with university location. Again, the locational quotient of university teachers is given by the regional percentage relative to the national percentage.

Social provision. Here, Anderson *et al.*'s (2010) concept of the social provision index is followed. The purpose of this index is to account for the effect of the social welfare system. It is assumed that a region with more workers in social and health care and education industries bring local residents better social welfare. This indicator is constructed as the share of workers in social and health care and education services over the total population in each region[12].

Quality of regional political institution. Finally, the EQI index[13] is introduced for regional government quality (Charron *et al.*, 2014). Although a measure of political institution quality cannot precisely reflect the nature of the cultural-cognitive economy (Scott, 2010; 2014), it is assumed that a "good" local government helps the higher-level activities of creative workers and is also essential in providing social security for them.

The EQI index is time-invariant, and so needed to be supplemented by other measures of government quality to fit within the panel structure of the data. Hence a traditional measure using the share of workers in the public administration [14] is used as a proxy for the short-term local government performance. The logic here is

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[12] The locational quotient of university teachers focuses on the location/quality of local universities, while the social provision index describes the pattern regarding the quality of the local social welfare system. Although the inclusion of university teachers in both cases results in an overlap, two variables are based on different dimensions and a considerable number of employees in the education industry are not university teachers, such as pre-primary teachers, primary education, other education and educational support activities. With respect to this, the "double-counting" is not regarded as an issue in this study.

[13] *"The European Quality of Government Index (EQI) is the result of novel survey data on corruption and governance at the regional level within the EU, conducted first in 2010 and then again in 2013. The data focus on both perceptions and experiences with public sector corruption, along with the extent to which citizens believe various public sector services are impartially allocated and of good quality"* (Charron *et al.*, 2014).

[14] Ideally, the calculation of this variable should be based on the workers who are working for local government. However, further breakdown for public administration and defence, and compulsory social security is not accessible in the EU LFS.

analogous to the definition of social provision (Anderson *et al.*, 2010)[15], in that variation in employment in public sectors can be taken to have a substantial impact on the short-term performance of local government. To address the issue of the time-invariance of the EQI, an interaction term between the EQI index and the share of workers in public administration is included. In this specification, the interactive term is interpreted as how the overall quality of a local government influences the distribution of creative workers through the variation of public administration employment[16].

[15] Observing with-in variations, it is plausible to assume that more workers in this industry will provide more effective supports and services to population in a region as the majority of them are government employees according to the definition of NACE1/1.1/2.1. Since the perception about impartiality and honesty in a local government could not change dramatically in the short term, the change in the number of workers results in the variation of effectiveness.

[16] In this special case, it is necessary to omit the time-invariant variable EQI in the regression as it can be assumed as a fixed effect in the error term. For details, see Blanchard and Wolfers (1999) and Adolph (2014).

Table 3.1: Definitions of variables in Chapter 5

Variable labels	Description
Dependent variables	
The total creative class	Locational quotient of the total creative class – defined as senior government officials, managers, scientists and associate professionals in science, health and business administration excluding writers and creative or performing artists (bohemians), public service administrative professionals (government employees), university teachers and all non-native born workers within this specification (included in openness variable).
Creative graduates	Locational quotient of creative graduates* – defined as the total creative class who have university degrees
Non-creative graduates	Locational quotient of non-creative graduates* – defined as the total creative class who do not have university degrees
The creative core	Locational quotient of the creative core – defined as scientists excluding public service administrative professionals, university teachers and all non-native born workers within this specification
Creative professionals	Locational quotient of creative professionals – defined as senior government officials, managers and associate professionals in science, health and business administration excluding all non-native born workers within this specification
Independent variables	
People climate	
Bohemians (LB)	Locational quotient of bohemians – defined as writers and creative or performing artists
Openness (LO)	Locational quotient of migrant labour in labour market* – defined as non-native born workers
Regional facilities	
Universities (LT)	Locational quotient of universities and research institutions – defined as university teachers
Social provision (S)	Share of workers in education and social services industries
Others	
Overall institution quality (EQI)	EQI index 2010*
Government performance (L)	Share of workers in public administration industries
Interactive term (LEQI)	EQI *L

Notes: 1.* indicates a new measure in comparison to the existing literature. 2. Locational quotients are calculated by dividing shares of target population in each region by average national shares.
Sources: the EU LFS.

3.4 Chapter 6: estimates for new graduates and education backgrounds in the European labour market

Compared to previous chapters, the discussion in Chapter 6 is no longer based on the regional level as limited observations of new workers for each target country prevent further breakdown of the dataset. Ideally the EU LFS survey can cover all of the EU countries, but the core variable "hatfield", which indicates interviewee's education/training background by 14 general subjects, has only been available since 2003 for limited countries, thus only the U.K., France, Italy, Spain, Germany, the Netherlands and Denmark are the research targets. As **Table 3.2** shows, this thesis proposes the following classification to link different education backgrounds to the concept of the creative class.

1. New bohemian workers: LFS subject codes 200 (humanities, languages and arts) and 222 (foreign languages), which are likely to be relevant to creative occupations 245 (journalism, art and writing), 347 (work in art, entertainment and sports) and 521 (modelling).

2. New creative core workers: LFS subject codes 100 (teacher training and education science), 400 (science, mathematics and computing), 420 (life science), 440 (physical science), 460 (mathematics and statistics) and 481 (computer science), which are likely to be relevant to creative occupation groups 21 (physical, mathematical and engineering science professionals), 22 (life science and health professionals), 23 (teaching professionals) and 24 (other professionals).

3. New creative professionals: LFS subject codes 300 (social sciences, business and law), 482 (computer use), 500 (engineering, manufacturing and

construction) and 700 (health and welfare), which are likely to be relevant to creative occupations 1 (high level management), 241 (work related to the organisation and economy of business), 242 (work with law), 31 (technical work in non-biological areas), 32 (technical work in biological areas) and 34 (other associate professionals).

It is worth mentioning that this alignment is rough as the specific subject codes that are accurately related to each creative occupation or small groups of creative occupations are unobtainable in the EU LFS. It is especially true when measuring new workers who have an education background related to the jobs of bohemians or creative professionals. However, meaningful results about the match or mismatch between qualifications and occupations are expected as this attempt can still capture this pattern in a broad sense.

With regard to the division between new graduates and non-graduates, the integration of education/training backgrounds is another challenge; the focuses of education systems vary across target countries. For example, education/training background is not specialised by the standardised secondary education in the U.K. (A-levels), but in the Netherlands, high school education (middelbare school) is a part of voortgezet onderwijs (continued education) including three streams, vmbo, havo and vwo, and students can only enter a research university with a vwo. Therefore, it is not a surprise that almost no observations can be found by education/training background at the level of ISCED 3 and 4 in the U.K. (most of the observations are defined as "unknown subject 900"), while there is a considerable amount in the case of the Netherlands. Given this issue, concern has been expressed that the comparison between graduates and non-graduates by education/training background is not applicable to the target countries. Even though it is feasible in countries such as the Netherlands or Germany, the difference in the focus of secondary education, vocational education and tertiary education impedes us in meaningfully interpreting results on a comparative basis. Further development of database construction regarding this issue is required. For now, however, the econometric models in this thesis only focus on general education/training backgrounds as a whole without considering further breakdown to the level (type) of educational attainment.

In order to maximise the sample size, the dataset includes micro-level records based on the longest time period for each target country, such as the period 2004-2007 for the U.K. and Italy and the period 2006-2007 for the Netherlands and France and in the period 2003-2007 for Spain and Denmark. The exception is Germany where the variable "educfild[17]" is only available in the year 2003. In addition, the time period after 2007 is not included as the economic crisis in Europe, which began in 2008, is argued to completely change the pattern of job outcomes for graduates and non-graduates (Hurley *et al.*, 2013).

Moreover, the variable "wstat1y (situation with regard to activity one year before survey)" is used to define newly graduated students. As the EU LFS derived this variable to represent the situation of every interviewee one year before the survey, it is plausible to assume that those workers, who were pupils, students or had further training and unpaid working experience, can be a cohort of new graduates/non-graduates according to the previous academic year. This group is further confined by the age band of 22 as interviewees at the age above this band are less likely to be newly graduated students but instead be workers who already have considerable work experience to redevelop skills and knowledge in the workplace. With this adjustment, the valid observations/weighted observations for each country based on the available

[17] The purpose of this variable is consistent with this study as "*the knowledge of the field of the highest educational level attained is used in the analysis of the matching between education schemes and labour market needs*" (The EU LFS explanatory notes, 2012, p.122-213).

time periods are listed in **Table 3.3.** Finally, the personal characteristics of individuals are also controlled for, such as age (variable “age”), gender (variable “gender”), the level of educational attainment (variable “hatlev1d”), part-time/full-time (variable “ftpt”), self-employment/employment (variable “stapro”) and ethnicity (variable “countryb”).

Table 3.2: Matching education/training backgrounds to the creative class

The category of education background in the EU LFS	Education/training background related to the creative class
100 Teacher training and education science	The creative core
200 Humanities, languages and arts	Bohemians
222 Foreign languages	Bohemians
300 Social sciences, business and law	Creative professionals
400 Science, mathematics and computing	The creative core
420 Life science (including biology and environmental science)	The creative core
440 Physical science	The creative core
460 Mathematics and statistics	The creative core
481 Computer science	The creative core
482 Computer use	Creative professionals
500 Engineering, manufacturing and construction	Creative professionals*
600 Agriculture and veterinary	Other subjects
700 Health and welfare	Creative professionals*
800 Services	Other subjects
900 Unknown	Other subjects

Table 3.3: Sample size in Chapter 6

Country	Actual	Weighted	Time period
The U.K.	1,566	2,831,653	2004-2007
France	6,209	877,314	2006-2007
Spain	2,662	859,135	2003-2004,2006-2007
Italy	9,625	1,138,187	2004-2007
The Netherlands	5,101	834,041	2006-2007
Denmark	3,105	400,029	2003-2007
Germany	793	204,786	2003

Appendix

Appendix 3. A: Data sources

Variables	Label	Description	Primary source
Gross value added	GVA	Millions of euro, 1995 price,1995-2007	Eurostat/Cambridge Econometrics
Labour input	L	Hours worked for total labour input, millions	EU LFS
Creative labour services	CR	Hours worked for the total creative class by educational levels, millions	EU LFS
Non-creative labour services	NCR	Hours worked for the non-creative class by educational levels, millions	EU LFS
ICT capital services	ICT	Regional ICT capital services, millions of euro, reference year 1995	Own calculation
Non-ICT capital services	NICT	Regional ICT capital services, millions of euro, reference year 1995	Own calculation
Graduates	H	Hours worked for workers who have bachelor degrees or above, millions	EU LFS
Average Annual Earnings	N/A	Gross annual earning, national currency at current price	EU SES
Value shares of CR,NCR,ICT,NICT over output	N/A	Regional income shares of relevant inputs	Own calculation
ICT/non-ICT capital services per hour worked	CAPIT_QPH CAPNIT_QPH	Euro/national currency, reference year 1995	EU KLEMS

Appendix 3. B: Data structure

Code	Country	NUTS	Time series	Region
AT	Austria	2	1998-2007	9
BE	Belgium	2	1996-2007	11
CZ	Czech Republic	2	1997-2007	8
DE	Germany	2	2002-2007	33
ES	Spain	2	1995-2007	17
FI	Finland	2	1999-2007	5
FR	France	2	1995-2007	22
HU	Hungary	2	1997-2007	7
IT	Italy	2	1995-2007	19
UK	UK	1	1999-2007	12
SE	Sweden	2	1999-2006	8

Note: Due to data inconsistency, Brandenburg (D40), Koblenz (DB1), Trier (DB2) and Rheinhessen-Pfalz (DB3) are removed from the German regions. Ciudad Autónoma de Ceuta (ES63) and Ciudad Autónoma de Melilla (ES64) are removed from the Spanish regions. Provincia Autonoma Bolzano/Bozen (ITD1) and Provincia Autonoma Trento (ITD2) are removed from the Italian regions.

Appendix 3. C: The definition of creative occupations

ISCO-88	Description
	Creative professionals
111	Legislators
112	Senior government officials
113	Traditional chiefs and heads of villages
114	Senior officials of special-interest organisations
121	Directors and chief executives
122	Production and operations department managers
123	Other department managers
131	General Managers
223	Nursing and midwifery professionals
241	Business professionals
242	Legal professionals
311	Physical and engineering science technicians
312	Computer associate professionals
313	Optical and electronic equipment operators
314	Ship and aircraft controller and technicians
315	Safety and quality inspectors
321	Life science technicians and related associate professionals
322	Modern health associate professionals (except nursing)
323	Nursing and midwifery associate professionals
324	Traditional medicine practitioners and faith healers
341	Finance and sales associate professionals
342	Business services agents and trade brokers
343	Administrative associate professionals
345	Police inspectors and detectives
346	Social work associate professionals
	Bohemians
245	Writers and creative or performing artists
3131	Photographers and image and sound recording equipment operators
347	Artistic, entertainment and sports associate professionals
521	Fashion and other models
	The creative core
211	Physicists, chemists and related professionals
212	Mathematicians, statisticians and related professionals
213	Computing professionals
214	Architects, engineers and related professionals
221	Life science professionals
222	Health professionals (except nursing)
231	College, university and higher education teaching professionals
232	Secondary education teaching professionals
233	Primary and pre-primary education teaching professionals
234	Special education teaching professionals
235	Other teaching professionals
243	Archivists, librarians and related information professionals
244	Social science and related professionals
247	Public service administrative professionals

Note: Occupation 3131 is omitted due to lack of 4-digit ISCO 88 code based variables in the EU LFS

Appendix 3. D: The comparison of total workforce/employees between the EU LFS and the EU KLEMS

Country	Year	Total workforce			Employee		
		EU LFS	EU KLEMS	Ratio	EU LFS	EU KLEMS	Ratio
Austria	2004	3,703,669	3,957,656	1.07	3,265,879	3,314,405	1.01
	2005	3,769,986	3,957,656	1.06	3,316,966	3,349,816	1.01
	2006	3,869,857	4,008,028	1.05	3,396,596	3,405,230	1.00
	2007	3,931,556	4,074,854	1.06	3,450,087	3,477,119	1.01
	2008	3,994,195	4,151,269	1.06	**	**	**
	2009	3,989,923	4,240,265	1.06	**	**	**
Germany	2004	33,928,685	39,034,000	1.15	31,779,028	34,658,000	1.09
	2005	363,29,793	38,976,000	1.07	32,720,202	34,480,000	1.05
	2006	37,163,198	39,192,000	1.05	33,460,260	34,684,000	1.04
	2007	37,985,680	39,857,000	1.05	34,245,780	35,288,000	1.03
	2008	38,586,928	40,348,000	1.05	**	**	**
	2009	38,599,797	40,370,000	1.05	**	**	**
Italy	2004	21,838,438	24,149,900	1.11	16,117,280	18,029,315	1.12
	2005	22,142,048	24,255,500	1.10	16,533,604	18,359,673	1.11
	2006	22,563,389	24,874,500	1.10	16,914,762	18,796,422	1.11
	2007	22,800,429	25,187,600	1.10	17,167,038	19,115,237	1.11
	2008	23,002,010	25,255,800	1.10	**	**	**
	2009	22,662,279	24,840,000	1.10	**	**	**
France	2004	24,505,409	26,175,516	1.07	22,099,420	22,768,400	1.03
	2005	24,705,526	26,348,691	1.07	22,237,152	22,870,968	1.03
	2006	24,871,785	26,633,504	1.07	22,290,828	23,084,993	1.04
	2007	25,367,738	27,005,559	1.06	22,768,756	23,401,509	1.03
	2008	25,725,279	27,137,272	1.05	**	**	**
	2009	25,544,320	26,782,692	1.05	**	**	**
The UK	2004	28,126,052	30,913,000	1.10	24,689,090	25,178,051	1.02
	2005	28,405,399	31,326,000	1.10	24,989,492	25,468,194	1.02
	2006	28,669,561	31,662,000	1.10	25,158,918	25,640,849	1.02
	2007	28,836,028	31,890,000	1.11	25,279,052	25,749,142	1.02
	2008	29,084,373	31,993,000	1.10	**	**	**
	2009	28,589,974	31,434,000	1.10	**	**	**

Notes:
1. Example in Austria, Italy, Germany, France and the United Kingdom.
2. ** the employee data is only available to make comparison before 2007.
3. Ratio=EU KLEMS/EU LFS.

Appendix 3. E: The comparison of yearly working hours between the EU LFS and the EU KLEMS

Yearly working hours					Yearly working hours				
Country	Year	EU LFS	EU KLEMS	Ratio	Country	Year	EU LFS	EU KLEMS	Ratio
Austria	2004	6691	6,783	1.01	Germany	2004	61692	56,062	0.91
	2005	6670	6,795	1.02		2005	63205	55,775	0.88
	2006	6855	6,818	0.99		2006	64882	55,808	0.86
	2007	6964	6,920	0.99		2007	65485	56,679	0.87
	2008	7029	6,987	0.99		2008	66036	57,362	0.87
	2009	6721	6,754	1.00		2009	64065	55,826	0.87
Netherlands	2004	11139	11,489	1.03	Italy	2004	38451	44,293	1.15
	2005	11178	11,496	1.03		2005	39156	44,370	1.13
	2006	11493	11,679	1.02		2006	40495	45,143	1.11
	2007	11682	11,950	1.02		2007	40495	45,143	1.11
	2008	11784	12,155	1.03		2008	41056	45,751	1.11
	2009	11687	11,999	1.03		2009	41036	45,532	1.11
France	2004	39278	39,280	1.00	The UK	2004	45534	51,961	1.14
	2005	40170	39,393	1.00		2005	46151	52,402	1.14
	2006	40539	39,225	1.00		2006	46452	52,909	1.14
	2007	41201	40,095	0.96		2007	46772	53,312	1.14
	2008	41872	40,479	0.97		2008	46619	52,812	1.13
	2009	40783	39,431	1.09		2009	45630	51,701	1.13

Notes:
1. Unit: million.
2. Ratio=EU KLEMS/EU LFS.

Appendix 3. F: Matching data from the EU SES to the NUTS standard for the German regions

Region	NUTS at level 2	Regional classification in the EU SES
Stuttgart	DE11	Baden-Württemberg, Bavaria
Karlsruhe	DE12	Baden-Württemberg, Bavaria
Freiburg	DE13	Baden-Württemberg, Bavaria
Tübingen	DE14	Baden-Württemberg, Bavaria
Oberbayern	DE21	Baden-Württemberg, Bavaria
Niederbayern	DE22	Baden-Württemberg, Bavaria
Oberplatz	DE23	Baden-Württemberg, Bavaria
Oberfranken	DE24	Baden-Württemberg, Bavaria
Mittelfranken	DE25	Baden-Württemberg, Bavaria
Unterfranken	DE26	Baden-Württemberg, Bavaria
Schwaben	DE27	Baden-Württemberg, Bavaria
Berlin	DE30	Schleswig-Holstein, Hamburg,Lower Saxony, Bremen, Berlin
Bremen	DE50	Schleswig-Holstein, Hamburg,Lower Saxony, Bremen, Berlin
Hamburg	DE60	Schleswig-Holstein, Hamburg,Lower Saxony, Bremen, Berlin
Darmstadt	DE71	Hesse, Rhineland Palatinate,Saarland
Gieβen	DE72	Hesse, Rhineland Palatinate,Saarland
Kassel	DE73	Hesse, Rhineland Palatinate,Saarland
Mecklenburg-Vorpommern	DE80	Hesse, Rhineland Palatinate,Saarland
Braunschweig	DE91	Hesse, Rhineland Palatinate,Saarland
Hannover	DE92	Hesse, Rhineland Palatinate,Saarland
Lüneburg	DE93	Hesse, Rhineland Palatinate,Saarland
Weser-Ems	DE94	Hesse, Rhineland Palatinate,Saarland
Düsseldorf	DEA1	North Rhine-Westphalia
Köln	DEA2	North Rhine-Westphalia
Münster	DEA3	North Rhine-Westphalia
Detmold	DEA4	North Rhine-Westphalia
Arnsberg	DEA5	North Rhine-Westphalia
Saarland	DEC0	Hesse, Rhineland Palatinate,Saarland
Chemnitz	DED1	Hesse, Rhineland Palatinate,Saarland
Dresden	DED2	Hesse, Rhineland Palatinate,Saarland
Leipzig	DED3	Hesse, Rhineland Palatinate,Saarland
Schleswig-Holstein	DEF0	Baden-Württemberg, Bavaria
Thüringen	DEG0	Baden-Württemberg, Bavaria

Appendix 3. G: Regional capital services estimation and capital/labour ratio in the U.K. in 2000, 2005 and 2008

Year	Region	Total workforce (thousands)	Estimated regional capital stock (millions)	Regional capital/labour ratio
2000	North East England	1044.05	6356.95	6.08
2000	North West England	2986.91	14748.27	4.93
2000	Yorkshire and the Humber	2228.61	11689.89	5.24
2000	East Midlands	1967.65	11340.31	5.76
2000	West Midlands	2367.56	12034.85	5.08
2000	East of England	2617.11	12795.03	4.88
2000	Greater London	3386.62	15371.70	4.53
2000	South East England	3980.98	19993.67	5.02
2000	South West England	2329.29	11742.36	5.04
2000	Wales	1212.91	6288.71	5.18
2000	Scotland	2282.36	15907.76	6.96
2000	Northern Ireland	672.55	3740.88	5.56
2005	North East England	1109.51	6982.17	6.29
2005	North West England	3152.22	16979.89	5.38
2005	Yorkshire and the Humber	2371.28	13547.95	5.71
2005	East Midlands	2098.74	13168.87	6.27
2005	West Midlands	2482.43	14787.30	5.95
2005	East of England	2734.25	15846.33	5.79
2005	Greater London	3501.51	18356.44	5.24
2005	South East England	4068.96	23027.12	5.65
2005	South West England	2451.32	15058.08	6.14
2005	Wales	1307.40	7649.97	5.85
2005	Scotland	2420.68	20758.04	8.57
2005	Northern Ireland	723.93	4187.47	5.78
2008	North East England	1141.51	6592.34	5.77
2008	North West England	3123.27	17040.58	5.45
2008	Yorkshire and the Humber	2430.35	13400.06	5.51
2008	East Midlands	2144.52	12758.52	5.94
2008	West Midlands	2452.74	13627.22	5.55
2008	East of England	2795.17	15405.77	5.51
2008	Greater London	3719.64	21264.55	5.71
2008	South East England	4185.15	22278.59	5.32
2008	South West England	2537.39	13836.76	5.45
2008	Wales	1326.26	7166.57	5.40
2008	Scotland	2499.29	21689.41	8.67
2008	Northern Ireland	757.52	3986.59	5.26

CHAPTER 4

HOW CAN CREATIVE WORKERS CONTRIBUTE TO REGIONAL ECONOMIC PERFORMANCE?

4.1 Introduction

This chapter focuses on hypotheses 4.1-4.3 which seek to investigate several hypothesised relationships among output growth, the creative class and ICT. This is carried out at the regional level in Belgium, Germany, France, Italy, Spain, the U.K., Czech Republic, Hungary, Sweden and Finland. The reason is twofold; first, the selected regions from the above countries are representative of the regions in Europe, including many advanced and less developed economies (Florida, 2008). Second, the data for these countries is comparatively complete and precise in the accessible datasets. The regional classification is defined by Nomenclature of Territorial Units for Statistics (NUTS) at level 2[18], which is a geocode standard for referencing the subdivisions of countries in the EU. The time series in this study varies, given the issue of missing data and inconsistency. For example, the time series in France, Italy or Spain cover 1995-2007 but the time span is shorter in the U.K. and Sweden i.e. 1999-2007 and 1999-2006 respectively. Finally, the various datasets that were used in this study to generate variables at the regional level were the EU LFS[19], the EU SES[20],

[18] In the U.K., data is only available at NUTS 1 level from the EU LFS.
[19] EU Labour Force Survey Database
[20] European Structure of Earnings Survey

the EU KLEMS[21] , the Cambridge Econometrics and Eurostat[22]. The details of data availability have been listed in **Appendix 3.A**.

In brief, the findings based on a production model are partly consistent with the creative class thesis as the presence of the creative class significantly contributes to output growth in either growth accounting or regression exercises. This is a similar case for ICT capital services. In comparison, the non-creative population and non-ICT capital services are less likely to be influential forces when explaining the regional growth. The multi-dimensional measure for the contribution of the creative population is believed to be more comprehensive than Florida's creativity index, which, from a different perspective, reveals an uneven creative performance in the main European regions.

Econometric analysis also suggests that the overall impact of creative workers has a significantly positive role in the growth in regional output in the long term. In addition, the accumulation of ICT capital is a good channel to increase creative worker's contribution to GVA growth. However, the larger coefficient size for both creative workers and ICTs indicates an underestimation of the effects for ICT capital accumulation and creative labour service flows as described by pre-assumed revenue shares based on the strict neo-classical assumptions.

The results suggest that creative workers perform more efficiently in regions with a higher level of ICT capital services, but also the creative class exhibits different functions in comparison to human capital (i.e graduates). The empirical evidence

[21] The EU KLEMS project ran from 2003 until 2008. It was funded by the European Commission, Research Directorate General as part of the 6th Framework Programme, Priority 8, "Policy Support and Anticipating Scientific and Technological Needs".

[22] Eurostat is the statistical office of the European Union situated in Luxembourg. Its task is to provide the European Union with statistics at European level that enable comparisons between countries and regions.

further supports that these two theories should not contradict each other, as graduates who work in non-creative professions contribute less than those who work in creative jobs to the level change in either GVA or total factors productivity (TFP).

4.2 Models

This section illustrates the principle of the Growth Accounting method and the setup of the panel regressions. It is worth mentioning the difference between these two approaches: the growth accounting approach pre-assumes the factor shares and allows for different production function across regions over time, while in the econometric analysis it is assumed that common production characteristics in an aggregate regional production function in order to estimate inputs elasticity. However, as shown below, this difference in setup does not result in inconsistent conclusions.

4.2.1 The Growth Accounting method: a regional level approach

To assess the contribution of various inputs to aggregate economic growth, the growth accounting framework is applied. This methodology was first set out by Solow (1956), refined by Jorgenson and Griliches (1967) and then put in a more input-output framework by Jorgensen *et al.* (1987). It is based on production possibility frontiers where output growth is a function of capital, labour and intermediate inputs, and technology. This study further approximates an aggregate value added production function at the regional level, which provides real value added output $Y_{i,t}$ (GVA) as a function of capital ($K_{i,t}$), labour ($L_{i,t}$) and technology($A_{i,t}$) inputs for region i at time t.

$$Y_{i,t} = g_{i,t}(K_{i,t}, L_{i,t}, A_{i,t}) \quad (4.1)$$

Under the assumptions of profit-maximising behaviour and competitive markets, such that input factors are paid their marginal product and constant returns to scale, there is information on how much capital, labour and technological changes each contribute to growth in GVA. Using the translog functional form, common in such analyses, the basic model can be defined as follows:

$$\Delta \ln Y_{i,t} = \overbrace{\bar{v}^{Y}_{K,i,t}\Delta \ln K_{i,t}}^{\text{Capital Input}} + \underbrace{\bar{v}^{Y}_{L,i,t}\Delta \ln L_{i,t}}_{\text{Labour Input}} + \Delta \ln A'^{Y}_{i,t} \; (4.2)$$

In equation 4.2, $\Delta \ln Y_{i,t}$,$\Delta \ln K_{i,t}$, $\ln L_{i,t}$, $\Delta \ln A'^{Y}_{i,t}$ are the logarithmic growth rates of value added output [23], capital input[24], labour input[25] and value added TFP respectively in region i at time t, and the $\bar{v}$s are relative revenue shares in value added. In each region i, income shares of labour ($v^{Y}_{L,i,t}$) and capital ($v^{Y}_{K,i,t}$) in equation 4.2 are the share of labour compensation over total value added output and the share of capital rentals over value added output respectively. In practice, continuous observations from datasets are difficult to obtain; therefore, an average of relative weights over period t and t-1 is taken. Then in equation 4.3, $\bar{v}^{Y}_{L,i,t}$, $\bar{v}^{Y}_{K,i,t}$ represents the average shares of labour services (L_i) and capital services (K_i) for region i over period t and t-1.

$$\bar{v}^{Y}_{L,i,t} = 0.5 * (\bar{v}^{Y}_{L,i,t} + \bar{v}^{Y}_{L,i,t-1})$$

$$\bar{v}^{Y}_{K,i,t} = 0.5 * (\bar{v}^{Y}_{K,i,t} + \bar{v}^{Y}_{K,i,t-1}) \; (4.3)$$

[23] Value added in 1995 prices.
[24] Aggregated capital service flows are derived as the growth of capital stocks by asset type, weighted by relative capital compensation share. Again 1995 is the basic year.
[25] Labour service flows are measured by the growth of total hours worked for different types of labour services. The division by type depends on the setup of the research as will be explained later.

Under the assumptions of constant returns to scale and full factor utilisation, the value of outputs is equal to the value produced by all inputs.

To account for the differences in marginal productivity by educational attainments, aggregate labour input L_{it} is defined as the Tornqvist volume index[26] of hours worked by individual labour types as below:

$$\Delta \ln L_{i,t} = \sum_{j} \overline{w}^{L}_{j,i,t}\, \Delta \ln H_{j,i,t}$$

$$= \overline{w}^{L}_{H,i,t} \Delta \ln H_{H,i,t} + \overline{w}^{L}_{M,i,t} \Delta \ln H_{M,i,t} + \overline{w}^{L}_{L,i,t} \Delta \ln H_{L,i,t} (4.4)$$

Equation 4.4 illustrates that the growth of total hours worked is decomposed into three levels by educational attainment. Therefore $\Delta \ln H_{H,i,t}$, $\Delta \ln H_{M,i,t}$ and $\Delta \ln H_{L,i,t}$ represent the logarithmic growth rates of labour services for high-skilled (H), medium-skilled (M) and low-skilled (L) workers respectively and are weighted by their relative wage bill shares ($\overline{w}^{L}_{H,i,t}$, $\overline{w}^{L}_{M,i,t}$, $\overline{w}^{L}_{L,i,t}$), averaged over periods t and t-1. It is assumed that wages are equal to marginal products, so this process ensures that labour inputs with a higher price also have a larger influence in the input index. In respect, subtracting composition adjusted labour ($\Delta \ln L_{i,t} = \sum_j \overline{w}^{L}_{j,i,t}\, \Delta \ln H_{j,i,t}$) by growth of total hours worked ($\Delta \ln H_{i,t}$)will produce labour composition ($\Delta \ln LC_{i,t}$), which is a reflection of labour quality change (equation 4.5). Equation 4.2 can then be rewritten in equation 4.6.

$$\sum_{j} \overline{w}^{L}_{j,i,t}\, \Delta \ln H_{j,i,t} = \Delta \ln LC_{i,t} + \Delta \ln H_{i,t} \ (4.5)$$

[26] Aggregate input is unobservable and it is commonly expressed as a translog function of its individual components. Then the corresponding index is the Tornqvist volume index. The method from Timmer *et al.*, (2010) is followed, using this index to measure all aggregation of quantities in the models. This approach is a discrete time approximation, which uses annual moving weights based on averages of adjacent points in time.

$$\Delta \ln Y_{i,t} = \overbrace{\bar{v}^{Y}_{K,i,t} \Delta \ln K_{i,t} +}^{\text{Capital Input}} + \underbrace{\bar{v}^{Y}_{L,i,t}(\Delta \ln LC_{i,t} + \Delta \ln H_{i,t})}_{\text{Labour Input}} + \Delta \ln A'^{Y}_{i,t} (4.6)$$

In addition to educational attainment, another dimension of labour type is defined to incorporate creative workers, such that

$$\Delta \ln L_{i,t} = \bar{w}^{L}_{CR,i,t} \Delta \ln CR_{i,t} + \bar{w}^{L}_{NCR,i,t} \Delta \ln NCR_{i,t} \ (4.7)$$

with $\bar{w}^{L}_{CR,i,t}$ and $\bar{w}^{L}_{NCR,i,t}$, the period-average compensation shares of creative/non-creative labour in total labour compensation.

Next, the labour division by educational attainments is mapped onto the labour division by occupation. Here the calculations of composition adjusted labour input and labour composition are the same as equation 4.4. However, this should be carried out for both the creative and the non-creative labour services shown in equation 4.8 below. $b^{CR}_{j,i,t}$, $b^{NCR}_{j,i,t}$ and $e^{CR}_{j,i,t}$, $e^{NCR}_{j,i,t}$ are average annual incomes and number of workers respectively for both the creative workers (CR) and non-creative workers (NCR) by educational level j in region i. Therefore, the average wage bill shares of the creative ($\bar{w}^{CR}_{j,i,t}$) and the non-creative workers ($\bar{w}^{NCR}_{j,i,t}$) are based on their periodic values ($w^{CR}_{j,i,t}$, $w^{NCR}_{j,i,t}$)over period t and t-1. $w^{CR}_{j,i,t}$ or $w^{NCR}_{j,i,t}$ is the ratio of labour compensation at educational level j for either the creative workers or the non-creative workers over total labour compensation of the creative workers or the non-creative workers by all educational levels (see equation 4.9).

$$\Delta \ln LC^{CR}_{i,t} + \Delta \ln H^{CR}_{i,t} = \sum_{j} \bar{w}^{CR}_{j,i,t} \Delta \ln H^{CR}_{j,i,t}$$

$$\Delta \ln LC^{NCR}_{i,t} + \Delta \ln H^{NCR}_{i,t} = \sum_{j} \bar{w}^{NCR}_{j,i,t} \Delta \ln H^{NCR}_{j,i,t} \ (4.8)$$

$$w^{CR}_{j,i,t} = \frac{e^{CR}_{j,i,t} b^{CR}_{j,i,t}}{\sum_j e^{CR}_{j,i,t} b^{CR}_{j,i,t}} \quad , \bar{w}^{CR}_{j,i,t}=0.5*(\bar{v}^{CR}_{j,i,t} + \bar{v}^{CR}_{j,i,t-1})$$

$$w^{NCR}_{j,i,t} = \frac{e^{NCR}_{j,i,t} b^{NCR}_{j,i,t}}{\sum_j e^{NCR}_{j,i,t} b^{NCR}_{j,i,t}} \quad , \bar{w}^{NCR}_{j,i,t}=0.5*(\bar{w}^{NCR}_{j,i,t} + \bar{w}^{NCR}_{j,i,t-1}) \quad (4.9)$$

Similarly, to analyse the individual effects of ICT and non-ICT capital, asset types are allocated into two groups based on the Tornqvist index: ICT and non-ICT assets, such that

$$\Delta \ln K_{i,t} = \bar{w}^{K}_{ICT,i,t} \Delta \ln ICT_{i,t} + \bar{w}^{K}_{NICT,i,t} \Delta \ln NICT_{i,t} \ (4.10)$$

with $\bar{w}^{K}_{ICT,i,t}$ and $\bar{w}^{K}_{NICT,i,t}$, the period-average compensation shares of ICT/non-ICT assets in total capital cost[27]. Finally, respective value shares for each input in total value added output can be computed as $\bar{v}^{Y}_{ICT,i,t} = \bar{v}^{Y}_{K,i,t} * \bar{w}^{K}_{ICT,i,t}$, $\bar{v}^{Y}_{NICT,i,t} = \bar{v}^{Y}_{K,i,t} * \bar{w}^{K}_{NICT,i,t}$, $\bar{v}^{Y}_{CR,i,t} = \bar{v}^{Y}_{L,i,t} * \bar{w}^{L}_{CR,i,t}$ and $\bar{v}^{Y}_{NCR,i,t} = \bar{v}^{Y}_{L,i,t} * \bar{w}^{L}_{NCR,i,t}$. Based on this setup, total GVA growth by regions at time t in equation 4.2 can be further decomposed into growths of ICT, non-ICT capital services ($\Delta \ln ICT_{i,t}$, $\Delta \ln NICT_{i,t}$) as well as growths of adjusted creative /non-creative labour services ($\Delta \ln LC^{CR}_{i,t} + \Delta \ln H^{CR}_{i,t}, \Delta \ln LC^{NCR}_{i,t} + \Delta \ln H^{NCR}_{i,t}$) and the contribution of value added TFP ($\Delta \ln A'^{Y}_{i,t}$), weighted by their relative revenue shares ($\bar{v}^{Y}_{ICT,i,t}$, $\bar{v}^{Y}_{NICT,i,t}$, $\bar{v}^{Y}_{CR,i,t}$ and $\bar{v}^{Y}_{NCR,i,t}$).

Using the above formulas, a full decomposition of growth in value added output into five elements was developed as follows:

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[27] Following the standard from the OECD manual (OECD, 2001), capital compensation is defined as the user cost. Therefore, for a particular type of asset, its rental fee is $p^{K}_{k,t} = p^{I}_{k,t-1} i_t + \delta_k p^{I}_{k,t} - (p^{I}_{k,t} - P^{I}_{k,t-1})$ with i_t representing the nominal return, δ_t the depreciation rate of asset type and investment price of asset type k. This rental price $p^{K}_{k,t}$ reflects the price at the equilibrium point where the investor is indifferent between buying and renting capital good for a one-year lease in the rental market.

$$\Delta \ln Y_{i,t} = \overbrace{\bar{v}^{Y}_{ICT,i,t} \Delta \ln ICT_{it}}^{\text{ICT Capital Input}} + \overbrace{\bar{v}^{Y}_{NICT,i,t} \Delta \ln NICT_{i,t}}^{\text{NICT Capital Input}}$$

$$+ \underbrace{\bar{v}^{Y}_{CR,i,t} (\Delta \ln LC^{CR}_{i,t} + \Delta \ln H^{CR}_{i,t})}_{\text{Creative Labour Input}} + \underbrace{\bar{v}^{Y}_{NCR,i,t} (\Delta \ln LC^{NCR}_{i,t} + \Delta \ln H^{NCR}_{i,t})}_{\text{Non-Creative Labour Input}} + \Delta \ln A'^{Y}_{i,t} \quad (4.11)$$

In conclusion, it is worth mentioning the following points for the Growth Accounting method regarding this study. Firstly, the contribution of capital by flows rather than stocks is measured (Hall and Jorgenson, 1967; Jorgenson and Griliches, 1967). This is because either gross or net capital stock is an inconsistent dimension in measuring changes of growth value added flows in a model that includes labour service flows. Also the measure of capital stock cannot reflect the productive efficiency of capital assets as the gross capital stock values all assets as new, implying that they are all productive at the same level (OECD, 2001).

Secondly, the neo-classic economic assumptions are somewhat controversial. Particularly under the assumption of full utilisation, this thesis assumes an aggregate behaviour for representative competitive firms and does not attempt to account for the variation in the rate of capital/labour utilisation across different firms. However, this is not always a precise representation of reality; a model-based approach can still provide a consistent theoretical framework, which facilities the exploration of complex economic and social issues.

Finally, the application of the Growth Accounting method in relation to the regional level derives new practical problems. Therefore, the estimation of labour service flows and capital service flows at the regional level requires further techniques and assumptions as has been explained in Chapter 3.

4.2.2 Econometric model

Two regression models are used when explaining the changes of both output and TFP levels. The first model is derived from the classical Douglas-Cobb production function and the second one is empirically based.

Model 1: the impact of the creative class and ICT on output level change

Before discussing model specification, to formulate a European regional production function requires a further assumption in addition to standard neo-classical economic assumptions. Referring to McCann's example (2013, p.247-248), let's assume that there are two regions in an economy A and B: the marginal product of capital in region A is lower than the marginal product of capital in region B, meanwhile the marginal product of labour in region A is higher than the marginal product of labour in region B. Under the assumption of a competitive market, production factors are paid according to their productivities and marginal profit of capital in region A is lower than region B and wages in region A are higher than region B.

If these production factors are allowed to flow, the difference in capital-labour ratio between these two regions encourages labour migration from region B to A. Furthermore, capital will also be transferred from region A to B and this interregional factor reallocation will not stop until there is no difference in regional capital-labour ratios. Ultimately, the capital-labour ratios in both regions will be the same in the long term.

The example above demonstrated the one sector neo-classical model. This is crucial in this thesis to the theoretical framework used for the analysis based on the aggregate regional production function, as it implies that all regions will converge towards to the same production function with the same capital-labour ratio in the long term. In other words, if a production function can be modelled in one region, then it is possible to model the production function for all regions in a similar economic system.

When examining European regions, the separate national economies have been progressively integrated over the past half-century. This integration has involved the reduction of cross-border tariffs and the removal of restrictions for factor migration. Such a process was accelerated with unprecedented speed when the common EU passport system was introduced in the 1990s, which allows labour migration to freely flow across all EU nations for the purpose of employment. Therefore, this institutional arrangement should allow the one-sector reallocations of factors across the EU, as well as some potential capital creation effects (MaCann, 2013, p.251).

Based on the assumption of the one sector interregional factor allocation, all regions can be put together to estimate an aggregate production function at the regional level. To estimate the relative long-run coefficients, variations of each input across regions but not across times are focused on. This is because of the high variability of factors choices across time in different regions, reflecting forces that are most probably not linked to technology[28] (Ascari and Cosmo, 2005; Marrocu *et al*., 2010). Instead, technology should not be too volatile during the short time frame of

[28] Strictly following the setup of the production function theory, an *isoquant* can be estimated by either observing the cross-sectional variation of capital-labour ratio for different economic agents at a time point or by the relative positions of these economic agents within the following time periods. The move of an *isoquant* solely indicates technological progress/regress.

this study. For example, the longest time period is only 12 years in France, Spain, Belgium and Italy. It is also important to note that Germany only has five years of recorded observations.

There have been several well-known techniques that are used to estimate coefficients in the long-run production function such as the dynamic GMM model, or the Panel dynamic OLS model (PDOLS). However, they may be deemed as inappropriate in this case as the dataset is based on an unbalanced panel structure over the limited time period. Instead, it is more appropriate to use a simple LSDV model (i.e. the country FE model). Therefore, the average coefficients for a long-run European regional production function based on a pooled set of 143 regions (observations) over the whole time period are estimated.

Model 1 is specified as the tradtional log-linearised production funtion to separate impacts of the creative/non-creative labour services, ICT/non-ICT capital services and the interactive effect of creative workers and ICT on the level of GVA for the period 1995-2007 for the pooled dataset of 143 European regions, such that

$$Y_{i,t} = \alpha_i + \alpha_1 CR_{i,t} + \alpha_2 NCR_{i,t} + \beta_1 ICT_{i,t} + \beta_2 NICT_{i,t} + \gamma_1 (CR_{i,t} * ICT_{i,t}) + \delta_t + \tau_j + \mu_{i,t} \quad (4.12)$$

where $Y_{i,t}$ is used as the deflated value of GVA based on the year 1995[29]. $CR_{i,t}$, $NCR_{i,t}$ $ICT_{i,t}$ and $NICT_{i,t}$ are the number of hours worked by the creative/non-creative workers and the values of ICT/non-ICT capital services (at the 1995 price level) respectively for i region (i=143) in the period t.

[29] The GVA deflators are collected from Eurostat and the basic data of GVA is collected from the Cambridge Econometrics.

A TSLS (Two Stage Least Square) model is used to estimate this regional production function with common production chracteristics. For possible endogeneity concerning input factors in the growth process, the instrumental variables are represented by one-period lagged ICT and non-ICT capital regressors and creative labour regressor and the interactive term (for testing endogeneity, see section 4.3.3). Dummy variables concerning time (δ_t) and country (τ_j) are included to account for common macroeconomic shocks for all regions and country-specific effects in any period t[30]. The interactive effect between creative labour services and ICT capital services is measured by the interactive term $\mathrm{CR}_{\mathrm{i,t}} * \mathrm{ICT}_{\mathrm{i,t}}$. For an alternative measure, the relative hours worked by creative graduates ($\mathrm{GCR}_{\mathrm{i,t}}$) replace variables $\mathrm{CR}_{\mathrm{i,t}}$ in equation 4.12 in order to evaluate the impacts of creative sub-categories.

