Chapter 1

Understanding and Explaining Regional Growth

Introduction and key policy messages

An understanding of how regional development policy can best support regional growth stems from an understanding of regional economic performance. OECD regions are very heterogeneous; each possesses very different levels of income, rates of employment, mixes of high and low productivity activities, internal and external assets, comparative advantages, stages of development and public policies. This chapter attempts to quantify disparities in regional economic performance, and to analyse why and how regions grow differently.

Key Policy Messages

- Across all OECD countries, regions vary greatly in per capita income levels and growth rates; there are few signs that they are becoming more similar.
- Urban areas tend to have higher income levels than rural regions, but not necessarily higher growth rates; there is no consistent relationship between urban concentration and economic performance.
- Lagging regions contribute significantly to overall national growth. In most countries, they have generated more than 50% of national growth over the past decade.
- Growth is linked to the use of productive factors (labour, capital, technology). Faster growth in all types of regions depends on a combination of the increased use of labour with increased productivity.
- Higher productivity, in turn, depends on a range of factors, notably infrastructure, human capital and innovation performance.
- No single factor explains improved performance in a region. The positive impact of infrastructure investment on growth, for example, depends on educational levels and innovation performance.
- Simple concentration of investment and assets is not enough. The key appears to be how assets are used, how different stakeholders interact and how synergies are exploited in different types of regions. The market does not always appear to maximise this potential alone.

Persistent disparities suggest unused potential for growth in developed countries

Nations have different social, economic and trade policies; different educational and legal systems and institutions; and different economic histories. These result in different endowments of physical and human capital. It is therefore unsurprising that regions have different average levels of per capita income (whether measured as household income or GDP). Within an individual country, policies, institutions and history are essentially common to all. Hence, per capita incomes should be similar across the regions within that country. However, this is not the case. Furthermore, disparities typically persist for decades, even generations. It is clear that countries cannot rely on market forces to eliminate income differentials (*i.e.* firms moving to areas where labour is cheaper or more plentiful, or labour moving to areas where wages are higher). Income convergence is slow or non-existent. New theories of place-based economic growth imply that the growing populations and wealth of major urban areas are an unavoidable result of their economies of scale and not something that necessarily require corrective action. Thus, patterns of growth lie at the heart of the debate over what public policy, and more specifically regional policy, should be aiming to do, how to do it and where.

Table 1.1. **Ratios of per capita GDP by region, 2005**

Country	Ratio of highest to lowest	Ratio of second highest to lowest
Australia	1.57	1.52
Austria	2	1.52
Belgium	2.75	1.37
Canada	2.39	2.21
Czech Republic	2.69	1.18
Denmark	1.63	1.23
Finland	1.56	1.19
France	1.95	1.2
Germany	2.58	2.01
Greece	1.76	1.11
Hungary	2.57	1.56
Italy	2.04	2.04
Japan	1.71	1.71
Korea	1.28	1.24
Mexico*	6.24	4.49
Netherlands	1.31	1.15
Norway	1.87	1.26
Poland	2.32	1.57
Portugal	1.7	1.33
Slovak Republic	3.43	1.32
Spain	1.91	1.85
Sweden	1.66	1.13
UK	2.01	1.41
USA	5.17	2.46
National GDP, EU15	2.92	1.8
National GDP, EU27	4.27	2.63
National GDP, OECD	7.46	4.6