In conclusion, the econometric model from a different perspetive evaluates the impact of both the creative class and ICT capital services on output level change in the long run. In comparison with the Growth Accounting method, this thesis estimates the elasticities of labour and capital inputs rather than just pre-assuming them. However, such an aggregate estimation of elasiticities masks a large amount of heterogeneity in traditional input production effectiveness across sectors, which could be related to the existence of spillover effects.

Model 2: the impact of the creative class, human capital and ICT on TFP level change

An empirical model was derived to account for the influence of skills on the level of TFP at the regional level. The level of TFP is calculated by indexing the

[30] The nature of the creative class thesis determines that controlling for sectoral heterogeneity is inappropriate when using region as a unit of analysis. In that case, both the research objective and the analytical angle in the regression will be completely changed.

contribution of TFP to GVA growth from the growth accounting calculation in section 4.2.1. As the TFP level is derived as a residual, variables of the labour service inputs from model 1 are replaced by relative shares[31] over total employment, also capital variables are transformed in per worker term, such that

$$TFP_{i,t} = \alpha_i + \beta_1 Skilled\ workers_{i,t} + \beta_2 ICT_{i,t} + \beta_3 Interactive\ terms_{i,t} + \beta_4 Control\ variables_{i,t} + \delta_t + \tau_i + \mu_{i,t} \quad (4.13)$$

In equation 4.13, variables of skilled workers are expressed as per worker term and are log-transformed. Skilled workers are measured in terms of graduate creative, non-graduate creative and graduate non-creative workers, which allows the impacts of the creative class and human capital to be intergated. Due to the different nature concerning model 2, other important factors that could impact TFP change are also taken into consideration. As the fixed effects model elimiates the issue of unobservable endogeneity (i.e. τ_i), the exlusion of time-invariant variables such as typology or specfic institutional effects will not bias the results.

The first control variable is high-tech physical capital, which represents a significant aspect of technology that is essential to enhance productivity in local economic systems. Such a positive impact has been well-documented as mentioned in the literature review. This study used the density of ICT capital services as an indicator.

The second variable is R&D expenditure. In accordance with the traditional knowledge capital model that asserts the importance of intangible capital, such as the

[31] For the sake of consistency, the impact of the creative class, graduates and their non-overlapping sub-categories are still tested.

number of patents (Griliches, 1979), R&D expenditure is claimed to play an important role in explaining productivity difference between industries and firms (Doraszelski and Jaumandreu, 2013) or at the regional level (Albert and Maudos, 2006). The R&D expenditure by region over the years was collected from Eurostat and was then expressed in per worker term.

The third variable is diversity, as in one of the Ts that Florida originally advocated (Florida, 2002). Unlike previous studies, this thesis used the share of migrant workers over total employment rather than the share of the foreign-born population over total population, as it may be a better indicator that reflects how open a region is to absorb and integrate people of different cultures into the regional labour market.

Another important factor in the local economic system is the structure of inhabited settlements; this allows the capture of the role of agglomeration economy. This study also includes regional population density for controlling the “catch-all” effects such as land prices or wage levels.

Finally, the relationship between ICT and the creative class or graduates is measured by the interactive term between the share of skilled workers and relative ICT capital density. This is designed to measure if skilled workers could enhance their contribution to productivity through the application of ICT or vice versa.

4.3 Results and analysis

This section first describes the average growth rates from the creative class and the distribution of ICT capital services in the eleven European countries. Then, analysis of the results is carried out separately based on the Growth Accounting method and panel econometric model.

4.3.1 Descriptive analysis

In this study, the level of ICT capital and creative labour services are two very important indicators to reflect the development level in a European economy. An initial descriptive analysis thus allows us to understand how these possible sources of growth performed in the past decade and how relative performance varied across regions and countries. Here, the performance of the creative class was presented by average growth rate based on the available time series for targeted countries. ICT capital services were measured by value of ICT capital services per worker by regions in each country.

Growth rate of creative workers

According to Florida's classification of workforce, the total workforce can be separated into three categories: the creative class, the service class and the working class[32]. The employment growth rates for these working groups were taken on average based on the available time series from the EU LFS.

Table 4.1 shows that the performance of the various classes is different. The growth rate of the creative class is higher in the majority of the countries compared to the service class, the working class and the total employment. In Spain, Austria,

[32] The working class that Florida mentioned is production workers. Agriculture workers were not included in this study due to the fact that the relative share of total employment is very small in a country.

Belgium and France, the average growth rates are 5.57, 3.44, 3.00 and 2.95 percent respectively. Other countries such as the U.K., Sweden, the Czech Republic and Germany cannot be consistently compared as only the shorter time periods are available, but significant growth of the creative class was still observed. In the meantime, the growth of the service class across most of the countries is lower than the creative class. A positive growth rate in the working class was captured in hardly any of the countries with the exception of Spain. However, Italy and Spain are exceptional cases. The growth of the creative class in Italy was lower than the service class in the given period as the economic system in Italy may have been reliant on contributions from service-intensive industries such as tourism. In Spain, growth rates of all classes are significant and positive. This may be due to the strong catch-up effect.

The creative class was inevitably influenced by the economic recession beginning in 2007, with a downward-sloping trend in growth rate in most of the countries[33]. However, it was impacted less; its growth rate slowed down but was still positive. It is interesting to see that in developed European countries such as Austria, the U.K., France or Germany, both the creative class and the service class were heavily impacted and the service class had even slower growth, while in the less developed countries such as the Czech Republic, Hungary and Italy, the service class exhibited a complementary role to the total employment growth. Italy is again the extreme case, showing a -3.27 growth in the creative class and 3.70 growth in the service class. Such a complementary effect was not quite so helpful in reversing the negative growth of total employment in the recession period. It may only be a simple reflection of the fact that workers were more likely to move to jobs with low entry

[33] The measure of employment growth in this study is different from the calculation of unemployment rates based on national accounts.

requirements in these countries.

Furthermore, a comparison was made across the targeted countries in terms of the average values of ICT/NICT capital services and the average hours worked by creative/non-creative workers. All the average values were calculated based on the available time period, as the time series is not consistent for different countries in the EU LFS database. As can be seen in **Figure 4.1**, the average value of ICT capital services and the average total hours worked by creative workers are less than those of NICT capital services and non-creative workers in all of the target countries. It is realistic to see that the larger main European economies such as Germany, the U.K., France, Italy and Spain, have much higher absolute values of capital services and total hours worked compared to the other smaller countries; however, the value gap between ICT and non-ICT capital services is quite different. Particularly in the U.K. and Finland, this difference is small, while it is large in Italy, France and Spain. For the total hours worked by creative/non-creative workers, the U.K. again has the smallest gap between these two working groups, followed by Finland and Belgium.

In summary, the creative class was associated with a higher average growth rate compared to the other classes in most of the targeted countries. It indicates a very positive development trajectory for the creative class in the past decade. It was also observed that the economic structure is quite different across countries, as the gap between different types of labour and capital service inputs vary significantly. This finding potentially suggests a future direction beyond this study and is consistent with the existing literature: the great potential of the creative class but also a possible heterogeneity across the European countries (Marocccu and Paci, 2012).

The density of ICT capital services in European regions

For the first time, this study estimated the level of ICT/non-ICT capital services at the regional level in the main European regions. Thus this section will demonstrate the growth tendency of ICT capital services in the past decade and how it is distributed across regions. This descripive analysis will confirm the importance of ICT capital services and explain why ICT capital input is an interesting aspect to this study.

The average growth rates of ICT capital and non-ICT capital services were taken from the avaliable periods and then ranked accordingly in descending order. The ranking list is not exhaustive because there is insufficient space for a detailed description. In this study, the economic recession period is not included becauce the EU KLEMS stopped providing the figures for ICT/non-ICT capital services per hour after 2007. Hence the average growth rate of ICT and non-ICT capital services is defined to represent ICT and non-ICT capital service accumulation in the normal period ,excluding the recession period from 2008.

Appendix 4.A evidently shows that the growth of ICT capital services was rapid at a double-digit rate, in comparison with non-ICT capital services in most of the regions. The highest growth rates of the ICT capital services are mainly captured in Belgium and Austria. For example, Prov. Brabant Wallon (21.05 percent), Prov. Vlaams-Brabant (18.08 percent), Prov. Limburg (BE) (17.36 percent), Prov. Namur (17.28 percent) and Prov. Luxembourg (BE) (18.00 percent) are the top five on the list. While most of the regions in Spain and Italy have slower growth, the growth rate is still kept above 10 percentage points (e.g. 10.57 percent in Lombardia or 14.10 percent in Comunidad de Madrid). A similar conclusion can be also obtained in the selected eastern European countries. Most of the Czech and Hungarian regions also have high growth rates. (e.g. Eszak-Magyarorszag (16.76 percent) or Praha (14.14 percent)). In comparison, regional growth of non-ICT capital services is much lower than ICT capital sevices, since in most of the regions non-ICT capital service growth is also significantly positive.

Such a rapid growth of ICT capital services cannot be observed in the U.K., Germany and Sweden, which in contrast experienced comparatively lower growth levels. In many of the German, British and Swedish regions, the growth rate of the ICT capita was less than 10 percentage points, such as Stuttgart (7.73 percent) and Kassel (6.92 percent) in Germany, London (9.40 percent) in the U.K. and Stockholm (6.04 percent), Sydsverige (6.10 percent) or Västsverige (7.53 percent) in Sweden.

If the above results are put into practice, a well-defined cluster of the historical high-performing regions can be portrayed. The comparatively lower ICT capital services growth rate in Sweden and Finland could demostrate that the level of ICT usage had already begun at a high starting point within the innovation and technology cluster. This knowledge-intensive based cluster can be further witnessed within most of the German regions, many of the French regions, in addition to most of the U.K. regions and some of Spanish regions. Particularly, Austria and Belgium are the high ICT-usage countries, where the average growth rate of ICT capital services is above 15 percentage points across all regions. Furthermore, the less developed economies such as the Cezch Republic and Hungary also experience a high growth rate but this is probably explained by the catch-up effect.

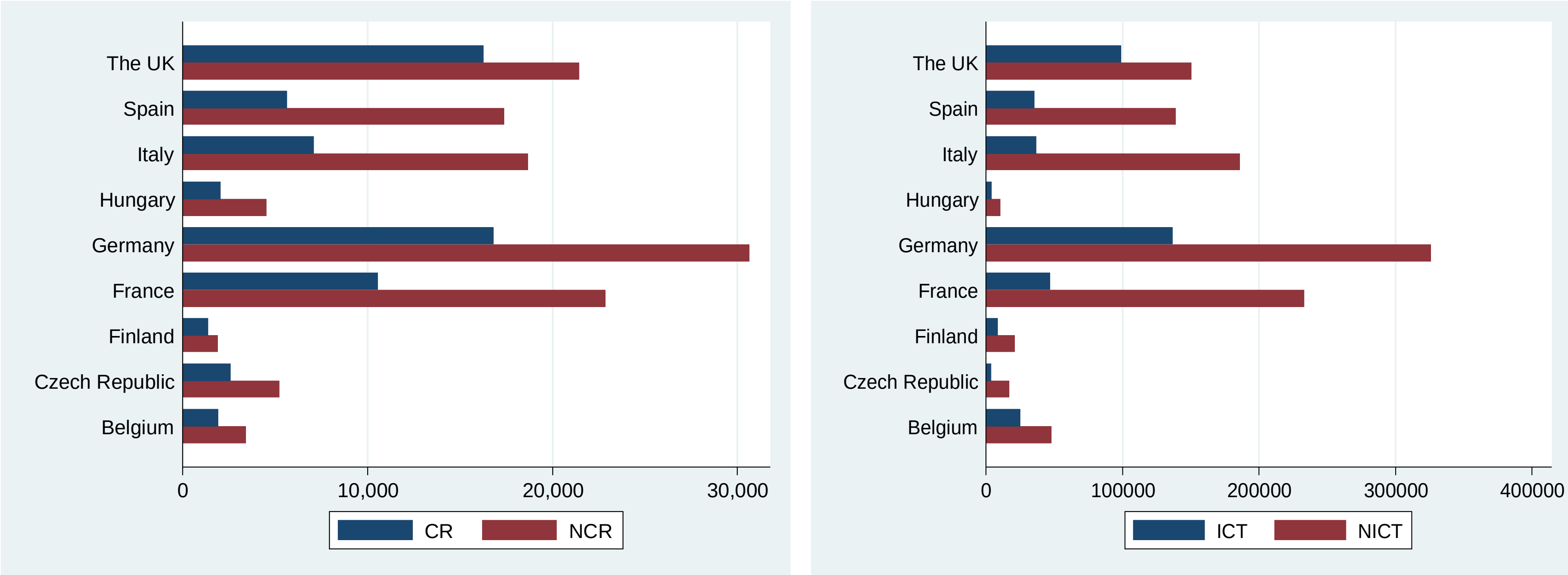
However, growth rate is only an indicator to reflect regional performance of ICT capital accumulation levels. The value of ICT capital services per worker for each region is now discussed and summarised to reflect the distribution pattern of ICT usage. Regional ICT capital services per worker is equal to the value of ICT capital

Table 4.1: Average employment growth rates (percent per annum)

Country	Total employment		Creative class		Service class		Working class	
	Overall	Recession	Overall	Recession	Overall	Recession	Overall	Recession
Austria	0.78	0.80	3.44	1.94	1.31	1.40	-2.23	-2.35
Belgium	1.43	1.02	3.00	2.47	1.01	0.76	-0.47	-0.57
Czech R.	-0.31	-0.85	1.58	0.41	-1.19	0.82	-0.93	-2.99
Germany	0.78	0.90	1.53	1.34	1.13	0.24	-0.57	-0.04
Spain	3.41	-2.91	5.57	0.02	3.32	-1.90	1.47	-8.74
Finland	1.29	-0.89	1.96	0.16	1.47	-1.02	0.35	-2.57
France	1.24	0.07	2.95	1.80	0.99	0.22	-0.55	-3.21
Hungary	0.92	-1.19	1.57	0.02	1.49	0.74	-0.10	-3.90
Italy	1.27	-0.10	1.49	-3.27	1.99	3.70	-0.03	-1.68
Sweden	1.08	-0.08	2.54	2.14	0.45	-2.10	-0.41	-1.71
The U.K.	0.69	-0.44	1.57	0.36	0.96	-0.10	-2.17	-4.44

Notes:
1.Time period for Germany is 2002-2010, time period for the Czech Republic is 1998-2010, time period for Finland, Hungary and Sweden is 1997-2010, due to lack of data from the EU LFS.
2. Time period of economic recession is 2008-2010. All figures are expressed in percentage point/ points.
Source: The European Labour Force Survey.

Figure 4.1: The average values of ICT/NICT capital services and the average total hours worked by creative/non-creative workers



Notes:

1. The average values were calculated based on the available time period in different countries. The calculation of ICT/non-ICT capital services takes 1995 as the reference year.
2. The unit of capital services: million euros. The unit of labour services: million hours.

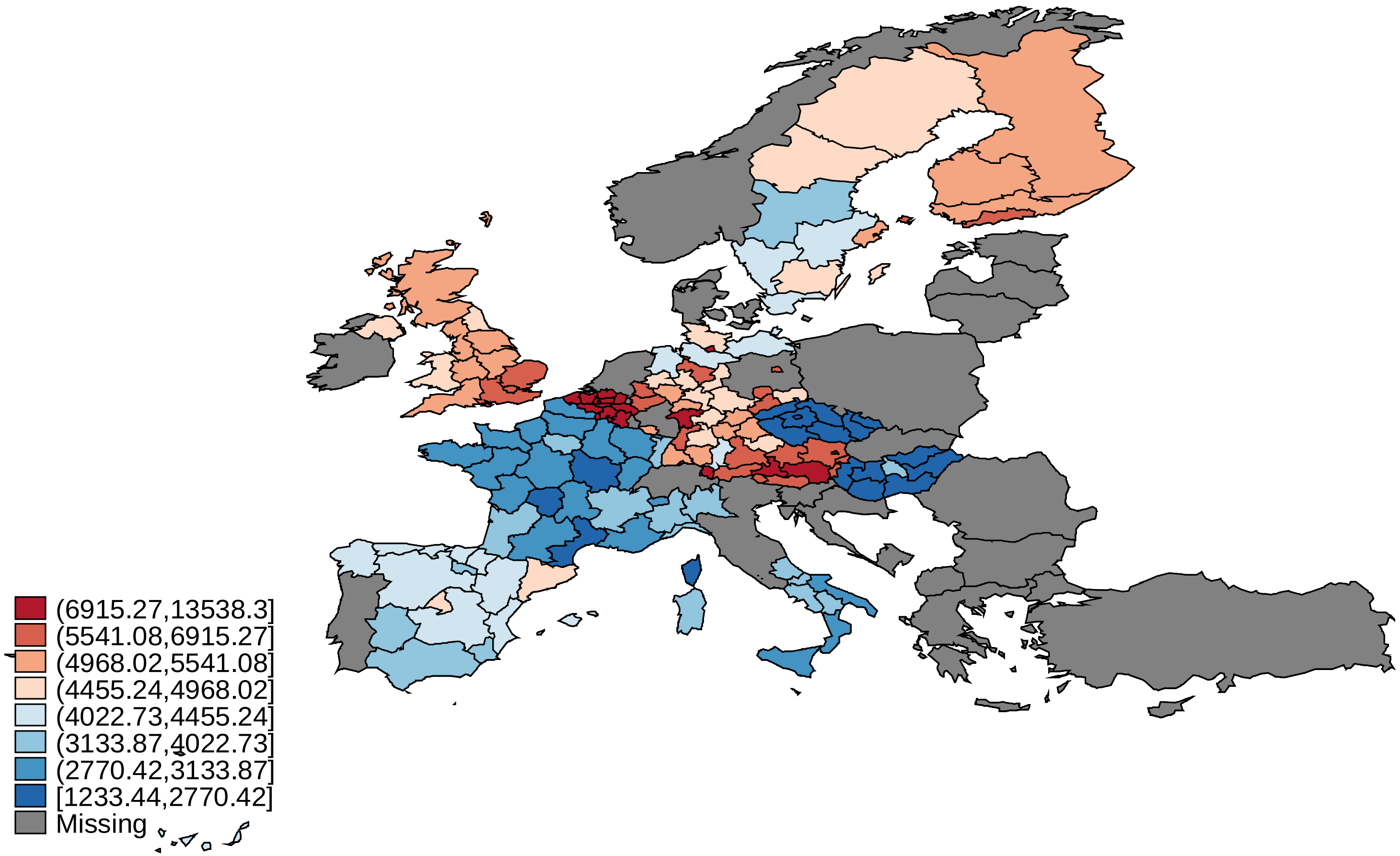
services divided by the number of relative regional workers by region, and the year 2007 is taken as the reference year. **Appendix 3.B** shows the existence of a Scandinavian innovation and technology cluster of ICT capital-intensive regions located in Sweden[34] and Finland represented by Stockholm (5863.26) in Sweden and Etelä-Suomi (5742.04) and Åland (5769.97) in Finland .

Furthermore, most of the regions in the traditional developed European metropolitan regions also have very high rankings, led by Rég. Bruxelles (14176.6) in Belgium and Wien (8991.82) in Austria, followed by Hamburg (7931.94) and Bremen (7393.39) in Germany and South East (U.K.) (5904.74) or Greater London (5752.34) in the U.K. In comparison, most of the regions in Spain, France and Italy have lower ICT capital services per worker values. Comunidad de Madrid, Île de France and Lombardia, the most populated and representative regions in Spain, France and Italy, only have per worker values of 4522.94, 3731.12 and 3548.90 respectively. Finally, it is not surprising to see that ICT capital services per worker is very low (below 2500 euros per worker) in most of the regions in Hungary and the Czech Republic, despite relative growth rates being high in the past. This result is reflective of the fact that the gap in ICT capital services diffusion is still significant compared to western Europe, since there has been good progress in promoting knowledge and an ICT capital intensive economy in eastern European regions.

In conclusion, the findings reveal that the demand in ICT capital services is growing much faster than non-ICT. This trend appears to be true in most of the regions in this study. It potentially portrays quite an overlapped cluster of the knowledge and innovation intensive economies, mainly located in the Nordic counties, in many regions of the U.K., Austria, Belgium and Germany, some of the regions in

[34] The 2007 NUTS code in Sweden is taken as the standard.

Figure 4.2: ICT capital services per worker at the regional level in Europe



France, Italy and Spain but rarely in the eastern European counties (see **Figure 4.2**). Such a phenomenon naturally raises the question: does the rapid increase in demand of ICT capital services cause economic growth? For the first time, this thesis proposes this question with a regional scope. In association with the outstanding performance from the creative class, it is interesting to see how they could seperately contribute to economic growth and how they could be related each other.

4.3.2 Growth accounting analysis

The economic system in the European regions

Appendix 4.C illustrates the contributions from both labour and capital inputs as well as TFP across regions in the ten countries. This is a clear way of examining how the creative labour service flows, ICT capital service flows as well as other input flows contribute to the total value added output flows. The length of the different coloured bars represent the level of contribution in a region from the creative (dark blue)/non-creative (red) labour services, ICT (green)/non-ICT capital services (orange) and TFP (light green).

The details of the growth accounting decomposition are listed in **Appendix 4.D**. A region in France is used as an example to demonstrate how to interpret the results. In the region of Île de France, the largest and most populated region in France, the average growth rate of the growth value added is 2.30 percentage points in the period 1995-2007. Creative labour service flows are responsible for 0.80 percentage points and the non-creative class only has a negative contribution -0.20. The factor share of ICT capital services is small, but ICT capital service flows are responsible for

0.30 percentage points of the total output growth rate compared to 0.40 from non-ICT capital service flows. The undistributed percentage points are the contribution of the value added TFP. In this case, the large and positive figure of the TFP indicates that this region received significant benefit from technological progress and technological efficiency improvement, as the contribution of TFP is 1.01 percentage points[35]. In addition, the contributions of the creative/non-creative labour services and ICT/non-ICT capital services were computed and analysed for the rest of the 142 regions.

Referring to the technique that estimated the income share over total output for ICT capital services, shares of ICT capital services only change slightly across regions and over time in a country. If the neo-classical economic assumptions are followed, the pre-assumed value share for ICT capital is much smaller compared to non-ICT capital and other labour input categories. When comparing the results across regions in different countries, the mean values of the value share of ICT capital services and the percentage that it contributes to GVA growth across regions and over time for each country were calculated[36]. Similarly, this calculation was also performed on the rest of the input factors and the findings were summarised as follows.

ICT capital services

At the regional level, **Table 4.2** indicates that the highest average shares of ICT capital are seen, not surprisingly, in the intensive ICT-using economies such as Germany (0.067), the U.K. (0.052) or Finland (0.070) while it is considerably lower in Spain (0.024), Italy (0.027) and France (0.032). However, with the various high

[35] The sum of the averaged contribution points for each input could not precisely equal to the averaged output growth rate.

[36] This method may be deemed appropriate as it is difficult to summarise common characteristics regarding the nature of economic systems when every region is taken as the unit of measurement. For example, for a group of regions where the contribution of ICT is high, the contribution of NICT could be either low or high, which is also the situation for CR and NCR.

growth rates, the contribution of ICT capital service flows on regional economic growth varies. Within the German regions, the growth of ICT capital services on average accounts was 36.45 percent of the total GVA growth, followed by Belgium (24.18 percent), Italy (19.50 percent) and the U.K. (18.96 percent). For Sweden, the Czech Republic and Spain, relative percentages are low, indicating the figures of 10.52 percent, 13.27 percent and 9.49 percent respectively.

Creative labour services

The contribution of the creative class appears to be significant but quite heterogeneous in many of the European regions. On average, its positive role is especially obvious in the U.K. (30.96 percent), Belgium (34.92 percent), Italy (51.77 percent) and France (47.49 percent) where such a contribution from the creative labour services is higher than the non-creative labour services in the majority of regions. The exception, Spain, shows that both the creative labour (44.08 percent) and non-creative labour services (59.52 percent) explain a larger share of GVA growth than capital accumulation. However this is not the case in the Nordic countries. Results in Sweden and Finland indicate a different economic system in Scandinavia as technological progress and efficiency appear to be the main sources of regional GVA growth. In comparison, the significant contribution of the creative class can be captured in some regions, but such an effort from the particular labour type to output growth is small, only showing the figures of 10.36 percent and 9.12 percent respectively.

In the less developed European economies, the impact of the creative class is also limited. In Hungary, the average contribution of the creative class (17.56 percent) is not very different from the contribution of the non-creative class (17.01 percent).

All regions in the Czech Republic, illustrate that the catch-up technological progress is the driving force of regional economic growth in recent years; therefore, the contribution from labour services is smaller. The contribution of creative labour services only explains 6.84 percent of total GVA growth and for non-creative labour services, the value is even negative (-15.40 percent).

Non-creative labour and non-ICT capital services

Despite the significant contributions from ICT capital and creative labour services, the influence of the traditional inputs i.e. non-ICT capital and non-creative labour services is still fundamental in many of the countries. Particularly, the non-ICT capital accumulation explains a large share of GVA growth in Germany (50.42 percent), Italy (42.50 percent), Spain (30.05 percent) and the Czech Republic (30.55 percent). While in the U.K. and Finland, the share is relatively small, only accounting for 8.47 percent and 1.77 percent of GVA growth on average. It is difficult to state that high share of growth from non-ICT capital services is a sign of a traditional manufacturing based economy and vice versa. However, these findings at least reveal that there are great differences in regional economic structure across countries; labour contributions are important in some countries and it is capital accumulation or technological progress in all the others. The estimation of non-ICT capital's contribution is generally consistent with existing literature at the national level. For example, it is on average 0 percent in Finland, 33 percent in Spain, 60 percent in Italy and 14 percent in the U.K. in the period 1995-2004 (Timmer *et al*., 2003).

Observing the impact of non-creative labour services, it is only significant in the countries which heavily rely on labour contribution. Not surprisingly, the growth of non-creative labour services explains the biggest share of GVA growth in Spain

(59.52 percent), followed by Italy (20.35 percent), the U.K. (20.12 percent) and Hungary (17.01 percent). Within countries with a higher contribution from capital accumulation, it does not contribute as much to output growth such as the Czech Republic (-15.40 percent), Germany (-4.94 percent), Sweden (-8.41 percent) and Finland (0.08 percent). In comparison, its contribution is much lower than the contribution from creative labour services with the exception of Spain, where the difference in the contribution from both creative and non-creative labour services is not significant.

Total factors productivity (TFP)

The decomposition of GVA growth in this thesis demonstrates a universal TFP improvement. Such an effect on output growth is very strong in the Nordic context, such as in Finland (72.06 percent) and Sweden (65.16 percent). In less developed economies, the very significant technological catch-up effect is also observed. Particularly in the Czech Republic, the growth of TFP explains 65.16 percent of GVA growth. For western European economies, the figure is 21.50 percent in the U.K. and 15.97 percent in Belgium. However, it might seem improbable, as under strict neo-classical assumptions, the negative contributions in Spain (-43.13 percent), Italy (-34.11 percent) and France (-4.04 percent) indicate technological regress.

In fact, measured TFP growth, as a residual measure, includes a range of other effects at regional level. Firstly, in addition to technological innovation, it also includes the effects of organisational change. Successful reorganisation within firms or industries will lead to higher TFP growth. However, in the short term, TFP might decrease as resources are diverted to the reorganisation process (Hulten, 2010).

Secondly, the TFP measure calculation is based on deviations from the neo-classical assumption that marginal cost is equal to marginal revenue. Nevertheless, it is possible that either ICT investments or the influx of creative labour in a region have been driven more by herd behaviour than by economic fundamentals (O'Mahony and Vecchi, 2005). Therefore, seeking creative competitiveness, as Florida advocated, or in the run up to the dotcom bubble, the marginal costs of creative labour and ICTs may be higher than their marginal revenues. In other words, the effects of ICT investments and creative labour services are overestimated while the impact of TFP is underestimated. Thirdly, TFP measures at the regional level "*not only account for the impact of TFP but also include the average effects of market share reallocation across firms in different industries*" (Timmer *et al*., 2010, p.88). As the estimation of ICT capital services and creative labour services is the sum of relative values from each industry within each region, TFP growth for a particular industry in a region may be high through a shake-out of least productive firms, while some other regions may have a low TFP growth due to this reallocation mechanism. Therefore, on average, the total TFP growth at the regional level shows a different perspective to existing literature at the industry or firm level.

Based on the above discussion, the TFP estimation in this study can be defined as a combination of technological progress and efficiency changes. As described in the case of Spain and Italy, technological innovation should positively contribute to economic growth, reducing but not eliminating the very strong negative effect of technological inefficiency on TFP growth. In other words, regional economies in these countries possibly experienced technological efficiency regress, suggesting that technological efficiency trade-off with rapid economic growth. Accordingly, the lower TFP contribution to GVA growth in Germany and France than had been found in previous studies at the national level may also confirm this perspective, as the regional level analysis accounts for the considerable effects of organisational changes on average.

In conclusion, based on the strict neo-classical economic assumptions, the Growth Accounting method portrays a complex picture concerning the impact of the creative class and ICT as their effects are generally significant, but the level of contribution depends on the nature of the regional economic structure. Firstly, the effect of ICT capital accumulation on GVA growth is greatly consistent with the existing literature. Secondly, in regions where capital or technological innovation and efficiency account for a large share of GVA growth, the relative contribution of creative labour services is not readily obvious as described, while it does explain a large share of growth elsewhere, where the labour contribution most matters. Therefore, it is difficult to discuss the quality of the creative economy at this stage, but the relative effects from creative labour services are evident in most of the regions.

Table 4.2: The average income shares of each input and the relative contributions to GVA in % at the regional level

Country	ICT capital		Creative labour		Non-ICT capital		Non-creative labour		TFP
	Value share	% to GVA growth	Value share	% to GVA growth	Value share	% to GVA growth	Value share	% to GVA growth	% to GVA growth
Belgium	0.038	24.176%	0.375	34.917%	0.368	26.217%	0.219	-1.276%	15.966%
Czech R.	0.042	13.274%	0.329	6.836%	0.322	30.547%	0.354	-15.402%	64.745%
Germany	0.067	36.446%	0.239	16.002%	0.346	50.421%	0.349	-4.939%	2.071%
Finland	0.070	16.985%	0.378	9.118%	0.175	1.765%	0.427	0.077%	72.055%
France	0.032	14.106%	0.295	47.491%	0.214	29.214%	0.460	13.226%	-4.037%
Spain	0.024	9.485%	0.244	44.080%	0.203	30.048%	0.530	59.518%	-43.130%
Italy	0.027	19.498%	0.288	51.765%	0.227	42.495%	0.458	20.346%	-34.106%
The U.K.	0.052	18.956%	0.450	30.957%	0.140	8.468%	0.358	20.124%	21.495%
Hungary	0.041	19.115%	0.280	17.560%	0.315	20.852%	0.364	17.005%	25.469%
Sweden	0.046	10.520%	0.372	10.361%	0.167	22.368%	0.414	-8.413%	65.164%

Preliminary statistical analysis

Thus far, the contributions from the creative labour and ICT capital services appear significant in many European regions. However, such analysis only describes the static performance of each input. It may be clear how much creative labour and ICT capital services contributed to different levels of output growth by region but the relative causality remains less so. The econometric analysis concerning how these inputs are causal in relation to output change will be outlined in section 3.4.3. This section focuses on a research question regarding what happens if a region with high growth from the creative class/ICT capital services associates with high growth in value added output.

A simple pairwise correlation test was applied, as the estimation of input elasticity was no longer the purpose of the statistical analysis but rather what relationship any two inputs or any one input with an output could positively co-exist. With this in mind, the average values of growth rates for creative labour services, ICT capital services and GVA were taken and the correlations between them plotted in a two-way scatterplot. **Figure 4.3** shows us meaningful results, as a region with higher growth from the creative class or ICT is more likely to associate with higher value added output growth. Also, there is a positive correlation between the growth of creative labour services and ICT capital accumulation.

In conclusion, the preliminary statistical analysis indicated that economic prosperity is possibly related to the high contribution of the creative labour and ICT capital services. This finding further cites a significant heterogeneity regarding the performance of the creative class and ICT capital services across regions within

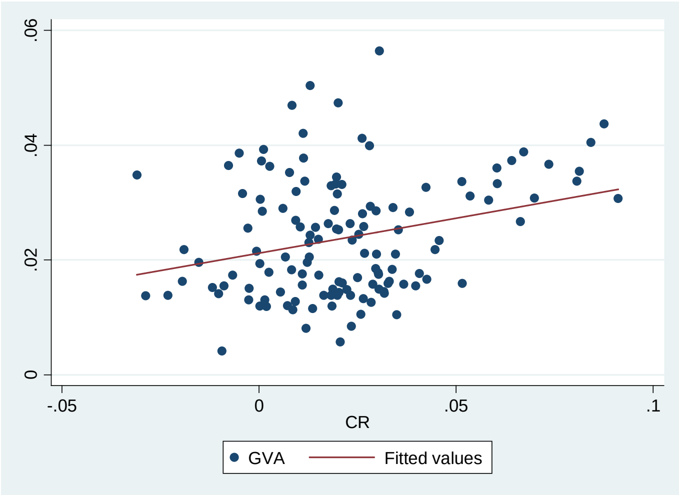
European countries. The particular type of workforce or capital services could all increase due to macroeconomic shocks, but how it contributes to an economy may be quite different. Moreover, it is interesting to note that the contribution level of ICT capital services is positively correlated with creative labour services. This may suggest a possibly positive relationship between these two. However, it is not clear what will be impacted and in which way, so a further analysis is necessary.

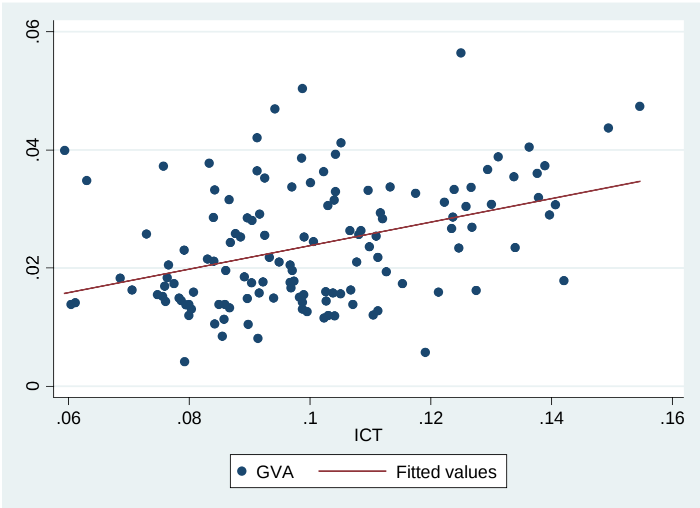
The long-term growth trajectory of each input factor

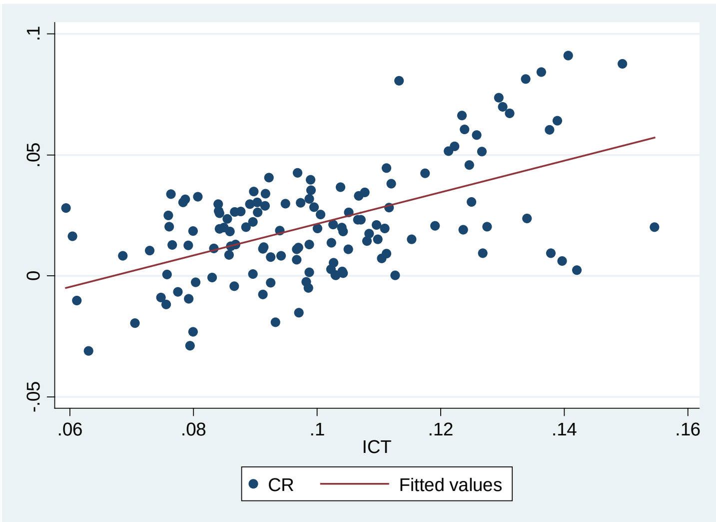
In this section, the growth pattern of each input comes to the fore, particularly the creative labour and ICT capital services. The average contribution points of $\mathrm{ICT_i}$ to GVA were defined as $\mathrm{ICT_{i,t}}$ and $\mathrm{ICT_{i,t+1}}$ in the period 1 and 2 (roughly t= period 1995-2001 and t+1= period 2002-2007), then the difference in contribution point over these two periods ($\Delta\mathrm{ICT_i} = \mathrm{ICT_{i,t+1}} - \mathrm{ICT_{i,t}}$) may be indicative of a growth trajectory for ICT in region i. Similarly, this calculation was performed on non-ICT capital (ΔNICT), creative workers (ΔCR), non-creative workers (ΔNCR) and TFP (ΔTFP).

As can be seen in **Appendix 4.E**, $\Delta\mathrm{ICT_i}$ have negative values in most of the regions in the advanced economies. This finding may be deemed realistic, as the accelerator effect of weakening GDP growth and the impact of the equity price falls on the cost of finance led to a decreasing rate of ICT investment growth post-2000 (McMahon *et al.*, 2005). However, the difference between $\mathrm{ICT_{i,t+1}}$ and $\mathrm{ICT_{i,t}}$ in Hungary is not significant. This may indicate the fact that those less developed European countries are still at the stage of “catch-up”. In contrast, the positive value of $\Delta\mathrm{ICT_i}$ is seen in Sweden, which may be due to the continuous application and investment in technology-intensive capital.

Figure 4.3: Correlation test







In addition, it is interesting to observe that ΔCR_i is positive in many advanced European economies too. This may confirm that a continuous effort had been given to promote the creative economy in many European countries, but such a performance remains quite heterogeneous. In the U.K., France, the Czech Republic and Sweden, the contribution of creative labour services is very important and such an effect is even being continuously amplified.

Spain also illustrated a similar tendency even through this was not the case for many regions. For less developed European countries, such as Hungary (Italy may be the case too), the primary task appears to be related to how it can retain the creative class in their countries as ΔCR_i is negative in all of the regions. Moreover, the growth pattern from the other inputs also cannot be ignored. In many countries, with the exception of Sweden and Belgium, $\Delta NICT_i$ is positive in many regions. The U.K. and Italy also demonstrate that the contribution of non-creative workers was growing. Finally, the number of regions where there is either a positive or negative contribution change for each input is summarised, as shown in **Table 4.3**.

Table 4.3: The contribution change of each input in the two equal periods

	ΔCR		ΔNCR		ΔICT		ΔNICT		ΔTFP	
	P	N	P	N	P	N	P	N	P	N
BE	6	5	7	4	0	11	3	8	4	7
FR	11	11	5	17	2	20	13	9	12	10
HU	0	7	0	7	1	6	6	1	6	1
ES	7	10	1	16	0	17	5	12	16	1
IT	3	16	11	8	0	19	16	3	6	13
SE	6	2	5	3	7	1	1	7	3	5
CZ	8	0	7	1	0	8	4	4	5	3
UK	9	3	8	4	0	12	5	7	3	9

Note: P=positive contribution change, N=negative contribution change.

In conclusion, the growth accounting analysis revealed that there is not a polarised role of the so-called creative class for regional economic development in the main European regions. The economic performance depends on the economic system, labour market mechanism, technological progress as well as many other factors, but not just a simple agglomeration of one or two input factors. The average contributions from the creative labour and ICT capital services are significant across regions. In particular, the presence of the creative class has become another source of growth in recent years. However, the prophecy of the future prosperity of the creative economy, as Florida predicted ten years ago, remains unfulfilled. In many Italian and Spanish regions, the contribution of creative labour service flows is low. Labour inputs even no longer matter but technology, research and high-tech intensive capital investment in many Nordic regions. In the long term, promotion of the creative economy also exhibits heterogeneity as the increasing contribution of the creative class can only be observed in some advanced European economies such as the U.K. or France.

4.3.3 Econometric analysis

The impact of creative workers and ICT on output growth

The Growth Accounting method provides an evaluation of the possible effects of creative labour and ICT capital services to output growth. However, it describes the issue rather than explaining it. In this section, econometric models are included, which try to directly estimate the elasticities of both creative labour and ICT capital inputs to value added output in terms of level changes. Expectations predict that econometric models are complementary to the growth accounting estimation, which further provides evidence about the relationship between creative workers and ICT.

However, it is worth noting that adding interaction variables may dramatically change the interpretation of all of the coefficients. If there was no interaction term, the coefficients of the creative class and ICT capital services would be α_1 and β_1 (referring to equation 4.12), which represent the unique effect of the creative class and ICT capital services on value added growth respectively. Since the interaction term indicates that the effects of the creative class and ICT capital services are different for different values of ICT capital and creative labour services, the unique value of the creative class is not limited to α_1 but also depends on the values of γ_1 (the coefficient of the interactive term) and ICT capital. Therefore, the total effect for the creative class is $\alpha_1 + \gamma_1 * \text{ICT}$ and for ICT capital is $\beta_1 + \gamma_1 * \text{CR}$. Accordingly, α_1 and β_1 only represent the unique effects of the creative class and ICT capital on value added output when the value of ICT or CR is equal to 0.

Table 4.4 illustrates that average values based on the available time periods for different countries were taken as the reference point. The summary statistics indicate a very significant level of regional heterogeneity. For example, the logged hours worked by creative workers has the highest value at 8.21 in the French metropolitan region Île de France compared to only 1.97 in the Finish region Åland.

In **Table 4.5**, all variables are based on the regional level and were logged. As can be seen in model I, the pooled-OLS model did not produce any meaningful results. This could be for many reasons and one has been illustrated earlier: the very large heterogeneity across regions, countries and years will bias results.

However, a region FE model may not be an adequate technique for this study either, even though it is well-accepted as an approach to eliminate endogeneity from unobserved and unobservable effects. As mentioned in section 4.2.2, the high variation in factor choices by economic agents over time in different regions is not most probably linked to technology but some exogenous factors (e.g. natural calamity, strike, policy intervention, etc.). Therefore, the additional measurement error problems could emerge from relying on time-variation (Griliches and Mairesse, 1997).

Table 4.4: Summary statistics

Based on avaliable time periods and143 European NUTS regions

Variable	Definition	Mean	Max	Min	Sd
GVA	Gross value added	10.20	12.75	6.62	1.09
ICT	ICT capital services	7.46	9.52	4.29	1.06
NICT	Non-ICT capital services	8.63	10.92	5.12	0.94
CR	Hours worked by the total creative workers	5.68	8.21	1.97	0.99
NCR	Hours worked by the total non-creative workers	6.48	8.42	2.66	0.88
GCR	Hours worked by the creative graduates	5.03	7.73	1.25	1.04
NGCR	Hours worked by the creative non-graduates	4.86	7.25	1.3	1.06

Notes:
1. All variables are naturally logged.
2. The unit of hours worked is per million. The value of gross value added and capital services are measured by per million 1995 euros (ECU).
3. Only the NUTS 1 code is available in the U.K.

Sources: GVA: the Cambridge Economics, ICT/NICT: the EU KLEMS and the EU LFS, CR/NCR/GCR/NGCR: the EU LFS.

The following attempt, based on the region FE specification, confirmed the above prediction. As shown in model II, controlling for fixed effects over 143 regions is problematic and again, only largely biased results were produced. At this point, neither the assumption of the one-sector interregional factor allocation nor the assumption of constant returns to scale can be held.

In response, this thesis only relied on cross-sectional variation (i.e. a pooled style) to estimate the aggregated production function. As can be seen in model III, year dummies are included for controlling jointly trending effects, such as common economic shocks, and country dummies are further added to capture the effect that countries of various sizes go into the panel at different time points. Now the results became acceptable, a one percent increase in ICT capital, creative labour and non-creative labour services yield 0.231+0.017*CR[37], 0.266+0.017*ICT and 0.179 percent increase in value added output. NICT capital services, however, remain insignificant.

Table 4.5: The contribution of creative labour and ICT capital services

Dependent variable: gross value added

	(I)	(II)	(III)	(IV)	(V)
The creative class	-0.236***	0.018	0.266***	0.303***	0.303***
	(0.043)	(0.014)	(0.050)	(0.069)	(0.070)
Non-creative workers	-0.061***	-0.039**	0.179***	0.165***	0.173**
	(0.031)	(0.008)	(0.053)	(0.069)	(0.077)
ICT capital	-0.316***	0.040**	0.231***	0.287***	0.293***
	(0.029)	(0.014)	(0.056)	(0.070)	(0.081)
NICT capital	0.922***	0.085**	-0.061	-0.044	-0.121
	(0.023)	(0.018)	(0.073)	(0.093)	(0.111)
Interactive term	0.058***	0.009***	0.017***	0.016**	0.016***
(ICT*CR)	(0.004)	(0.001)	(0.004)	(0.004)	(0.004)
Year dummy	No	Yes	Yes	Yes	Yes
Country dummy	No	Yes	Yes	Yes	Yes
Region dummy	No	Yes	No	No	No
_cons	6.080***	8.476***)	2.141***	2.000***	2.000***
	(0.158)	(0.126)/	(0.228)	(0.314)	(0.331)
R-squared	0.92	0.83	0.95	0.95	0.95
N. of cases	1458	1458	1458	1316	1316

Notes:
1. (I) Pooled OLS, (II) region FE, (III) country FE, (IV) based on model (III), ICT, NICT and CR were instrumented by their own one-period lagged value, (V) based on model (IV), robust variance was added.
2. CR=creative labour services, NCR=non-creative labour services, ICT=ICT capital services, NICT=non-ICT capital services, ICT*CR=the interactive term between ICT capital and creative labour services.
3. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, standard errors shown in parenthesis.

Given the fact that regional level dummies were not included in model III, unobservable effects are not strictly controlled and so the model may still suffer endogeneity. To test endogeneity, a Durbin-Wu-Hausman Test (see Woodridge, 2010) was adopted and the results are shown in **Table 4.6**. The results in the first column indicate that the coefficients of residuals from reduced forms of ICT capital, non-ICT capital and creative labour services were significant when they were added on to the original regression beside the non-creative class[38]. And the results were significantly

[37] For the sake of simplicity, here we just use the terms CR and ICT to represent their different categories.
[38] The distinction among the possible forms of endogeneity is not always sharp (Woodridge, 2012). In this study, the labour input from non-creative services is not endogenous in the regional economic

different if residuals from those three variables were involved, confirmed by the second stage test where the P-values (see behind the back slash signs in the first column) were all below 0.05. As a result, ICT, non-ICT, the creative class and the interactive term (ICT*CR)[39] are considered as endogenous.

Table 4.6: Tests of endogeneity for the independent variables

	Durbin-Wu-Hausman Test	Weak Instrument
ICT capital services	0.72(0.000***)\0.000***	0.85(0.001***)
Non-ICT capital services	0.35(0.086**)\0.003***	0.86(0.001***)
The creative labour services	-.0.22(0.075**)\0.03**	0.56(0.001***)
Non-creative labour services	-.0.038(0.78)\0.23	n/a

Notes:
1. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
2. In the Durbin-Wu-Hausman Test, the P-values behind the back slash signs are the results at the second stage of the test.
3. Year and country dummies were included in all the tests.

To handle this endogeneity problem, there is another way in addition to the data transformation based techniques such as the region FE model. Here, it is assumed that past values of regressors are significantly correlated with their current values but not the current error terms (Wooldridge, 2009)[40]. The inclusion of more than one-period lagged values as instruments significantly reduces the sample size in this study; therefore, only one-period lagged values of regressors were taken as the possible instrumental variables. The second column within **Table 4.6** shows that candidate instruments are not weak instruments, as their coefficients to endogenous variables in reduced forms are significantly large.

With the above model specification, observations of one time period are dropped from the total sample. Furthermore, year dummies and country dummies

system. This may imply that the changing economic situation is not a determinant in impacting the demand of non-creative (low skilled) workers across different European regions on average.

[39] If CR and ICT are endogenous, then ICT*CR appears to be endogenous too.

[40] As the model is just identified, the validity of instruments is not testable by some techniques such as the over-identification test.

absorb a significant amount of the expected unobservable and heterogeneous effects, thus the value of R squared on average is high (roughly around 0.95). Now in model IV, a one percent increase in ICT capital or the creative labour services yields about 0.287+0.016*CR or 0.303+0.016*ICT increases in output. This estimate appears to be consistent with the findings from previous studies, as ICT investment produces excess returns as compared to the predication from the growth accounting approach (O'Mahony and Vecchi ,2005; Boselli, 2010).

However, non-ICT capital again has no significant impact on output variation as its coefficient is negative and insignificant. Also, the contribution of non-creative labour does not seem proportionate to its volume; the coefficient in this case is only 0.165 while its scale is much larger than the creative class in terms of working hours (see Figure 3.1). Finally there is a significant positive interactive effect between ICT capital and the creative class, with a significant coefficient of 0.016.

Potential issues of heteroskedasticity and autocorrelation were further tested; this is shown in **Table 4.7**. Here, it can be seen that the LR test (see Drukker, 2003) indicates a significant difference between heteroskedastic and homoskedastic GLS panel regressions. Autocorrelation was also identified by the Wooldridge Test (see Wooldridge, 2010). However, due to the sample size (1458) being selectively small as well as having a short time series, it can be argued that the results are not seriously biased due to heteroskedasticity or autocorrelation. Nevertheless, such an effect needs to be taken into account. In model V, the robust variance was introduced based on the setup in model IV. We see that the coefficients of all variables almost remain the same but the values of standard error increase.

In conclusion, model V is adopted as the main econometric model for this study. Although regional/sector heterogeneity is not controlled for and potential endogeneity may still exist, this model produced plausible results according to the basic setup of production function theory.

Table 4.7: Tests for heteroskedasticity and autocorrelation

	LR Test for Heteroskedasticity	**Wooldridge Test for Autocorrelation**
Hypothesis	H0: no difference between heteroskedastic and homoskedastic regressions	H0: no first-order autocorrelation
Result	LR chi2(142)=2902.06 Prob > chi2 = 0.0000	F(1, 141) = 121.712 Prob > F = 0.0000

The model was next extended to allow for the effect of both the creative class and human capital, and then the creative and non-creative workers were decomposed into three sub-categories: high-skilled creative workers, medium/low-skilled creative workers and non-creative workers[41]. Although it is difficult to tell whether creativity or education is more likely to contribute to the shaping of some types of workers (e.g. the creative graduates), this type of breakdown can further provide an opportunity to analyse not only the creative class but also the associated effect from higher education.

Observing **Table 4.8**, model III shows that the contribution of ICT capital and creative graduates' labour services are most significant, with coefficients of 0.382 and 0.161 respectively. Once again, there is no direct evidence to show a significant impact on output level change from non-ICT capital and the coefficient of the non-

[41] Further decomposition the group of non-creative workers into the sub-groups of non-creative graduates and non-graduate non-creatives was not carried out. As far as the issue of multicollinearity is concerned, the size of coefficient for ICT and CR is largely driven by the way the sub-groups of the total employment were defined. However, with the setup in this section, the results are most close to economic realities.

creative graduates is small, at 0.125. If the impact from non-creative workers is also taken into account, findings are consistent with **Table 4.5**, as the total contribution of the creative class (i.e. 0.161+0.013*ICT+0.125=0.286+0.013*ICT) appears to be greater than non-creative workers (0.193).

Table 4.8: Gross value added output with further breakdowns of creative/non-creative workers

Dependent variable: gross value added output

	(I)	(II)	(III)
ICT capital services	-0.121	0.369^{***}	0.382^{***}
	(0.028)	(0.055)	(0.071)
NICT capital services	1.151^{***}	-0.036	-0.106
	(0.025)	(0.077)	(0.098)
Creative graduates labour services	-0.188^{***}	0.126^{***}	0.161^{***}
	(0.036)	(0.035)	(0.046)
Non-graduate creative labour services	0.099^{***}	0.109^{***}	0.125^{**}
	(0.016)	(0.037)	(0.068)
Non-creative labour services	-0.381^{***}	0.200^{**}	0.193^{**}
	(0.036)	(0.058)	(0.076)
Interactive term (ICT*GCR)	0.038^{***}	0.015^{**}	0.013^{**}
	(0.003)	(0.004)	(0.004)
Year dummies	No	Yes	Yes
Country dummies	No	Yes	Yes
_cons	4.937^{***}	3.710^{***}	3.869^{***}
	(0.278)	(0.279)	(0.394)
R-squared	0.92	0.96	0.96
N. of cases	1458	1458	1316

Notes:
1. All variables are log-transformed.
2. (I) the original OLS regression, (II) country FE model, (III) 2SLS regression with robust variance, ICT, NICT and CR are instrumented by their one-period lagged values.
3. The creative graduate is measured by creative workers who have a bachelor degree or above.
4. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, standard errors shown in parenthesis.

Finally, the summarised results for interactive terms between ICT capital services and working groups when measuring the different skilled workers are listed in **Table 4.9**. Also, ICT capital accumulation and labour services produced by skilled workers were averaged based on the available time periods and were then expressed in percentiles.

We can see that a region with a higher level of ICT capital services or creative labour input can produce more units of output. For example, the region with 6.12 units of ICT capital services increased the total marginal effect of the creative class from an initial value of 0.303 to 0.401[42]. Within a 90 percentile region, such an effect was amplified to 0.450. In contrast, a higher level of creative class labour input also increased the efficiency of ICT capital from an initial value of 0.293 to 0.367 in a region where the creative class labour input is 4.60.

In conclusion, for the first time econometric analysis has estimated the economic impact of creative workers together with ICT capital /non-ICT capital services on value added output at the regional level. In contrast to previous studies based on either the firm/industry level or national level, this regional study focuses on the role of geographic proximity in shaping successful economic performance; geographic proximity may not be the factor that causes growth. However, it is an important factor to shape the location of behaviour of economic agents and the linkage between them (Ascani *et al*., 2012). The findings are summarised as follows:

The role of ICT/non-ICT capital

Firstly, the estimation shows that in industrialised European economies, the accumulation in ICT capital services is likely to have a casual effect on value added output growth. At the regional level, this effect is much stronger than estimations at firm or industry levels, where the effects of ICT capital services are in a range from 0.293 to 0.450 according to the categories of creative labour services. However, this may be plausible as the measure of capital service flows is sustainably different from the measure of capital stock. By looking at **Figure 4.1** again, the aggregate value of ICT capital services appears to be very large if it is estimated by multiplying it's per hour value by the total hours worked. As for the aggregate value of non-ICT capital

[42] To estimate the marginal effect of creative labour services and ICT capital services, the perfect differential equation for the creative class can be expressed $\frac{\partial Y}{\partial CR} = \beta_1 + \gamma ICT$ if $Y=\alpha + \beta_1 CR + \beta_2 ICT + \beta_3 NCR + \beta_4 NICT + \gamma(ICT * CR) + \varepsilon$. In the same way, $\frac{\partial Y}{\partial ICT} = \beta_2 + \gamma CR$.

services, it is still higher, but on average such a gap is much smaller compared to the difference in their compensation shares. With this in mind, the estimation clearly captures the extent of this pattern.

In addition, the size of the ICT coefficient may reflect *"the presence of external values caused by networking or productivity spillovers that push up the social value of ICT capital over private return"* (Venturini, 2007, p.19). In other words, high coefficients may indicate not only the impact of ICT on GVA but also the positive effects from spillovers when only country heterogeneity can be controlled in this study. As Cimoli *et al.* (2010, p.169-172) further summarised, the aggregate impact of ICT is always higher than the sectoral impact. This suggests that the existence of spillovers associated with ICT and country and sectoral heterogeneity plays a central role in explaining the pervasiveness of ICT in an economic system.

Moreover, findings may capture the long-term effect of ICT capital in the regional economic system. Pesaran and Shin (1999) noted that pooling data is an acceptable technique that produces the long-term production function coefficients – production functions across industries in different countries will converge to the same point in the long run, especially when two or more countries are very close in terms of technology use and the path of development. At this point, the coefficient estimation for ICT capital services is consistent with existing literature. For example, O'Mahony and Vecchi (2005) imply that ICT capital accumulation accounts for approximately 40 percent of output growth in the long run.

Finally, it is no surprise to see that the impact of non-ICT capital services inputs on output growth is insignificant (Vu, 2005) or negative (Venturini, 2007) in developed economies. This regional study once again reveals the similar pattern;

through a larger sample size, non-ICT capital does not have a clear role in regional economic development in terms of the level change of value added output. This finding may be viewed as realistic as this study includes most of the developed and industrialised regions in Europe.

The role of creative workers and the interaction with ICT

The impact of skilled workers on regional economic growth is also readily evident. In terms of production, the impact of creative workers is much stronger than non-creative workers since their labour shares and income shares are smaller or similar in most of the target countries – this is another case of increasing returns to scale which implies the significant external values of the creative class.

Furthermore, the highly educated creative workers make higher contributions than non-graduate creative workers to output growth in terms of labour input. This finding is consistent with previous studies and coincides with the on-going argument from Florida's supporters, as well as Glaeser's followers. On one hand, Florida's proposition appears to be correct as contribution from the creative class is much higher than those of the creative have-nots. On the other hand, graduates are also an important source of growth, as non-graduates who work in creative professions contribute less to output growth than those who also have a university degree.

Finally, the reciprocal role between ICT capital accumulation and creative workers is confirmed by the significantly positive sign of interactive terms. Greater accumulation of ICT capital will produce more units of output through the skilled worker's labour services. Vice versa, the existence of more skilled workers also contributes to the efficiency of ICT capital application. These findings empirically support Autor *et al.*'s (1998) conclusion that the application of ICT capital is complementary to skilled workers who get involved in non-routine tasks, such as graduates, and this discussion is also extended from a new angle based on specific divisions in occupations.

Table 4.9: The total marginal effects of ICT and creative workers on GVA by percentile

	10%	20%	30%	40%	50%	60%	70%	80%	90%	Mean
Values of ln(ICT)	6.12	6.60	6.81	7.34	7.55	7.72	8.05	8.35	8.89	7.64
Values of ln(CR)	4.60	5.08	5.30	5.42	5.66	5.9	6.14	6.41	6.99	5.68
Values of ln(GCR)	3.88	4.42	4.56	4.74	5.02	5.23	5.52	5.82	6.39	5.02
ICT_1:0.293+0.016* ln(CR)	0.40	0.41	0.41	0.42	0.42	0.43	0.43	0.44	0.45	0.43
ICT_2:0.382+0.013* ln(GCR)	0.43	0.44	0.44	0.44	0.45	0.45	0.45	0.46	0.46	0.45
CR:0.303+0.016*ln(ICT)	0.37	0.37	0.38	0.38	0.38	0.39	0.39	0.40	0.40	0.38
GCR:0.161+0.013* ln(ICT)	0.25	0.25	0.25	0.26	0.27	0.27	0.27	0.28	0.28	0.27

Notes:
1. The values of variables in this table were all log-transferred.
2. ICT_1 and ICT_2 are the coefficients of ICT capital services corresponding to the last columns in Table 4.5 and Table 4.8.
3. CR: labour services of the creative class. GCR: labour services of creative graduates.

The impact of creative workers and ICT on economic efficiency

Empirical model 2, from a different perspective revealed the positive role of creative workers in the local economic system. This was different from the method that defined the residual from regression as TFP, as the regional TFP level in this study is obtained from the growth accounting calculation at the first stage (see section 4.3.2). In comparison to econometric methods that pre-assume input elasticity is constant, the Growth Account method allows for variation in input elasticity across regions and over years, which produces a more accurate estimation.

The logged contribution of TFP to GVA growth is initially converted back to the real growth rate and then is indexed based on the basic year (TFP=100). This empirical model based on the fixed effects model also includes control variables that are essential to explain the difference in regional productivity, such as R&D investment or the joint effect of skilled workers and ICT capital.

Summary statistics are listed in **Table 4.10**. Due to most of the dependent and independent variables being expressed per worker term, the relative logged values are negative figures. **Table 4.11** shows the pairwise correlations between independent variables entered into the regressions. Included is the full time period of observations regarding the very limited samples in each cross-section (around 143). The VIF test implies that the empirical model does not suffer from the problem of multicollinearity, evidenced by the fact that all the VIF scores are well below five. Although in this case the creative class and ICT capital variables are expressed in different ways, similar patterns are still captured in comparison to the previous analyses. In addition, with a significantly positive relationship between ICT capital and the creative class (0.520), the share of the creative class is also positively correlated with the share of migrant workers (0.373) and R&D expenditure per worker (0.316), while ICT capital services per worker is positively correlated with the R&D expenditure per worker (0.568) and the share of migrant workers (0.462).

It seems, therefore, that creative workers, who mainly perform non-routine tasks, are benefited by R&D investment and also demand a highly open atmosphere. In an effort to complete non-routine tasks, more ICT applications may be necessary in the modern workplace and in turn produce a higher level of attached services.

The model firstly only includes the creative class and human capital at a time, as they are sceptical to be highly corrected so that we can avoid the issue of multicollinearity. However, if the human capital and the creative class are supposed to capture different aspects of the worker, potential and actual skills, they should be included in the same regression model otherwise the result will again be biased due to the omitted variable problem. **Table 4.12** reports the basic estimation of human capital and the creative class in column 1 (I) and 2 (I), showing the insignificant coefficients of -0.029 and -0.155 respectively. This finding is different from previous studies (Marrocu and Paci, 2012) as a different technique was used to estimate the TFP level; the growth accounting model not only controlled for the impacts of unitary labour and capital inputs but also the individual effects of both human capital and creative workers. As a result, it is believed that the TFP estimation in this study is more precise to reflect technological progress and efficiency with minimised measurement errors.

Table 4.10: Summary statistics

	Mean	Max	Min	Sd
Share of the creative class	-1.13	-0.26	-2.12	0.36
Share of creative graduates	-1.87	-0.98	-3.18	0.38
Share of non-graduate creatives	-2.86	-1.52	-4.93	0.69
Share of graduate non-creatives	-2.86	-1.52	-4.93	0.69
Share of graduates	-1.53	-0.64	-2.86	0.42
ICT capital services per worker	-5.90[43]	-4.23	-7.73	0.58
R&D expenditure per worker	-7.84	-3.87	-11.5	1.14
Population density	6.08	7.07	0	0.99
Share of foreign-born workers	-2.92	-1.20	-4.60	0.80
Level of TFP	4.60	5.13	4.26	0.09

Table 4.11: Correlation test

	Creative Class	ICT	R&D	Density	Diversity	VIF Scores
Creative workers	1					1.44
ICT	0.520*** (0.000)	1				2.25
R&D	0.316*** (0.000)	0.568*** (0.000)	1			2.81
Density	-0.080*** (0.002)	0.0351 (0.180)	0.002 (0.940)	1		1.03
Diversity	0.373*** (0.000)	0.462*** (0.000)	0.312*** (0.000)	-0.084*** (0.001)	1	1.48

Notes: 1. In the last column, the result of the standard VIF test for multicollinearity is reported.
2. Diversity: share of migrant workers. Density: population density per square kilometre.
3. * p < 0.10, ** p < 0.05, *** p < 0.01

Sources: creative workers: the EU LFS, ICT: the EU KLEMS/ the EU LFS, density and diversity: the Eurostat

[43] The logged value of ICT capital services per worker is negative, as the measure unit is millions of euros.

So far, it has been argued that the estimation may lead to misleading conclusions if the issue of disaggregation of human capital and the creative class variables are overtaken. According to the creative class thesis, the functions of the creative class and human capital in a regional economic system need to be complementary, not competing. In an attempt to reduce problems in measurement, a further breakdown divided total skilled workers into three sub-groups: the graduate creatives, the non-graduate creatives and the non-creative graduates. Columns 4 (I) and 5 (I) show that the presence of highly educated creative workers or other sub-categories are still not significant to explain the level change of TFP.

Observing other controlled variables, a positive and robust effect from ICT capital and R&D expenditure to enhance local economic efficiency were found, showing the coefficients around 0.09 and 0.10 respectively. For the variables concerned with population density, it seems to be less important to favour the local efficiency enhancement in all models. This result could be plausible, as in most of the developed European countries, a knowledge-intensive economy is now more likely to link to innovation, skills and the application of technology, but only slightly relates to the externality of an agglomeration economy (Melo and Graham, 2009).

Finally, a positive relation was not found between the share of migrant workers and TFP level. Many migrant workers, due to limited ability, a language barrier or other unfavourable factors may only participate in low-skilled jobs, which in turn negatively impact the regional economic efficiency. This result may reflect the fact that migrant workers' participation rate is conceptually different from the so-called tolerance, as ethnic diversity adversely impacted economic growth in the long term (Easterly, 2001). However, it is plausible to think that the impact of ethnic diversity may be indirectly linked to productivity enhancement, as it is a good indicator in explaining the consumer preferences of the creative class; this will be discussed in a later chapter.

At this stage, the findings support the proposal indicated in the first section: the high variation in factor choices made by economic agents across different regions over time is not most probably linked to technology. In any of the above setups, the share of skilled workers is not significant enough to explain the level change of TFP. In addition, the measure of TFP needs further attention. Although several previous studies focus on the cross-sectional variation of factor shares in technological progress, oversight of the individual effects of relevant working sub-groups or other specific inputs could lead to biases.

In an attempt to connect the contribution of skilled workers to regional economic systems, relative interactive terms between different sub-categories of workers and ICT capital were also included. The interactive terms not only explained the reciprocal process but also singled out a possible channel to enhance the economic efficiency. In model II the coefficients of skilled worker related variables were found to be significant in all columns. The coefficient of the creative graduates is 0.223 and for the whole creative class the figure increases to 0.623 as the standard error is also large. However, such a change is less dramatic for graduates, as the coefficient is 0.151. It appears that the significant and positive outcome of the interactive terms confirmed the complementary process between the presence of skilled workers and the density of ICT capital. This effect is especially strong for the whole creative class (0.103), followed by the creative graduates (0.039) and all graduates (0.028).

The significant negative values for graduate non-creatives in column 5 (II) seem to be implausible. However, this problem is likely due to multicollinearity;

because of the overlapping components between graduates and the creative class it is possible to have contemporaneous movement for both; for example, the share of graduate creatives increases to the same degree as non-creative graduates. The later VIF test reveals this pattern, with a VIF score of 5.99, which implies the presence of multicollinearity. Nevertheless, this is not regarded as an inherent disadvantage in the analysis of sub-populations, as the sign and coefficient for the creative graduates are as expected.

Why do the insignificant coefficients for skilled workers in each model turn to significant coefficients when interactive terms have been added on? The explanation is similar to the discussion on the production function analysis in the previous section. Observing equation 4.13, the original effect is β_1. With the interaction term, the effect now becomes $\beta_1 + \beta_3 * \mathrm{ICT}$. Another way of saying this is that the slopes of the regression lines between the TFP level and share of the skilled workers count are different for the different categories of ICT capital services – β_3 indicates how different these slopes are. Therefore, the marginal effects of the share of skilled workers to the TFP level change in association with the contribution from the selected categories of ICT capital accumulation are under discussion.

Since skilled workers can contribute to economic performance through multiple channels, it is asserted that ICT is powerful. On one hand, the contribution of skilled workers, such as the creative class, graduates and the creative graduates, largely increases through its application and diffusion. In contrast, the presence of skilled workers also enhances the contribution of ICT capital per worker. The coefficients of ICT capital services per work increased from 0.096 to around 0.181 across the different model specifications.

Table 4.12: The impact of creative workers and ICT capital services on the TFP level change

Dependent variable: TFP level										
	(1)		(2)		(3)		(4)		(5)	
Variables of skilled workers	I	II	I	II	I	II	I	II	I	II
Graduates	-0.029	0.151***								
	(0.015)	(0.067)								
The creative class			-0.155	0.623***						
			(0.022)	(0.128)						
Creative graduates					-0.153	0.223***	-0.015	0.223***	-0.012	0.157***
					(0.017)	(0.070)	(0.016)	(0.070)	(0.016)	(0.072)
Non-graduate creatives							-0.011	-0.009	-0.018	-0.016
							(0.014)	(0.014)	(0.014)	(0.013)
Graduate non-creatives									-0.038*	-0.032*
									(0.008)	(0.009)
Interactive terms										
ICT× Graduates		0.028***								
		(0.009)								
ICT× The creative class				0.103***						
				(0.020)						
ICT× Graduate creatives						0.039***		0.038***		0.027***
						(0.009)		(0.010)		(0.011)
Control variables										
ICT capital services per worker	0.096***	0.132***	0.101***	0.181***	0.096***	0.152***	0.097***	0.152***	0.104***	0.142***
	(0.018)	(0.021)	(0.015)	(0.029)	(0.016)	(0.026)	(0.016)	(0.026)	(0.016)	(0.023)
Ethnic diversity (share of migrants)	-0.040***	-0.044***	-0.041***	-0.037***	-0.040***	-0.044***	-0.041***	-0.044***	-0.041***	-0.043***
	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
R&D expenditure per worker	0.086***	0.093***	0.083***	0.091***	0.085***	0.094***	0.084***	0.094***	0.085***	0.091***
	(0.008)	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)
Population density	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
_cons	5.779***	6.351***	5.796***	6.351***	5.767***	6.176***	5.762***	6.153***	5.684***	5.975***
	(0.111)	(0.157)	(0.113)	(0.157)	(0.114)	(0.59)	(0.117)	(0.162)	(0.117)	(0.170)
R-squared	0.26	0.27	0.26	0.28	0.26	0.27	0.26	0.27	0.26	0.29
N. of cases	1454	1454	1454	1454	1454	1454	1454	1454	1454	1454

Notes: 1.All independent variables are expressed in per worker term and are log-transformed excluding population density. 2.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, standard errors shown in parenthesis. 3. Year dummies are included in all regressions.

In conclusion, the second empirical model seems to confirm the conclusion based on the preliminary statistics analysis (see section 4.3.1), as ICT capital contributes to economic efficiency, but the contribution of skilled workers is also captured. Although the discrepancy remains unexplored regarding how the impact of skilled workers on the improvement of economic efficiency in panel data could be properly tested, ICT capital application appears to be a good channel in enhancing the performance of creative workers and graduates; with the joint effect from the level of ICT capital services accumulation, the marginal effect of skilled workers becomes very strong in explaining the temporal change of the TFP level.

Therefore, findings are consistent with the production function analysis. The interactive relationship between skilled workers and ICT capital can produce positive effects on economic performance. It seems that the creative class, who have utilised skills, have a much stronger effect with ICT diffusion than graduates, whose degrees are only likely to represent their potential. It would be a mistake to say that graduates lack skills, but the utilisation rate of ICT for graduates in different occupations varies and in turn mitigates this positive effect on the average scope. In contrast, the creative class centres on many highly-skilled ICT occupations such as engineers, scientists, reporters or technicians, thus it may be not surprising to see better performance associated with ICT.

This thesis supports the positive effect of ICT-skilled workers on economic performance. However, the creative class is a broad concept, which includes not only narratively defined ICT workers[44] (e.g. Riley and Robinson, 2011) but also many other occupations with different economic functions. When this is broken down

[44] To evaluate ICT-skills themselves, some research is focused at a very detailed level. For example, Riley and Robinson (2011) defined a list of occupations to represent ICT workers based on the 4-digit level ISCO codes in the major group 3.

further, separating the effect from the creative class and human capital, only creative graduates, who work on actual creative job, have significant explanatory power to explain the regional economic efficiency. Therefore, it seems important to acknowledge that the effectiveness of graduates varies according to the creativity content of a graduate's actual occupation.

4.4 Conclusions

Following hypotheses 4.1-4.3, it was decided to discuss the roles of creative workers, graduates and ICT from the production side. In Chapter 4, the economic impacts of the creative class was discussed and analysed using the Growth Accounting method, complemented by econometric analysis. Together with the findings from ICT, the conclusion is drawn as below:

Hypothesis 4.1: is the relationship between the creative class and the regional economic performance positive?

In response to hypothesis 4.1, the growth of creative labour services appears to be an important source of output growth in many of the European regions in the last decade, but this is not universally so as in many other regions. According to the Growth Accounting method, economic growth is also determined by other factors and does not only rely on the polarised growth of the creative labour services. ICT capital investment, technological progress/efficiency or even traditional labour and capital inputs could significantly contribute to regional development. This fact cannot simply be explained by the different development levels throughout the regions in the targeted countries.

Compared to Florida's (2004) study about Europe, a different definition regarding the quality of the creative economy was proposed, challenging the philosophy of the creativity index. Despite its synthetic nature, it is too arbitrary to combine different Ts (talent, technology and tolerance) to predict the level of "creativity" in a common way, no matter how it is calculated or abstracted by weights or latent variables. It is undeniable that tolerance and technology are, to a great extent, related to the performance of the creative class in an economic system, but this pattern is more complicated, requiring several analyses at multiple levels.

Therefore, observing the pure labour input from the creative class is a direct way to examine its contribution based on the concrete economic reality. The overall conclusion about Europe does not totally deviate from Florida's, but there is a quite different understanding about the creative economy in Europe. In association with economic contributions from other inputs, there are too many issues that cannot be properly explained by Florida's 3Ts and his previous European studies. In this case, hypothesis 4.1 can be only conditionally verified.

Hypothesis 4.2: are creative worker's skills complementary to the application of ICT, or vice versa?

Bearing in mind the above points, the econometric analysis investigates hypothesis 4.2 regarding the role of the creative class, together with ICT, in the economic system. For the first time, this thesis estimated the level of ICT capital services at the regional level for the main European regions over time. The research also contributes to associating creative workers with other important inputs such as ICT capital services and human capital. The econometric analysis demonstrated that in the whole European context, the changes in regional creative labour and ICT capital services have stronger explanatory powers in explaining the growth in gross value added, compared to changes in levels of non-creative labour and non-ICT capital services. It is also interesting that the co-existence of the creative class and ICT capital can result in a greater change of output in Europe through a positive interactive effect, than through the contributions from each of these inputs separately.

The further econometric analysis regarding the economic efficiency (TFP) clearly implies that the creative class has a greater impact on the change in regional TFP levels than graduates in association with the effect of ICT capital services in Europe. This finding that the presence of the creative class has a stronger effect than graduates in explaining productivity is consistent with several previous studies (e.g. Florida *et al.*, 2008; Marrocu and Paci, 2012). In summary, it is believed that hypothesis 4.2 can be held.

Hypothesis 4.3: is the contribution from different creative sub-categories to the regional economic performance similar?

In order to test hypothesis 4.3, the creative class and graduates were finally combined together. Later, the evidence coincides with the on-going argument between Florida's supporters and Glaeser's followers. Graduates who work in creative professions contribute more to output level than those who do not, while non-graduate creative workers have a lower contribution than those creative graduates. This is also confirmed in the second empirical model explaining TFP. Therefore, graduates and the creative class not only have different impacts on economic performance but also are supportive to each other and neither is dispensable.

In conclusion, explicit interactions between ICT and the creative class have suggested that they are not choices but are integrated. With respect to this, it appears that understanding regarding the source of economic growth is no longer an isolated topic but needs to be seen in the context of broader based economic development. Therefore, a creative worker's capacity has to be maximised through a suitable channel, such as through the integration of ICT. From another perspective, the creative class thesis also provides a new concept in human capital based ICT policy-making. It appears that an appropriate socio-economic environment is essential for making economic progress in the knowledge based economy. Therefore, the promotion of the creative economy deserves consideration when exploring the potential of ICT.

Appendix

Appendix 4. A: Ranking of average ICT/NICT capital service growth rates

Country	Ranking	Region code	Region	ICT growth	NICT growth
BE	1	16	Prov. Brabant Wallon	21.05	5.52
BE	2	14	Prov. Vlaams-Brabant	18.08	3.42
BE	3	19	Prov. Luxembourg	18.00	3.32
BE	4	12	Prov. Limburg	17.36	3.29
BE	5	20	Prov. Namur	17.28	2.80
BE	6	13	Oost-Vlaanderen	17.06	2.99
AT	7	5	Steiermark	17.04	2.32
HU	10	140	Kozep-Magyarorszag	16.76	2.40
FR	11	92	Corse	16.54	9.63
BE	12	15	West-Vlaanderen	16.51	2.83
AT	13	9	Vorarlberg	16.47	1.12
BE	14	11	Prov. Antwerpen	16.32	2.66
ES	15	69	Región de Murcia	16.21	6.91
BE	16	10	Bruxelles / Brussels	16.01	1.78
ES	31	56	Cantabria	14.43	5.37
DE	32	34	Hamburg	14.28	5.89
CZ	33	132	Praha	14.14	5.07
ES	34	61	Comunidad de Madrid	14.10	6.12
IT	83	96	Lombardia	10.57	2.51
UK	96	114	Yorkshire	9.97	1.26
DE	97	32	Berlin	9.93	2.74
DE	136	46	Detmold	8.51	2.55
DE	137	42	Weser-Ems	8.41	1.84
FR	138	75	Centre (FR)	8.39	1.84
FR	139	71	Île de France	8.32	2.04
FR	140	74	Haute-Normandie	8.29	1.88
FR	141	77	Bourgogne	8.19	2.13
SE	142	131	Övre Norrland	8.10	4.60
DE	143	49	Chemnitz	8.01	2.49
SE	144	126	Småland med öarna	7.98	3.34
DE	145	37	Kassel	7.89	1.37
SE	146	129	Norra Mellansverige	7.67	5.28
SE	147	128	Västsverige	7.53	4.73
SE	148	130	Mellersta Norrland	6.13	4.04
SE	149	125	Östra Mellansverige	6.12	3.62
SE	150	127	Sydsverige	6.10	3.54
SE	151	124	Stockholm	6.04	3.07

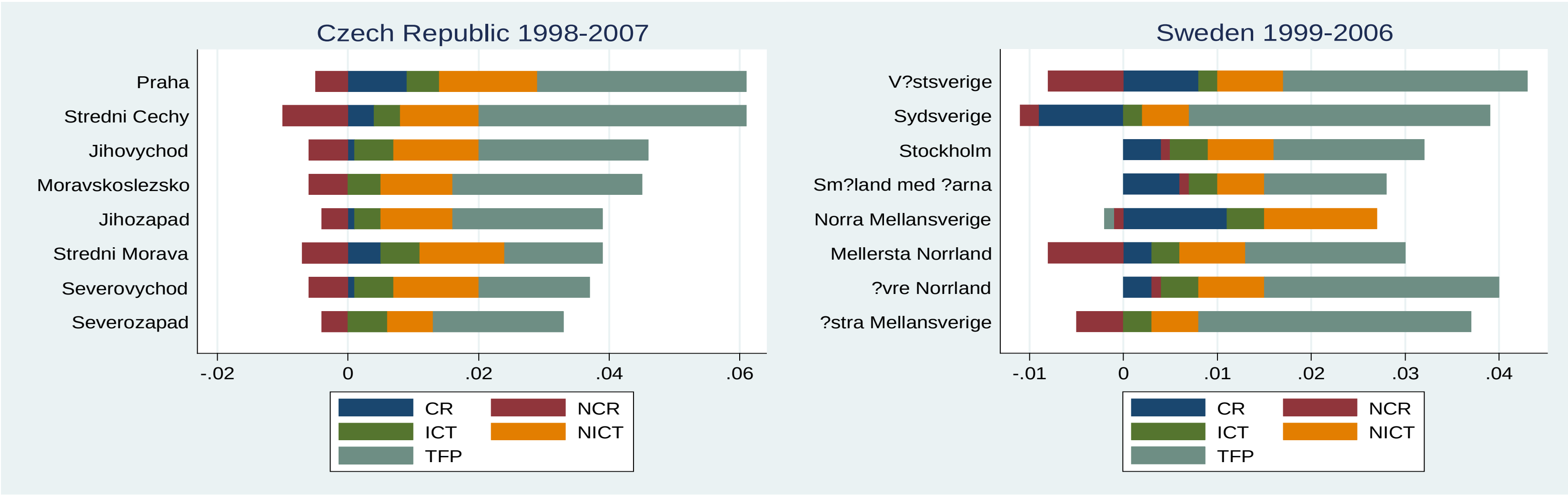
Notes: 1. The average growth rates of ICT/NICT capital services are calculated for the period 1995-2007 at the 1995 price level. 2. AT=Austria, BE=Belgium, DE=Germany, FR=France, ES=Spain, IT=Italy, U.K.=the U.K., SE=Sweden, CZ=Czech Republic, HU=Hungary, FI=Finland. All figures are expressed in percentage points, nonexhaustive list.

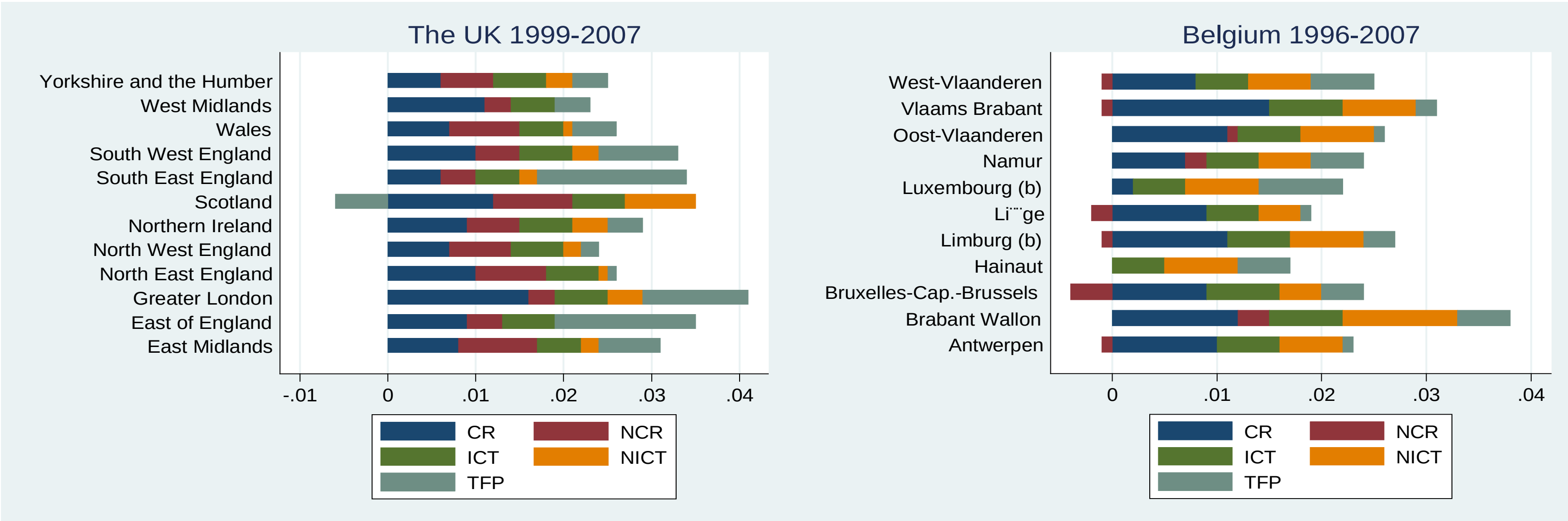
Appendix 4. B: Ranking of ICT capital services per worker

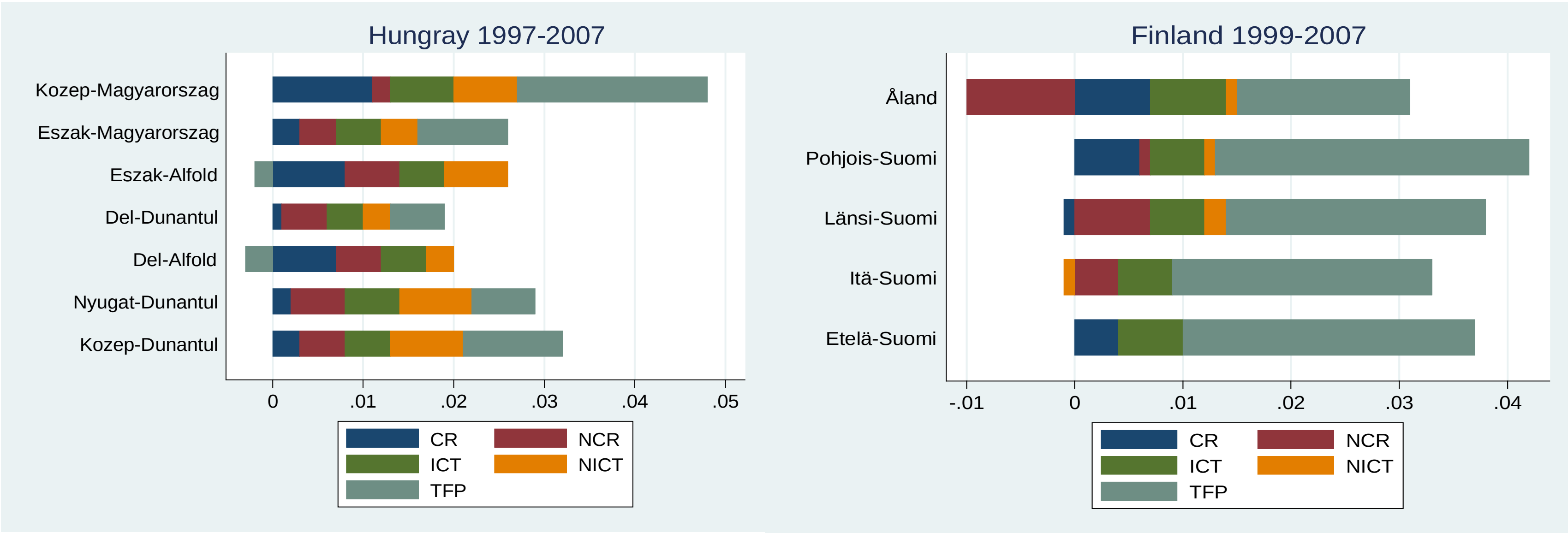
Country	Ranking	Year	Region code	Region	ICT services per worker
BE	1	2007	14	Prov. Vlaams-Brabant	14438.7
BE	2	2007	10	Rég. Bruxelles	14176.6
BE	11	2007	19	Prov. Luxembourg (BE)	9956.49
AT	12	2007	3	Wien	8991.82
DE	13	2007	34	Hamburg	7931.94
DE	14	2007	33	Bremen	7393.39
DE	15	2007	25	Oberbayern	7353.6
AT	16	2007	9	Vorarlberg	7292.26
DE	17	2007	35	Darmstadt	7277.06
DE	26	2007	51	Leipzig	6639.23
DE	27	2007	44	Köln	6543.37
UK	30	2007	117	East of England	6026.47
DE	31	2007	40	Hannover	5938.48
DE	32	2007	29	Mittelfranken	5921.21
UK	33	2007	119	South East (UK)	5904.74
SE	34	2007	124	Stockholm	5863.26
FI	35	2007	151	Åland	5769.97
UK	36	2007	118	London	5752.34
FI	37	2007	148	Etelä-Suomi	5742.04
UK	45	2007	113	North West (UK)	5118.32
FI	46	2007	149	Länsi-Suomi	5112.46
DE	47	2007	41	Lüneburg	5091.41
UK	48	2007	116	West Midlands (UK)	5087.69
DE	62	2007	46	Detmold	4755.86
DE	63	2007	53	Thüringen	4746.33
DE	64	2007	39	Braunschweig	4738.2
SE	66	2007	125	Östra Mellansverige	4709.69
ES	75	2007	61	Comunidad de Madrid	4522.94
SE	78	2007	129	Norra Mellansverige	4416.15
FR	91	2007	71	Île de France	3731.12
IT	97	2007	96	Lombardia	3548.90
HU	142	2007	146	Del-Alfold	2000.12
HU	143	2007	143	Del-Dunantul	1975.78
CZ	149	2007	139	Moravskoslezsko	1230.86
CZ	150	2007	134	Jihozápad	1227.17
CZ	151	2007	138	Strední Morava	1132.06

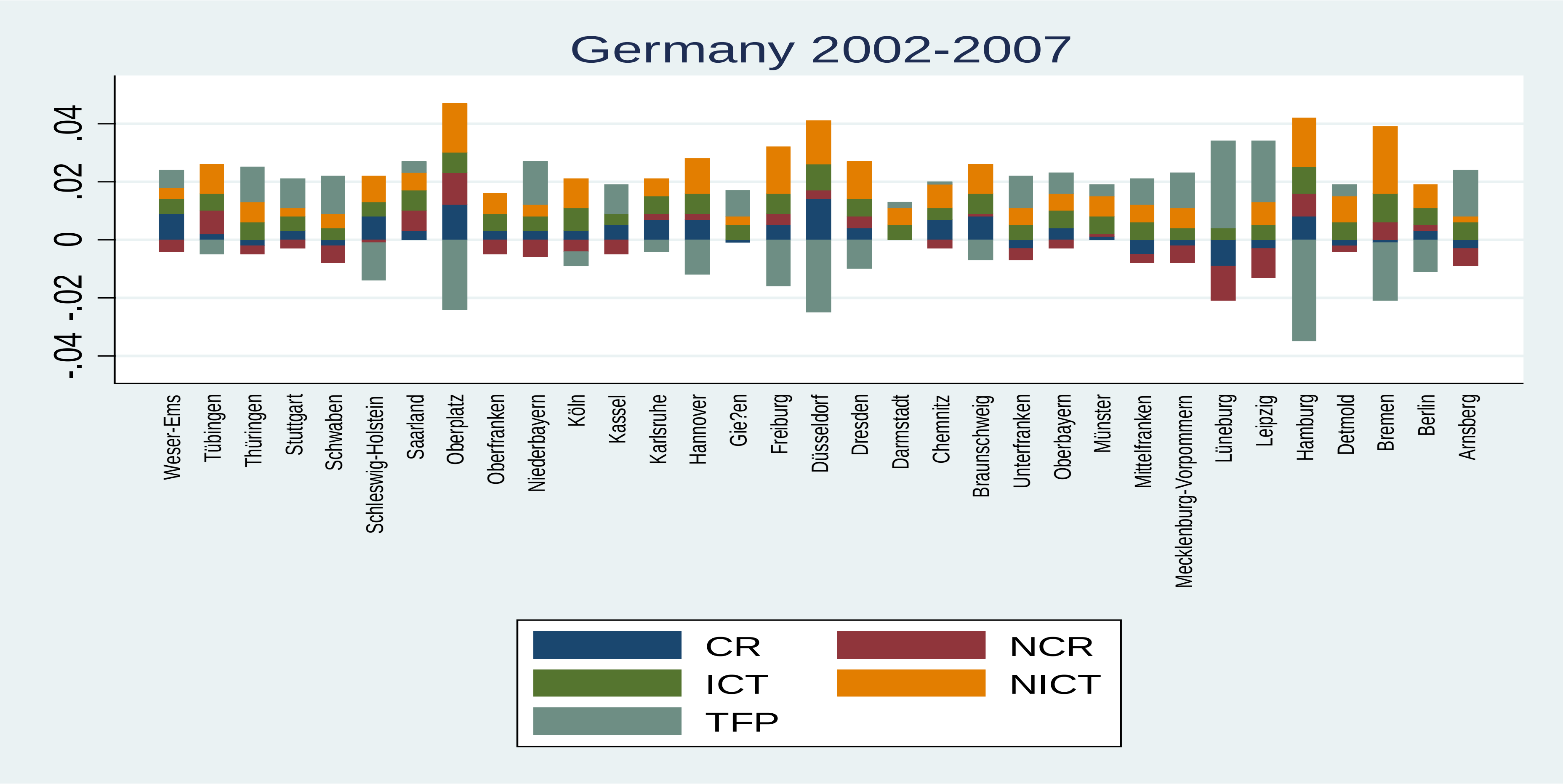
Notes: 1. ICT capital per worker is expressed in Euro at 1995 price level. 2. AT=Austria, BE=Belgium, DE=Germany, FR=France, ES=Spain, IT=Italy, U.K.=the U.K., SE=Sweden, CZ= the Czech Republic, HU=Hungary, FI=Finland. 3. nonexhaustive list.