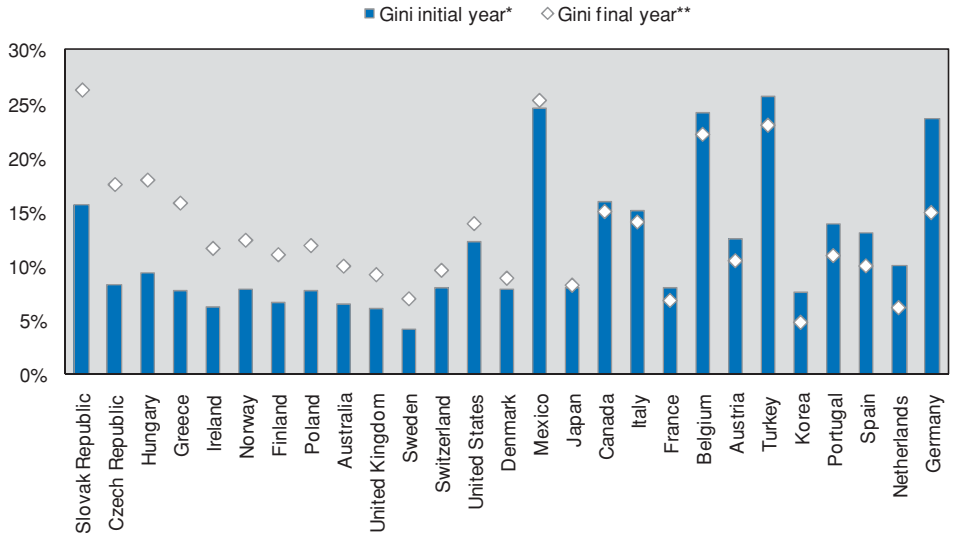
*2004 for Mexico

Source: OECD (2008), Regional Database.

OECD countries are characterised by substantial regional disparities. Per capita GDP in the top-ranked region of a country is at least double that of the lowest-ranked region, and sometimes far more than that (Table 1.1). In many countries, the region in which the capital city is located has by far the highest GDP per capita. The main exceptions in the EU are Germany, where the Hamburg region has a higher per capita GDP than the Berlin

region; and Italy, where the Milan region has a higher GDP per capita than Rome. Table 1.1 also shows that when the highest per capita GDP region is excluded, differentials are narrower, although they still remain large. In general, the lowest GDP regions in European countries fall behind the region with the second highest GDP by 20-60%, leaving considerable scope for catching up. Income differentials within most non-European countries (where regions generally cover larger geographical areas than the regions considered here) tend to be wider. Other measures, namely the Gini[1] coefficient (see Figure 1.1), the Atkinson[2] measure, and a general entropy[3] measure, give similar results.

Figure 1.1. **Regional disparities in per capita GDP within OECD countries**



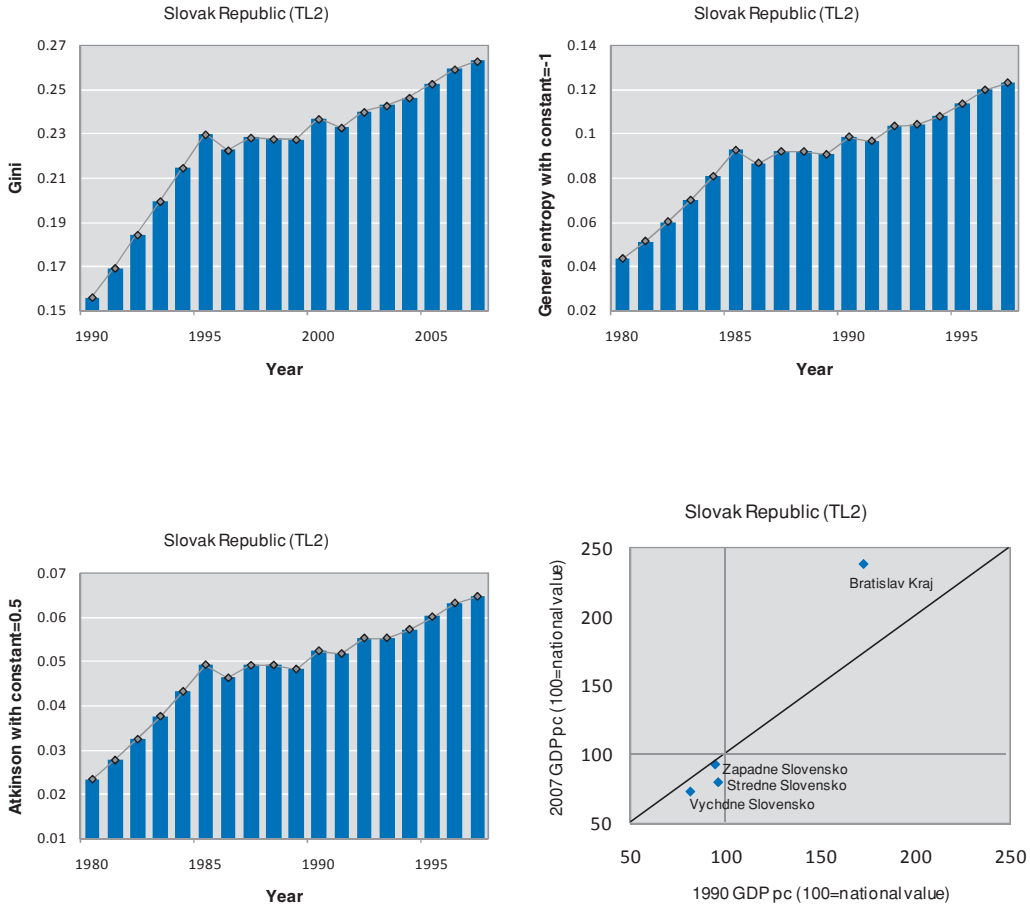
* The initial year is 1963 for the United States, 1980 for Austria, Belgium, Finland, France, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, the United Kingdom; 1981 for Australia; 1985 for Korea; 1990 for the Czech Republic, Hungary, Poland, the Slovak Republic, and Turkey; and 1991 for Germany.