Appendix 4. C: Average contributions of labour and capital inputs in GVA growth in the main European regions




The UK 1999-2007
Yorkshire and the Humber
West Midlands
Wales
South West England
South East England
Scotland
Northern Ireland
North West England
North East England
Greater London
East of England
East Midlands
-.01
0
.01
.02
.03
.04
CR
NCR
ICT
NICT
TFP
Belgium 1996-2007
West-Vlaanderen
Vlaams Brabant
Oost-Vlaanderen
Namur
Luxembourg (b)
Li¨¨ge
Limburg (b)
Hainaut
Bruxelles-Cap.-Brussels
Brabant Wallon
Antwerpen
0
.01
.02
.03
.04
CR
NCR
ICT
NICT
TFP


Hungray 1997-2007
Kozep-Magyarorszag
Eszak-Magyarorszag
Eszak-Alfold
Del-Dunantul
Del-Alfold
Nyugat-Dunantul
Kozep-Dunantul
0
.01
.02
.03
.04
.05
CR
NCR
ICT
NICT
TFP
Finland 1999-2007
Åland
Pohjois-Suomi
Länsi-Suomi
Itä-Suomi
Etelä-Suomi
-.01
0
.01
.02
.03
.04
CR
NCR
ICT
NICT
TFP


Germany 2002-2007
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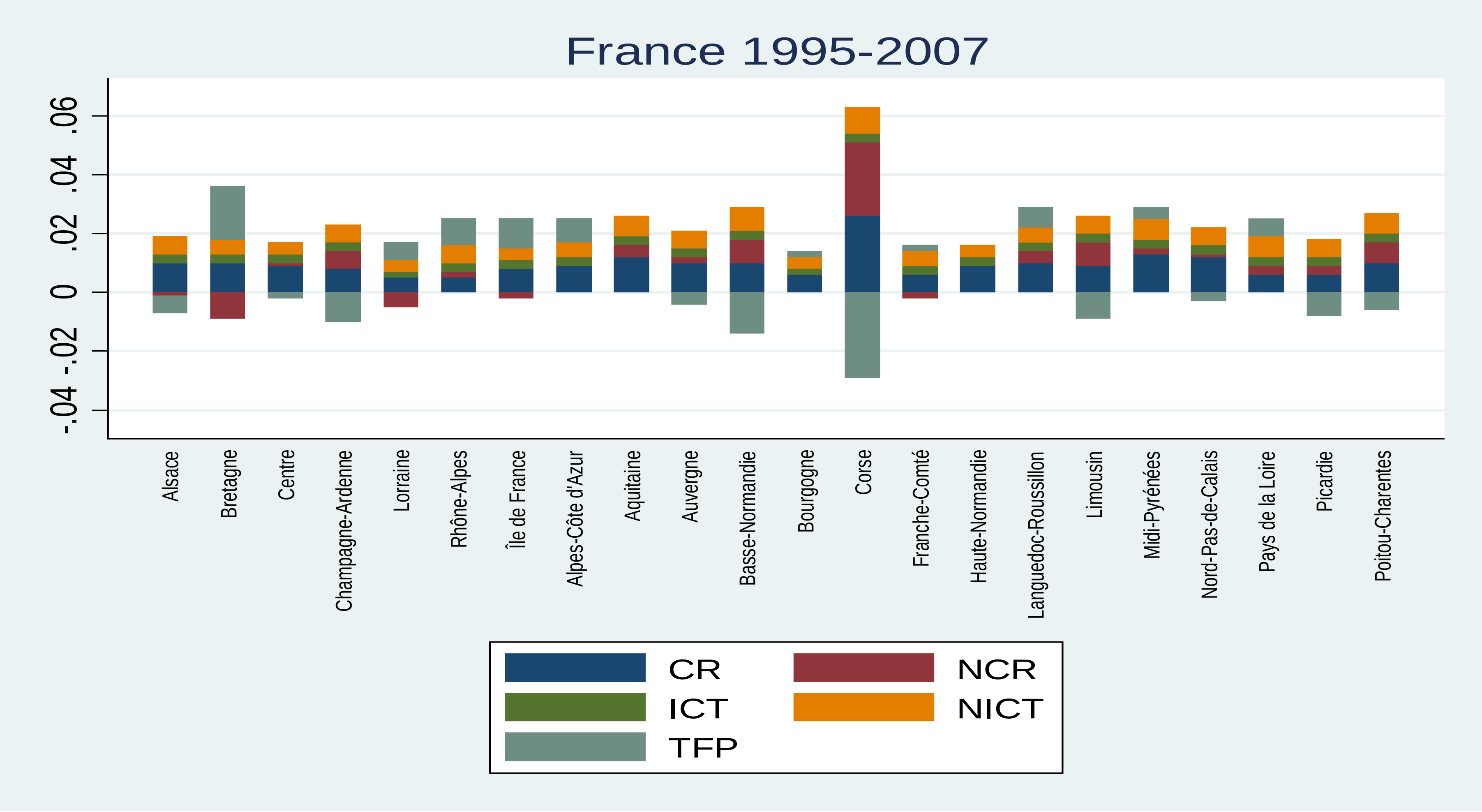
.02
.04
Weser-Ems
Tübingen
Thüringen
Stuttgart
Schwaben
Schleswig-Holstein
Saarland
Oberplatz
Oberfranken
Niederbayern
Köln
Kassel
Karlsruhe
Hannover
Gie?en
Freiburg
Düsseldorf
Dresden
Darmstadt
Chemnitz
Braunschweig
Unterfranken
Oberbayern
Münster
Mittelfranken
Mecklenburg-Vorpommern
Lüneburg
Leipzig
Hamburg
Detmold
Bremen
Berlin
Arnsberg
CR
NCR
ICT
NICT
TFP


France 1995-2007
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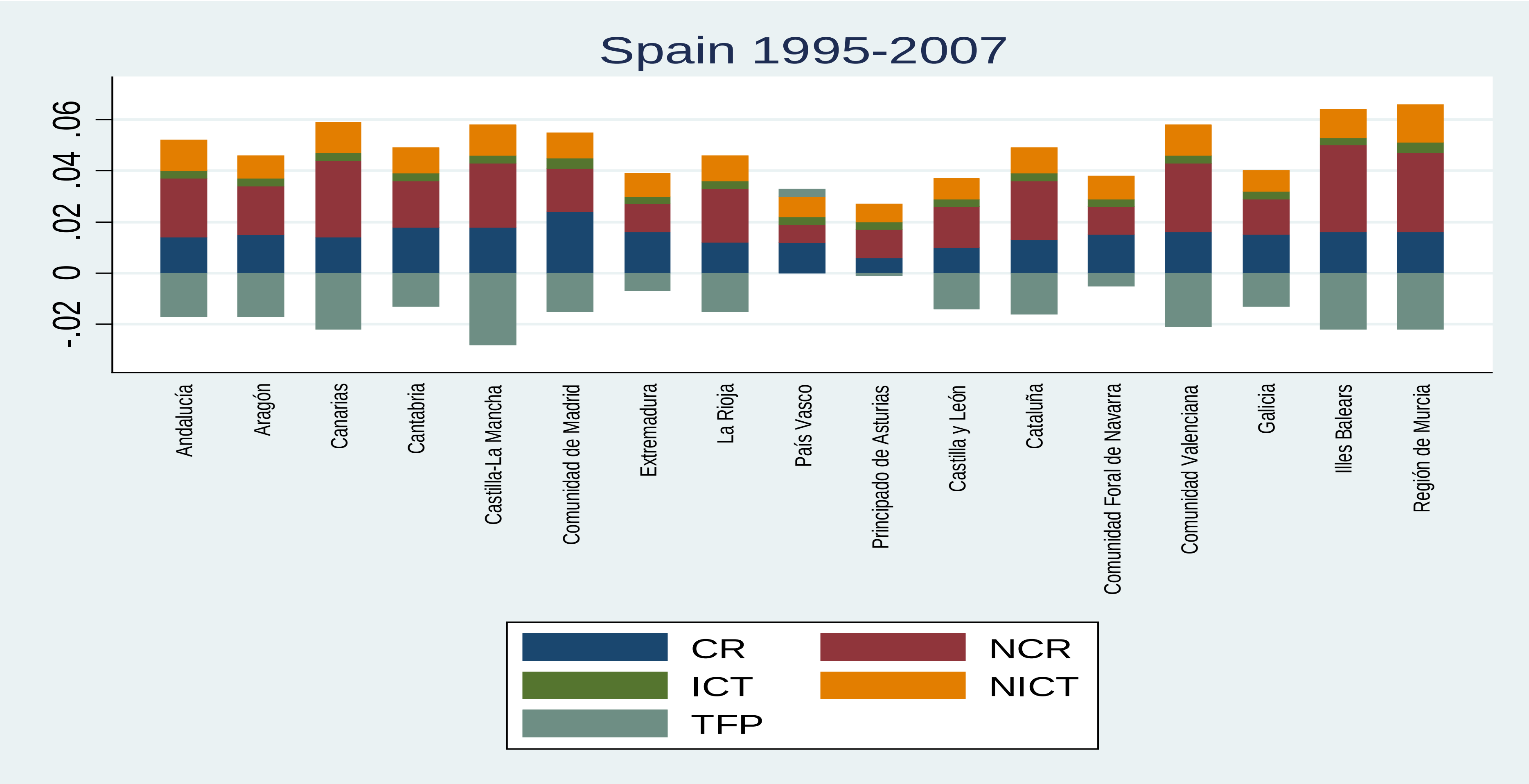
-.02
0
.02
.04
.06
Alsace
Bretagne
Centre
Champagne-Ardenne
Lorraine
Rhône-Alpes
Île de France
Alpes-Côte d'Azur
Aquitaine
Auvergne
Basse-Normandie
Bourgogne
Corse
Franche-Comté
Haute-Normandie
Languedoc-Roussillon
Limousin
Midi-Pyrénées
Nord-Pas-de-Calais
Pays de la Loire
Picardie
Poitou-Charentes
CR
NCR
ICT
NICT
TFP


Spain 1995-2007
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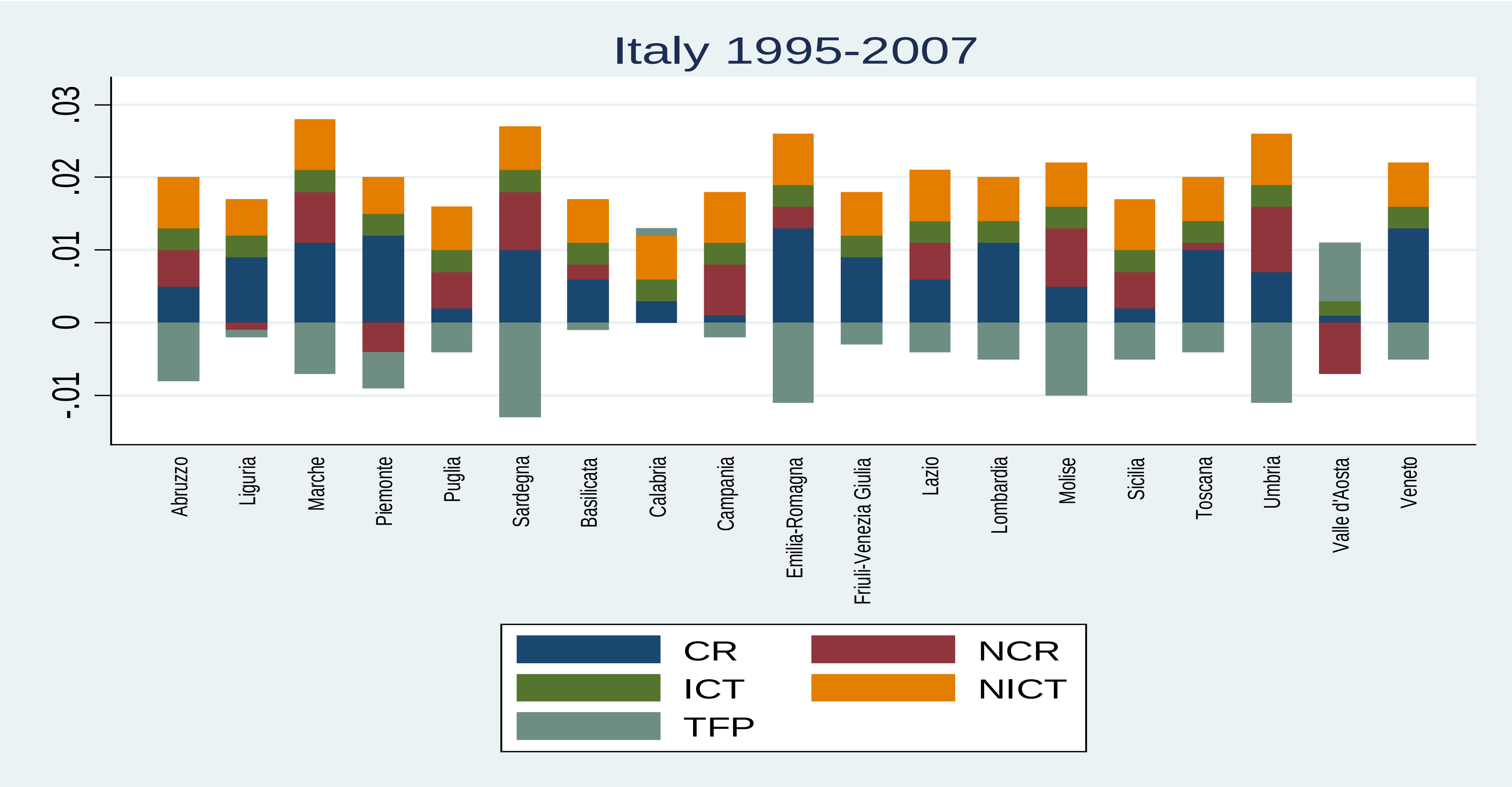
0
.02
.04
.06
Andalucía
Aragón
Canarias
Cantabria
Castilla-La Mancha
Comunidad de Madrid
Extremadura
La Rioja
País Vasco
Principado de Asturias
Castilla y León
Cataluña
Comunidad Foral de Navarra
Comunidad Valenciana
Galicia
Illes Balears
Región de Murcia
CR
NCR
ICT
NICT
TFP


Italy 1995-2007
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.02
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0
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Abruzzo
Liguria
Marche
Piemonte
Puglia
Sardegna
Basilicata
Calabria
Campania
Emilia-Romagna
Friuli-Venezia Giulia
Lazio
Lombardia
Molise
Sicilia
Toscana
Umbria
Valle d'Aosta
Veneto
CR
NCR
ICT
NICT
TFP

Appendix 4. D: Average contributions of labour and capital inputs in GVA growth in the main European regions

Belgium (1996-2007)

Region	CR	NCR	ICT	NICT	TFP	GVA=CR+NCR+ICT+NICT+TFP
Rég. Bruxelles - Cap.- Brussels Hfdst. Gewest	0.009	-0.004	0.007	0.004	0.004	0.020
Antwerpen	0.010	-0.001	0.006	0.006	0.001	0.022
Limburg (b)	0.011	-0.001	0.006	0.007	0.003	0.025
Oost-Vlaanderen	0.011	0.001	0.006	0.007	0.001	0.026
Vlaams Brabant	0.015	-0.001	0.007	0.007	0.002	0.031
West-Vlaanderen	0.008	-0.001	0.005	0.006	0.006	0.024
Brabant Wallon	0.012	0.003	0.007	0.011	0.005	0.038
Hainaut	0.000	0.000	0.005	0.007	0.005	0.016
Liège	0.009	-0.002	0.005	0.004	0.001	0.017
Luxembourg (b)	0.002	0.000	0.005	0.007	0.008	0.021
Namur	0.007	0.002	0.005	0.005	0.005	0.024

Hungary (1997-2007)

Region	CR	NCR	ICT	NICT	TFP	GVA=CR+NCR+ICT+NICT+TFP
Kozep-Magyarorszag	0.011	0.002	0.007	0.007	0.021	0.047
Kozep-Dunantul	0.003	0.005	0.005	0.008	0.011	0.032
Nyugat-Dunantul	0.002	0.006	0.006	0.008	0.007	0.029
Del-Dunantul	0.001	0.005	0.004	0.003	0.006	0.019
Eszak-Magyarorszag	0.003	0.004	0.005	0.004	0.010	0.027
Eszak-Alfold	0.008	0.006	0.005	0.007	-0.002	0.023
Del-Alfold	0.007	0.005	0.005	0.003	-0.003	0.016

Sweden (1999-2006)

Region	CR	NCR	ICT	NICT	TFP	GVA=CR+NCR+ICT+NICT+TFP
Stockholm	0.004	0.001	0.004	0.007	0.016	0.032
Östra Mellansverige	0.000	-0.005	0.003	0.005	0.029	0.032
Småland med öarna	0.006	0.001	0.003	0.005	0.013	0.028
Sydsverige	-0.009	-0.002	0.002	0.005	0.032	0.030
Västsverige	0.008	-0.008	0.002	0.007	0.026	0.034
Norra Mellansverige	0.011	-0.001	0.004	0.012	-0.001	0.024
Mellersta Norrland	0.003	-0.008	0.003	0.007	0.017	0.022
Övre Norrland	0.003	0.001	0.004	0.007	0.025	0.040

Czech Republic (1998-2007)

Region	CR	NCR	ICT	NICT	TFP	GVA=CR+NCR+ICT+NICT+TFP
Praha	0.009	-0.005	0.005	0.015	0.032	0.056
Stredni Cechy	0.004	-0.010	0.004	0.012	0.041	0.050
Jihozapad	0.001	-0.004	0.004	0.011	0.023	0.036
Severozapad	0.000	-0.004	0.006	0.007	0.020	0.028
Severovychod	0.001	-0.006	0.006	0.013	0.017	0.031
Jihovychod	0.001	-0.006	0.006	0.013	0.026	0.039
Stredni Morava	0.005	-0.007	0.006	0.013	0.015	0.033
Moravskoslezsko	0.000	-0.006	0.005	0.011	0.029	0.039

Finland (2000-2007)

Region	CR	NCR	ICT	NICT	TFP	GVA=CR+NCR+ICT+NICT+TFP
Itä-Suomi	0.000	0.004	0.005	-0.001	0.024	0.032
Etelä-Suomi	0.004	0.000	0.006	0.000	0.027	0.035
Länsi-Suomi	-0.001	0.007	0.005	0.002	0.024	0.036
Pohjois-Suomi	0.006	0.001	0.005	0.001	0.029	0.042
Åland	0.007	-0.010	0.007	0.001	0.016	0.021

Germany (2002-2007)

Region	CR	NCR	ICT	NICT	TFP	GVA=CR+NCR+ICT+NICT+TFP
Stuttgart	0.003	-0.003	0.005	0.003	0.010	0.018
Karlsruhe	0.007	0.002	0.006	0.006	-0.004	0.016
Freiburg	0.005	0.004	0.007	0.016	-0.016	0.016
Tübingen	0.002	0.008	0.006	0.010	-0.005	0.022
Oberbayern	0.004	-0.003	0.006	0.006	0.007	0.020
Niederbayern	0.003	-0.006	0.005	0.004	0.015	0.020
Oberplatz	0.012	0.011	0.007	0.017	-0.024	0.022
Oberfranken	0.003	-0.005	0.006	0.007	0.000	0.011
Mittelfranken	-0.005	-0.003	0.006	0.006	0.009	0.014
Unterfranken	-0.003	-0.004	0.005	0.006	0.011	0.016
Schwaben	-0.002	-0.006	0.004	0.005	0.013	0.014
Berlin	0.003	0.002	0.006	0.008	-0.011	0.008
Bremen	-0.001	0.006	0.010	0.023	-0.020	0.018
Hamburg	0.008	0.008	0.009	0.017	-0.035	0.006
Darmstadt	0.000	0.000	0.005	0.006	0.002	0.013
Gieβen	-0.001	0.000	0.005	0.003	0.009	0.017
Kassel	0.005	-0.005	0.004	0.000	0.010	0.014
Mecklenburg-Vorpommern	-0.002	-0.006	0.004	0.007	0.012	0.014
Braunschweig	0.008	0.001	0.007	0.010	-0.007	0.019
Hannover	0.007	0.002	0.007	0.012	-0.012	0.016
Lüneburg	-0.009	-0.012	0.004	0.000	0.030	0.014
Weser-Ems	0.009	-0.004	0.005	0.004	0.006	0.018
Düsseldorf	0.014	0.003	0.009	0.015	-0.025	0.016
Köln	0.003	-0.004	0.008	0.010	-0.005	0.012
Münster	0.001	0.001	0.006	0.007	0.004	0.021
Detmold	-0.002	-0.002	0.006	0.009	0.004	0.015
Arnsberg	-0.003	-0.006	0.006	0.002	0.016	0.015
Saarland	0.003	0.007	0.007	0.006	0.004	0.026
Chemnitz	0.007	-0.003	0.004	0.008	0.001	0.017
Dresden	0.004	0.004	0.006	0.013	-0.010	0.017
Leipzig	-0.003	-0.010	0.005	0.008	0.021	0.022
Schleswig-Holstein	0.008	-0.001	0.005	0.009	-0.013	0.008
Thüringen	-0.002	-0.003	0.006	0.007	0.012	0.020

Note: DE40, DEB1, DEB2, DEB3 are not included due to data inconsistency.

Spain (1995-2007)

Region	CR	NCR	ICT	NICT	TFP	GVA=CR+NCR+ICT+NICT+TFP
Galicia	0.015	0.014	0.003	0.008	-0.013	0.027
Principado de Asturias	0.006	0.011	0.003	0.007	-0.001	0.025
Cantabria	0.018	0.018	0.003	0.010	-0.013	0.035
País Vasco	0.012	0.007	0.003	0.008	0.003	0.033
Comunidad Foral de Navarra	0.015	0.011	0.003	0.009	-0.005	0.033
La Rioja	0.012	0.021	0.003	0.010	-0.015	0.031
Aragón	0.015	0.019	0.003	0.009	-0.017	0.030
Comunidad de Madrid	0.024	0.017	0.004	0.010	-0.015	0.039
Castilla y León	0.010	0.016	0.003	0.008	-0.014	0.023
Castilla-La Mancha	0.018	0.025	0.003	0.012	-0.028	0.031
Extremadura	0.016	0.011	0.003	0.009	-0.007	0.031
Cataluña	0.013	0.023	0.003	0.010	-0.016	0.034
Comunidad Valenciana	0.016	0.027	0.003	0.012	-0.021	0.037
Illes Balears	0.016	0.034	0.003	0.011	-0.022	0.041
Andalucía	0.014	0.023	0.003	0.012	-0.017	0.036
Región de Murcia	0.016	0.031	0.004	0.015	-0.022	0.044
Canarias	0.014	0.030	0.003	0.012	-0.022	0.037

Note: ES63, ES64 are not included due to data inconsistency.

France (1995-2010)

Region	CR	NCR	ICT	NICT	TFP	GVA=CR+NCR+ICT+NICT+TFP
Île de France	0.008	-0.002	0.003	0.004	0.010	0.023
Champagne-Ardenne	0.008	0.006	0.003	0.006	-0.010	0.013
Picardie	0.006	0.003	0.003	0.006	-0.008	0.011
Haute-Normandie	0.009	0.000	0.003	0.004	0.000	0.015
Centre	0.009	0.001	0.003	0.004	-0.002	0.014
Basse-Normandie	0.010	0.008	0.003	0.008	-0.014	0.016
Bourgogne	0.006	0.000	0.002	0.004	0.002	0.014
Nord-Pas-de-Calais	0.012	0.001	0.003	0.006	-0.003	0.018
Lorraine	0.005	-0.005	0.002	0.004	0.006	0.012
Alsace	0.010	-0.001	0.003	0.006	-0.006	0.013
Franche-Comté	0.006	-0.002	0.003	0.005	0.002	0.014
Pays de la Loire	0.006	0.003	0.003	0.007	0.006	0.025
Bretagne	0.010	-0.009	0.003	0.005	0.018	0.028
Poitou-Charentes	0.010	0.007	0.003	0.007	-0.006	0.021
Aquitaine	0.012	0.004	0.003	0.007	0.000	0.025
Midi-Pyrénées	0.013	0.002	0.003	0.007	0.004	0.029
Limousin	0.009	0.008	0.003	0.006	-0.009	0.017
Rhône-Alpes	0.005	0.002	0.003	0.006	0.009	0.024
Auvergne	0.010	0.002	0.003	0.006	-0.004	0.018
Languedoc-Roussillon	0.010	0.004	0.003	0.005	0.007	0.029
Provence-Alpes-Côte d'Azur	0.009	0.000	0.003	0.005	0.008	0.026
Corse	0.026	0.025	0.003	0.009	-0.029	0.034

Italy (1995-2007)

Region	CR	NCR	ICT	NICT	TFP	GVA=CR+NCR+ICT+NICT+TFP
Piemonte	0.012	-0.004	0.003	0.005	-0.005	0.010
Valle d'Aosta/Vallée d'Aoste	0.001	-0.007	0.002	0.000	0.008	0.004
Liguria	0.009	-0.001	0.003	0.005	-0.001	0.014
Lombardia	0.011	0.000	0.003	0.006	-0.005	0.014
Veneto	0.013	0.000	0.003	0.006	-0.005	0.017
Friuli-Venezia Giulia	0.009	0.000	0.003	0.006	-0.003	0.015
Emilia-Romagna	0.013	0.003	0.003	0.007	-0.011	0.016
Toscana	0.010	0.001	0.003	0.006	-0.004	0.016
Umbria	0.007	0.009	0.003	0.007	-0.011	0.015
Marche	0.011	0.007	0.003	0.007	-0.007	0.021
Lazio	0.006	0.005	0.003	0.007	-0.004	0.018
Abruzzo	0.005	0.005	0.003	0.007	-0.008	0.012
Molise	0.005	0.008	0.003	0.006	-0.010	0.013
Campania	0.001	0.007	0.003	0.007	-0.002	0.015
Puglia	0.002	0.005	0.003	0.006	-0.004	0.012
Basilicata	0.006	0.002	0.003	0.006	-0.001	0.016
Calabria	0.003	0.000	0.003	0.006	0.001	0.013
Sicilia	0.002	0.005	0.003	0.007	-0.005	0.012
Sardegna	0.010	0.008	0.003	0.006	-0.013	0.014

Note: ITD1, ITD2 are not included due to data inconsistency.

U.K. (1999-2007)

Region	CR	NCR	ICT	NICT	TFP	GVA=CR+NCR+ICT+NICT+TFP
North East England	0.010	0.008	0.006	0.001	0.001	0.026
North West England	0.007	0.007	0.006	0.002	0.002	0.024
Yorkshire and the Humber	0.006	0.006	0.006	0.003	0.004	0.026
East Midlands	0.008	0.009	0.005	0.002	0.007	0.032
West Midlands	0.011	0.003	0.005	0.000	0.004	0.024
East of England	0.009	0.004	0.006	0.000	0.016	0.034
Greater London	0.016	0.003	0.006	0.004	0.012	0.041
South East England	0.006	0.004	0.005	0.002	0.017	0.034
South West England	0.010	0.005	0.006	0.003	0.009	0.033
Wales	0.007	0.008	0.005	0.001	0.005	0.026
Scotland	0.012	0.009	0.006	0.008	-0.006	0.029
Northern Ireland	0.009	0.006	0.006	0.004	0.004	0.029

Appendix 4. E: The difference in contribution point for each input

Italy

Period 1: 1995-2001, Period 2: 2002-2007

Region	ΔCR	ΔNCR	ΔICT	ΔNICT	ΔTFP
Piemonte	-0.009	-0.009	-0.004	-0.002	0.021*
Valle d'Aosta/	-0.010	0.022*	-0.002	0.006*	-0.007
Liguria	0.010*	-0.002	-0.002	0.005*	-0.022
Lombardia	-0.002	-0.006	-0.003	0.002*	0.002*
Veneto	-0.009	0.000	-0.003	0.000	0.004*
Friuli-Venezia Giulia	0.000	-0.006	-0.002	0.005*	-0.008
Emilia-Romagna	0.003*	0.005*	-0.002	0.007*	-0.023
Toscana	0.004*	-0.010	-0.002	0.001*	-0.002
Umbria	-0.015	0.001*	-0.002	-0.001	0.006*
Marche	-0.008	-0.007	-0.003	0.001*	0.006*
Lazio	-0.009	0.003*	-0.002	0.006*	0.005*
Abruzzo	-0.008	0.007*	-0.002	0.002*	-0.013
Molise	-0.009	-0.002	-0.002	0.004*	0.000
Campania	-0.017	0.008*	-0.002	0.006*	-0.009
Puglia	-0.013	0.010*	-0.002	0.005*	-0.017
Basilicata	0.000	0.016*	-0.001	0.005*	-0.037
Calabria	0.000	0.013*	-0.002	0.002*	-0.028
Sicilia	-0.007	0.006*	-0.002	0.002*	-0.010
Sardegna	-0.013	0.006*	-0.001	0.009*	-0.015

Belgium

Period 1: 1996-2001, Period 2: 2002-2007

Region	ΔCR	ΔNCR	ΔICT	ΔNICT	ΔTFP
Bruxelles-	0.005*	0.002*	-0.004	-0.001	-0.013
Antwerpen	0.000	0.017*	-0.004	0.003*	-0.016
Limburg	-0.009	-0.002	-0.003	-0.001	0.002*
Oost-Vlaanderen	0.008*	0.010*	-0.003	0.000	-0.014
Vlaams Brabant	-0.036	0.009*	-0.005	-0.005	0.016*
West-Vlaanderen	0.011*	0.005*	-0.003	0.001*	-0.022
Brabant Wallon	0.050*	0.016*	-0.002	0.005*	-0.092
Hainaut	0.033*	-0.006	-0.002	0.000	-0.026
Liège	-0.001	-0.016	-0.003	-0.002	0.023*
Luxembourg	0.020*	0.003*	-0.003	0.000	-0.019
Namur	-0.011	-0.016	-0.003	0.000	0.025*

Spain

Period 1: 1995-2001, Period 2: 2002-2007

Region	ΔCR	ΔNCR	ΔICT	ΔNICT	ΔTFP
Galicia	0.006*	-0.014	-0.001	0.000*	0.019*
Principado de Asturias	0.003*	-0.012	-0.001	-0.002	0.021*
Cantabria	-0.015	-0.023	-0.002	-0.007	0.043*
País Vasco	-0.007	-0.025	-0.002	-0.003	0.031*
Comunidad Foral de Navarra	-0.003	-0.020	-0.002	-0.002	0.018*
La Rioja	0.014*	-0.010	-0.001	-0.001	-0.009
Aragón	0.001*	-0.002	-0.001	0.000	0.008*
Comunidad de Madrid	-0.006	-0.016	-0.002	-0.004	0.013*
Castilla y León	-0.006	-0.003	-0.001	0.001*	0.019*
Castilla-La Mancha	0.004*	0.004*	0.000	0.005*	-0.009
Extremadura	0.001*	-0.014	-0.001	0.003*	0.012*
Cataluña	-0.007	-0.012	-0.002	-0.004	0.017*
Comunidad Valenciana	-0.008	-0.018	-0.001	-0.002	0.017*
Illes Balears	-0.004	-0.037	-0.001	-0.003	0.016*
Andalucía	-0.001	-0.014	-0.001	-0.001	0.019*
Región de Murcia	-0.024	-0.010	-0.001	0.002*	0.026*
Canarias	0.004*	-0.028	-0.002	-0.004	0.008*

Hungary

Period 1: 1997-2002, Period 2: 2003-2007

Region	ΔCR	ΔNCR	ΔICT	ΔNICT	ΔTFP
Kozep-Magyarorszag	0.000	-0.007	0.000	0.003*	-0.015
Kozep-Dunantul	-0.006	-0.003	0.000	0.002*	0.026*
Nyugat-Dunantul	-0.006	-0.011	0.000	0.000	0.003*
Del-Dunantul	-0.007	-0.015	0.001*	0.004*	0.002*
Eszak-Magyarorszag	-0.012	-0.011	0.000	0.005*	0.017*
Eszak-Alfold	-0.009	-0.014	0.000	0.005*	0.013*
Del-Alfold	-0.001	-0.004	0.000	0.003*	0.006*

The U.K.

Period 1: 1999-2002, Period 2: 2003-2007

Region	ΔCR	ΔNCR	ΔICT	ΔNICT	ΔTFP
North East England	0.008*	-0.008	-0.004	-0.006	0.004*
North West England	0.005*	0.000	-0.005	-0.002	-0.006
Yorkshire and the Humber	0.003*	-0.001	-0.004	0.002*	-0.009
East Midlands	0.004*	-0.001	-0.003	-0.003	-0.005
West Midlands	0.008*	0.001*	-0.004	-0.003	-0.010
East of England	-0.002	0.001*	-0.005	0.001*	0.002*
Greater London	0.033*	0.014*	-0.005	0.003*	-0.042
South East England	0.006*	0.014*	-0.005	0.002*	-0.027
South West England	0.010*	0.009*	-0.004	0.000	-0.024
Wales	-0.009	0.008*	-0.004	-0.005	-0.001
Scotland	0.004*	0.010*	-0.006	0.006*	-0.010
Northern Ireland	-0.005	0.003*	-0.003	-0.003	0.009*

Sweden

Period 1: 1999-2003, Period 2: 2004-2006

Region	ΔCR	ΔNCR	ΔICT	ΔNICT	ΔTFP
Stockholm	0.015*	0.000	0.001*	-0.002	0.004*
Östra Mellansverige	0.018*	0.004*	0.001*	-0.001	-0.014
Småland med öarna	0.001*	0.005*	0.001*	0.000	-0.005
Sydsverige	0.013*	0.015*	0.002*	-0.003	-0.016
Västsverige	-0.007	0.038*	0.002*	0.000	-0.029
Norra Mellansverige	0.012*	0.005*	0.000	-0.006	0.006*
Mellersta Norrland	-0.012	0.027	0.001*	0.001*	-0.005
Övre Norrland	0.008*	-0.002	0.001*	-0.002	0.027*

France

Period 1: 1995-2001, Period 2: 2002-2007

Region	ΔCR	ΔNCR	ΔICT	ΔNICT	ΔTFP
Île de France	-0.011	-0.015	-0.002	0.000	0.016*
Champagne-Ardenne	0.007*	-0.007	-0.001	0.004*	-0.013
Picardie	-0.020	-0.019	-0.003	-0.005	0.039*
Haute-Normandie	0.005*	-0.003	-0.001	0.003*	-0.011
Centre	0.001*	-0.019	-0.002	-0.001	0.014*
Basse-Normandie	0.001*	0.003*	0.000	0.006*	-0.011
Bourgogne	0.005*	0.000	-0.001	0.005*	-0.018
Nord-Pas-de-Calais	-0.003	-0.018	-0.002	-0.004	0.026*
Lorraine	-0.015	-0.027	-0.003	-0.009	0.050*
Alsace	-0.001	-0.021	-0.001	-0.003	0.015*
Franche-Comté	-0.018	-0.031	-0.003	-0.006	0.036*
Pays de la Loire	0.006*	-0.005	-0.001	0.008*	-0.022
Bretagne	-0.025	-0.026	-0.002	-0.003	0.048*
Poitou-Charentes	0.010*	-0.005	0.000	0.007*	-0.017
Aquitaine	0.002*	-0.022	-0.001	-0.001	0.012*
Midi-Pyrénées	-0.008	-0.016	-0.001	0.001*	0.022*
Limousin	0.003*	0.001*	0.000	0.009*	-0.019
Rhône-Alpes	-0.011	-0.005	-0.001	0.005*	0.004*
Auvergne	-0.007	-0.002	-0.001	0.001*	0.001*
Languedoc-Roussillon	0.007*	0.007*	0.001*	0.016*	-0.036
Alpes-Côte d'Azur	-0.012	0.001*	0.000	0.007*	-0.001
Corse	0.035*	0.076*	0.005*	0.042*	-0.161

The Czech Republic

Period 1: 1998-2003, Period 2: 2004-2007

Region	ΔCR	ΔNCR	ΔICT	ΔNICT	ΔTFP
Praha	0.008*	-0.010	-0.007	-0.016	0.041*
Stredni Cechy	0.031*	0.030*	-0.003	0.014*	-0.046
Jihozapad	0.007*	0.010*	-0.005	0.002*	0.007*
Severozapad	0.048*	0.005*	-0.004	0.000	-0.028
Severovychod	0.015*	0.004*	-0.001	0.005*	0.007*
Jihovychod	0.023*	0.009*	-0.001	-0.001	-0.008
Stredni Morava	0.003*	0.012*	0.000	0.000	0.009*
Moravskoslezsko	0.014*	0.021*	0.000	0.002*	0.021*

Notes:
1.* indicates the difference in contribution point for an input is positive.
2. Given the issue of data inconsistency or unavailability, the whole time period is roughly divided into 1995-2001 and 2002-2007
3. The calculation of contribution point for each input to GVA growth is based on the Growth Accounting method.
4. $\Delta\text{ICT} = \text{ICT}_{t+1} - \text{ICT}_t$, where ΔICT indicates the difference in contribution point over period t and period t+1 for a region. The same calculation is performed on ΔCR, ΔNCR, ΔNICT and ΔTFP.
5. Germany is not included in this study as the time period is short (i.e. 2002-2007).

CHAPTER 5

THE REGIONAL DENSITY OF THE CREATIVE CLASS

5.1 Introduction

Based on hypotheses 5.1-5.3, this chapter aims to explore which factors explain the distribution of creative workers. The basic hypothesis is that creative workers are drawn by “people climate” factors of tolerance and openness, as well as factors such as universities and the quality of regional political institutions. Also, it is hypothesised that creative workers respond more strongly to the people climate in large metropolitan areas that have a critical mass, whereas other factors such as universities act as attractors in smaller areas The location of skilled workers is defined as their “locational quotient”, calculated by dividing the share of creative workers in each region by the average national share. For independent variables, similar locational quotients are derived for bohemians and migrant workers (to represent “people climate”), and for workers in universities. In addition, the relationship between the distribution of creative workers and the quality of political institution/local government performance is examined since the role of institutions has frequently been mentioned but not been empirically tested. Here, new data is used from the report measuring government quality and subnational variation (hereafter referred to EQI database) (Charron *et al*., 2014).

Findings, in brief are as follows. Firstly, it appears that European creative workers generally move to places with tolerant and open milieus in line with Florida’s suggestion. Particularly, the location of universities, the level of social opportunity and the institutional quality of local government seems important.

Secondly, creative worker preferences appear to depend on the size of the region. In smaller regions, preferences are related to factors such as university locations and the quality of local government. By contrast, in bigger metropolitan regions, a tolerant and open society appears to be the primary concern.

Thirdly, a further breakdown of the creative workers also indicates interesting patterns, with creative graduates, along with the creative core, appearing to have similar preferences regarding the desirability of good universities, social services and local government performance. In contrast, creative non-graduates and creative professionals appear mainly interested in a "bohemian climate".

Overall, the quality/performance of local government appears as a surprisingly good determinant of the distribution of creative workers. The positive relationship is especially evident within small-sized regions. The implication for local government policy trying to attract creative workers is that there is no one-size-fits-all approach.

5.2 Models

To test hypothesis 5.1 to 5.3 that creative workers are attracted to regions with openness and tolerance two econometric models are used. The basic approach is the fixed effects model. A dynamic system GMM model is then explored, which allows for lagged adjustment and aims to reinforce the findings from the basic approach, but with a long-run perspective.

The macro level: the fixed effects model

The basic empirical model is given below:

$$LCR_{i,t} = \alpha_i + \beta_1 LB_{i,t} + \beta_2 LO_{i,t} + \beta_3 LT_{i,t} + \beta_4 S_{i,t} + \beta_5 L_{i,t} + \beta_6 LEQI_{i,t} + \tau_t + \delta_i + \mu_{i,t} \quad (5.1)$$

In equation 5.1, LCR, LB, LO, LT, S, L and LEQI are abbreviations for the location index of creative workers, bohemians, migrant workers, university teachers, and the level of social provision, the share of workers in public sectors and the product of the EQI index and the share of workers in public sectors respectively.

Fixed effects are represented by δ_i including both unobservable region-specific characteristics and time-invariant observables (e.g. EQI). Also, dummy variables concerning time effects (τ_t) are included to account for macroeconomic shocks for all regions in each year. Finally, both dependent and independent variables are log-transformed.

Within the theoretical framework in this study, the hypothesis is that the regional location of creative workers is determined by tolerance (the location of bohemians), openness (the location of migrant workers), the location of universities (the location of university teachers), the availability of social opportunities (the level of social provision), the short-term performance of local government (the share of employment in public sectors) and the overall quality of political institution in the region (the EQI index).