**The final year is 2007 for all countries except for Korea and Norway (2005) and for Turkey (2001).

Source: Own calculations using the Cambridge Econometrics Database for European countries. For the remaining countries data are taken from: Australian Bureau of Statistics for Australia, Statistics Canada for Canada, Ministry for Internal Affairs and Communications for Japan, Korea National Statistical Office for Korea, National Statistical Office (INEGI) for Mexico, and US Bureau of Economic Analysis for the United States.

Disparities across countries in the OECD have evolved in very different ways. Many countries (typically new EU member states such as the Czech Republic, Hungary, Poland and the Slovak Republic; but also Ireland, the United Kingdom, Sweden, Greece, Switzerland and Norway) have seen territorial inequality increase (Figure 1.2 gives one example, and Chapter 4 shows trends in OECD countries). Other countries – such as Austria, Belgium, Germany, the Netherlands, Norway, France, Portugal, Turkey and Spain – have experienced convergence (Figure 1.3 gives one example, and Chapter 4 shows country trends). But there are also experiences of rising and falling inequality – such as Italy, Canada, the United States, Finland, Australia, Mexico, Korea and Japan (Figure 1.4 gives one example, and Chapter 4 shows country trends).

Figure 1.2. **Inequality indices and movements in regional GDP per capita in the Slovak Republic 1990-2007**