Care was taken to avoid biases arising from possible data overlap between dependent and independent variables. To this end, bohemians, university teachers, creative migrant workers and those who work in actual social care and public administration jobs (ISCO-88 occupation group 247) were removed from the total creative class. By the same token, university teachers were removed from the creative core, graduate bohemians, graduate creative migrant workers and university teachers from creative graduates and those similar non-graduates from non-graduate creative workers. Clearly many factors may influence the distribution of creative workers in addition to hypothesised factors. These extra factors include local historical background, landscape and temperature. However, as that these factors are time-invariant, they will be swept out in the fixed effects model.

The long-run perspective: the dynamic system GMM model

The typical fixed effects model may suffer from the problem of model misspecification because it omits dynamic effects. Worker's locational preferences are likely to be determined by their current and the past realisations of independent variables. Therefore, the basic model can be further extended to an autoregressive panel model such that

$$LCR_{i,t} = \alpha LCR_{i,t-1} + \beta_1 LB_{i,t} + \beta_2 LB_{i,t-1} + \beta_3 LO_{i,t} + \beta_4 LO_{i,t-1} + \beta_5 LT_{i,t}$$

$$+\beta_6 LT_{i,t-1} + \beta_7 S_{i,t} + \beta_8 S_{i,t-1} + \beta_9 L_{i,t} + \beta_{10} L_{i,t-1} + \beta_{11} LEQI_{i,t} +$$

$$\beta_{12} LEQI_{i,t-1} + \tau_t + \delta_i + \mu_{i,t} \quad (5.2)$$

where the location of creative workers is not only determined by the current level of the people climate or the business climate, but is also pre-determined by the general urban environment in the past. Here the model follows Blundell and Bond (1998), and does not impose implied common factor restrictions because dynamics may be thought of as an empirical approximation to some general adjustment process[45].

Based on this model specification, the empirical model may suffer dynamic panel bias (Nickell, 1981), as some of the lagged variables could be correlated with the fixed effects in error terms. For example, the economic recession in 2008 may have influenced the regional distribution of creative workers so that the shock appears in the error terms. This positive correction between a regressor and error violates the basic assumption necessary for the consistency of OLS estimation.

The normal within group transformation, however, does not eliminate dynamic panel bias (Bond, 2002). In the process of demeaning, the lagged dependent variable becomes $y_{i,t-1}^{*} = y_{i,t-1} - \frac{1}{T-1}(y_{i,2} + \cdots + y_{i,T})$ while the error term becomes $v_{i,t}^{*} = v_{i,t} - \frac{1}{T-1}(v_{i,2} + \cdots + v_{i,T})$. Although the fixed effect δ_i has been removed from the error term $y_{i,t-1}$, the term in $y_{i,t-1}^{*}$ contemporaneously moves with the $-\frac{1}{T-1}v_{i,t-1}$ in $v_{i,t}^{*}$. Therefore, the regressor still correlates with the error term after transformation.

In response to the above issue, Blundell-Bond's (1998) system GMM estimator is a powerful tool in eliminating such a dynamic bias, which is a theoretical extension of Anderson-Hsiao's (1981) difference and levels estimator, Arellano-Bond's (1991) DPD estimator and Arellano and Bover's (1995) forward orthogonal deviations (FOD) estimator. According to Roodman (2006), the main difference between this system GMM model and previous difference based models is the way of instrumenting. Generally speaking, where Arellano-Bond instruments differences

[45] In other words, we assume the existence of the long-run effect.

with levels, Blundell-Bond instruments levels with differences. If variables are random-walk like, as is very possibly the case for this study, the system GMM estimator undoubtedly outperforms the difference GMM estimator as past changes are more predictive of current levels than past levels are of current changes. Also a new design of moment condition involves all available lagged variables as instruments while most of them will automatically be redundant if the necessary condition of valid instrument cannot be held.

Finally, rewriting equation 5.2 in an error correction form yields

$$\Delta LCR_{i,t} = \emptyset(LCR_{i,t-1} + \theta_1 LB_{i,t} + \theta_2 LO_{i,t} + \theta_3 LT_{i,t} + \theta_4 S_{i,t} + \theta_5 L_{i,t} + \theta_6 LEQI_{i,t})$$

$$-\beta_2 \Delta LB_{i,t} - \beta_4 \Delta LO_{i,t} - \beta_6 \Delta LT_{i,t} - \beta_8 \Delta S_{i,t} - \beta_{10} \Delta L_{i,t} - \beta_{12} \Delta LEQI_{i,t} + \tau_t + \mu_{it}$$

(5.3)

where the long-run coefficients for each variables are

$$\theta_1 = \frac{\beta_1+\beta_2}{1-\alpha}, \theta_2 = \frac{\beta_3+\beta_4}{1-\alpha}, \theta_3 = \frac{\beta_5+\beta_6}{1-\alpha}, \theta_4 = \frac{\beta_7+\beta_8}{1-\alpha}, \theta_5 = \frac{\beta_9+\beta_{10}}{1-\alpha}, , \theta_6 = \frac{\beta_{11}+\beta_{12}}{1-\alpha}$$

$$\emptyset = -(1-\alpha)$$

when $\Delta LCR_{i,t}, \Delta LB_{i,t}, \Delta LO_{i,t}, \Delta LT_{i,t}, \Delta S_{i,t}$, $\Delta L_{i,t}$ and $\Delta LEQI_{i,t}$are all equal to 0 at the equilibrium point in the long run.

In conclusion, it is possible to construct more efficient estimators of the dynamic panel model. It is especially suitable for "small T, large N" panels with not strictly exogenous independent variables, unbalanced panel structure and heteroskedasticity or autocorrelation within observations (Roodman, 2006). However, it is worth noting that the application of the model in this study relies on the nature of the dataset. For analysis in sub-groups such as small/medium/large regions, this model may not be applicable.

5.3 Results and analysis

Descriptive analysis

The main goal of this chapter is to assess the influence of different amenities on the distribution of creative workers. It is informative to outline the overall level of these variables before considering their variation over time. Therefore, **Figures 5.1** to **5.6** summarise the main target variables in the reference year of 2010. Here, locational quotients and the index for social provision are re-calculated by dividing relative regional shares by an overall share for all the target regions (Europe=100) in order to make the description across different regions and countries comparable.

By looking at **Figure 5.1**, there is an indication that the education and social care systems in western European and the Nordic counties employ more workers than the eastern European countries such as the Czech Republic and Hungary. In particular, the U.K., Sweden, Germany and Finland have a high level of social provision. A similar pattern can be captured in a few regions in France; however, none of regions in Spain and Portugal show this pattern. From this picture, it seems as though capital is not necessarily favourable for gaining obvious advantages in accessing more public resources. This point is indicated by the fact that in the most populated and developed district in Île de France, France only 7.1 percent of the population work for the social care and education system, which is slightly below the European average of 7.3

percent. In Greater London, this figure is 9.5 percent, but again, this percentage is lower than some other regions of the U.K. such as South East England (11.0 percent) and South West England (10.2 percent).

Given the issue of data constraints, the definition of openness is slightly different to Florida's, and this study uses the share of migrants or foreign-born workers. In **Figure 5.2** the distribution of migrant workers in the local labour market shows us a completely different picture compared to that for social provision. Migrant workers are more likely to locate at regions in France and Spain, where the relative shares of migrant workers is high overall. Furthermore, migrant workers also appear to gather around metropolises such as Greater London, Paris (Île de France), Stockholm, Madrid and Lisbon. On average, the density of migrant worker in the U.K. does not rank as top in Europe, even though the share of migrant workers in the capital district of Greater London is extremely high, at 34.2 percent. Similarly, in Paris and Stockholm, these ratios are 32.8 percent and 19.1 percent respectively.

Figure 5.3 shows the distribution of bohemians. As Florida argued, workers in artistic occupations are the bohemians who favour local amenities. Hence they indicate a region's capacity to attract other creative workers. The findings reveal that the distribution of bohemian people is, to some extent, similar to the distribution of migrant workers. It is interesting to see that the U.K., Finland, Sweden and Germany have significantly higher proportions of bohemian populations that are distributed across regions evenly. In comparison to the European average ratio of 1.0 percent, all of regions in the U.K., Sweden and Finland and many of the regions in Germany show us a higher level. In the remaining regions, such a pattern is, however, not very clear as only a few regions can be identified as being rich in a bohemian climate, and many regions in the Eastern European countries can only be 180haracterized as being extremely unfavourable, accounting for only 35.4 percent of the European average.

The distribution of the bohemian population in response to economic scale seems straightforward in that in all of the capitals, the level of the bohemian population appears to be higher than the European average. For example, the most "bohemian" region is Greater London (2.8 percent over total employment), followed by other city regions like Île de France, Stockholm, Madrid, Lisbon, Athens, Praha, Berlin and Wien. Therefore, the distribution of bohemians in Europe seems to strongly support the favourable role of the metropolis as Florida (2008) has pointed out.

Next the quality of regional political institutions is considered in **Figure 5.4**, based on Charron *et al.*'s (2014) study for target regions, using measures of government effectiveness, impartiality and honesty. Here, it is assumed that the quality of the political institutions across regions in Finland is constant since there is no regional information. In addition to the exclusive focus on the regional variation of the EQI, this thesis discusses if its level follows a similar pattern of change to other indicators mentioned above.

Figure 5.4 shows a strong national division. In general, regions in the Nordic countries, such as in Sweden and Finland, have the highest scores for political institutions, followed by some western European regions such as Rég. Bruxelles-Cap.-Brussels Hfdst. Gewest in Belgium (81.6), Burgenland in Austria (90.6), Thüringen in Germany (91.7) or the East Midlands and Scotland in the U.K. (88.9 and 89.6 respectively). In contrast, the majority of regions in France, Spain, Portugal and Greece show lower values of the EQI and regions in the Eastern European countries rank the lowest. It is intriguing to see that the quality of the political institutions is not always positively correlated with economic scale. Many metropolitan areas that are strongly appealing to the bohemian population or migrant workers do not have equivalently high scores, such as Greater London (72.3), Île de France (73.5) or Madrid (60.0).

As far as the distribution of university teachers is concerned, the descriptive analysis at this stage could be inaccurate in some regions due to the data collection technique employed by the EU LFS. This survey based dataset, unlike the national accounts, has small numbers in some occupations. This is the reason why missing values were observed in some regions for a particular year. However, a plausible distribution pattern can still be portrayed as shown in **Figure 5.5**. The high shares of university teachers can be seen in the total employment in the U.K. (particularly in England) and in some regions in France, Spain and Sweden.

Finally, the distribution of creative workers (see **Figure 5.6**) hints that the level of creative labour is overall higher in the U.K. and Nordic countries while being very low in many regions in Italy, Spain and Portugal as well as in the Eastern European countries. As is the case for migrant workers and bohemians, the majority of metropolises have a significantly higher proportion of their population working in creative jobs.

In summary, the descriptive analysis in this section suggests that Florida's arguments are suitable for the big region context, particularly the European mega-regions (e.g. Greater London, Paris, Madrid, Berlin and Kozep-Magyarorszag (Budapest). Here a high share of bohemians, migrant workers and the location of universities co-exist with a high share of creative workers. However, this tendency is much less obvious for the rest of the regions.

Figure 5.1: The level of social provision at the regional level in Europe (Europe=100, 2010)

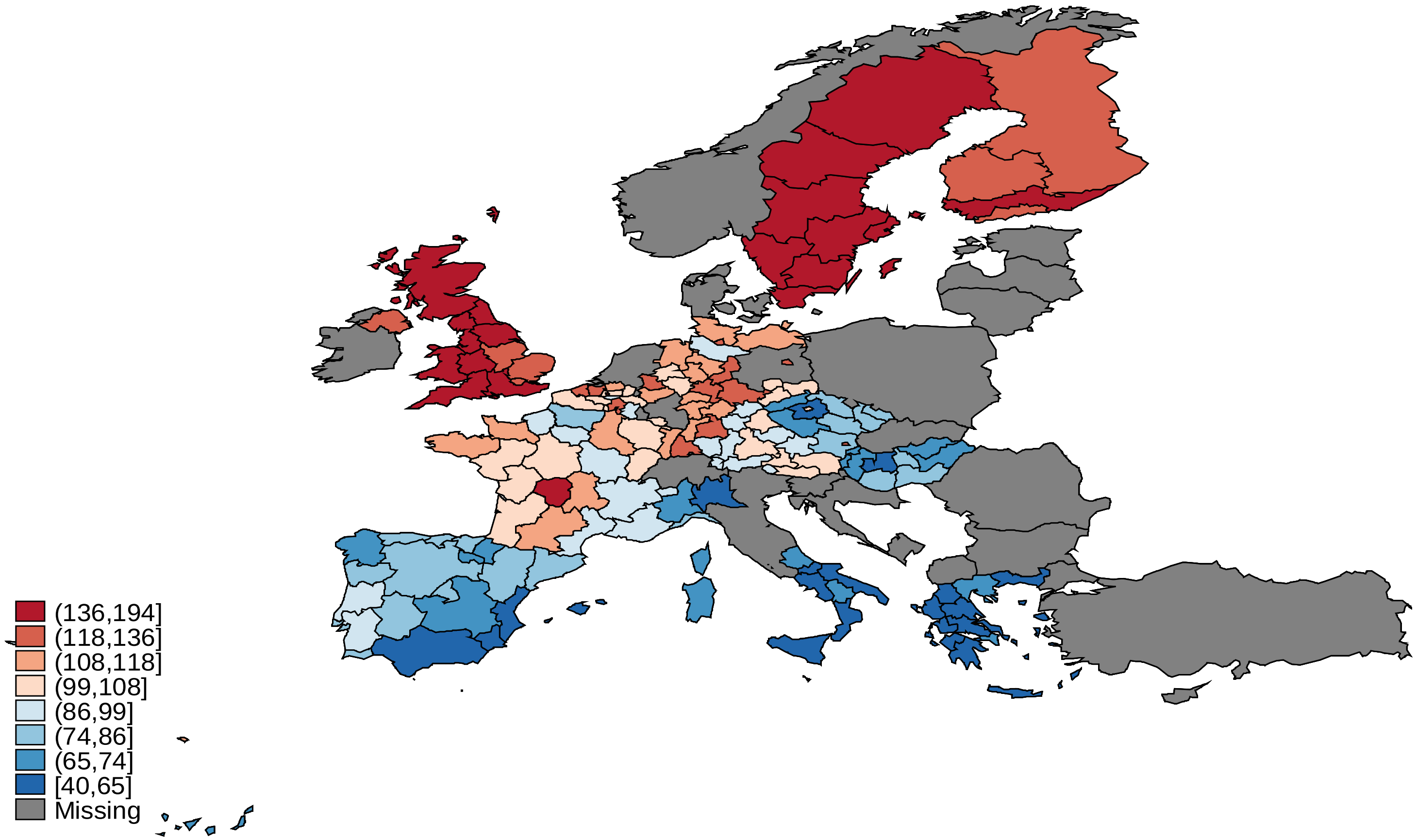


Figure 5.2: The distribution of migrant workers at the regional level in Europe (Europe=100, 2010)

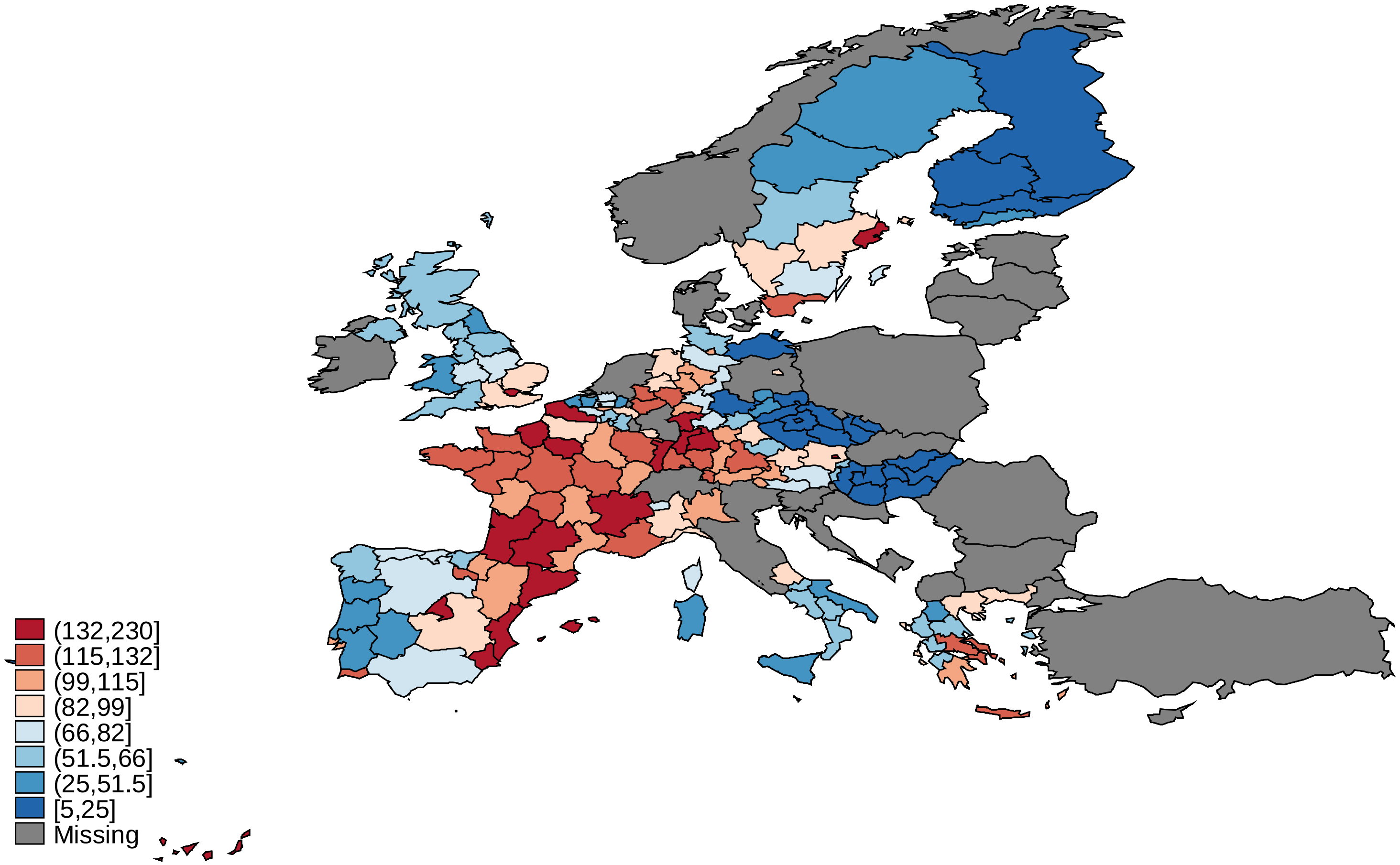


Figure 5.3: The distribution of the bohemian population at the regional level in Europe (Europe=100, 2010)

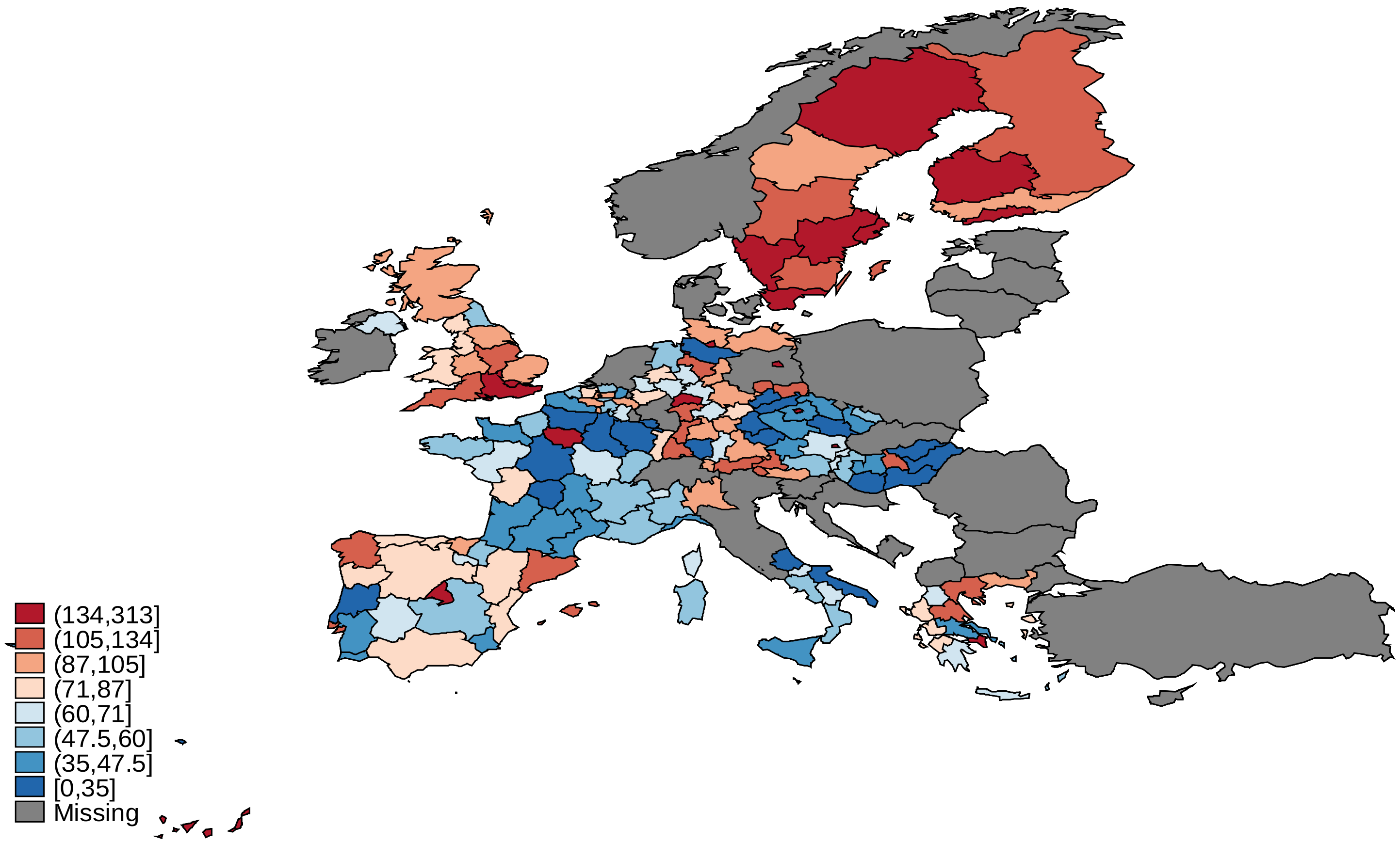
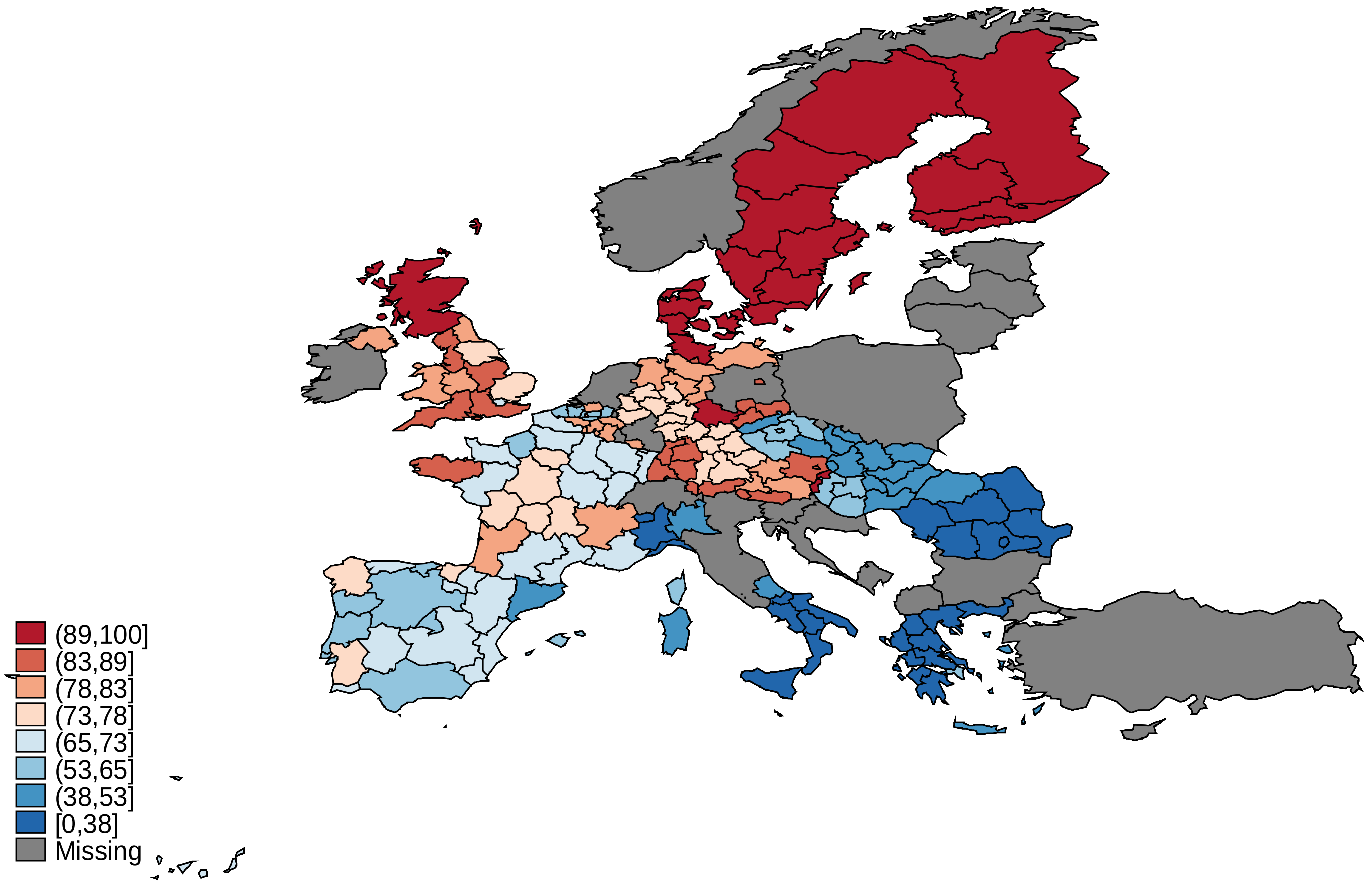


Figure 5.4: The quality of political institutions at the regional level in Europe (2010)



Note: Sjaelland in Denmark=100/ Bucuresti Ilfov in Romania=0

Figure 5.5: The distribution of university teachers at the regional level in Europe (Europe=100, 2010)

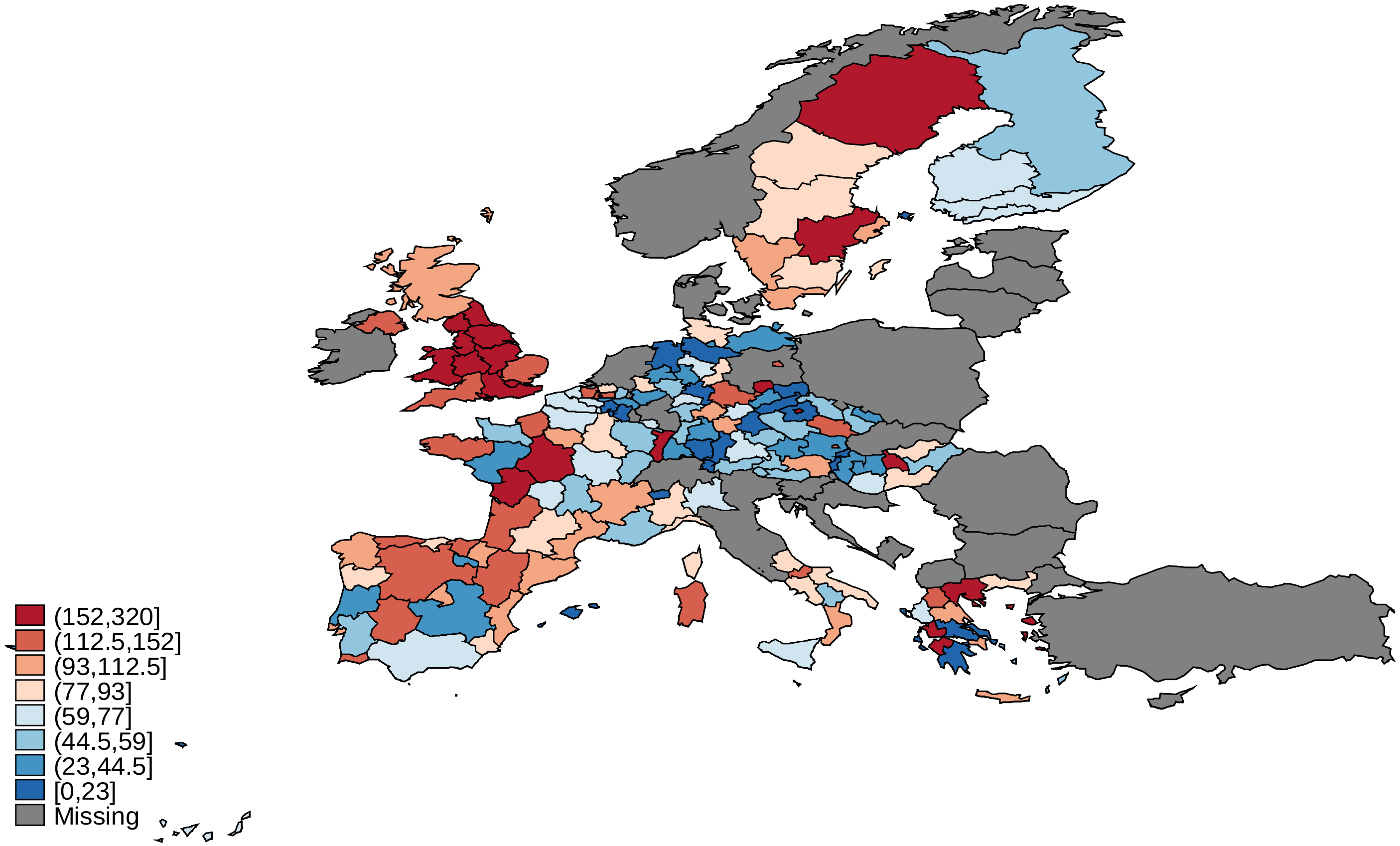
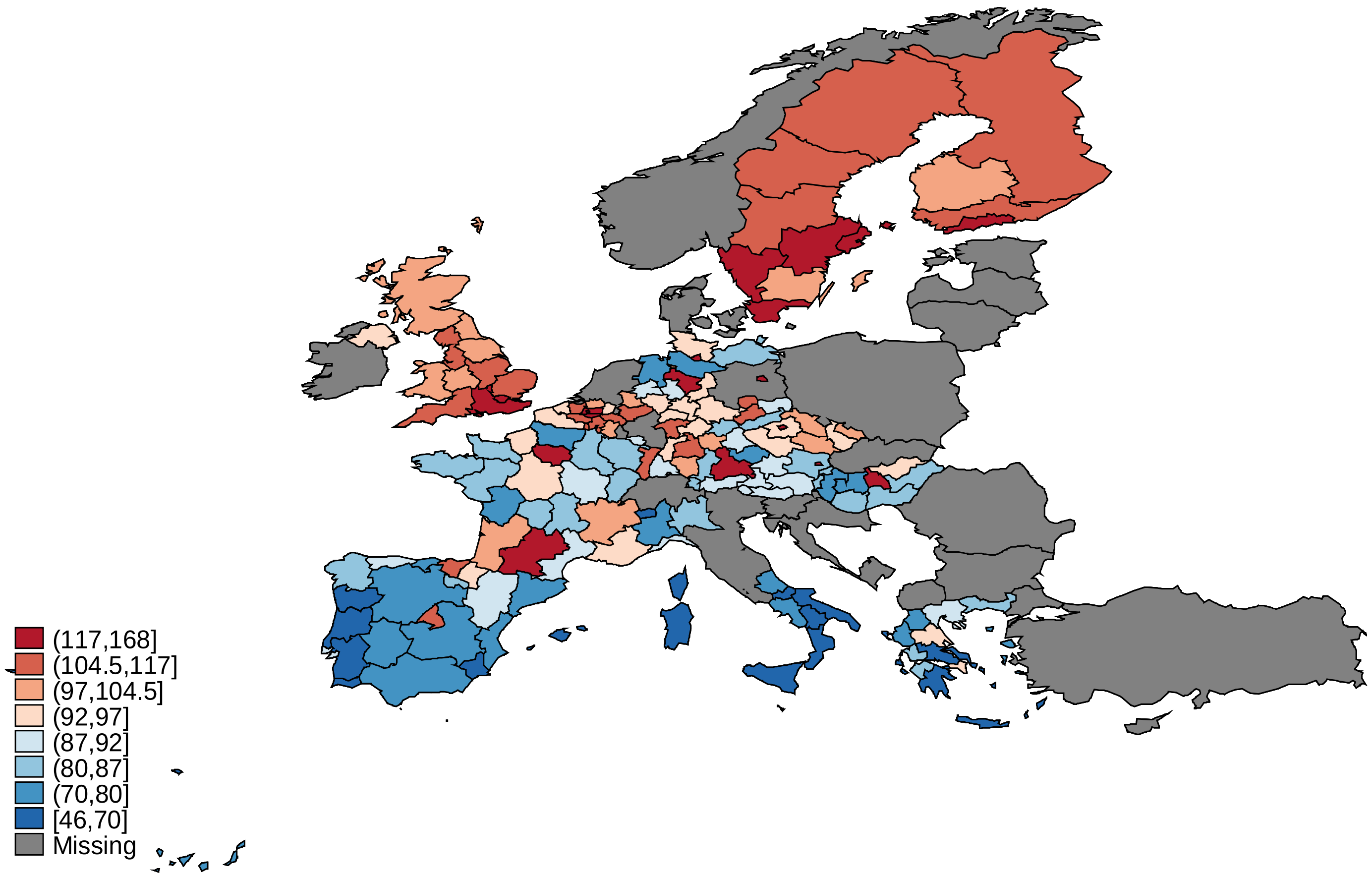


Figure 5.6: The distribution of creative workers at the regional level in Europe (Europe=100, 2010)



Basic results

Regional analysis involves many issues as mentioned earlier, particularly for a longitudinal dataset. Hence, as described above, three analytical models are adopted with different perspectives to deliver robust results. The direct application of the raw data would be problematic as the variables were derived from different scales; for example, employment shares to represent social provision levels but an index for political institutions. As shown in **Appendix 4.B**, both dependent and independent variables to a certain degree have skewed and wide distributions. In response, a log-transformation can be valuable both for making the patterns of the data more interpretable and for helping to meet the basic assumptions of inferential statistics. Admittedly, a problem with this approach is that it may result in small variance because the data variables are mainly based on population shares. However, in practice significant variation can nevertheless be observed. As can be seen in **Table 5.1**, the value of the locational quotient of the creative class varies from 5.06 to 3.65 and the standard deviation is 0.17. Some of the independent variables exhibit even more variation, for example, the locational quotient of bohemians varies between 5.92 and 1.37.

Table 5.2 shows correlations between the main variable in 2010 is taken as a reference for presenting the correlation test. As can be seen, there is a strong correlation between the location of the creative class and variables relating to people climate and regional social provision, with the location of bohemians having the most significant link.

Table 5.1: Summary statistics

Description	Mean	Max	Min	Sd
Creative class	4.525	5.055	3.654	0.165
Creative graduates	4.518	5.363	3.299	0.219
Creative non-graduates	4.530	5.133	3.299	0.186
The creative core	4.555	5.259	3.449	0.212
Creative professionals	4.508	5.109	3.475	0.190
Bohemians	4.281	5.916	1.368	0.551
Openness	4.369	6.056	1.778	0.484
University	4.396	6.309	1.353	0.604
Social provision (%)	-2.853	-0.768	-4.803	0.422
Government performance (%)	-2.364	-1.191	-3.294	0.364
Interactive term LEQI	-9.642	-3.581	-14.877	2.014

Notes:
1. All variables are log-transformed.
2. The first eight variables are location quotient based. The levels of social provision and government performance are expressed by the percentage of employees in education and social welfare and public administration respectively.
3. Taking the locational quotient of the creative class as an example, its antilog of mean value is 92.3, meaning that shares of creative workers across all target regions are below corresponding national shares (100) on average.

Moreover, the model does not suffer from multicollinearity as the majority of correlations between the independent variables are not large. Also, the diagnostic test indicates that all of the VIF scores are below five (see **Table 5.3**). In particular, as can be seen, the correlation of the bohemians variable with openness is only 0.17 and with university teachers only 0.27. It is also notable that a higher level of social provision is strongly correlated, 0.69, with a higher quality of political institutions. This finding, to a great extent, confirms the validity of the EQI index (Charron *et al.*, 2014), since one of sub-components for the EQI index is how local residents evaluate the quality of local social welfare and education systems[46].

[46] A correlation exercise for other years in the sample was also run, giving similar results to 2010.

Table 5.2: Pairwise correlation matrix

Year 2010

	The Creative Class (CR)	Bohemian (LB)	Openness (LO)	University (LT)	Social provision (S)
Bohemian (LB)	0.541***	1			
	(0.000)				
Openness (LO)	0.197***	0.166***	1		
	(0.005)	(0.000)			
University (LT)	0.382***	0.270***	0.0125	1	
	(0.000)	(0.001)	(0.886)		
Social provision (S)	0.323***	0.162***	-0.0199	0.237**	1
	(0.000)	(0.279)	(0.817)	(0.025)	
EQI Index	0.152*	0.061	0.0716	0.048	0.691***
	(0.052)	(0.442)	(0.404)	(0.557)	(0.000)

Note: *p*-values in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5.3: Diagnostic test for multicollinearity

Variable	VIF scores	1/VIF scores
Bohemian (LB)	1.43	0.69
Openness (LO)	1.11	0.89
University (LT)	1.11	0.89
Social provision (S)	1.43	0.69
EQI Index	1.38	0.72

Fixed effects model

It is clear that regional specific effects are important. Many of these effects, however, are not observable and could correlate with the independent variables. Therefore, the coefficient estimates will be biased due to endogeneity (i.e. a common omitted third factor determining both dependent and independent variables). In response, a fixed effects model is used to allow for regional fixed effects, to pick up unmeasured cultural, historical and geographic factors. It can be seen that the coefficients for the bohemian climate, university effects and the level of social provision are all positive and significant, though the elasticity for the social provision variable (the share of workers in education and social services industries) is largest at about 0.2[47]. However, the impact of openness and the measure of political institutions is not significant.

[47] Two reasons may be associated with the large coefficient of the level of social provision. Firstly, a considerable amount of creative workers who work in education and social services industries is not excluded from the total number of creative workers. However, the measure of creative workers would no longer be consistent to the nature of the creative class if this subcategory is further excluded (universities teachers, bohemians, workers in public administration and migrant creative workers have been excluded). Secondly, this variable is derived as share based in comparison to other locational quotients based on relative shares. Therefore, even though it has been log-transformed; the relative change of a share may yield a greater effect as a higher level of variations could be observed. In essence, the larger coefficient of the level of social provision could not imply that it is more important than other independent variables, but a simple reflection of the difference in measurement. As it is difficult to measure the concept of social provision in a temporal order based on any of the existing databases, this thesis focuses on how the size of the coefficient concerning this variable varies in the different model specifications, rather than focusing on comparing it to other locational quotients.

Country-specific time trends are also added to the FE specification. As can be seen in the last column in **Table 5.4**, university effects decrease to 0.014. Also a higher coefficient in the bohemian climate, the level of social provision and the measure of government performances can be observed. Once again, the impact of openness and the measure of political institutions remain insignificant.

Endogeneity tests (see **Table 5.5**) do not reveal any problems after the removal of the fixed effects[48], thus the fixed effects model appears robust. At this stage, it is possible to conclude that the locational preference of creative workers appears to be largely influenced by the bohemian climate, as Florida proposed. The importance of universities is also identified. Although the university elasticity is a bit lower than the people climate, the study directly links universities to the distribution of the creative class. This finding may indicate that the creative class indeed has some similar preferences as educated workers in general. While Florida tries to distinguish the creative class and human capital, what cannot be neglected is that a significant part of the creative class or human capital factors overlap since many creative people are highly educated. Although it is not possible to tell if these graduate creative workers are shaped more by creativity or education, they are, to some extent, behaving in a common way.

[48] Theoretically, a model could still suffer endogeneity after the removal of the fixed effects, given the fact that some time-variant unexplainable factors in the error term could still correlate with independent variables. In this case, the IVFE model can be a solution.

Table 5.4: Fixed effects specification

Dep var: ln (loc quotient creative workers)

	(I) Region FE	**(II) Region FE**
Bohemian (LB)	0.023*** (0.0039)	0.026*** (0.0041)
Openness (LO)	0.006 (0.0073)	0.008 (0.0075)
University (LT)	0.016*** (0.0033)	0.014*** (0.0035)
Social provision (S)	0.200*** (0.0104)	0.215*** (0.0107)
Share of workers in public sectors (L)	0.090*** (0.0177)	0.114*** (0.0177)
Interactive term (L*EQI)	0.003 (0.0033)	0.003 (0.0033)
Dummy variables	Time trends	Country-specific time trends
Constant	5.158*** (0.0619)	5.246*** (0.0712)
Within R^2	0.23	0.29
N. of cases	2191	2191

Notes:
1. LQ indicates locational quotient indicator.
2. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, standard errors shown in parenthesis.

Table 5.5: Endogeneity test (a)

Variable	Chi-square value of C Statistic	P-value
Location of bohemians	0.173	0.6773
Location of migrants	1.021	0.3122
Location of universities	0.202	0.6535
Social provision	0.363	0.5471
Share of workers in public sectors	0.543	0.3690
Interactive term (EQI*L)	1.739	0.1873

Note: The endogeneity test was developed by Baum *et al.* (2007). The detail of this technique will be explained in the following section.

It is interesting to consider whether there are different effects for peripheral (i.e. employment less than 300,000) and metropolitan regions (with employment over 720,000[49]). **Table 5.6** shows the estimated model for each group size. Although the whole sample cannot be divided into sub-categories of metropolises and peripherals due to data constraints, it is still plausible to assume that regions with larger workforces capture this pattern of difference.

Starting with a fixed effects model, where year dummies are included to take account of common economic shock, **Table 5.6** shows some difference in coefficients between the three groups of regions. The bohemian variable is strongly linked with the distribution of the creative class in large-sized regions (0.057), but is not significant in small-sized regions. More obviously, the impact of the openness variable has no significant effects in small-sized and midsized regions, but again its impact is very strong in large-sized regions, at 0.096. At the same time, the level of social provision has a significant impact in all three types of regions, with the strongest effect in large-sized regions. Finally, the effect of universities only has a

[49] The average number of employees was calculated by the available time period for each region and then the regional hierarchy was defined in terms of this value in the 30th, 60th and 90th percentiles respectively.

significant impact in small-sized regions, suggesting the important role of universities in regional development policy.

A further finding is that better quality political institutions appear to attract creative workers more strongly in small regions. As can be seen, the coefficients of L and the interactive term between L and the EQI index are only 0.049 and 0.007 in large regions, which further increase to 0.087 and 0.015 in smaller regions. Medium regions seem in between, as is perhaps appropriate, and the model generally performs worse, with a lower R^2, 0.15, less than half the size of that for the other region categories.

Since the inclusion of country-specific time trends is a plausible specification, there is no reason to restrict time trends as a constant across different countries. Therefore, next the analytical model is extended to allow for country-specific time trends. The results indicate a considerable difference within these two model specifications. As can be seen in the second column in each region category, the bohemian variable now gains significance in small-sized regions, with the positive coefficient, 0.023. At the same time, the elasticity of the level of social provision and universities slightly increases to 0.172 and 0.036, though the openness variable remains insignificant. In contract, the obvious changes can be observed in the measure of local governments, as this variable no longer has significant explanatory power. However, the relationship between L and the EQI index is still strong at 0.013.