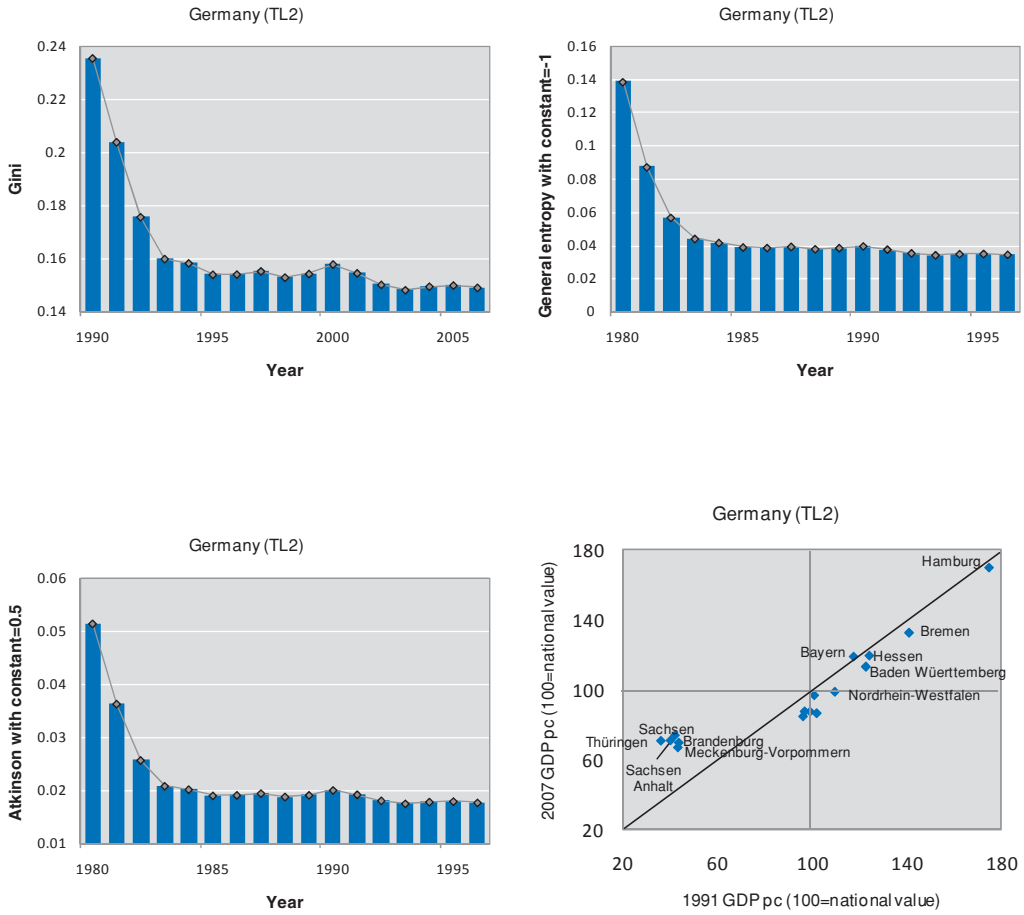


*Inequality indices: Gini, general entropy and Atkinson.

**Regional movements in GVA per capita as percentage of the national level.

Source: Own calculations using data from Cambridge Econometrics.

Figure 1.3. **Inequality indices and movements in regional GDP per capita in Germany 1991-2007**