Table 5.6: The fixed effects model: a further investigation on region sizes

Dep var: ln (loc quotient creative workers)

	Small-sized regions		**Midsized regions**		**Large-sized regions**	
Bohemian (LB)	0.023*	0.009	0.012**	0.010**	0.047***	0.057***
	(0.0012)	(0.009)	(0.0052)	(0.0050)	(0.0090)	(0.0086)
Openness (LO)	-0.014	-0.019	0.002	0.002	0.080***	0.096***
	(0.0174)	(0.0194)	(0.0119)	(0.0106)	(0.0174)	(0.0164)
University (LT)	0.036***	0.033***	0.003	0.003	-0.001	-0.001
	(0.0061)	(0.0061)	(0.0047)	(0.0042)	(0.0080)	(0.0076)
Social provision (S)	0.172***	0.145***	0.134***	0.131***	0.455***	0.349***
	(0.0357)	(0.0499)	(0.0162)	(0.0142)	(0.0232)	(0.0241)
Local government performance (L)	0.095	0.087**	0.091**	0.090**	0.101**	0.049**
	(0.0608)	(0.0489)	(0.0333)	(0.0264)	(0.0350)	(0.0350)
Interactive term (L*EQI)	0.013**	0.015**	-0.007	-0.007	0.005	0.007*
	(0.0070)	(0.0068)	(0.0058)	(0.0051)	(0.0041)	(0.0041)
Constant	5.117***	5.104***	4.996***	4.971***	5.596***	5.108***
	(0.1881)	(0.2027)	(0.121)	(0.0941)	(0.335)	(0.131)
Dummies	Country-specific time trends	Time trends	Country-specific time trends	Time trends	Country-specific time trends	Time trends
R^2	0.43	0.24	0.24	0.15	0.59	0.50
N. of cases	588	588	868	868	735	735

Notes:
1. Small, medium and large regions are defined as regions with employment less than 325,000, greater than 325,000 while less than 770,000 and greater than 770,000 respectively.
2. * p < 0.10, ** p < 0.05, *** p < 0.01, standard errors shown in parenthesis.

A similar pattern can also be seen in large-sized regions. In addition to the slightly changed coefficients for bohemians, openness, universities and social provision, the coefficient of local government performance significantly increases to 0.101, but the measure of local political institutions loses significance, though its coefficient is not largely changed. In the end, the results in midsized regions appear to be stable, as the majority of coefficients remain similar.

In conclusion, the findings seem robust. Even though some coefficients are not consistent within two specifications, this is likely due to the lack of degrees of freedom (e.g. the number of observations for small-sized regions is only 588, while the corresponding number of dummies is more than 50). Thus, Florida's thesis appears to be most valid in the big region (metropolitan) context, where creative workers are drawn by the people climate (the bohemian and openness variables). In small regions by contrast, the creative class seems instead to stick to a "conventional lifestyle", caring especially about the quality of local institutions including local government and the social welfare system.

The dynamic GMM model

The thesis now turns to a specification allowing dynamic adjustment, using the system GMM (Generalised Method of Moments) as implemented in Stata (see Cameron and Trivedi, 2010, p.328-330). Flows of creative workers could be self-determined (Faggian *et al*., 2011) in the sense that creative workers are drawn to places where there are already creative workers. This process would link the current dependent variable to its past realisation. Admittedly, the panel dataset has a relatively short time dimension (T=15) relative to its regional dimension (N=193), but still it is possible to test for some dynamic effects.

This is not the first time system GMM has been used to analyse the impact of the creative class. Möller and Tubadji (2009) used the system GMM model to discuss the creative class in Germany. This contribution supports the plausibility of this application in this case. To be specific, the model involves introducing one-period lagged dependent and independent variables into the regression, so here the sample size is reduced from 2191 to 1956.

Table 5.7 presents the results, starting with a "naïve" form, the pooled OLS model. As can be seen, the location of creative workers is significantly related to its past realisation, showing a figure of 0.847. Also, the coefficients of current values of the location of bohemians, the location of university teachers, the level of social provision and the interaction term L*EQI are 0.033, 0.022, 0.193 and 0.025 respectively. However, the current impacts of openness and government performance are not significant. The long-run effects will be discussed later, in connection with the preferred results in column V.

Theoretically, the OLS estimator should lead to an upward bias that will be counteracted by an opposite bias with the FE estimator (Bond, 2002). As shown in the second column, the inclusion of regional dummies indeed reduces the coefficients of the lagged dependent variable from 0.847 to 0.451 and also the rest of the independent variables. The demeaning transformation cannot completely eliminate the problem of endogeneity from lagged dependent variables, so in response, the Anderson-Hsiao (1981) difference and levels GMM estimator is reported, which is a prelude to the later work by Arellano and Bond (1991). The basic principle for this approach is to instrument differenced endogenous variables by their past lagged levels. The result then shows that the coefficient of lagged dependent variable is 0.478, which lies between 0.847 and 0.451.

An alternative is Arellano and Bond's difference GMM estimator. However, as shown in the fourth column in **Table 5.7**, it performs even less well. Here, the coefficient of the lagged dependent variable is only 0.237, which is smaller than that for the fixed effects model. Other coefficients are also diminished, implying implausibly small elasticities. This result can be regarded as normal as this differencing transformation approach will not perform very well if the dependent variable behaves as a random-walk. In other words, past levels of the creative population's preferences may convey little information about further changes in preferences. So finally, the Blundell-Bond system GMM estimator will be addressed

Since the system GMM model involves level equations (i.e. the fixed effects are not yet removed), it is always necessary to test the possible endogeneity for regressors. Beside the dynamic panel bias caused by the lagged dependent variable, there is no reason to assume that the rest of the independent variables are strictly exogenous. The endogeneity test employed here is based on the approach by Baum *et al*. (2007). In conditional homoscedasticity, this technique is mathematically equal to the Wu-Hausman F-test version of the endogeneity test but it is rather more robust regarding various violations.

Table 5.7: Model specification: a dynamic framework
Dep var: ln(loc quotient creative workers)

	(I)Pooled- OLS	(II)FE	(III) Anderson-Hsiao difference and levels GMM (1981)	(IV)Arellano-Bond difference GMM (1991)	(V) Blundell-Bond system GMM (1998)
CR_{t-1}	0.847***	0.451***	0.478***	0.237***	0.824**
	(0.0117)	(0.0210)	(0.1302)	(0.0109)	(0.0466)
B_t	0.033***	0.025***	0.024***	0.007	0.031***
	(0.0035)	(0.0037)	(0.0047)	(0.0146)	(0.0110)
B_{t-1}	-0.015**	-0.013**	-0.021***	-0.009	-0.020**
	(0.0035)	(0.0037)	(0.0058)	(0.0074)	(0.0008)
O_t	-0.002	-0.008	0.006	0.001	0.009
	(0.0079)	(0.0084)	(0.0117)	(0.0179)	(0.0167)
O_{t-1}	0.028	-0.000	-0.003	-0.005	-0.002
	(0.0079)	(0.0081)	(0.0107)	(0.0134)	(0.0149)
T_t	0.022***	0.016***	0.019***	0.022***	0.022***
	(0.031)	(0.032)	(0.0038)	(0.0058)	(0.0048)
T_{t-1}	-0.011***	-0.010***	-0.010*	-0.003	-0.009
	(0.031)	(0.033)	(0.0049)	(0.0053)	(0.0060)
S_t	0.193***	0.192***	0.202***	0.118	0.202***
	(0.0127)	(0.0129)	(0.0159)	(0.1034)	(0.0664)
S_{t-1}	-0.181***	-0.078***	-0.0693***	0.039	-0.181***
	(0.0122)	(0.0129)	(0.0310)	(0.0343)	(0.0602)
L_t	-0.039	0.071***	0.073***	0.097	0.065
	(0.0576)	(0.0180)	(0.0219)	(0.0691)	(0.0533)
L_{t-1}	0.010	-0.021	0.001***	0.152***	-0.030
	(0.0556)	(0.0180)	(0.0238)	(0.0556)	(0.0481)
$LEQI_t$	0.025**	0.002	0.004	-0.001	0.003
	(0.0133)	(0.0029)	(0.0031)	(0.0065)	(0.0043)
$LEQI_{t-1}$	-0.017	0.002	-0.003	-0.011**	-0.003
	(0.0130)	(0.0030)	(0.0032)	(0.0046)	(0.0036)
_cons	0.543***	2.968***	-0.002***	n/a	0.729***
	(01124)	(0.1284)	(0.0027)		(0.194)
Year Dummies	No	Yes	Yes	Yes	Yes
Region Dummies	No	Yes	No	No	No
N. of cases	1956	1956	1752	1752	1956
R^2	0.83	0.87	n/a	n/a	n/a

Note: variables in model III are difference-transformed,* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The lagged variables in differences are adopted as valid instruments since the difference transformation removes the fixed effects and the further lagging makes them exogenous to current error terms while still having impact on their current realisations. All suspect regressors will then be tested one by one. As shown in **Table 5.8**, the C-statistic for the bohemians and social provision variables indicates that they cannot be treated as exogenous, as the Chi-square values are 12.9 and 5.7 respectively. With this in mind, the bohemians and social provision variables appear to be endogenous.

In the last column, the Blundell-Bond system GMM estimator seems to fit well with the thesis' expectations: the coefficient of the lagged dependent variable is inside the credible range of 0.451-0.847 at 0.824. The rest of the independent variables also have plausible magnitudes and signs. In response to the endogeneity test shown above, the location of bohemians and social provision are treated as endogenous, while taking location of migrant workers, location of universities, and quality of local government as exogenous. As a result, the long-run coefficient of bohemians is (0.031-0.020)/ (1-0.824) =0.063[50], which shows a smaller impact on creative workers' consumer preferences than the location of universities 0.022/ (1-0.824) =0.125. The level of openness is again not significant in this regression, but the long-run effect of social provision is sizeable (0.202-0.181)/ (1-0.824) =0.119 which is, however, not as strong as the fixed affects estimator predicted (0.215). Finally, neither the local government performance nor its interaction with the EQI index has a positive long-run effect on average. Once again, this finding is consistent with the fixed affects model predicted, as only a good political institution appears to have a positive impact on the location of the creative class.

[50] If $Y(t)=aY(t-1) + b X(t) + cX(t-1)$, then $\partial Y/\partial X = (b+c)/(1-a)$.

In conclusion, column V's model has a better analysis of causality, yet depicts a similar picture to the fixed effects model. Hence, it seems plausible to conclude that the location preferences of creative workers are to some extent influenced by the distribution of bohemians. Similarly, the location of universities and the amount of social provision also play an important role, suggesting that the creative class and graduates inevitably exhibits similar preferences.

Table 5.8: Endogeneity test (b)

Variable	Chi-square values of C Statistic	P-value
B_t ,B_{t-1} (location of bohemians)	12.852***	0.0003
O_t ,O_{t-1} (location of migrants)	0.418	0.5181
T_t ,T_{t-1} (location of university)	2.238	0.1347
S_t ,S_{t-1} (social provision)	5.668***	0.0173
L_t ,L_{t-1} (government performance)	2.007	0.1951
L_{t*} $LEQI_t$,L_{t-1*} $LEQI_{t-1}$(Interaction)	0.012	0.9113

Note:

1. The endogeneity test is, however, different from the previous one as the regional-specific effect is not yet removed.

2. This endogeneity test was developed by Baum *et al.* (2007), which is calculated by the difference of two Sargan-Hansen statistics: one for the equation with the smaller set of instruments, where the suspect regressor(s) are treated as endogenous, and one for the equation with the larger set of instruments, where the suspect regressors are treated as exogenous. If a significant difference is identified, the suspect regressor(s) will be treated as endogenous.

3. The stata command used here is ivreg2 with endog() option.

Robustness Test: a reevaluation based on multiple dimensions

This section intends to test further the robustness of the empirical model by taking up different sub-categories of the creative class. The first sub-category takes workers who are defined as being in the creative core, with a clearer role in the realm of creative innovation-related development paths (Kratke, 2010). They may also have different preferences (Ashiem and Hansen, 2009; Beckstead *et al*., 2008; Hansen *et.al.*, 2009). The second type of breakdown has been recently discussed by Maroccu and Paci (2012), who combined both the creative class and human capital, putting forward the creative graduate concept.

Table 5.9 shows that these less controversial groupings (creative graduates or the creative core) exhibit different location preferences to the whole creative class. Preferences for movement to places with a bohemian or open climate are not seen. However, the role of local government is more marked for the creative core, since its long-run coefficient for the interaction L*EQI is (0.013-0.011)/ (1-0.693) =0.007, which is significantly larger than for the other groupings. Also the location of universities (T) has stronger explanatory power, showing current coefficients of 0.018 and 0.021.

In contrast, a different pattern is shown for the categories of non-graduate creative workers and creative professionals. As can be seen in the second and the last columns, the impact of the bohemian index and the lagged impact of the openness index are evident here, but university and social provision appear unimportant. This result is plausible since these groups synthesise knowledge (rather than creating it), and consequently require a people rather than a business climate.

5.4. Conclusions

In this chapter, we seek to investigate the validity of Florida's propositions regarding the people climate. Even though the promotion of the people climate is argued to be not a one-size-fits-all solution, the remedy for smaller regions to grow under the dominate milieu in the Creative Age has not been clearly proposed. With this question in mind, this chapter has aimed to examine the preferences of the creative class. In response to hypotheses 5.1-5.3, the findings can be categorised as bellow:

Hypothesis 5.1: is the effect of the people climate always positive across different regions?

The main answer to hypothesis 5.1 proposed at the beginning, is that many of the relationships put forward by Florida (2002, 2008) are evident in the European context. This conclusion is consistent with previous studies of the U.S. and Canada (McGranhan and Wojan, 2007; Reese *et al*., 2010). The thesis controlled for regional heterogeneity and for possible endogeneity caused by omitted variables or simultaneity. The location of bohemians and the location of migrant workers were all found to be positively related to the location of the creative class, but this relationship are more likely to be relevant in large (metropolitan) regions (those with more than about 770,000 employees) and less so in smaller ones (with less than approximately 320,000 employees).

Hypothesis 5.2: is the business climate important?

The level of social provision was also found to be a good proxy in determining the location of the creative class in all regional contexts. Therefore, hypothesis 5.2, to a certain degree, can be verified, as the basic aspects of socio-economic progress such as the quality of education and social welfare systems are still fundamental. However, it is most interesting that for the rest of business climate-related parameters, namely the quality of the local political institutions and the location of universities, their positive roles are only evident in small regions. This finding has positive policy implications for local government in small areas, possibly using university development, for example, to attract the creative workers who are important for regional development.

Hypothesis 5.3: Are the creative class' consumer preferences different in each creative sub-category?

Finally, it is believed that hypothesis 5.3 cannot be rejected. Even though the model does not fit all sub-categories within whole creative class equally well, results show the importance of the people climate (i.e. tolerance and openness) or the business climate (i.e. location of universities, social provision and good local government) in different contexts. The fact that the people climate is more important for the non-creative graduates and creative professionals, while the business climate is more important for creative graduates and the creative core, is consistent with Asheim and Hansen's (2009) argument that creative workers with different knowledge bases should have different preferences for residential location.

In conclusion, this study is likely to reveal causality, in response to the proverbial "chicken and egg" problem. It is not intended to discard the whole theory of the people climate, as the people climate indeed has strong explanatory power in explaining the distribution of the creative class in metropolitan areas. However, it may see counter intuitive that only the quality of local government is a good predictor in smaller regions. Some characteristics, although they have been mentioned but not greatly emphasized by Florida, appears to be very important. In this sense, small economies have chances to become creative powerhouses if local policy makers correctly associate the preferences of the creative class with their unique advantages.

Table 5.9: Robustness test: the different definitions of creative workers

	Creative graduates	Creative non-graduates	The Creative core	Creative professionals
CRt-1	0.767***	0.462**	0.693***	0.699***
	(0.0546)	(0.0507)	(0.0493)	(0.0554)
Bt	0.019	0.031***	0.001	0.024**
	(0.0158)	(0.0189)	(0.0164)	(0.0113)
Bt-1	0.000	-0.002	-0.001	0.002
	(0.0102)	(0.0136)	(0.0094)	(0.0093)
Ot	0.006	-0.014	-0.020	-0.016
	(0.0239)	(0.0242)	(0.0286)	(0.0159)
Ot-1	-0.004	0.050**	-0.005	0.024*
	(0.0213)	(0.0225)	(0.0257)	(0.0141)
Tt	0.018***	0.005	0.021**	0.012**
	(0.0066)	(0.0075)	(0.0074)	(0.0051)
Tt-1	0.002	0.005	0.007	0.002
	(0.0079)	(0.0071)	(0.0068)	(0.0065)
St	0.277***	0.052	0.198***	0.054
	(0.0594)	(0.1362)	(0.0600)	(0.0808)
St-1	-0.269***	0.003	-0.163***	-0.044
	(0.0544)	(0.1024)	(0.0627)	(0.0746)
Lt	0.106***	0.034	0.078**	0.045
	(0.0387)	(0.0416)	(0.0364)	(0.0325)
Lt-1	-0.054	-0.023	0.007	-0.050**
	(0.0385)	(0.0330)	(0.0374)	(0.0276)
LEQIt	0.001	-0.001	0.013**	-0.001
	(0.0060)	(0.0066)	(0.0056)	(0.0056)
LEQIt-1	-0.007	-0.003	-0.011**	0.008
	(0.0067)	(0.0056)	(0.0054)	(0.0049)
_cons	0.953***	2.220***	1.515***	1.393***
	(0.276)	(0.2700)	(0.2643)	(0.2449)
N. of cases	1955	1956	1956	1956
Arellano-Bond test for AR(1)	(Z) -7.38/ (P)0.000	(Z) -4.18 / (P)0.001	(Z) -5.28 / (P)0.000	(Z) -5.28 / (P)0.000
Arellano-Bond test for AR(2)	(Z) 0.64/ (P) 0.523	(Z) -0.08 / (P) 0.939	(Z) 0.97/ (P) 0.331	(Z) 0.97/ (P) 0.331

Notes: 1. Creative grads – the creative group (senior govt officials, managers, professionals, associate professionals and scientists) with a degree (note – excludes bohemians, univ teachers and migrants) (see also Table 4.1), 2.Creative core – same as creative group excluding senior govt officials, managers and associate professionals, 3.Creative professionals – senior govt officials, managers and associate professionals.

Appendix

Appendix 5. A: The EQI scores of local governments

Code	Region	EQI	Code	Region	EQI
AT11	Burgenland	90.62	FR53	Poitou-Charentes	78.32
AT12	Niederöstrerreich	84.49	FR61	Aquitaine	79.44
AT13	Wien	84.97	FR62	Midi-Pyrenees	70.18
AT21	Kärnten	88.12	FR63	Limousin	77.42
AT22	Steiermark	81.35	FR71	Rhone-Alpes	79.00
AT31	Oberösterreich	82.63	FR72	Auvergne	73.85
AT32	Salzburg	82.03	FR81	Languedoc-Roussillon	73.28
AT33	Tirol	87.66	FR82	Alpes-Cote d'Azur	66.28
AT34	Voralberg	86.16	FR83	Corse	64.28
BE1	Brussels	53.01	GR1	Voreia Ellada	31.34
BE2	Vlaams Gewest	81.55	GR2	Kentriki Ellada	38.31
BE3	Wallonie	60.89	GR3	Attica	55.90
CZ01	Praha	41.64	GR4	Nisia Aigaiou-Kriti	41.72
CZ02	Stredni Cechy	56.41	HU1	Közép-Magyarország	39.69
CZ03	Jihozapad	61.09	HU2	Dunántúl	54.90
CZ04	Severozapad	41.51	HU3	Észak és Alföld	52.30
CZ05	Severovychod	58.90	ITC1	Piemonte	58.07
CZ06	Jihovychod	51.69	ITC2	Valle d'Acosta	75.78
CZ07	Stedni Morava	49.66	ITC3	Ligura	49.61
CZ08	Moravskoslezsko	53.42	ITC4	Lombardia	46.76
DE1	Baden Wuttemberg	83.94	ITD1	Bolzano	78.74
DE2	Bavaria	78.09	ITD2	Trento	72.35
DE3	Berlin	83.94	ITD3	Veneto	50.57
DE4	Brandenburg	83.89	ITD4	Friuli-Venezia Giulia	64.96
DE5	Bremen	83.33	ITD5	Emilia-Romagna	53.20
DE6	Hamburg	83.51	ITE1	Toscana	48.65
DE7	Hessen	76.31	ITE2	Umbria	56.50
DE8	Mecklenburg-Vorpommen	83.25	ITE3	Marche	50.61
DE9	Lower Saxony	82.99	ITE4	Lazio	33.06
DEA	North Rhine Westphalia	78.14	ITF1	Abruzzo	40.86
DEB	Rhineland-Palatinate	80.58	ITF2	Molise	33.73
DEC	Saarland	80.58	ITF3	Campania	10.18
DED	Saxony	86.44	ITF4	Puglia	22.87
DEE	Saxony-Anhalt	81.43	ITF5	Basilicata	33.24
DEF	Schleswig-Holstein	90.30	ITF6	Calabria	13.00
DEG	Thuringia	91.67	ITG1	Sicilia	20.85
FR10	Ile-de-France	73.50	ITG2	Sardegna	41.33
FR21	Champagne-Ardenne	65.63	PT11	Norte	54.68
FR22	Picardie	71.85	PT15	Algarve	66.21
FR23	Haute-Normandie	64.29	PT16	Centro	61.05
FR24	Centre	74.95	PT17	Lisboa	64.74
FR25	Basse-Normandie	72.53	PT18	Alentejo	77.74
FR26	Bourgogne	72.15	PT20	Autónoma dos Açores	72.82
FR30	Nord - Pas-de-Calais	73.44	PT30	Autónoma da Madeira	67.76
FR41	Lorraine	66.90	ES11	Galicia	74.66
FR42	Alsace	71.93	ES12	Principado de Asturias	73.30

FR43	Franche-Comte	72.36	ES13	Cantabria	65.28
FR51	Pays de la Loire	69.36	ES21	Pais Vasco	76.64
FR52	Bretagne	84.30	ES22	Comunidad Foral de Navarra	65.92
ES23	La Rioja	67.45	ES70	Canarias (ES)	68.08
ES24	Aragón	69.13	SE1	Östra Sverige	92.13
ES30	Comunidad de Madrid	60.03	SE2	Södra Sverige	93.81
ES41	Castilla y León	60.97	SE3	Norra Sverige	89.61
ES42	Castilla-La Mancha	66.69	UKC	Northeast England	81.81
ES43	Extremadura	71.21	UKD	Northwest England	84.44
ES51	Cataluña	52.07	UKE	Yorkshire-Humber	76.00
ES52	Comunidad Valenciana	65.50	UKF	East Midland England	88.91
ES53	Illes Balears	64.53	UKG	West Midland England	79.21
ES61	Andalucia	57.84	UKH	East of England	78.42
ES62	Región de Murcia	68.34	UKI	London	72.34
UKJ	South East England	85.36	FI	Finland	92.17
UKK	South West England	85.55			
UKL	Wales	79.35			
UKM	Scotland	89.60			
UKN	N. Ireland	82.12			

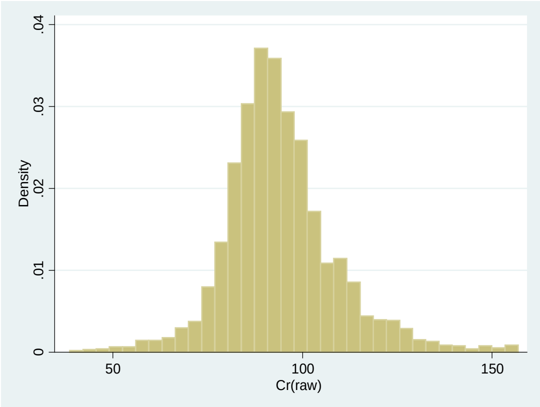
Notes:

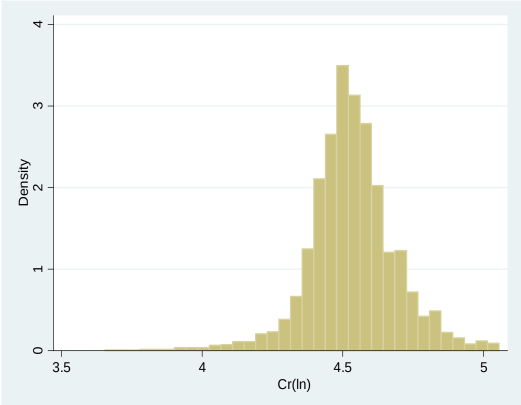
1. For Belgium, Germany, Hungary, Greece, the U.K. and Sweden, only NUTS 1 is available. For Finland, there is no information by regions.

2. Source: Measuring the quality of government and subnational variations (Charron *et al*., 2014), Report for the European commission, University of Gothenburg, Sweden.

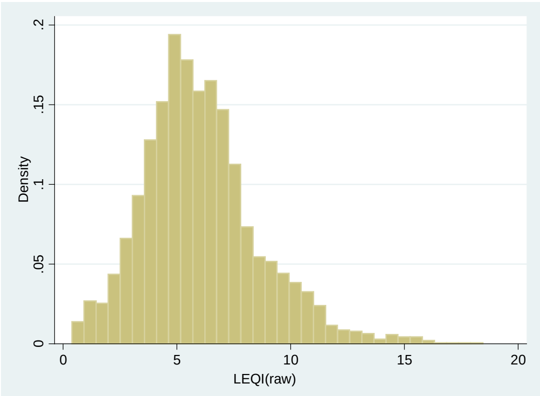
Appendix 5. B: Tests for normality

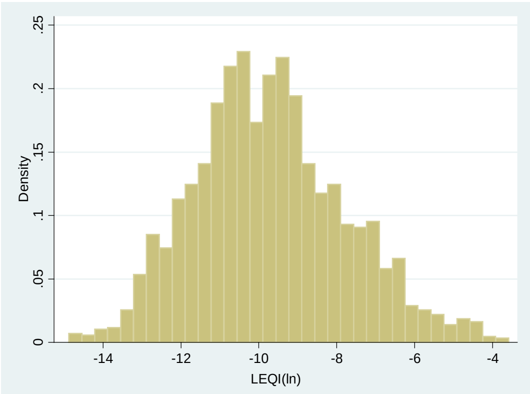
(1) Locational quotient of creative workers



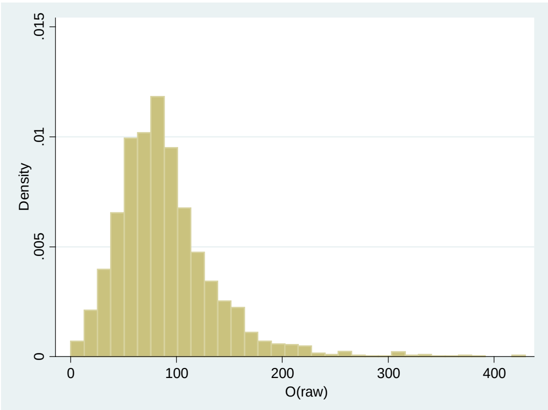


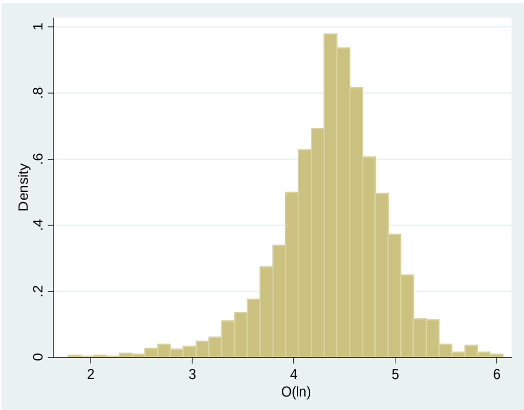
(2) Interation term L*EQI



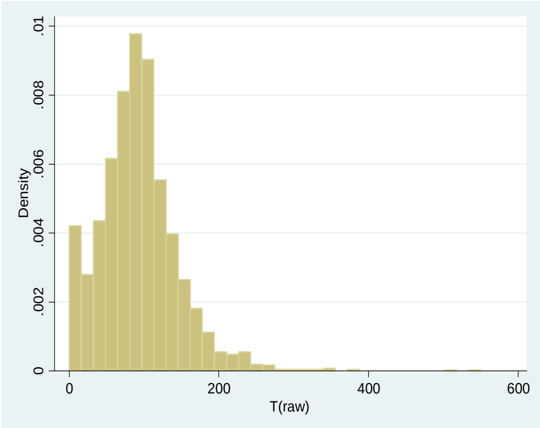


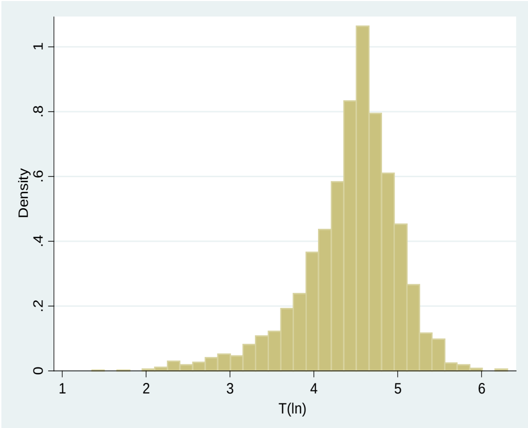
(3) Locational quotient of migrant workers



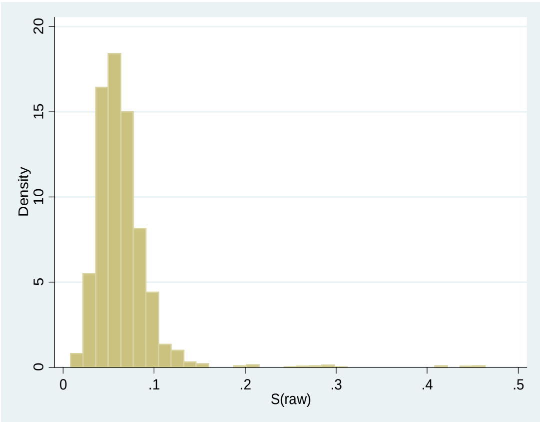


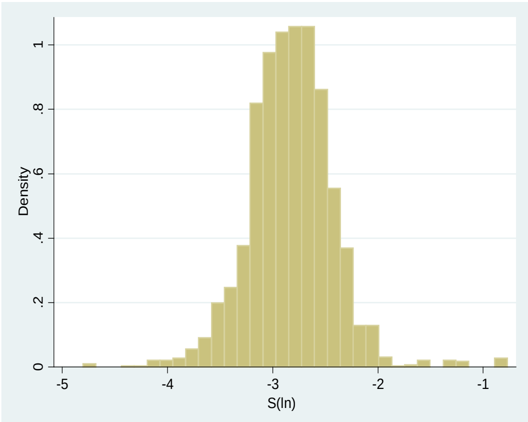
(4) Locational quotient of university teachers



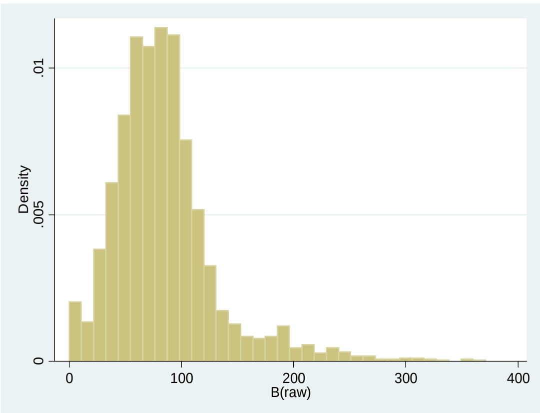


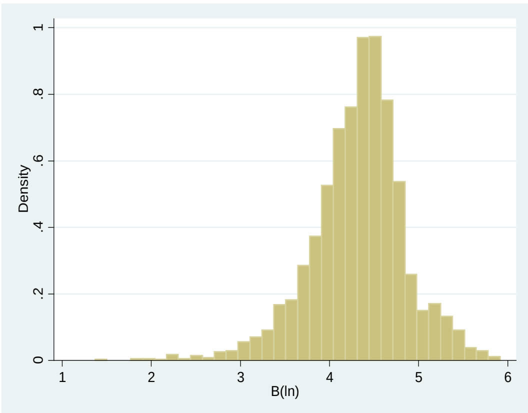
(5) Share of workers in public administration





(6) Locational quotient of bohemians





CHAPTER 6

THE PERFORMANCE OF NEW CREATIVE WORKERS IN THE EUROPEAN LABOUR MARKET

6.1 Introduction

Following hypothesis 6.1, Chapter 6 focused on the relationship between creative individuals and the education system. The significantly positive impacts of the creative class and its sub-category (e.g. creative graduates) on regional development and growth were shown, but how are they rewarded by labour markets? A healthy and creativity-engendering economy should not only attract creative workers from outside, but should also act as a powerhouse in forging well-trained and educated individuals in the creative disciplines. Therefore, the national education system plays an important role in acting as a supplier to the labour market, constantly providing appropriate skills and qualifications that the creative economy requires.

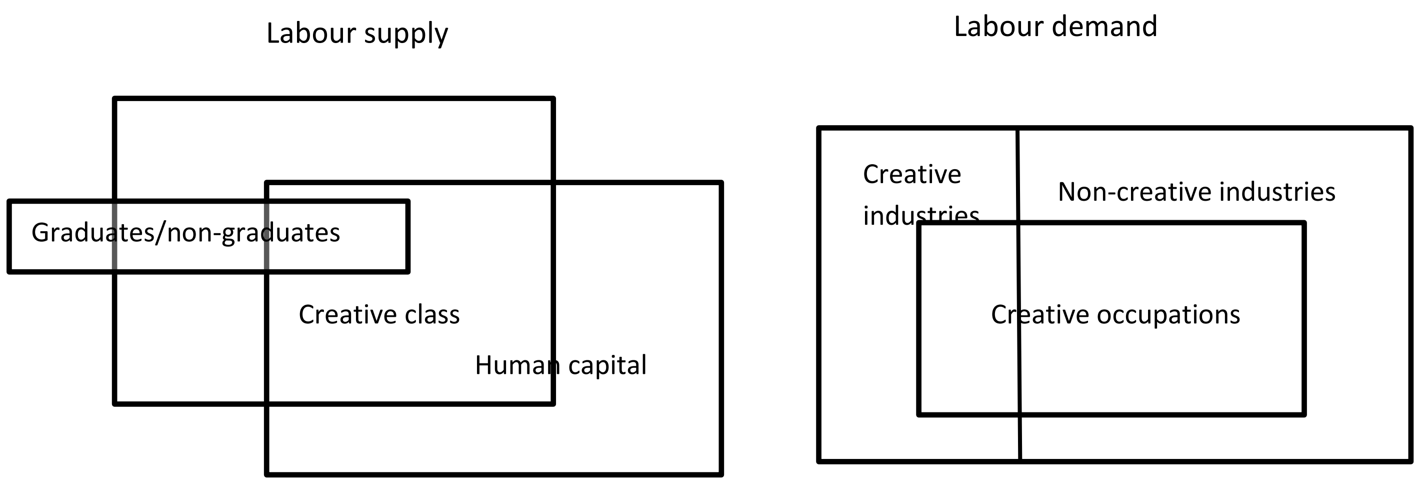
With regard to generating creative workers, to date there have only been a few empirical studies. Comunian *et al.* (2010) initially examined the labour market in the U.K. for bohemian graduates. Using micro-individual student data by the Higher Education Statistical Agency (HESA), bohemian graduates in the U.K. were believed to be unfairly rewarded in the year 2006 in terms of the level of salary and type of jobs offered to them. However, the scope is limited to bohemian graduates in the U.K., which leaves space for further research.

In this thesis, labour markets and education systems in seven European countries will be examined. Given that little comparative research has been undertaken on the scale of the creative economy across Europe (Carr, 2009), the EU LFS database provides an opportunity to link the main European creative economies together, such as the U.K., Germany, Spain, Italy and France. In addition, the Netherlands and Denmark are also included, as their economies have frequently been described as “creative” (Stam *et al*., 2008).

Compared to many pieces of research that focus on the narrative concept of the “creative industry” (DCMS, 1998), the creative occupations, which represent labour demand in the labour market, can be often embedded in other sectors. Therefore, creative occupations can be included in both the creative industries and the non-creative industries (Higgs *et al*., 2007). An analysis for graduates with arts, design, media or other creative education backgrounds might suit the scope of the creative industry. When the scale is further expanded to the whole creative class, this concept cannot cover the large number of workers who also have important creative skills that cannot be defined as “artistic”. Therefore, not only bohemians but also the rest of the creative workers are included in this study (see **Figure 6.1**). As in previous chapters, new creative workers are defined as bohemians, the creative core and creative professionals.

Finally, the definition of education in this study is a broad concept, which includes not only those graduates with a university or tertiary degree but also non-graduates. This attempt is responsive to the argument between the human capital theory and the creative class theory as a large number of creative workers do not have

Figure 6.1: The definition of labour supply and labour demand



a university degree (Florida, 2013; Mellander, 2009). However, artists are argued to be better educated (Menger, 1999) and for some traditional occupations such as HE and secondary education teachers, scientists, lawyers and medical practitioners, a university degree is regarded as a "stepping stone" onto a career ladder (Elias and Purcell, 2004). Given that most of these occupations are also categorised as creative occupations, this thesis is interested in analysing the job outcomes of both creative graduates and creative non-graduates across different countries.

6.2 Models

After having defined qualifications and creative occupations in section 3.4, the methodology of this chapter follows three steps:

Firstly, the simple descriptive statistics are presented to measure the situation of newly graduated students regarding both supply and demand in the labour market. An important setup here is that only individuals who have jobs in the current year are focused upon. In other words, only the relationship between the supply of labour (graduates/non-graduates) and the demand of labour (creative/non-creative occupations) is addressed, without consideration of unemployment as the EU LFS dataset contains insufficient information to analyse this pattern. Therefore, for graduates and non-graduate workers who were students and pupils from the last academic year, the only job outcome for them is if their occupations are now creative or non-creative based on Florida's definition.

Then a multinomial logit model identifies what factors affect the probability of obtaining a creative job for new workers. Formally

$$\Pr(Y = 0|X) = \frac{e^{x\beta^0}}{e^{x\beta^0} + e^{x\beta^1}}$$

$$\Pr(Y = 1|X) = \frac{e^{x\beta^1}}{e^{x\beta^0} + e^{x\beta^1}} \qquad (6.1)$$

In equation 6.1, outcomes 1 and 0 recorded in y represent the job outcomes in terms of creative and non-creative occupations respectively. A set of coefficient β^1 and β^0 is estimated, corresponding to each outcome. However, this model is unidentified as it has more than one solution β^1 and β^0 and leads to the same probability if Y=1 and Y=0. To solve this problem, β^0 has to be set at zero (Stata User's Guide, 2013). Therefore, the remaining coefficients β^1 will measure the relative change to the Y=0 group. In this case, the set of equations in 6.1 can be further expressed as

$$\Pr(\mathrm{Y}=0|\mathrm{X}) = \frac{1}{e^{x\beta^1}+1}$$

$$\Pr(\mathrm{Y}=1|\mathrm{X}) = \frac{e^{x\beta^1}}{e^{x\beta^1}+1} \qquad (6.2)$$

In this case, the relative probability of getting a creative job (Y=1) to the basic outcome of getting a non-creative job is:

$$\frac{\Pr(\mathrm{Y}=1|\mathrm{X})}{\Pr(\mathrm{Y}=0|\mathrm{X})} = e^{x\beta^1} \qquad (6.3)$$

Thus, the exponentiated value β^i is defined as the risk-relative ratio (RRR) for one-unit change in the corresponding variable X^i, which represents the different personal and course characteristics in this study.

At this stage, the definition of creative jobs is only a general concept. As the aim is to measure the effect of different characteristics on the outcome of creative jobs, all creative occupations will not be separated into sub-categories. However, the general education/training background of the whole creative class is still expected to reveal the differences in the education system and labour market across the target countries.

Finally, the heterogeneity across the different creative occupations is highlighted. Personal and course characteristics can result in different job outcomes regarding the nature of creative occupations that require quite different skills and qualifications. In this respect, the second multinomial logit model is further used to examine how course and personal characteristics influence the probability of getting a bohemian, creative core or creative professional job. The following model is estimated as:

$$\Pr(Y = 0|X) = \frac{1}{e^{x\beta^1} + e^{x\beta^2} + e^{x\beta^3} + 1}$$

$$\Pr(Y = 1|X) = \frac{e^{x\beta^1}}{e^{x\beta^1} + e^{x\beta^2} + e^{x\beta^3} + 1}$$

$$\Pr(Y = 2|X) = \frac{e^{x\beta^2}}{e^{x\beta^1} + e^{x\beta^2} + e^{x\beta^3} + 1}$$

$$\Pr(Y = 3|X) = \frac{e^{x\beta^3}}{e^{x\beta^1} + e^{x\beta^2} + e^{x\beta^3} + 1} \qquad (6.4)$$

In equation 6.4, outcomes 0, 1, 2 and 3 recorded in y represent the job outcomes in terms of non-creative, bohemian, creative core and creative professional occupations respectively. The deduction in calculating the risk-relative ratio for each sub-category is the same as equation 6.2 and 6.3.

6.3 Results and discussion

6.3.1 Descriptive analysis

Supply of graduates in the European labour market

If creative graduates/non-graduates can be decomposed by education backgrounds, then the comparison between the number of students who have a qualification and the number of them who actually get creative jobs will identify a "mismatch". This method can be useful as the mismatch between labour demand and labour supply could reveal important characteristics of the education system and labour market. However, compared to census based datasets such as HESA or DLHE in the U.K., the estimated results, according to the EU LFS, at the micro level may be less accurate. For example, Comunian *et al.* (2010) reported that over half bohemian graduates (50.6 percent) found a job in creative industries or in a creative occupation in non-creative industries in the U.K. in the period 2006-2007, while this figure is 44.7 percent in this case. The reason is twofold: on the one hand, the definition of education background in the EU LFS is vague compared to the 4-digit JACS (i.e. Joint Academic Coding System) code accessible in the HESA dataset. Therefore, the EU LFS subject code 200 (humanities, languages and arts) omitted some important subject areas such as media publishing and crafts. On the other hand, survey data also lacks accuracy at a very detailed level.

To observe the supply of graduates in the labour market requires the data from Eurostat. As can be seen in **Appendix 6.A**, the number of graduates evidently increased in the period 2000-2007 for the majority of subjects. The only exceptional case is France, where the pattern of this overall growth is not very clear, such as in the subject fields of science, mathematics and computing (-8.6 percent), humanities and arts (-10.1 percent) and social sciences, business and law (-0.1 percent). In contrast, Italy experienced a faster average growth in most subjects compared to the rest of the countries, such as teacher training and education science (27.4 percent), humanities and arts (10.8 percent) or social sciences, business and law (8.5 percent).

Turning to the share of graduates by subject, figures reveal that graduates with a background in social science, business and law account for the largest average share across all the target countries. For the other subjects, it is not possible to draw a universal conclusion as the ranking varies. However, the share of graduates with a health and welfare background or with an engineering, manufacturing and construction background is generally larger than those who have a background in science, mathematics and computing, humanities and arts or teacher training and education science. In comparison, the smallest number of graduates is allocated to the subject agriculture, veterinary and services, which is defined as “other subjects” in this thesis.

It is interesting to observe the significant variation in some subjects, which is consistent with the nature of an economy. For example, in the U.K. and the Netherlands, where the education industry is an important sector, the share of graduates with teacher training and education science is very high, showing figures of 16.5 percent and 10.2 percent respectively. For the countries where the overall EQI source is higher (the overall quality of local government, see Chapter 4), there is a greater demand for graduates in the health and welfare sector. For instance, the share of health and welfare graduates is relatively larger in Denmark (24.6 percent), Germany (23.9 percent), the Netherlands (19.0 percent) and the U.K. (17.3 percent), compared to Italy (14.9 percent), Spain (13.1 percent) and France (10.5 percent).