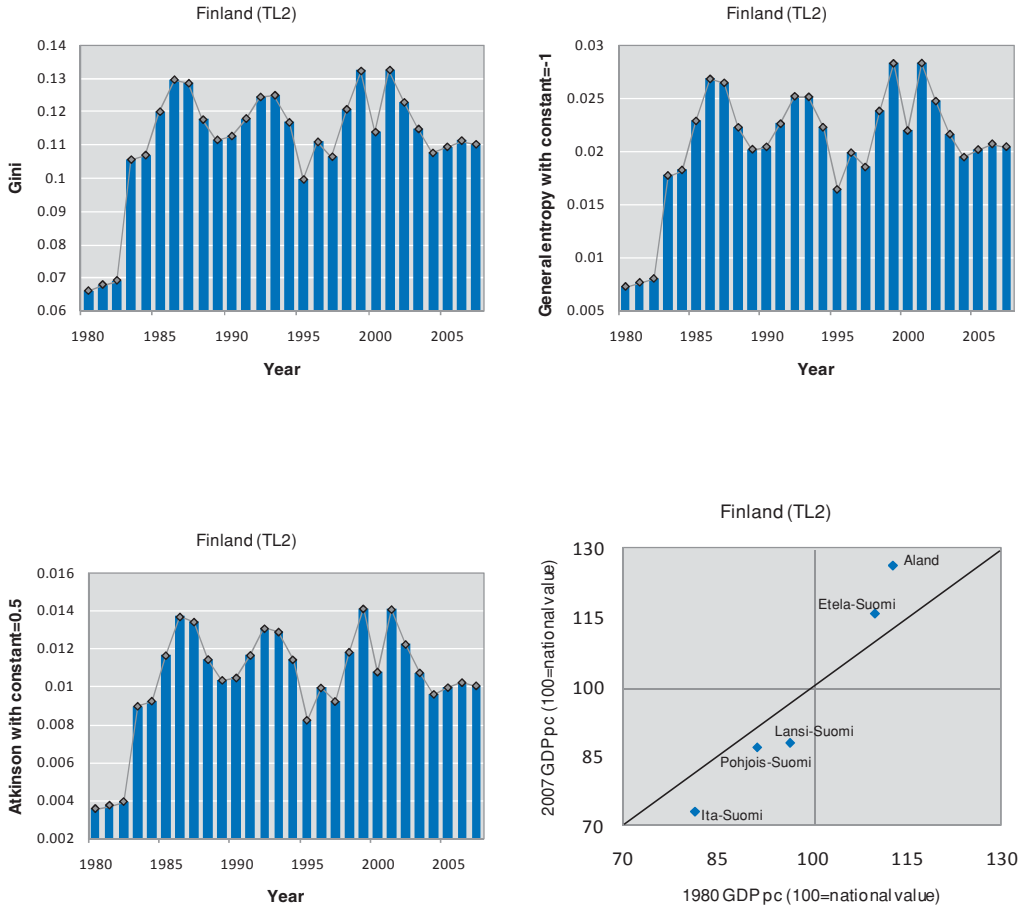


*Inequality indices: Gini, general entropy and Atkinson.

**Regional movements in GDP per capita as percentage of the national level.

Source: Own calculations using data from Cambridge Econometrics.

Figure 1.4. **Inequality indices and movements in regional GDP per capita in Finland 1980-2007**



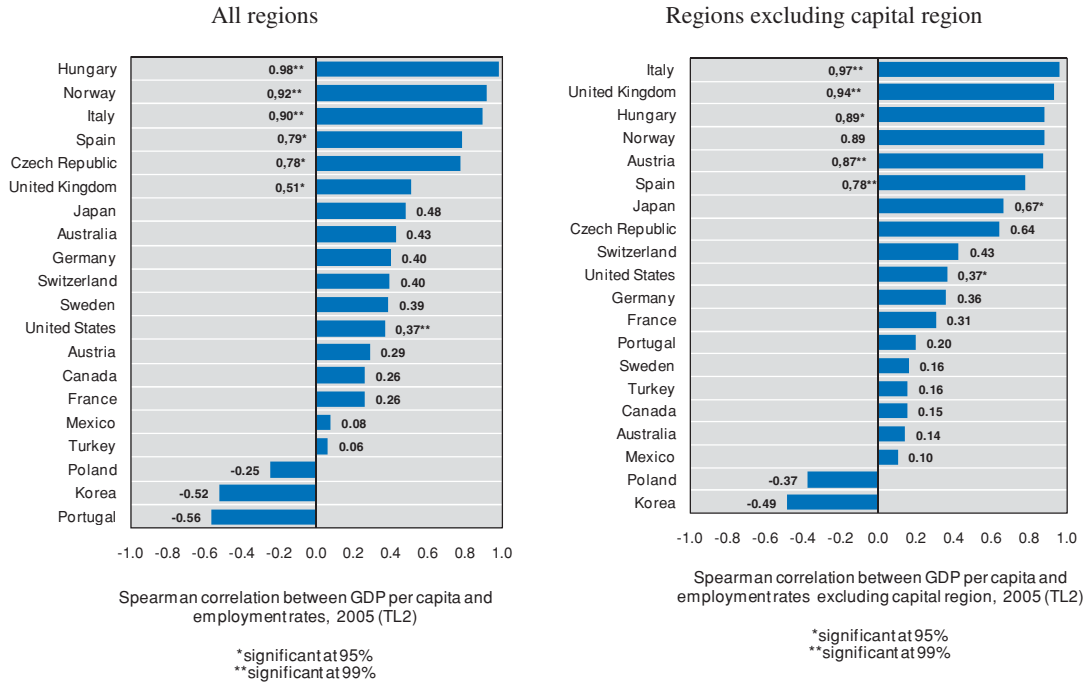
*Inequality Indices: Gini, General Entropy and Atkinson

**Regional movements in GVA per capita as percentage of the national level<

Source: Own calculations using data from Cambridge Econometrics.

Regions with higher employment and participation rates tend to enjoy higher per capita GDP, while those with low employment rates are behind in terms of per capita GDP (Figures 1.5 and 1.6). An estimated coefficient[4] suggests that regions with an employment rate one percentage point higher than the national average enjoy approximately one third of a percentage point higher per capita incomes than the national level. This implies that per capita regional GDP in most countries is in direct proportion to the numbers of people in employment in those regions.

Figure 1.5. **Spearman correlation between regional GDP per capita and regional employment rates 2005 (TL2)**



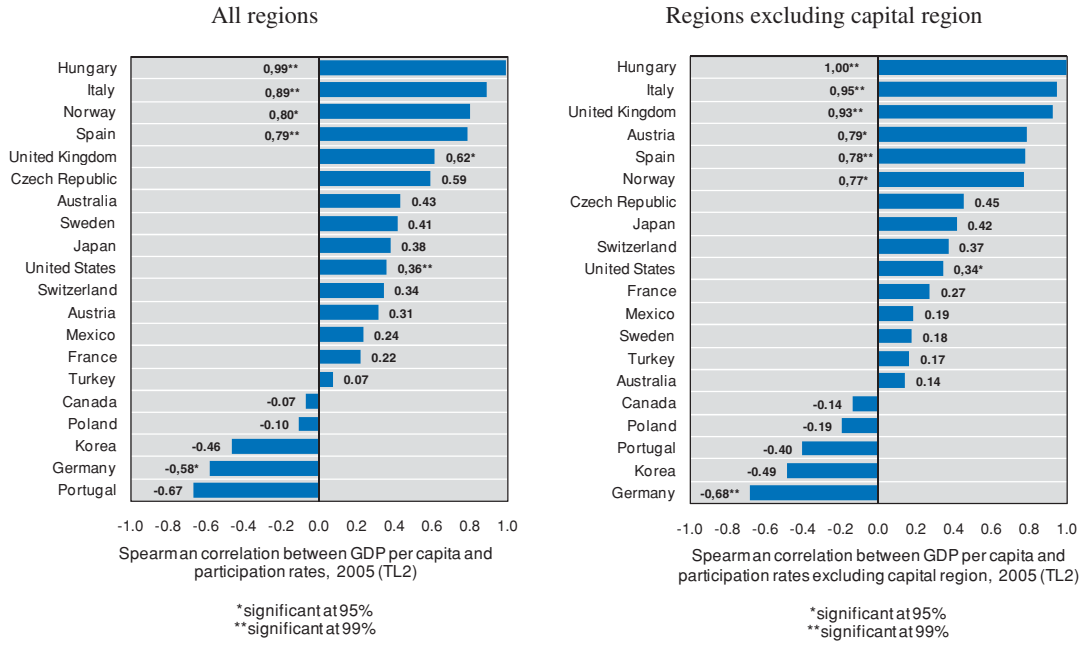
*/ Significant at the 95% confidence level; **/ Significant at the 99% confidence level.