In conclusion, the patterns and trends for European graduates were systematically evaluated in the seven countries. In this context, it is important to understand and monitor the size and the shape of higher education. Beside the various trends based on the detailed breakdown of data, there is a general growth trajectory. This result implies a strong supply of graduates in the European labour market, while some countries saw faster growth, such as the U.K., the Netherlands and Italy. At this stage, the analysis provides useful information and reference material to understand the impact of higher education.

Demand for creative workers in the European labour market

The last section gave sight of the growth of higher education in the target countries. Now the focus is on the demand for graduates as well as non-graduates in order to distinguish the impact of higher education. Due to the data constraint, the dataset from the Eurostat is no longer suitable as there is no information about the detailed breakdown of occupations. Instead, the EU LFS dataset is adopted to continue the investigation. Again the average of the results is taken based on the available time periods for each country. As shown in **Table 6.1**, it is readily evident that the Netherlands and Denmark have the highest shares of new graduates/non-graduates that actually have creative jobs, which account for 1.9 and 1.4 percent of the total average workforce respectively. For western European economies, this figure is 1.04 percent in Germany, followed by France (0.8 percent), the U.K. (0.7 percent), Spain (0.7 percent) and Italy (0.4 percent). Turning to the role of university degrees, the Netherlands and Denmark still have the highest shares of new creative workers who have a university degree, showing the figures of 0.9 percent and 0.8 percent respectively. In comparison, there is over 0.5 percent of new graduates who have creative jobs in the U.K., France and Spain. However, this pattern is less evident in Italy and Germany, as the number of new creative graduates almost accounts for the same share as those creative non-graduates.

The above discussion confirmed that higher education is in fact a signal to indicate the ability of new workers to get a creative job in the labour market. It is not surprising to see that a large share of new creative workers have university degrees, which is much higher than the average share of total new workers who have a university degree. For example, the total number of new graduates only account for 0.9 percent of the total workforce in the U.K., while 2.5 percent of new workers do not have a university degree. This finding may support the argument that the concept of the creative class and human capital is largely overlapping, and it also highlights the importance of the higher education system in shaping creative workers in the long term. However, as Florida argued, the creative occupations measure utilised skills rather than potential skills such as graduates; therefore, the higher level of the creative job outcomes cannot simply be explained by the higher level of human capital. The situation in Germany and Italy has already shown that almost half of non-graduates have creative jobs, and this share is also significant in the rest of the countries.

Table 6.1: Demand for creative workers

	The U.K.		France		Spain		Italy		Germany		The Netherlands		Denmark	
	Number	Share	Number	Share	Number	Share	Number	Share	Number	Share	Number	Share	Number	Share
Total workforce	27139629	100%	23823060	100%	16661549	100%	21696648	100%	37428520	100%	8103937	100%	2706812	100%
Decomposed based on education														
Workers with a university degree	8599671	32%	6403627	27%	5056154	30%	2965141	14%	9856865	26%	2377803	29%	772970	29%
Workers without a university degree	18539958	68%	17419433	73%	11605395	70%	18731507	86%	27571656	74%	5726134	71%	1933841	71%
Total		100%		100%		100%		100%		100%		100%		100%
Decomposed based on education and situation														
New workers with a university degree	250468	0.92%	238794	1.00%	149955	0.90%	66759	0.31%	199380	0.53%	117263	1.45%	33643	1.24%
New workers without a university degree	665468	2.45%	374712	1.57%	208746	1.25%	241805	1.11%	1058202	2.83%	583674	7.20%	155858	5.76%
Total		3.37%		2.58%		2.15%		1.42%		3.36%		8.65%		7.00%
Decomposed based education, situation and occupation														
New creative workers with a university degree	142411	0.52%	133842	0.56%	86884	0.52%	44123	0.20%	148264	0.40%	73096	0.90%	21635	0.80%
New creative workers without a university degree	53655	0.20%	55951	0.23%	25179	0.15%	50414	0.23%	237153	0.63%	84480	1.04%	14849	0.55%
Total		0.72%		0.80%		0.67%		0.44%		1.03%		1.94%		1.35%

Note: All shares in this table are calculated based the average number of total workforce in each country. For example, in the U.K., the share of new workers with a university degrees =250468/27139629=0.92%.

Source: The European Labour Force Survey

Creative occupations and education backgrounds

Next, the relationship between the number of creative occupations taken up by new graduates and their education backgrounds is addressed. As is clear from **Table 6.2**, it seems that new graduates who have an education, engineering, and health and welfare based background are more likely to become creative workers in the U.K., Denmark and the Netherlands. This inclination is particularly obvious in the U.K., as 87.4 percent of new graduates with qualifications related to education actually get creative jobs as well as 68.8 percent of new graduates with qualifications related to engineering and health and welfare-led subjects. In comparison, new graduates with qualifications related to science, social science, bohemian subjects and other subjects have a lesser chance of gaining a creative occupation. However, the employment structure across different subjects is less polarised in France and Spain as the difference between the shares of new creative workers with a degree related to education and science and the shares of the remaining subjects are not very significant.

Germany is a unique case because there is a high probability of getting creative jobs through all subjects. In addition to the high probability of getting creative jobs for new graduates who have education, bohemian, science and engineering, and health and welfare related backgrounds, 77.1 percent of new graduates with social science, business and law related backgrounds have creative jobs. Finally, the high share of creative graduates based in science, engineering, and health and welfare and other subjects is evident for Italy, while the difference in shares for the rest of the subjects is not significant.

Overall, graduates with bohemian, social science and other backgrounds have less adaptability compared to science graduates in the labour market. This mismatch may have an implication regarding the nature of higher education in these disciplines, as some of the creative skills have a wide application in the knowledge economy. Moreover, the high share of graduates with an engineering and health and welfare background are likely to be creative workers. It is not surprising that for those creative occupations such as 214 (architects, engineers and related professionals) and 222 (health professionals (except nursing)), the award of a relative university degree is a prerequisite similarly to HE, secondary education teachers and scientists. However, this pattern may also be indicative of the rapid structure change of the higher education system in Europe as more graduate jobs have been created in the health and welfare sector (i.e. creative professional jobs); many of these occupations were previously defined as *niche* occupations, where the majority of incumbents were non-graduates.

Table 6.2: Education backgrounds and creative occupations

Country	Education background	Graduates who get a creative job
The U.K.	Education-led subjects	87.35%
	Bohemian-led subjects	44.73%
	Social science-led subjects	42.95%
	Science-led subjects	58.71%
	Engineering and health welfare-led subjects	68.82%
	Others	39.76%
France	Education-led subjects	n/a
	Bohemian-led subjects	46.21%
	Social science-led subjects	42.55%
	Science-led subjects	56.06%
	Engineering and health welfare-led subjects	67.69%
	Others	40.48%
Germany	Education-led subjects	65.18%
	Bohemian-led subjects	56.52%
	Social science-led subjects	77.11%
	Science-led subjects	87.12%
	Engineering and health welfare-led subjects	81.57%
	Others	53.28%
Spain	Education-led subjects	58.70%
	Bohemian-led subjects	52.03%
	Social science-led subjects	63.00%
	Science-led subjects	62.21%
	Engineering and health welfare-led subjects	46.49%
	Others	69.67%
The Netherlands	Education-led subjects	73.04%
	Bohemian-led subjects	38.23%
	Social science-led subjects	54.45%
	Science-led subjects	55.86%
	Engineering and health welfare-led subjects	67.27%
	Others	53.64%
Italy	Education-led subjects	45.33%
	Bohemian-led subjects	44.01%
	Social science-led subjects	53.32%
	Science-led subjects	69.66%
	Engineering and health welfare-led subjects	77.56%
	Others	83.88%
Denmark	Education-led subjects	84.91%
	Bohemian-led subjects	45.45%
	Social science-led subjects	66.81%
	Science-led subjects	72.18%
	Engineering and health welfare-led subjects	70.67%
	Others	46.67%

Note: Insufficient observations can be used to measure the match/mismatch between education-led subjects and creative occupations in France.

Source: The European Labour Force Survey

Creative sub-categories and education backgrounds

Further attention now turns to new graduates who already had creative jobs, focusing on the bohemians, creative core and creative professionals and the results are summarised as follows.

Bohemian graduates

When creative graduates (i.e. new graduates who have creative jobs) with a bohemian background are aligned with bohemian occupations, it is clear that there is a very large mismatch across all of the target countries. Germany has the highest share of creative workers who have bohemian backgrounds and are actually working in bohemian occupations, accounting for 43.6 percent of the total number of new creative graduates in this discipline. In comparison, the rest of the countries have much lower shares, showing the figures of 29.5 percent in Italy, 27.2 percent in the Netherlands, 24.2 percent in the U.K., 18.6 percent in Denmark and only 12.6 and 9.1 percent in Spain and France respectively. At this stage, there might be various explanations behind this mismatch.

Firstly, as suggested by Throsby (1994), the very low figures in the targeted countries may imply that the age-earning profile is steeper for bohemians such as artists than other occupations, as the high growth of employment in bohemian workers generates the probability of rents for older and more established artists. In contrast, young bohemian graduates with little experience are less likely to be perfect substitutes.

Secondly, these results may suggest that the abilities required by a successful artistic career cannot easily be taught by regular education. Given the fact that the majority of bohemian workers spend a high proportion of their working hours in performing artist-related tasks, artistically creative jobs may demand more on-the-job experience.

Finally, many studies have already revealed the significant salary disadvantage for artists (Filer, 1986; Throsby, 1994; Oakley *et al.*, 2008), a fact which may explain that a high number of new bohemian graduates are willing to take non-bohemian jobs to avoid earning risks. With regard to this, the labour markets in Germany or the U.K. may be much more secure for bohemian graduates, while it is not the case in France and Spain.

Creative core graduates

In order to analyse the mismatch between the demand for the creative core and the supply of relevant qualifications, the creative core is categorised into two main sub-groups: university teachers and scientists. Given the fact that a precise match is not possible based on the nature of the EU LFS[51], this attempt, to a great extent, aligns the education background of education and science with the corresponding occupations. Therefore, it is assumed that a high share of new graduates with an education background could find creative core jobs and so could those who have a science-led background.

In general, new creative graduates with an education background are generally less mismatched to the corresponding creative core jobs, compared to those with science backgrounds. The U.K. has the highest share, showing that 90.6 percent of new creative graduates who took education subjects can find a creative core job. This figure is also high in Denmark, Germany, the Netherlands and Spain. The exception is

[51] Only a few observations of new creative workers in each subject area (LFS subject code).

Italy, where only 18.9 percent of new graduates can be identified. Turning to the science-led subjects, **Table 6.3** indicates that the share of new creative core graduates with science-led backgrounds over the total number of new creative graduates with the same background is comparatively low. Germany has the highest share with 79.0 percent, followed by Denmark, the U.K., Spain, the Netherlands, Italy and France.

The nature of *the traditional occupations*[52] may be linked to the creative core occupations, such as HE and secondary education teachers, as a university degree is an imperative (Elias and Purcell, 2004). Also, it may not be surprising to see that in some countries such as the U.K., where the education industry is an important sector of the national economy, there is high demand for new graduates with education-related backgrounds in the labour market (OECD, 2012). Therefore, it is realistic that a large share of relevant new graduates can be observed across all the target countries.

The higher share of new creative graduates with science-led subjects is observable. Even though its share of creative jobs is less than the share of graduates who have a degree related to education, engineering, and health and welfare in several target countries, its role seems to be important. This may be a simple reflection that the science base is increasingly concentrated in universities, R&D institutions and other public/private sectors among the OECD countries. Therefore, as the other important component of *the traditional occupations* and the creative class, policy initiatives designed to foster an innovation based economy demand more graduates with science-led backgrounds.

[52] Elias and Purcell (2004) defined a classification of occupations for graduate labour market, which contains traditional graduate occupation, modern graduate occupation, new graduate occupation and niche graduate occupations.

However, the significant mismatch for new science graduates as well as new education graduates in Italy and France may be indicative of the pattern of "oversupply" (Brown, 2003). In the case of the U.K. over the last two decades, Smith and White (2011) state that "*there seem to be too many people studying sciences for the labour market to cope with, or perhaps graduates are no longer of sufficient quality*". The findings in this section are consistent with this point of view. The occupation category (the creative core) includes a wider population of both teachers and scientists. The high mismatch rate implies a situation in which a large number of science graduates may be unable to access employment that values relative graduate skills.

Creative professionals

If the creative class is measured as a whole, the share of social science graduates who have a creative job is generally lower than those who have a background related to science (see **Table 6.3)**. Also a background of engineering and health and welfare seems to be an important factor in determining creative job outcomes. However, focusing on each creative occupation sub-category alone, the results demonstrate a different pattern.

For those countries where the mismatch between new science graduates and creative core occupations is comparatively large, such as Italy, France and the U.K., the share of new creative professionals with social science qualifications over the total number of new creative graduates with the same backgrounds is significantly higher. For example, these figures are 67.3 percent (compared to 52.0 percent) in France, 72.8 percent (compared to 58.8 percent) in Italy and 80.2 percent (compared to 55.3 percent) in the U.K. In contrast, new social science graduates have lower adaptability in getting creative professional jobs in Denmark (64.6 percent compared to 75.0 percent), the Netherlands (59.8 percent compared to 62.7 percent) and Germany (73.4 percent compared to 79.0 percent). These differences in mismatch rate between two subjects are not very significant. The exception is in Spain, where the gap with social science graduates is over 20 percent higher than science graduates in getting jobs related to their qualifications (40.0 percent compared to 64.4 percent).

These results, to a certain degree, imply that graduates in social science subjects offer a wide range of skills that are valuable to employers. In the U.K., Cooper and Wilsdon (2013) found that the proportion of social science graduates in employment is higher than for graduates of STEM subjects (i.e. science, technology, engineering and mathematics) or arts and humanities. Also a greater proportion of social science graduates become managers, directors or senior officers (i.e. occupations which are commensurate with qualifications) than other groups of graduates in the 3.5 years since they graduated. With respect to this, it is not surprising that social science graduates also have a higher or similar probability of getting relevant creative jobs in the majority of the target countries, as the concept of creative professionals is largely commensurate with their social science based qualifications.

As far as engineering and health and welfare in higher education are concerned, the data constraint impedes the separate investigation of the impact of engineering or health and welfare subjects. Therefore, the analysis could not identify the precise match/mismatch between one education background and corresponding occupations but rather the pattern of how new graduates with creative skills in this discipline could be distributed across different creative occupation categories. The results match the expectation. On one hand, most of the new creative graduates found creative jobs in the creative core and creative professional categories, while few of them could be bohemian workers. On the other hand, the highly polarised match rate in any of these two categories is not observable in the majority of countries. Apart from the nature of engineering and health science related occupations in the creative core, this finding further verifies the predication from the last section as many of the creative professional occupations, which were dominated by non-graduates, may start to demand more relative qualifications from higher education. For example, 68.1 percent of engineering and health and welfare graduates found a creative professional job in France. Even though the analysis left space for further research, this high match rate is a likely cause for this reason.

In conclusion, a series of descriptive statistics on the demand and supply of the creative labour market across the seven European countries have been presented. No matter that the focus is on all the creative graduates or its sub-categories, a significant mismatch brings a complexity of understanding regarding the role of education in shaping the creative class. Higher education seems to play an important role as a much higher proportion of new creative workers have a university degree. However, many new creative graduates did not find jobs that are commensurate with their knowledge, skills and qualifications. In general, new bohemian graduates are less likely to find creative jobs, compared to new graduates in the remaining subjects. Observing the specific sub-categories of new creative workers alone, education science and social science graduates are more likely to find equivalent creative jobs, compared to others who have backgrounds in science, bohemian subjects and other subjects.

Table 6.3: Higher education with different creative occupations

Country	Background	Bohemians	Creative core	Creative professionals
France	education	0.00%	n/a	0.00%
	bohemian	9.07%	62.32%	28.62%
	social science	5.88%	26.83%	67.29%
	science	0.76%	52.04%	47.20%
	engineering/health	0.00%	31.87%	68.13%
	others	0.00%	41.89%	58.11%
Germany	education	0.00%	82.89%	17.11%
	bohemian	43.60%	37.99%	18.41%
	social science	2.46%	24.14%	73.39%
	science	0.00%	79.04%	20.96%
	engineering/health	0.00%	70.25%	29.75%
	others	0.00%	62.81%	37.19%
Spain	education	9.30%	71.93%	18.77%
	bohemian	12.58%	26.10%	61.31%
	social science	0.53%	59.44%	40.03%
	science	3.65%	64.39%	31.96%
	engineering/health	13.67%	49.04%	37.29%
	others	0.69%	32.25%	67.05%
The Netherlands	education	3.59%	78.61%	17.80%
	bohemian	27.19%	40.35%	32.46%
	social science	8.86%	31.35%	59.79%
	science	5.14%	62.68%	32.18%
	engineering/health	6.72%	53.77%	39.51%
	others	3.05%	31.02%	65.94%
Italy	education	18.95%	33.76%	47.29%
	bohemian	29.45%	33.62%	36.92%
	social science	4.24%	22.95%	72.81%
	science	4.06%	58.77%	37.17%
	engineering/health	0.00%	43.52%	56.48%
	others	7.01%	43.53%	49.46%
Denmark	education	0.82%	88.03%	11.15%
	bohemian	18.64%	40.44%	40.92%
	social science	13.65%	21.71%	64.64%
	science	0.80%	74.97%	24.23%
	engineering/health	1.69%	42.82%	55.49%
	others	3.33%	49.18%	47.48%
The U.K.	education	1.57%	90.62%	7.80%
	bohemian	24.24%	40.15%	35.61%
	social science	1.15%	18.67%	80.18%
	science	6.92%	55.33%	37.75%
	engineering/health	4.70%	44.30%	51.00%
	others	28.14%	23.66%	48.19%

Source: The European Labour Force Survey

6.3.2 Econometric analysis

Basic setup

Based on the descriptive statistics on how supply and demand matched, this section investigates what type of individuals is more likely to become creative workers by econometric exercises. However, not all of the independent variables are accessible or accurate in the EU LFS dataset. For example, the variables of ethnicity (variable "countryb") only contain few observations for new workers in Spain, so its inclusion will result in failure of the calculation by the maximum likelihood method. In the case of Italy, there is a similar issue as this variable is only available from 2005 onwards. For Germany, even though this variable was used as the indictor for representing the level of openness in Chapter 5, because only German residence and no-response residence are the available categories it is not included, as a significant bias may exist in comparison to the analysis at the aggregate level. Finally, in order to evaluate the impact of metropolitan areas on creative job outcomes, metropolitan regions are distinguished from other regions in the regression. In Italy, Lazio and Piemonte are defined as metropolitan regions and in the Netherlands and Denmark, the variable is dropped due to unavailable data.

Model I: how can students become creative workers?

The analysis begins with the whole creative class, and higher education and education background are separately included in two regressions. The results are presented in relative risk ratio. A ratio above one means that a relevant variable positively affects the outcome of getting a corresponding creative job compared to the base category (i.e. non-creative occupations). As can be seen in the first column in Model I in **Appendix 6.B**, the difference in gender appears to have a significant impact on the outcome of creative jobs. Male graduates are more likely to enter a job in creative occupations than female graduates in the U.K., France, Italy, Germany and Denmark, but the reverse is seen in Spain and the Netherlands. As for age, graduates in the age band 22-27 have a higher probability of becoming creative workers than those in the age band 17-22. This result may imply an effect similar to higher education, as the majority of graduates in the age band 22-27 are composed of college graduates, while younger ones are more likely to be non-graduates from secondary education or vocational education. There are strong indications that new creative workers prefer to be self-employed or have full-time jobs in the majority of the target countries.

Looking at the role of higher education, it seems that its positive effect on creative job outcomes is significant in all of the target countries, where the highest coefficient is observed in Spain (6.63[53]) followed by Denmark (4.48), Italy (4.35), Germany (4.20), the U.K. (3.32), France (3.31) and the Netherlands (2.75). In addition, new creative workers are more likely to migrate towards metropolitan areas with the exception of Italy. This is not surprising given the fact that metropolitan regions provide greater opportunities for new graduates to develop their personal careers (Faggian and McCann, 2009).

As far as course characteristics are concerned (see the second column in Model I in **Appendix 6.B**), the results appear to be consistent with the findings in the descriptive analysis when measuring the creative class as a whole. With the exception

[53] For example, new workers with a university degree increase the change of getting creative jobs by 563 percent in Spain.

of Italy, new workers with education, science and engineering, and health and welfare backgrounds have a higher positive effect on the probability of entering a creative job than other subjects.

In conclusion, the discussion based on the multinomial logit model highlights an important aspect to the creative class thesis which Florida cannot avoid – it is true that the formation of creative skills may rely on on-the-job experience or amenities, but since the outset, higher education has played a critical role in shaping new creative workers. However, the variety of positive coefficients in different subjects is difficult to interpret at this stage. For example, smaller coefficients from bohemian-led subjects may imply either a much wider application of creative skills to other non-bohemian creative jobs or a weaker effect of the relevant higher education in shaping creative workers. Therefore, the discrepancy between different occupation groups and higher education requires further decomposition of the whole creative class, as addressed in the next section.

Model II: a specific analysis by different groups of creative workers

This section proposes a breakdown of all the creative occupations into three categories: bohemians, the creative core and creative professionals (see Model II for each country in **Appendix 6.B**). Also, we focus on the interpretation for independent variables regarding their abilities to distinguish between pairs of group and contributions which they make to changing the odds of being in one dependent variable group. For instance, having a background in arts and languages increases the chance of being a bohemian worker by approximately 139.4 percent while a background of engineering or health and welfare decreases this chance by 41.2

percent in the U.K. In addition, the component of bohemian occupations is dropped in France as very limited observations of new bohemian workers in the sample results in calculation failure by the maximum likelihood function. Finally, the important results are summarised as follows:

Personal characteristics

Age: the probability of getting creative jobs increases with age in the majority of the target countries. This is a finding similar to the probit model.

Ethnic background: new workers from an ethnic minority are less likely to find creative jobs with a few exceptions. In Denmark, being a new worker who was born in a foreign country increases the chance of getting bohemian, creative core and creative professional jobs by 14.9 percent, 50.2 percent and 27.7 percent respectively. In Italy, being a non-native born worker increases the chance of getting creative professional jobs by 46.2 percent.

Self-employment: there is a clear indication that new creative workers are more likely to be self-employed and it is particularly obvious in the bohemian category; for example, the RRR of being a self-employed is well over 12 and 18 respectively compared to getting a full-time job in the U.K. and Germany. However, this phenomenon is not considered to be due to the nature of the creative class but as a realistic situation for new workers in the labour market. As mentioned earlier, new workers may need a long period to integrate their skills and qualifications with on-the-job experience; thus, they are less likely to be perfect substitutions for older workers. As a result, there is a large number of new creative workers becoming self-employed due to the unavailability of regular jobs. Particularly for new bohemian workers, it could be more that the nature of the jobs requires self-employment. Many creative sectors such as the TV and film industry hire on a contract basis rather than providing permanent employment. Artists often see themselves as self-employed if they are frequently moving between contracts (O'Connar, 2000).

Full time/part time: new bohemian workers in Spain and Italy have a higher probability of doing part-time bohemian jobs, while new workers who are defined as the creative core and creative professionals are less likely to do so. Also, being a part-time worker increases the chance of getting a creative core job by 9.8 percent in Spain. In association with the discussion about self-employment, this finding, from a different perspective, again can be seen to confirm the insecure position of bohemian students in the labour market.

Higher education

The positive effect from higher education is readily evident in the majority of the creative sub-categories across countries. In general, the strongest effect captured is among creative core occupations, then creative professional and bohemian jobs. For example, in the U.K., having a university degree increases the chance of getting a creative core job by around 410 percent, a creative professional job by around 180 percent and a bohemian job by around 147 percent. This finding again supports the important role of higher education and further reveals that higher education seems to be more important in shaping creative workers in relation to the concept of the creative core.

Education backgrounds

A comparison across backgrounds in a category

Based on the descriptive statistics, how qualifications and knowledge match to creative jobs based on econometric exercises needs to be addressed. As far as the different education backgrounds in each occupation category are concerned, it seems that in many countries, creative job outcomes are responsive to qualifications and skills. In addition to the case of the U.K., holding a qualification in arts and languages significantly increases the chance of getting bohemian jobs in the Netherlands, Italy and Germany, while there is no significant difference in creative job outcomes in Denmark. The only exception is Spain, where new workers with this background are more likely to get jobs in other creative occupation categories. Such consistency between a qualification and a job outcome is more indicative in the sub-category of the creative core. Holding a prestigious science-led (excluding education science) qualifications and getting a creative core job is straightforward in all of the target countries except Italy. For instance, the RRR for science-led subjects leading to a creative core job is well over 10, compared to 3.31 (humanities, arts and language) and 2.93 (social science, business and law) in the Netherlands. Also, as another important background in shaping creative core workers, being educated by education-science led subjects increases the chance of getting equivalent jobs. Such an effect is very dominant in the U.K., the Netherlands and Denmark, showing RRR values of 51.40, 16.15 and 27.49 respectively.

Finally, the discussion on creative professional jobs may be difficult as the required skills may vary considerably across workplaces as mentioned earlier. Therefore, it is difficult to capture the dominant advantages from the background of social scientists; instead, several subjects can be meaningful to explain the job outcome of creative professionals (e.g. engineering, and health and welfare subjects). However, being educated in social science-led subjects still has a strong explanatory power in many countries. The strongest effect is observed in Germany, where being educated in social science-led subjects increases the chance of getting creative professional jobs by around 700 percent.

A comparison across categories for a background

The impact of each education/training background through different sub-categories of the creative class is also examined. Here the perspective is different from the above section; the aim is to ascertain how a new worker with an education/training background could find different jobs in the labour market rather than evaluating the impacts of different subjects in getting the same type of jobs. It is worth mentioning that the findings may be slightly different from the descriptive statistics regarding this pattern, as the measure of education/training background inevitably includes both graduates and non-graduates.

The results again indicate that in many cases, holding a relevant qualification gives a better chance of getting a corresponding job. Particularly for new workers with education-science, social science and science backgrounds, this pattern is straightforward in the majority of countries. For example, holding a qualification related to social science subjects increases the chance of getting a creative professional job by 225 percent in Denmark, while doing so decreases the chance of getting a creative core job by 1.6 percent and increases the chance of getting a bohemian job by only 24.6 percent. Similarly with a qualification related to science, the chance of getting a creative core job is increased by 413 percent, which is much higher than getting a bohemian job (increased by 96.9 percent) or a creative professional job (163 percent).

However, the boundary among occupations that require skills and use education/training is not very clear for new workers with a bohemian background. Even though holding a qualification related to bohemian subjects is more likely to get a bohemian job compared to remaining subjects, the horizontal comparison portrays a different picture. Only in Germany and Italy, do new workers with this background have obviously more chances of getting a bohemian job, while they are also likely to get a creative core or creative professional jobs in the rest of the countries.

6.4 Conclusions

Based on hypothesis 6.1, this chapter verified some well-known situations regarding new graduates of arts, STEMs (i.e. science, technology, engineering and mathematics) and social science in the European labour market, but from a very different perspective; the concept of the creative economy has already been integrated with the role of the education system.

Hypothesis 6.1: is the education system in the European labour market efficient in shaping creative workers?

Despite the fact that various personal characteristics may determine an individual's job outcome in the labour market, education backgrounds are generally consistent with corresponding creative job outcomes in Europe. It seems that higher education indeed has a significant impact on the formation of the creative class, regardless of whether the creative class is evaluated as a whole or based on separate categories. Even though this study is constrained by sample size, the length of time period and the level of breakdown in subjects or occupations, the above conclusions have been confirmed through multiple analytical techniques.

In other words, it is believed that hypothesis 6.1 can be verified, as widening access to education and particularly higher education generally matches policy markers' expectations in the target European countries. The education system in Europe appears to be considerably specialised compared to the more general education programmes in the U.S.; the former ensures highly specialised skills training for specific tasks, while the latter implies a greater adaptability in response to changes in the economic situation (Machin and McNally, 2007). However, the existence of the significant mismatch between qualifications and occupations is still a serious problem. The application of the creative class thesis has given local government a renewed challenge: "*how might a given volume of support best be raised and distributed among competing revenues of expenditure?*" (Throsby, 1994, p.25). Rather than focusing on one sector alone (e.g. cultural industries), now the question is how to efficiently integrate resources in response to the demand from the creative economy.

Therefore, the policy implications from this study are two-fold. On one hand, the reform of the education system, although it has been the subject of lively discussion in recent decades, has not been clearly linked up with the missions of the creative economy in Europe. If promotion of the creative economy is a valuable option for local policy makers, then there is a need to focus on the efficiency of the education system regarding the three sub-categories of creative workers in parallel.

On the other hand, several explanations have been provided to explain the mismatch, but without further investigation it is difficult to conclude whether this phenomenon is caused by an over-supply of graduates or a shortage of skilled workers. However, such an unidentified causality does not impede the proposal of a meaningful policy recommendation: graduates need to be directed into subject areas where relevant demand is high in the labour market.

Appendix

Appendix 6.A: The supply of graduates in the European labour market (2000-2007)

Denmark	Teacher training and education science	Number	3902	Germany	Teacher training and education science	Number	28946	France	Teacher training and education science	Number	22890
		Growth Rate	1.69%			Growth Rate	7.51%			Growth Rate	17.36%
		Share	8.71%			Share	8.53%			Share	3.86%
	Humanities and arts	Number	6067		Humanities and arts	Number	41494		Humanities and arts	Number	74006
		Growth Rate	4.62%			Growth Rate	14.76%			Growth Rate	-10.06%
		Share	13.54%			Share	12.23%			Share	12.49%
	Social sciences, business and law	Number	12659		Social sciences, business and law	Number	77421		Social sciences, business and law	Number	238926
		Growth Rate	8.66%			Growth Rate	8.07%			Growth Rate	-0.06%
		Share	28.25%			Share	22.81%			Share	40.31%
	Science, mathematics and computing	Number	3774		Science, mathematics and computing	Number	64466		Science, mathematics and computing	Number	74472
		Growth Rate	3.26%			Growth Rate	10.26%			Growth Rate	-8.57%
		Share	8.42%			Share	10.35%			Share	12.56%
	Engineering, manufacturing and construction	Number	6797		Engineering, manufacturing and construction	Number	64466		Engineering, manufacturing and construction	Number	113773
		Growth Rate	3.94%			Growth Rate	1.58%			Growth Rate	4.95%
		Share	15.17%			Share	18.99%			Share	19.19%
	Health and welfare	Number	11012		Health and welfare	Number	81397		Health and welfare	Number	62172
		Growth Rate	1.13%			Growth Rate	0.59%			Growth Rate	1.44%
		Share	24.58%			Share	23.98%			Share	10.49%
	Agriculture, veterinary and services	Number	2125		Agriculture, veterinary and services	Number	18800		Agriculture, veterinary and services	Number	27548
		Growth Rate	3.40%			Growth Rate	2.85%			Growth Rate	7.49%
		Share	4.74%			Share	5.54%			Share	4.65%

Spain	Teacher training and education science	Number	33679	Italy	Teacher training and education science	Number	29858	The Netherlands	Teacher training and education science	Number	16112
		Growth Rate	1.89%			Growth Rate	27.44%			Growth Rate	5.99%
		Share	11.81%			Share	9.56%			Share	16.52%
	Humanities and arts	Number	26096		Humanities and arts	Number	43996		Humanities and arts	Number	7274
		Growth Rate	1.00%			Growth Rate	10.78%			Growth Rate	9.93%
		Share	9.15%			Share	14.08%			Share	7.46%
	Social sciences, business and law	Number	85991		Social sciences, business and law	Number	106352		Social sciences, business and law	Number	35291
		Growth Rate	-2.63%			Growth Rate	8.50%			Growth Rate	8.06%
		Share	30.16%			Share	34.04%			Share	36.17%
	Science, mathematics and computing	Number	29799		Science, mathematics and computing	Number	22001		Science, mathematics and computing	Number	6115
		Growth Rate	0.11%			Growth Rate	6.90%			Growth Rate	10.28%
		Share	10.45%			Share	7.04%			Share	6.27%
	Engineering, manufacturing and construction	Number	63494		Engineering, manufacturing and construction	Number	49135		Engineering, manufacturing and construction	Number	11986
		Growth Rate	3.04%			Growth Rate	8.50%			Growth Rate	2.16%
		Share	22.27%			Share	15.73%			Share	12.29%
	Health and welfare	Number	37200		Health and welfare	Number	46662		Health and welfare	Number	18525
		Growth Rate	4.28%			Growth Rate	8.96%			Growth Rate	3.23%
		Share	13.05%			Share	14.94%			Share	18.99%
	Agriculture, veterinary and services	Number	23774		Agriculture, veterinary and services	Number	11819		Agriculture, veterinary and services	Number	4690
		Growth Rate	5.11%			Growth Rate	40.57%*			Growth Rate	10.36%
		Share	8.34%			Share	3.78%			Share	4.81%

The U.K.	Teacher training and education science	Number	61295
		Growth Rate	4.52%
		Share	10.23%
	Humanities and arts	Number	92093
		Growth Rate	4.70%
		Share	15.36%
	Social sciences, business and law	Number	177706
		Growth Rate	4.55%
		Share	29.65%
	Science, mathematics and computing	Number	91621
		Growth Rate	1.17%
		Share	15.28%
	Engineering, manufacturing and construction	Number	90149
		Growth Rate	0.83%
		Share	15.04%
	Health and welfare	Number	103493
		Growth Rate	7.00%
		Share	17.27%
	Agriculture, veterinary and services	Number	10983
		Growth Rate	-5.22%
		Share	1.83%

Notes:

1. Number: the average number of graduates by education/training fields in the period 2000-2007.
2. Growth rate: the average growth rate of graduates by fields in the period 2000-2007.
3. Share: the average share for each field is calculated by dividing its average number of graduates by the average total number of graduates for each country.
4.* The number of graduates with a background in services is 1,215 in 2000; however, this figure was dramatically increased to 9,849 in 2001 in Italy.
5. The sum of shares for all education/training fields in each country does not precisely equal one – this is due to the fact that the number of graduates is estimated by an average value over periods.

Source: Eurostat

Appendix 6.B: the multinomial logit model (relative risk ratio)

Basic category: non-creative jobs (0) **(Germany)**	The creative jobs(1)	The creative jobs(1)	Bohemian jobs (1)	Bohemian jobs (1)	Creative core jobs (2)	Creative core jobs (2)	Creative professional jobs (3)	Creative professional jobs (3)
	Model I		Model II					
Personal characteristics								
Female	0.921***	1.133***	0.929***	0.778***	0.628***	0.841***	1.238***	1.530***
Age	1.176***	1.292***	1.292***	1.394***	1.231***	1.352***	1.142***	1.240***
Non-native born	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Self-employment	2.925***	3.561***	31.174***	18.867***	2.211***	2.714***	2.055***	2.351***
Part time	0.442***	0.332***	0.488***	0.215***	0.590***	0.374***	0.361***	0.310***
Higher education	4.203***		3.357***		9.569***		2.353***	
Course characteristics								
Education science and teaching training		4.057***		0.000		5.412***		2.280***
Humanities, arts and language		2.407***		10.962***		1.613***		1.876***
Social science, business and law		3.429***		0.873***		1.215***		7.999***
Science (exclude education science)		10.820***		0.000		11.394***		10.087***
Engineering and health welfare		4.034***		0.489***		3.646***		5.222***
Location								
Berlin	0.953***	1.219***	1.662***	1.712***	0.807***	1.205***	1.035***	1.166***
Time effects	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Constant	0.022***	0.023***	0.014***	0.007***	0.000***	0.000***	0.005***	0.004***
Number of observations	204786	179694	204786				179694	
Log pseudo-likelihood	-114571.63	-103982.69	-203454.19				-174039.64	
LR:χ^2	50647.32	36158.42	72079.00				74486.80	
Pseudo R^2	0.189	0.148	0.150				0.176	

Basic category: non-creative jobs (0) **(Denmark)**	The creative jobs(1)	The creative jobs(1)	Bohemian jobs (1)	Bohemian jobs (1)	Creative core jobs (2)	Creative core jobs (2)	Creative professional jobs (3)	Creative professional jobs (3)
	Model I		Model II					
Personal characteristics								
Female	0.804***	0.882***	0.579***	0.641***	0.640***	0.628***	0.990	1.140***
Age	1.239***	1.409***	1.189***	1.334***	1.365***	1.603***	1.189***	1.335***
Non-native born	1.158***	1.339***	0.959	1.149***	1.179***	1.502***	1.183***	1.277***
Self-employment	5.955***	6.243***	3.400***	3.963***	3.337***	3.211***	8.350***	8.840***
Part time	0.549***	0.451***	1.010	0.679***	0.481***	0.344***	0.530***	0.484***
Higher education	4.484***		2.663***		5.467***		4.281***	
Course characteristics								
Education science and teaching training		10.774***		0.669***		27.494***		2.927***
Humanities, arts and language		1.438***		1.265***		1.852***		1.308***
Social science, business and law		2.118***		1.246***		0.984***		3.251***
Science (exclude education science)		3.105***		1.969***		5.128***		2.630***
Engineering and health welfare		2.164***		0.249***		2.280***		2.889***
Location								
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Time effects								
Year 2004	0.586***	0.556***	0.599***	0.562***	0.725***	0.654***	0.526***	0.511***
Year 2005	0.525***	0.585***	0.717***	0.784***	0.648***	0.735***	0.440***	0.484***
Year 2006	0.621***	0.627***	0.536***	0.515***	0.696***	0.652***	0.606***	0.639***
Year 2007	0.726***	0.748***	0.699***	0.732***	0.965	0.962	0.629***	0.651***
Constant	0.004***	0.001***	0.001***	0.001***	0.001***	0.001***	0.005***	0.001***
Number of observations	398858	398858		385149			398858	
Log pseudo-likelihood	-189757.31	-198438.44		-302356.75			-304016.52	
LR:χ^2	123850.15	106487.88		138154.62			134835.08	
Pseudo R^2	0.246	0.212		0.182			0.186	

Basic category: non-creative jobs (0) **(The Netherlands)**	The creative jobs(1)	The creative jobs(1)	Bohemian jobs (1)	Bohemian jobs (1)	Creative core jobs (2)	Creative core jobs (2)	Creative professional jobs (3)	Creative professional jobs (3)
	Model I		Model II					
Personal characteristics								
Female	1.138***	1.222***	0.887***	0.881***	0.870***	0.939***	1.455***	1.754***
Age	1.179***	1.247***	1.147***	1.169***	1.210***	1.375***	1.210***	1.253***
Non-native born	0.758***	0.706***	0.609***	0.580***	0.870***	0.752***	0.702***	0.729***
Self-employment	5.285***	5.295***	13.344***	11.358***	5.548***	5.590***	3.706***	3.964***
Part time	0.318***	0.242***	1.154***	0.879***	0.326***	0.175***	0.235***	0.234***
Higher education	2.750***		2.134***		8.571***		1.455***	
Course characteristics								
Education science and teaching training		2.896***		1.890***		16.147***		1.098***
Humanities, arts and language		1.901***		3.798***		3.305***		1.076***
Social science, business and law		1.928***		1.386***		2.930***		1.832***
Science (exclude education science)		3.318***		1.314***		10.609***		2.448***
Engineering and health welfare		2.929***		1.271***		5.562***		2.778***
Location								
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Time effects								
Year 2007	1.272***	1.271***	1.595***	1.568***	1.169***	1.208***	1.256***	1.249***
Constant	0.016***	0.003***	0.001***	0.001***	0.001***	0.000***	0.014***	0.005***
Number of observations	834041	834041	834041				834041	
Log pseudo-likelihood	-431452.01	-438821.5	-651731.18				-649774.56	
LR:χ^2	178831.57	164092.59	223681.96				227595.20	
Pseudo R^2	0.172	0.156	0.135				0.149	

Basic category: non-creative jobs (0) **(France)**	The creative jobs(1)	The creative jobs(1)	Bohemian jobs (1)	Bohemian jobs (1)	Creative core jobs (2)	Creative core jobs (2)	Creative professional jobs (3)	Creative professional jobs (3)
	Model I		Model II					
Personal characteristics								
Female	0.984***	1.141***	2.424***	n/a	0.905***	1.057***	1.012***	1.143***
Age	1.128***	1.224***	0.855***	n/a	1.224***	1.343***	1.084***	1.173***
Non-native born	0.490***	0.416***	0.000	n/a	0.474***	0.404***	0.495***	0.468***
Self-employment	2.411***	2.819***	21.142***	n/a	0.418***	0.870***	3.994***	0.410***
Part time	0.525***	0.520***	0.154***	n/a	1.300***	0.364***	0.257***	3.362***
Higher education	3.315***		8.768***	n/a	3.659***		3.058***	
Course characteristics								
Education science and teaching training		0.000***		n/a		0.000		1.722***
Humanities, arts and language		2.023***		n/a		2.292***		1.320***
Social science, business and law		1.529***		n/a		0.887***		1.815***
Science (exclude education science)		3.832***		n/a		4.853***		2.923***
Engineering and health welfare		2.176***				1.918***		2.333***
Location								
Île de France	2.586***	2.798***	4.599***	n/a	2.006***	2.214***	3.019***	3.090***
Time effects								
Year 2007	0.888***	0.939***	2.131***	n/a	0.890***	0.940***	0.856***	0.872***
Constant	0.019***	0.003***	0.033***	n/a	0.001***	0.000***	0.033***	0.005***
Number of observations	873167	873167		873167			877314	
Log pseudo-likelihood	-474748.66	-488767.79		-677894.66			-651771.2	
LR:χ^2	172907.08	144868.82		223587.20			199697.07	
Pseudo R^2	0.150	0.129		0.141			0.133	

Basic category: non-creative jobs (0) **(Spain)**	The creative jobs(1)	The creative jobs(1)	Bohemian jobs (1)	Bohemian jobs (1)	Creative core jobs (2)	Creative core jobs (2)	Creative professional jobs (3)	Creative professional jobs (3)
	Model I		Model II					
Personal characteristics								
Female	1.183***	1.436***	0.956***	0.797***	1.050***	1.395***	1.354***	1.618***
Age	1.124***	1.218***	1.031***	1.094***	1.196***	1.329***	1.087***	1.163***
Non-European ethnicity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Self-employment	1.582***	1.541***	1.361***	1.162***	1.672***	1.756***	1.541***	1.473***
Part time	0.937***	0.971***	2.153***	1.975***	1.085***	1.098***	0.716***	0.754***
Higher education	6.624***		5.713***		78.530***		4.078***	
Course characteristics								
Education science and teaching training		2.312***		1.602***		4.001***		1.059***
Humanities, arts and language		1.555***		1.488***		0.865***		2.248***
Social science, business and law		3.245***		0.105***		3.830***		4.062***
Science (exclude education science)		3.230***		0.169***		4.145***		3.463***
Engineering and health welfare		2.243***		0.498***		2.844***		2.340***
Location								
Madrid	1.400***	1.496***	2.297***	2.759***	1.543***	1.663***	1.166***	1.212***
Time effects								
Year 2005	1.043	1.005	0.619***	0.641***	1.213***	1.115***	0.990	0.972
Year 2006	0.912***	0.912***	0.751***	0.780***	0.727***	0.707***	1.111***	1.118***
Year 2007	1.134***	1.142***	0.706***	0.748***	1.127***	1.075***	1.251***	1.295***
Constant	0.010***	0.004***	0.007***	0.008***	0.004***	0.000***	0.023***	0.005***
Number of observations	857402	857402		857402			857402	
Log pseudo-likelihood	-524212.57	-544636.73		-888362.7			-886139.08	
LR:χ^2	140081.07	99232.74		182091.68			186538.92	
Pseudo R^2	0.118	0.100		0.100			0.101	

Basic category: non-creative jobs (0) **(The U.K.)**	The creative jobs(1)	The creative jobs(1)	Bohemian jobs (1)	Bohemian jobs (1)	Creative core jobs (2)	Creative core jobs (2)	Creative professional jobs (3)	Creative professional jobs (3)
	Model I		Model II					
Personal characteristics								
Female	0.772***	0.778***	0.671***	0.666***	0.705***	0.660***	0.837***	0.871***
Age	1.212***	1.262***	1.153***	1.230***	1.323***	1.369***	1.171***	1.214***
Non-native born	0.681***	0.651***	0.582***	0.567***	0.748***	0.824***	0.658***	0.587***
Self-employment	4.147***	4.348***	12.929***	12.189***	1.802***	1.951***	3.017***	3.295***
Part time	0.231***	0.194***	0.589***	0.416***	0.193***	0.167***	0.190***	0.165***
Higher education	3.320***		2.467***		5.098***		2.802***	
Course characteristics								
Education science and teaching training		14.005***		1.932***		51.404***		2.108***
Humanities, arts and language		1.743***		2.394***		2.643***		1.229***
Social science		1.512***		0.109***		0.955		2.276***
Science (exclude education science)		2.744***		1.108***		5.427***		2.034***
Engineering and health welfare		2.239***		0.598***		3.552***		2.235***
Location								
Greater London	1.642***	1.685***	1.448***	1.372***	1.309***	1.405***	1.942***	1.964***
Time effects								
Year 2005	0.958***	1.013	1.107***	1.132***	0.775***	0.841***	1.036***	1.081***
Year 2006	1.025	1.042***	1.057	1.067	1.034	1.107	1.010	1.001
Year 2007	1.039***	1.082***	1.527***	1.610***	1.046	1.154***	0.926***	0.933***
Constant	0.006***	0.003***	0.001***	0.001***	0.000***	0.000***	0.007***	0.004***
Number of observations	3103438	2831653	3103438				2831653	
Log pseudo-likelihood	-1052677.9	-1000545	-1580955.1				-1462517.6	
LR:χ^2	934534.77	877983.47	1030645.71				1077105.96	
Pseudo R^2	0.307	0.305	0.246				0.269	

Basic category: non-creative jobs (0) **(Italy)**	The creative jobs(1)	The creative jobs(1)	Bohemian jobs (1)	Bohemian jobs (1)	Creative core jobs (2)	Creative core jobs (2)	Creative professional jobs (3)	Creative professional jobs (3)
	Model I		Model II					
Personal characteristics								
Female	0.682***	1.074***	0.591***	0.694***	0.659	1.482***	0.719***	1.082***
Age	1.096***	1.202***	1.008	1.058***	1.317	1.585***	1.084***	1.164***
Non-native born	1.264***	1.205***	0.582***	0.598***	0.989	0.794***	1.495***	1.462***
Self-employment	2.990***	3.216***	3.620***	3.577***	3.263	3.634***	2.781***	3.001***
Part time	0.588***	0.493***	1.971***	1.417***	0.649	0.428***	0.432***	0.396***
Higher education	4.346***		2.999***		15.230		3.241***	
Course characteristics								
Education science and teaching training		0.854***		1.214***		1.032		0.781***
Humanities, arts and language		1.141***		2.239***		1.246***		0.874***
Social science, business and law		1.570***		0.560***		1.504***		1.922***
Science (exclude education science)		1.764***		1.954***		2.844***		1.539***
Engineering and health welfare		3.233***		1.509***		7.880***		3.074***
Location								
Lazio+ Piemonte	0.801***	0.749***	0.996	0.885***	0.814***	0.719***	0.755***	0.728***
Time effects								
Year 2005	1.045***	1.150***	1.534***	1.570***	0.949***	1.119***	0.965***	1.067***
Year 2006	0.991***	1.068***	1.054***	1.086***	0.774***	0.868***	1.043	1.129***
Year 2007	0.910***	1.025***	1.010	1.055	0.829***	1.000	0.912***	1.029***
Constant	0.043***	0.004***	0.024***	0.008***	0.000***	0.000***	0.046***	0.006***
Number of observations	1138187	1135503		1138187			1135503	
Log pseudo-likelihood	-601387.15	-622783.92		-899096.25			-914481.76	
LR:χ^2	247311.47	201991.70		345521.23			311864.95	
Pseudo R^2	0.171	0.140		0.161			0.145	

Notes: 5. in the first column in each table, the creative class was measured as a whole.2. Drop observations with age above 27 in all countries. 3. Bohemian group is excluded due to insufficient observations in France. 4. The variable “educfild” is only accessible in 2003 in Germany. 5. Standard errors are not reported due to lack of space.