Note: The capital TL2 regions are Australian Capital Territory (AU8) for Australia; Wien (AT13) for Austria; Brussels (BE1); Ontario (CA35) for Canada; Praha (CZ01) for the Czech Republic; Hovedstadsregionen (DK01) for Denmark; Etela-Suomi (FI18) for Finland; Ile de France (FR10) for France; Berlin (DE3) for Germany; Attiki (GR3) for Greece; Kosep-Magyarorszag (HU10) for Hungary; Lazio (IT4) for Italy, Kanto (JPC) for Japan; Capital Region (KR01) for Korea; Distrito Federal (ME09) for Mexico; Zuid-Netherland (NL04) for the Netherlands; Oslo (NO01) for Norway; Mazowieckie (PL12) for Poland; Lisboa (PT17) for Portugal; Bratislav Kraj (SK01) for the Slovak Republic; Madrid (ES30) for Spain; Stockholm (SE01) for Sweden; Espace Mettelland (CH02) for Switzerland; Ankara (TR51) for Turkey; London (UKI) for the United Kingdom; and District of Columbia (US09) for the United States.

Source: Own calculations using the OECD Regional Database (2008).

Similarly, higher unemployment rates are associated with lower per capita regional GDP (Figure 1.7). Korea, Poland and Mexico are the only countries for which the relationship is the opposite to what would normally be expected, and it is insignificant for Australia, Austria, the Czech Republic, France, Sweden, Switzerland, Turkey and the United States. In general, however, the higher the unemployment rate, the lower the GDP per capita. The policy implication is that outside the capital city regions and in the majority of countries, labour is generally underused. These regions are therefore operating below their potential, with a direct impact on productivity and income.

Figure 1.6. **Spearman correlation between regional GDP per capita and regional participation rates 2005 (TL2)**



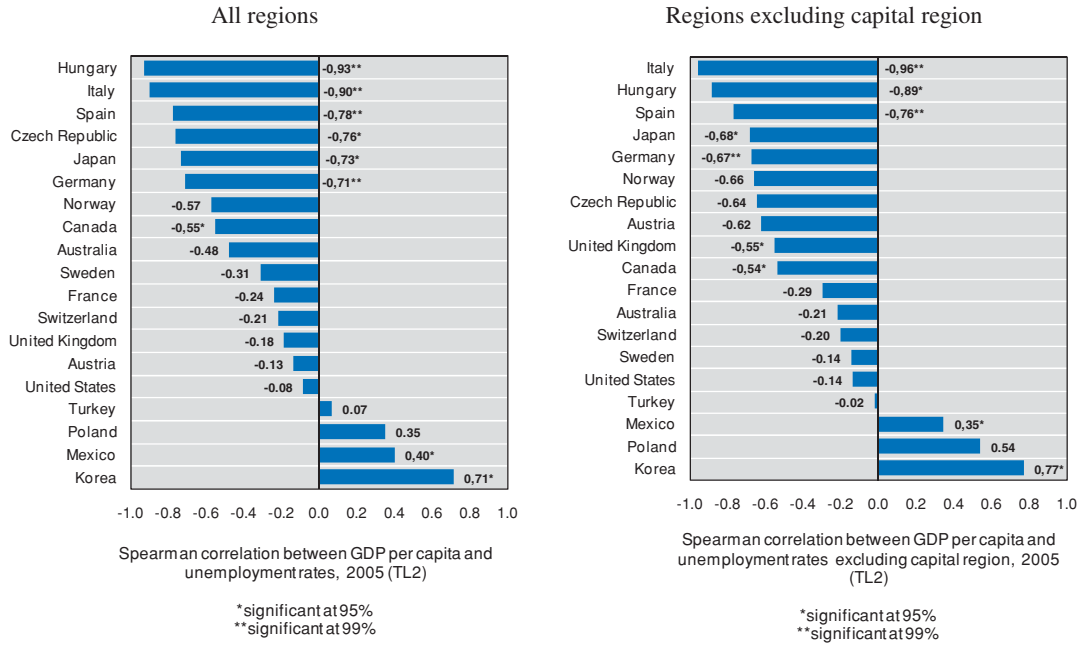
*/ Significant at the 95% confidence level; **/ Significant at the 99% confidence level

Note: See note for Figure 1.5.

Source: Own calculations using the OECD Regional Database (2008).