CHAPTER 7

CONCLUSION

In line with the hypotheses in section 2.3.2-2.3.4, the findings of Chapters 4, 5 and 6 are separately concluded in Chapter 7. In general, this thesis has reviewed the grand creative class thesis in response to critical voices in three broad aspects: (1) the economic impact of workers with creative skills, (2) the relationship between creative workers and technology and (3) the specialised preferences of creative workers in different sized regions. Finally, the role of education in shaping new creative workers in the European labour market is also briefly discussed.

7.1 From a growth accounting perspective: a full-scale measurement of the impact of creative labour and ICT capital services in Europe

The focus of economic development

Focusing on hypothesis 4.1, the results of growth accounting shows that the growth of creative labour services appears to have been an important source of output growth in many of the European regions in the last decade, but this is not universally so as in many other regions. Therefore, this hypothesis can be only partially verified and the unclear role of the creative class across regions and countries constrained this research in drawing a universal conclusion. Instead this thesis proposed a new classification when measuring the development level of the creative economy in each country (see **Table 7.1**).

Table 7.1: The quality of the creative economy (the degree of contribution)

Type of economy	Definition
The paradigmatic creative economy	The creative class's contribution to GVA growth is higher than non-creative workers in the majority of regions.
The technology-driven economy	The creative class's contribution to GVA growth is significant in the majority of regions. However, either its contribution or the non-creative workers', is not a determinant in explaining GVA growth.
The traditional economy	The creative class's contribution to GVA growth is only greater than non-creative workers' in some regions.
The economy in transition	The creative class's contribution to GVA is not a determinant in explaining GVA growth in the majority of regions.

The paradigmatic creative economy

Generally speaking, the western developed European countries are more likely to enjoy economic advantage from the growth of creative labour services. This is particularly true in the U.K., France and Belgium, where the contributions of creative workers are significant and much higher than non-creative workers in the majority of regions. Based on strict neo-classical assumptions, this finding favours and visualises Florida's proposition just like the American cities that are at the top of the creative index list, where local economic development is heavily reliant upon the creative labour service flows and where great benefits have already been enjoyed as a result.

The technology-driven economy

Sweden and Finland have very different economic systems. The growth of creative or non-creative labour services is indeed significant in explaining GVA growth in many regions such as Stockholm or Pohjois-Suomi, but compared to the contributions from the growth of ICT capital services and TFP, labour's contribution in explaining GVA growth is small. As these countries are high on Florida's creativity index list, it may see counter intuitive that they do not receive the proportional benefit from creative labour services. However, it is not possible to conclude that the Nordic economies are non-creative, but instead that the influence of the creative class, or any other types of labour, could be multifaceted. Even if the creative labour contribution is minor, a judgement on the role of the creative class in this case cannot be made quickly. The Growth Accounting method may only capture one aspect of the matter.

The traditional economy

It is difficult to conclude whether labour or capital inputs matter the most in Germany, Spain and Italy, given the extent to which they have differing development models. For example, although the time series is short in the German case, the obvious contributions from non-creative labour and non-ICT capital services can be ascertained. In Spain and Italy, non-creative workers' contribution is higher than that of the creative class in many regions, although they are both important. These results only portrayed a very vague picture when trying to discern the primary driver of regional growth. It could be suggested that Germany is more likely to develop a balanced economy and still focus on a heavy manufacturing industry. Italy has a great share of service industries such as tourism and traditional manufacturing such as luxury products. For Spain, a significant catch-up effect was observed in terms of all inputs and it is still at the stage of economic transition. However, the growth of creative labour services is not a dominant force in explaining output growth in any of these countries.

The economy in transition

As the data was not sufficient to cover all of the less developed European countries, the discussion for Hungary and the Czech Republic can be considered to be typical cases. It is not clear what type of economic model they belong to since the former Soviet Union collapsed in 1991. After a period of temporary stagnation, it seems that these once planned economies are getting back on track to grow efficiently, but they are still at a stage of economic transition. The national economy relies on traditional labour and capital inputs in the majority of regions in Hungary. In contrast, the Czech Republic is more likely to follow the path of creative and technology-related realms; however, the overall scale is much less than for developed European countries. It is difficult to conclude that the Eastern European countries have successfully transformed to creativity or knowledge-intensive economies, but some of them have great potential.

The development rate of the creative economy

Next, the contribution of the creative class was compared for the two periods (approximately 1995-2001 and 2002-2007) and again the target countries[54] were categorised into three types of economy (see **Table 7.2**).

The creative engines

The contribution of creative labour services was increasing significantly in the majority of regions in the U.K., France, Sweden and the Czech Republic. Therefore, it

[54] Finland and Germany are not included in this analysis due data constraints.

seems that these countries were the leaders in attracting creative workers and effectively motivating them to contribute to regional economic development.

The creative sprawls

The increasing contribution from creative labour services was only captured in some of the regions in Spain and Belgium. It could be said that the influence of the creative class in these countries is not as significant as the creative engines in recent years whereas the creative power had indeed expanded. Germany was not included in the analysis due to the times series being too short, but it may belong to this group.

Table 7.2 The quality of the creative economy (the development rate)

Type of economy	Definition
The creative engines	The creative class's contribution is increasing in the majority of regions.
The creative sprawls	The increasing contribution from the creative class is only observable in some regions.
The creative dilemmas	The increasing contribution from the creative class is not observable in the majority of regions.

The creative dilemmas

This last group contains those countries which received obvious benefits from the creative workers in the past, but such a positive contribution is now decreasing, despite the employment rate of the creative class still growing. The most typical case is Hungary where there has been a negative growth tendency in the contribution from creative workers in all regions. It was not possible to carry out this analysis for other countries which embodied similar political and economic systems such as Romania or Bulgaria, as the dataset was unavailable. However, the situations there could be the same or even worse. It is quite doubtful that most of the traditional planned economies have the know-how to promote the creative economy effectively.

Finally, the development rate was used as an indicator to define the vitality of the creative economy in each country and to compare these findings to the corresponding contribution degrees (see **Table 6.3**). As these two scenarios largely overlapped (i.e. a higher contribution degree is likely to be associated with a higher development rate), the conclusion appears to contradict Florida's prognosis regarding Europe (Florida and Tinagli, 2004; Florida, 2014). If the U.K. is losing its ground, why does the creative class become more important in contributing output growth? If France really is a creative laggard, why are the contribution degree and the development rate both high in the majority of regions? Why do those creative leaders such as Sweden and Finland have the highest share of creative workers while most economic growth comes from TFP and ICT capital services? Therefore, it seems that Florida's creative parameters have little explanatory power and are disconnected from economic reality (Malanga, 2004; Montgomery, 2005).

The real situation of the creative economy in Europe

In the creative class thesis, the 3T indexes and the overall creativity index aim to reflect the true prosperity of a local economy, as the measure of output growth such as GDP or GVA is asserted to only be a crude conception of Industrial Age growth (Florida, 2013, p.397). How can we measure social progress or the overall welfare of a society? Here it is correct that the measure of output growth may be a unilateral standard and is not accurately associated with economic and social progress (Clark and Senik, 2011). However, have Florida's empirical analyses avoided this problem? In fact, he and his supporters frequently tried to link creative indexes to GDP growth in order to confirm the influential role of the creative class (Florida and Tinagli, 2004; Florida *el al*., 2008; Florida, 2013, 2014).

The measure of output growth is not flawless, but its importance cannot be avoided too. Any one of the indexes proposed by Florida is only an isolated reflection of the situation for the variable itself – we do not know how this variable can contribute to an economy unless we further link it to economic realities such as output growth. With respect to this, the Growth Accounting method, to a great extent, integrates the concept of the creative class (i.e. creative occupations) with several essential aspects of economic progress (e.g. output growth and the expansion of higher education). Admittedly, there have been methodological challenges in defining total hours worked, revenue share or capital services at regional level, but the findings in this research still provide many useful materials and references for us to understand the real impact of creative workers.

This thesis challenges the philosophy of the creativity index. Despite its synthetic nature, it is too arbitrary to combine different Ts (talent, technology and tolerance) to predict the level of "creativity" in a common way, no matter how it can be calculated by weights or latent variables. It is undeniable that tolerance and technology are, to a great extent, related to the performance of the creative class in an economic system, but this pattern is more complicated, requiring several analyses at multiple levels.

In summary, the creative class has been growing fast in Europe since the mid-1990s, but at different rates at the regional level. Such an uneven development level across regions will definitely leave room to flow creative talents – this is a great opportunity for everyone to spur the creative economy. In the meantime, ICT, or even non-ICT capital, is a crucial element to also grow regional economy. Is the singular measure of the creative class, following either this or Florida's method, really a better indicator to explain the so-called "true prosperity"? The evidences based on the Growth Accounting method have implied that choices between promoting the creative economy and promoting the ICT-driven economy may distort policy decisions. Therefore; instead of analysing these factors separately, the analysis can be integrated.

Table 7.3: The multi-dimensional measure of the creative economy's performance

	Creativity Intensive	Technology Intensive	Traditional	In transition	Creative engines	Creative sprawls	Creative dilemmas
Belgium	Yes	No	No	No	No	Yes	No
Germany	No	No	Yes	No	n/a	n/a	n/a
The Czech Republic	No	No	No	Yes	Yes	No	No
Spain	No	No	Yes	No	No	Yes	No
France	Yes	No	No	No	Yes	No	No
Italy	No	No	Yes	No	No	No	Yes
Hungary	No	No	No	Yes	No	No	Yes
Sweden	No	Yes	No	No	Yes	No	No
Finland	No	Yes	No	No	n/a	n/a	n/a
The U.K.	Yes	No	No	No	Yes	No	No

. *Note:* Germany and Finland are not included in the analysis regarding the development rate due to the times series being too short.

7.2 Econometric models: linking the role of the creative class to urban economic realities

In association with the findings above, it appears that creative economics theories should shift the attention from the conventional one factor-led growth model to a more diversified one concerning the efficiency improvement. Therefore, hypothesis 4.2, which analyses the relationship between the creative class and ICT, has been constructed. The econometric analysis at this stage investigates the role of the creative class in the economic system. In other words, the aim of this section is to explore the relationship between 2Ts (i.e. talent and technology). Florida stated that the least controversial of the Ts is technology, which is always the driving force for growth. Then the creative class remains positively correlated with various measures of innovation and technology (Florida, 2013, p.229). However, there are some issues in the way in which he defined innovation and technology. Whether using the share of working population in high-tech industries or patents per capita, the verification of Florida's prognosis regarding this nature of the creative class is not convincing. This is the one of reasons why ICT capital is replaced to measure the impact of technology

For the first time, this thesis estimated the level of ICT capital services at the regional level for the main European regions over time. Even though the estimation still relies on several assumptions, this attempt contributes to the regional study regarding either the creative class thesis or other types of economic theories. This study also contributes to associating creative workers with other important inputs such as ICT capital services and human capital. The econometric analysis demonstrated that in the whole European context, the changes in regional creative labour and ICT capital services have stronger explanatory powers in explaining the growth in gross value added, compared to the changes in non-creative labour and non-ICT capital services. It is also interesting that the co-existence of the creative class and ICT capital can result in a greater change of output in Europe through a positive interactive effect rather than through the contributions from each of these inputs separately.

Therefore, both the application of ICT and the influx of labour input from the creative class seem to be very important sources of regional economic growth. This finding is generally consistent with the conclusion from the creative class thesis and other literature (Florida, 2002, 2005, 2013; Clifton, 2008; Stolarick and Currid-Halket, 2013, etc.). Also, the evidently positive coefficient between creative labour services and ICT capital services imply that ICT is a good catalyst to link skills and regional economic systems. Such a joint role of ICT with the creative class confirmed what Florida expected, but takes it to a deeper level – for the first time, the relationship between technology and the creative class was visualised and detailed as opposed to Florida's loose set of figures from pairwise correlation tests.

In order to provide a more comprehensive understanding of the function of the creative class in the regional economic system, the discussion is further extended to the debate over the creative class and human capital. As human capital is defined as "*the stock of skills and knowledge embodied in the ability to perform labour so as to produce economic value*" (Sheffrin, 2003), neither potential skills nor utilised skills can be excluded from this broad definition. There are various ways to measure human capital such as by school enrolment rate (Barro, 1990), by years of schoolings (Nehru *et al*., 1993), by the ratio of skilled adults over total adults (Romer, 1994) or by the returns that an individual obtained throughout human capital investment (Mulligan and Sala-i-Martin, 1995). Therefore, it is hard to conclude that the creative class is a concept distinguishable from the broad sense of human capital. This argument is all about which variable could explain economic performance better: the share of the creative class or the share of graduates.

Nevertheless, such a comparison, although it has been tested by many previous studies, can still provide very useful information about the creative class and graduates. In order to test hypothesis 4.3, the econometric analysis has been linked to both their individual roles and joint effects in the regional economic system. The result clearly implies that the creative class has a greater impact on the change in regional TFP level than graduates in association with the effect of ICT capital services in Europe. This is a consistent finding with several previous studies, that the presence of the creative class has a stronger effect than graduates in explaining productivity (Florida *et al.*, 2008; Marrocu and Paci, 2012). However, this thesis' model specification, the definition of productivity as well as the econometric technique is much more rigorous. With respect to this, the creative class is believed to have a unique position in the economic system and it is a useful measure of skills to explain economic performance.

Once the creative class and graduates were combined together, the evidence coincides with the on-going argument between Florida's supporters and Glaeser's followers. Graduates who work in creative professions contribute more to output level than those who do not while non-graduate creative workers have a lower contribution than those creative graduates. This is also confirmed in the second empirical model explaining TFP. Therefore, graduates and the creative class not only have different impacts on economic performance but are also supportive to each other and neither is dispensable.

In a nutshell, rigorous methods have been used to better examine the influence of the creative class, situated in urban/ economic realities and theories. As made clear, this thesis aimed to demonstrate the limitations of looking at creative workers alone; instead, the preferred theoretical framework used here has taken into account many of the criticisms of the creative class thesis that have emerged over the last decade. It is proposed that understanding towards the source of economic growth is no longer an isolated topic but needs to be seen in the context of broader-based economic development. Therefore, creative workers' capacity has to be maximised through a suitable channel such as through the integration of ICT. The challenge is related to the absolute level of "the creative stock" but is also concerned with how creativity is stimulated through an effective economic system.

From another perspective, the creative class thesis also provides a new thought regarding human capital-based ICT policy making. As more and more developed nations have shifted attention from emphasising the simplistic production of ICT goods to efficiency gains, human capital development seems to be inextricably linked with technology capacity building. It not only contributes to building up technical knowledge and capabilities, but also helps us to cope with the rapidly changing social and economic realities (Singh, 2009, p.146). It is important then, to understand how technological progress and human capital development relate to and enrich each other (Nissanke, 2006). This thesis has presented solid evidence to support this point of view and further clarified how these two policy areas can be highly coordinated. It appears that an appropriate socio-economic environment is essential for making economic progress in the knowledge-based economy. Although many ICT policies in enhancing efficiency have been well-discussed (e.g. organisational structure adjustment, full involvement of government or advocacy of skills-based human capital development), the promotion of the creative economy deserves consideration. As long as a sufficient number of creative workers efficiently contribute to local economic development, we have a chance to fully explore the potential of ICT.

7.3 The regional density of the creative class

Over the last decade, the notion of creative cities/regions has gained considerable influence over urban development strategies. The mainstream "creative capital" theory emphasises the importance of high-tech, cultural diversity and tolerant amenity. In the European context, it appears that Florida's measure of milieus favours large-sized regions too, while only leaving few options to smaller regions. Without the diversified economic base, non-metropolitan regions are likely to be marginalised. Then they could confront more challenges in identifying themselves under the dominant milieu in the Creative Age.

The creative class thesis also potentially omitted the responsibility of local governments for constructing social welfare systems. Instead, too much focus is on consumer preferences, regardless of the varying natures of local economic systems. As long as the creative class thesis has been confirmed as a meaningful concept to explain economic growth, will the non-metropolitan regions automatically fail in attracting creative talent? This thesis aimed to show that they still have potential to avoid the simplistic application of the creative class thesis mainly based on the experience from large cities/regions.

Hypothesis 5.1 aims to verify if the findings in this thesis is consistent with previous studies, as the effect of the people climate is assumed to be significant in shaping creative labour flows in Europe and such an effect varies across different group sizes of regions. Overall, it is not intended that Florida's propositions are fully rejected. Although stubborn problems such as gentrification, marginalisation or uneven income distribution inevitably coexist with regional economic development in creative disciplines, the findings based on the dynamic GMM imply that the parameters of the creative debate have substantial influence in shaping the flow of creative talent in the majority of European regions. Therefore, the call for enhancing selected amenities still deserves policy consideration.

However, Florida's theory has to be modified. In response to hypothesis 5.2, several changes to the existing "creative parameters" were made and alternative development paths outlined. On one hand, either the level of rich amenities or cultural diversity has to be explained together with the regional baseline of public services (Andersen *et al.*, 2010, p. 236). If Florida's remedy is the icing on the cake, then the basic aspects of socio-economic progress such as the quality of education and social welfare systems are still fundamental. On the other hand, many more creative activities appear to be evident among the best performing regions in the EQI in comparison to being among the worst. The theory behind this is that with a good QoG (quality of government), a country can achieve successful economic and social progress (Holmberg *et al.*, 2009, p.135). The conclusion here agrees with several previous studies regarding this relationship (e.g. Frey and Stutzer, 2000); however, another line of thought has been added to the current debate: better local government could aid the prosperity of the creative economy in a specific context (i.e. small-sized regions). Although there have been methodological challenges in measuring this time-invariant variable in a temporal order, fixed effects regressions have revealed this pattern.

The EQI index reflects the perceptions of creative populations towards their local communities. The positive relationship between the locational preferences of creative workers and the quality of political institutions empirically confirms several assertions in the scholarly literature. The promotion of the creative economy should never deviate from the core values of a society: "*democratic values, social solidarity and the capacity for réjouissance*" (Scott, 2014, p.573). The creative class also shows a strong preference for individuality and self-expression and is reluctant to conform to traditional norms and institutional directives (Florida, 2013, p.56). If these arguments are linked to urban realities, members of the creative class should prefer to live in a place where "*collective action is easier as the bonds of familiarity and trust facilitate consensus and collaboration*" (Bradford, 2004, p.9) and the political activism is strong (Lewis and Donald, 2010, p.49).

In response, the capacity of a good local government appears to meet these demands from creative workers. A high quality government can efficiently formulate and implement policies, while attention and respect will also be paid to local residents' state and action for the institutions that govern social and economic inter-actions among them (Kaufmann *et al.*, 1999). This statement speaks of the importance of a broader role of local government in the Creative Age. Even in big regions, where Florida's milieus may have the dominant power to explain the locational preferences of creative workers, policy makers should never overlook the power of urban democracy.

Yet those overall policy recommendations may be not sufficient to understand the real role of the creative class according to various urban realities. Regional hierarchy brings complexity to understanding the dynamics of creative city regions. For non-metropolitan regions, how can they grow together with their large neighbours? Here, it is believed that small-sized city regions still have pre-existing advantages. On one hand, Charron *et al*. (2014) state that on average large-sized city regions have lower QoG scores compared to smaller-sized city regions in Europe. With larger economic scale, more complex social networks and critical mass infrastructures, a big region may have a greater capacity to address economic and social challenges, but on the downside, some inherent disadvantages are seemingly inevitable too, such as social inequalities, corruption and administrative inefficiency. While these patterns determine the level of social sustainability, small-sized regions in Europe appear to successfully help creative workers to create some of the identities that reflect their creativity, which are not tolerance and openness but individuality and social responsibility. On the other hand, a small-sized region also has potential to become an innovation hub. The presence of a university substantially contributes to community economic health (Sands and Reese, 2013). As a certain amount of creative employees are scientists, university teachers and university-affiliated hospital staff, the co-existence of universities and other types of research institutions in small-sized regions may potentially create more job opportunities and then attract new creative workers in the same discipline or even other creative workers. At this point, the group of small-sized European regions again outperforms its counterpart in attracting creative talent.

It is difficult to include all indicators regarding the concept of social sustainability and livability, but this thesis' point of view regarding the development path in small-sized European city regions is similar to the Canadian experience

(Lewis and Donald, 2010). Through good choices, non-metropolitan areas can still have a chance to be a part of the creative economy. Openness and tolerance are indeed important for the creative class, but it seems that the creative class exhibit different priorities when measuring places with different economic and social natures. The creative class may not always demand immediate access to rich amenities. Instead, it is highly probable that small city regions meet its demands too where consumption and entertainment can be found from nearby metropolises. Therefore, it is crucial for policy makers to re-conceive development strategy for small-sized city regions in order to define and promote their unique identities.

Unfortunately, neither the creative class thesis nor the concept of social sustainability could well explain the flow of creative talent in midsized city regions. On one hand, cultural amenity only has weak power in explaining the location of creative employment and the latter is not related to diversity. On the other hand, only the short-term performance of local government is related to the location of creative employment, but as the core variable to define one of the creative class' identities, the complementary impact of QoG has not being captured. Therefore, it is most difficult to draw a clear conclusion about the specialised preferences of the creative class in midsized European regions.

However, such a dilemma in forming an "identity" in midsized European regions could be due to various reasons. Firstly, several studies have pointed out serious problems about using the creative class thesis as a conceptual framework to explain both regional economic growth and creative workers' behaviours in the context of midsized city regions (Reese *et al*., 2010; Sands and Reese, 2013). As long as the research described a similar pattern in Europe, the concern has also been expressed regarding the application of the "overall approach". The creative class thesis appears to only be feasible in specific contexts. Secondly, the nature of midsized city regions could be an important aspect in understanding this situation. Between two polarities (i.e. large-sized and small-sized city regions), midsized city regions are less likely to obtain greater advances in either the high level of social sustainability or the high level of rich amenities. Therefore, the locational preferences of creative workers could still be determined by traditional factors such as average wage levels, job opportunities, geographical locations etc. These indicators, however, are difficult to measure at the regional level in Europe due to data constraints or because they have been removed through the data transformation process (e.g. the demeaning in the fixed effects model). Finally, this outcome is likely to be caused by the method for classifying the regional hierarchy in the study. Can a re-definition of midsized city regions yield different results? Possibly. Midsized city regions could have different characteristics which cannot be generally summarised under a rough classification. But again, this issue cannot easily be solved based on the EU LFS so further research in database development is required.

In the end, hypothesis 5.3 has been tested. Even though the main research question in Chapter 5 is about the modification of Florida’s advocacies regarding the people climate, the analysis at this stage provides useful information to understand the creative class’s consumer preferences. The result confirms that even for different groups of creative workers, their consumer preferences are not the same in a place. Further studies could be necessary, as data constraints in the EU LFS impede us to precisely measure this difference for creative workers by regions and further by working groups. However, it is believed that Florida’s one-size-fits-all solution again has been proven to be implausible.

This thesis, for the first time, puts many essential aspects of social and economic progress into the same theoretical framework. Based on advanced econometric models, the foregoing analysis suggested answers to the hypothesis proposed in section 2.3.3. While many interesting points have been raised regarding the promotion of the creative economy, it has to be accepted that this study is limited to defining the size of city regions or the insufficient number of observations. Also, the construction of variables to represent the aspects of the creative class thesis could be subjective. However, the findings are believed to contribute to the on-going debate over regional/urban development policies. In a nutshell, the relationship between different European cities and regions should not be competitive, instead both large-sized and smaller-sized city regions need to be socially and geographically networked. They all have chances to become creative powerhouses if local policy makers correctly associate the preferences of the creative class with their unique advantages.

7.4 Education and creative workers

In response to hypothesis 6.1, Chapter 6 aims to test the efficiency of the education system in shaping creative workers in the European labour market. A snapshot of the situation for new creative workers in the labour market across seven European countries was provided, but it must be accepted that the application of the EU LFS dataset has its own limitations. First of all, the discussion cannot be extended to the wage effect of education due to lack of available data, while the time period of 2003-2007 may be not indicative of recent circumstances from 2007 onwards. Secondly, a survey based dataset always has considerable biases. One of the most typical examples is that the scale of graduates or new workers can only be indirectly estimated through the assumption. Also in either probit or multinomial logit models, the size of coefficients for a particular variable is likely to be driven by the sample selection technique in each country. In response to these issues, this is the reason why this study adopted multiple analytical techniques based on various sources. By combining pieces of evidence from descriptive statistics as well as econometric analysis, it is still possible to draw a meaningful conclusion.

This study, for the first time, examined the possible relationship between education and the creative class across different European countries. Since Florida defined the creative class as highly skilled and well-educated individuals, the power of education is inevitably linked to the advocacy of the creative economy. Overall, higher education seems to be a crucial factor in determine creative job outcomes. Having a university degree is a great advantage in the long term – it increases innovation, wealth and productivity. University also teaches students how to learn and how to prepare for the labour market as employability has been incorporated into university curricula to help prepare students for the labour market (Redmond, 2013). Therefore, a successful economy or society depends on the wider participation of higher education, and it is not surprising that graduates generally outperformed non-graduates in terms of probability in getting creative jobs.

Nevertheless, the sub-categories of the creative class have quite different reactions regarding the effect from different education/training backgrounds. In order to visualise these patterns, probabilities of getting bohemian, creative core and creative professional jobs by different backgrounds for each country are ranked (highest probability=5/lowest probability=1). When an average value of rankings for each background is taken across the target countries (see **Figure 7.1**), it is clear that education schemes in developed European nations, to a great extent, match labour market needs. The findings show that new workers are generally assimilated into proper jobs with different rates, depending on the type of education/training they once participated in. More importantly, evidence has been found to suggest the way in which creative jobs can be structured. New workers with arts and humanities backgrounds are more likely to become bohemians, holding a qualification of science or education-science increases the chance of getting creative core jobs and in order to have a creative professional job, the background of social science and engineering/health and welfare appears to be necessary.

However, this taxonomy of definition regarding the match between skills and qualifications is all about how they can be coded but is not precisely related to what is happening in the labour market; new creative workers also have a high probability (highest probability=3/lowest probability=1) of finding jobs that are not commensurate with their qualifications (see **Figure 7.2)**. This is particularly evident for those who are holding qualifications related to arts/humanities, social science and engineering/health and welfare.

There is no doubt about the importance of education schemes and even more jobs require a university qualification than ever before, but the real challenge is that if higher education is a good proxy for potential ability and productivity, then how can such potential capacity be translated into a utilised skill? This is still a difficult question to answer. With respect to this, creative jobs do not have a clear boundary among occupations that require and use higher education.

Finally, it may be difficult to propose direct policy recommendations that could easily solve the issues identified in this thesis – there is a clear methodological challenge in defining new graduates as well as issues in the interpretation of results on education background. However, it is still necessary for policy makers to think about the following suggestions regarding the promotion of creative economy.

– The creative economy, as Florida suggested, is receiving benefits from the widening participation of higher education in Europe. Together with evidence from other literature (e.g. the increasing supply of graduates does not result in the phenomenon of oversupply (Wasmer *et al.*, 2007)), there is no reason to stop expanding the tertiary education sector in the target European countries.
– The evidence in this study suggests that the field of study matters in shaping creative workers, but a significant mismatch rate also co-exists. The possible solutions are firstly the adjustment of the wage system to accurately capture important aspects of the value of degrees, and secondly the differentiation of tuition fees and scholarships for different subjects in order to meet the real demand in the labour market. For example, providing high quality bursary and occupational guidance will encourage more individuals to participate in humanity and arts subjects.

Figure 7.1: The average ranking by education background for each creative job outcome

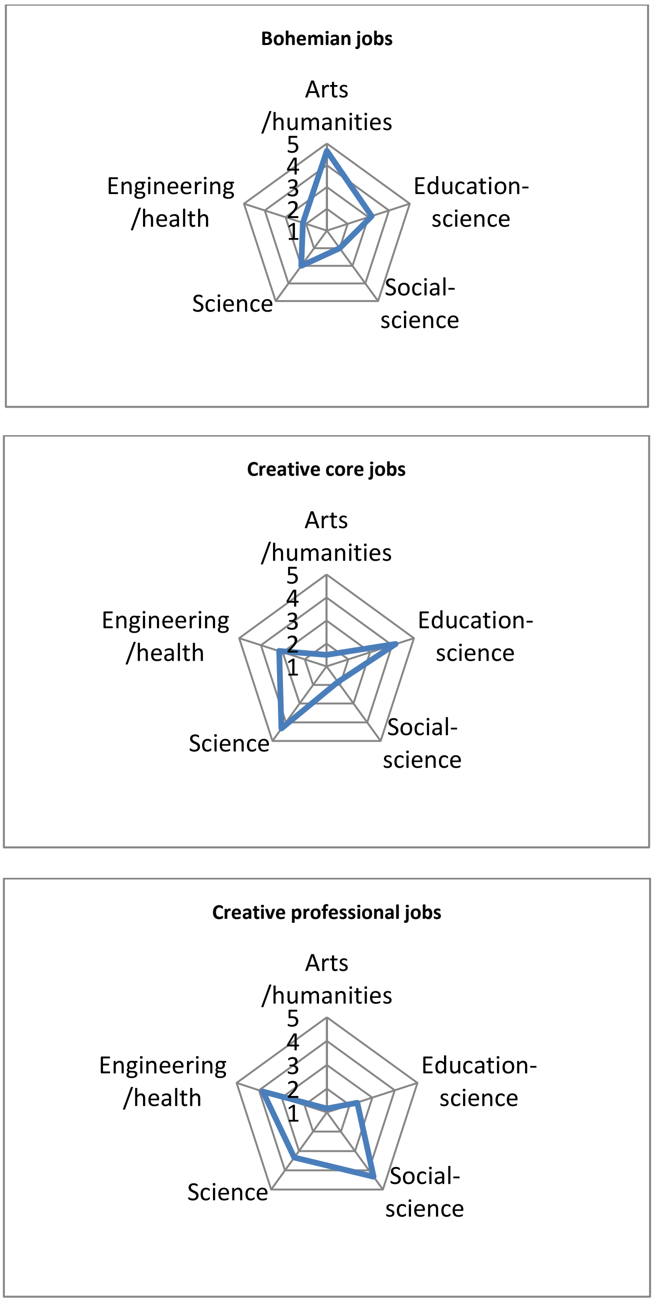
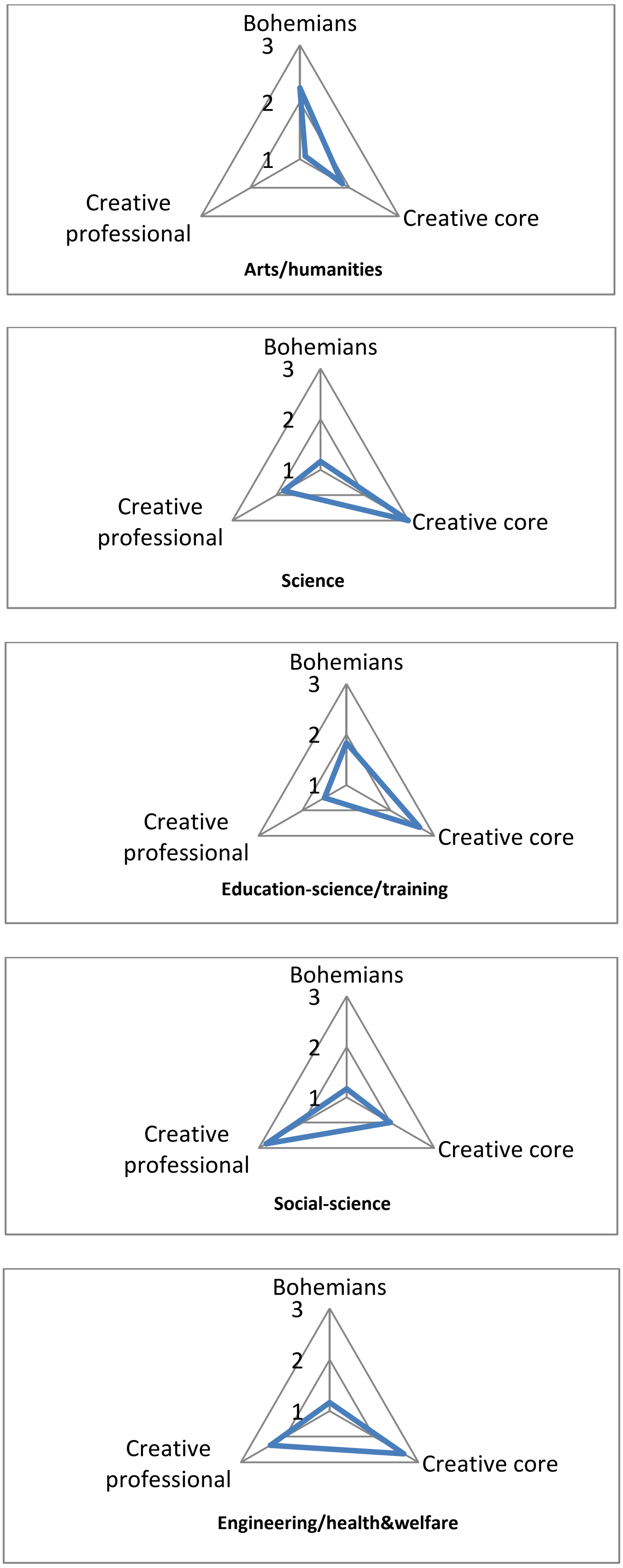


Figure 7.2: The average ranking by creative job outcomes for each education background



– It may be more realistic to accept the fact that such a "mismatch" between occupations and qualifications could exist for a long time. Qualifications are only useful for a short period for many new graduates in the labour market. Initial educational attainment alone cannot meet the high demands of the dynamic labour market in the 21st century; lifelong re-skilling and re-training in line with on-the-job experiences are required. Therefore, attention must be drawn to the balance between further training and tertiary education. This is a helpful suggestion for many creative workers who do not have a university degree. Here, governments can play an important role in providing better training opportunities.

7.5 Postscript: the future of the creative economy

In retrospect, one subject was actually focused on throughout the whole thesis: how we can correctly interpret the impact of the creative economy in European regions. This thesis has argued that geography still matters for economic development. In this sense, forces that stimulate growth are still associated with specific regional characteristics and they cannot easily be moved into different contexts (Ascani *et al.*, 2012). Among many existing theories that advocate the importance of the regional/local economy (e.g. Storper, 1995), Florida's theory proposes a new line of thought to the current debate, as for the first time, a region's future prosperity is highly coordinated with the changing nature of skilled workers.

However, how can we ensure that the benefits of the creative economy can be widely shared? How can we ensure that low-skilled local residents can be treated equally with the highly-skilled, such as the creative class? Urban inequality is always a complex problem for all countries in the world; thus, it is too harsh to criticise Florida for not solving this problem when no one else has either (Callahan, 2013). Even though the effect of this creativity-engendering strategy is not a universal uplift, it is still irrational to stop investing in skills or simply blocking the flow of well-educated and skilled people and jobs between cities and regions. Instead, it may be more pragmatic for policy makers to think about how the downside of creative class urbanism could be offset, while maximising the capacity of the creative economy.

Based on this assertion, this thesis, to a great extent, explored the future development path of the creative economy in European regions. Firstly, it is argued that the creative class is a useful concept that is different from the measure of human capital in terms of graduates. Florida's advocacy of generating creative competitiveness across cities and regions by building up selected amenities may be arguable, but the creative class is substantially contributing to regional economic growth. Secondly, technology is complementary to creative skills. If we look around the world, technology has already changed the world of work. However, skills to analyse can be easily computerised unlike skills to create. Unless future technology can simulate the human brain, creativity, as is emphasised throughout this thesis, cannot be substituted by computers. Where does this leave us? At least it can be confirmed that the creative class thesis is situated in urban reality as the creative class has been playing a crucial role in association with technology in the economic system. Thirdly, the analysis of the relationship between economic growth and political institution was not repeated as it has been discussed at length in much previous research. Instead, the perspective was shifted to several essential aspects of economic and social progress regarding the identities of the creative class. The "overall approach" is challenged, mainly based on the experience of large-sized city regions. It has seen a need for local policy makers to link their unique advantages to the different preferences of the creative class. The emphasis on consumption and entertainment based amenities could be a feasible policy option in attracting creative talent in large-sized city regions while in smaller-sized city regions, good local government can still help the creative class to develop identities that reflect creativity. Finally, where does the creative class come from? The emergence of creativity is indeed a complex social phenomenon and such a process is less likely to be routinised through an education system. However, does formal education really have no impact in shaping creative workers? The results indicate that education background has an evident impact on creative job outcomes, while the mismatch between occupations and qualifications is significant too. As long as Europe is facing a similar challenge as the U.S. (Florida, 2003b), there is a need for basic education reform policy to be highly coordinated with the real situation for new creative workers in the labour market.

In the new century, the social and economic sciences belong to multidisciplinary and overlapping disciplines. Maybe there has been too much debate about graduates versus the creative class, cities verses suburbs and justice versus inequality. Since we all accept that skills matter to growth, let’s focus on what the knowledge/creative economy really requires. Acknowledging that development is a localised process dependent on various economic and social forces is important. From a policy-making perspective, the thesis has suggested new ideas for us to cope with real challenges in the upcoming Creative/Knowledge Age.

7.6 Limitations of the research

In line with other studies, this research has limitations. Although this research integrated the concept of the creative class with other development theories for the first time, the biggest challenge is still the data constraint. Firstly, ISCO-88 3-digit occupation codes and NUTS 2 codes in the EU LFS are only available for some countries, thus many European economies have not been included. Having more detailed data, such as the 4-digit ISCO codes or NUTS 3 codes, is always expected in this research. However, even though such an individual database exists in the U.K., Germany and the Netherlands, observations from two or three advanced countries is very likely to overestimate the impact of creative workers for the whole of Europe, given the fact that none of the datasets in the other target countries could match this accuracy.

Secondly, the time period is from 1995-2007 for most of the countries. The period from 2008 onwards is not included for two reasons. On one hand, the economic crisis in Europe from 2008 dramatically changed the creative economy; thus, putting both normal and abnormal periods together to interpret the average influence of the creative economy could produce misleading results. On the other hand, the continuous updating of the NUTS, ISCO and NACE codes in the EU LFS impedes us in merging yearly data in a consistent way after 2007. For example, from 2009 onwards, the European commission adopted NACE 2.1 standards rather than NACE 1/1.1 from previous years. Since 2011, the ISCO-88 occupation codes have been replaced by new ICSO-00 codes.

Finally, some of Florida's variables that are commensurate with the American exercise cannot be completely duplicated. One of the issues is that it is difficult to estimate gay/lesbian populations across different European countries from any of the existing datasets. Even if the share of non-native born workers over the total number of workers was used as the substitution, the concept of the "cool" community that Florida advocated could not accurately be measured in this study. Also, the estimation of input shares and ICT capital services at the regional level relies on assumptions. Such an attempt will undoubtedly result in biases, but in Europe regional accounts lack information in these aspects.

7.7 Promising ideas for further research

From the findings in this thesis, a number of promising ideas for further research can be introduced. Firstly, not all of Florida's proposals have been tested, such as the "job follows people" assumption or the social externality from the creative class on the services class or the other "undervalued" population. Is the high-tech population really important for local economy in any case? How can we define the so-called "undervalued class" and how can we measure the relationship between meritocratic urbanism and social inequality? Secondly, it would be interesting to look at the spillover effect of the creative class at the city level in Europe –investigating the impact of the creative economy in addition to the regional analysis would be another angle. For example, how could a big metropolis, which is favoured by Florida's proposition, leverage the economic growth of surrounding areas? Therefore, further research could be integrated with spatial econometric models. Finally, although the effect of the political institution in relation to the value of creative workers has already been examined, it is still not clear what the role of local government is in promoting the creative economy. Does a local government have enough autonomic power to implement specialised strategies in favour of its own creative economy? Or is the involvement of local authorities important at all? Answering these questions is still a difficult task based on available datasets in Europe.

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