If participation rates in low GDP per capita regions could be brought up to those of the best-placed region, and if unemployment rates could be reduced towards national averages, per capita GDP in lagging regions would potentially rise, thereby reducing regional imbalances in GDP per capita (though rural-urban differentials might persist where they stem from factors other than labour market conditions, such as geographical remoteness). In most places, lagging regions have relatively fewer people in the active age group in their labour forces, and because more of them are unemployed. Furthermore, spatial patterns of unemployment tend to persist over prolonged periods of time, especially in Europe, suggesting that employment problems in particular regions do not reflect temporary or cyclical factors, but are structural in nature. Between 1993 and 2003, the relative position of 80% of high unemployment regions in Europe remained unchanged. The equivalent figure is about 65% in North America and less than 50% in the Asia/Pacific region (OECD, 2005). In that respect, and excluding most of the highest income regions, it seems that regional disparities reflect different labour market outcomes.

Figure 1.7. **Spearman correlation between regional GDP per capita and regional unemployment rates 2005 (TL2)**



*/ Significant at the 95% confidence level; **/ Significant at the 99% confidence level.

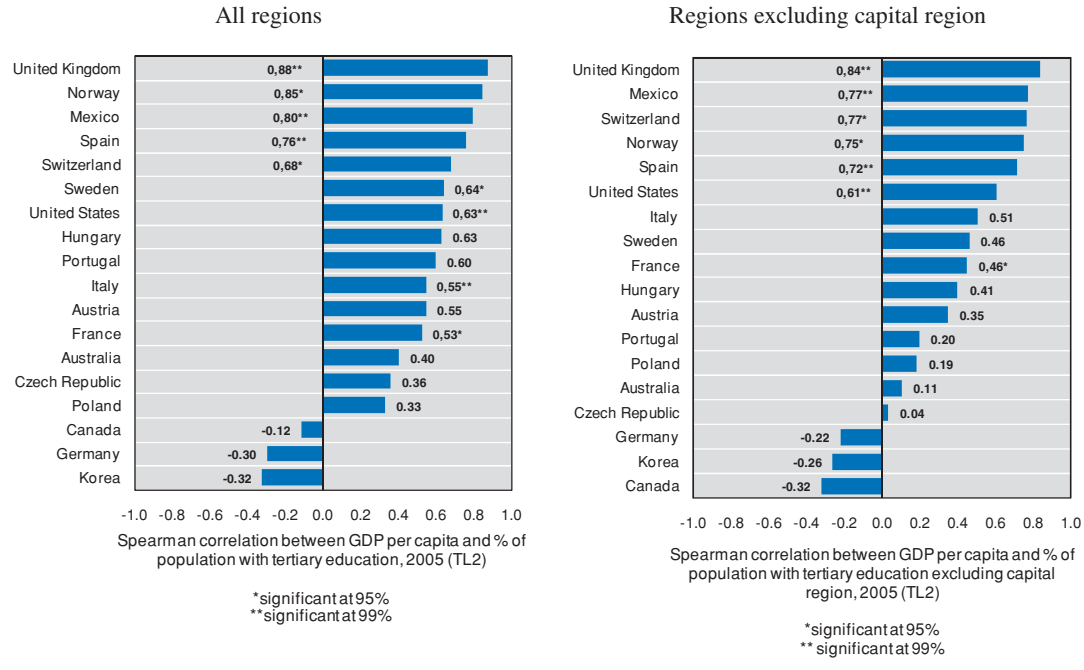
Note: See note for Figure 1.5.

Source: Own calculations using the OECD Regional Database (2008).

Two important supply factors influencing regional labour markets are educational attainment and production specialisation patterns. For example regional production specialisation patterns are estimated to account for 30% of the average employment differentials between regions in Italy, almost 50% in Germany and 40% in Spain. A number of empirical studies find links between educational attainment and regional unemployment rates (Overman and Puga (2002) and Elhorst (2003) for a survey). Regions where unskilled labour is relatively abundant are likely to be negatively affected by skill-biased technological change and competition from newly emerging countries.

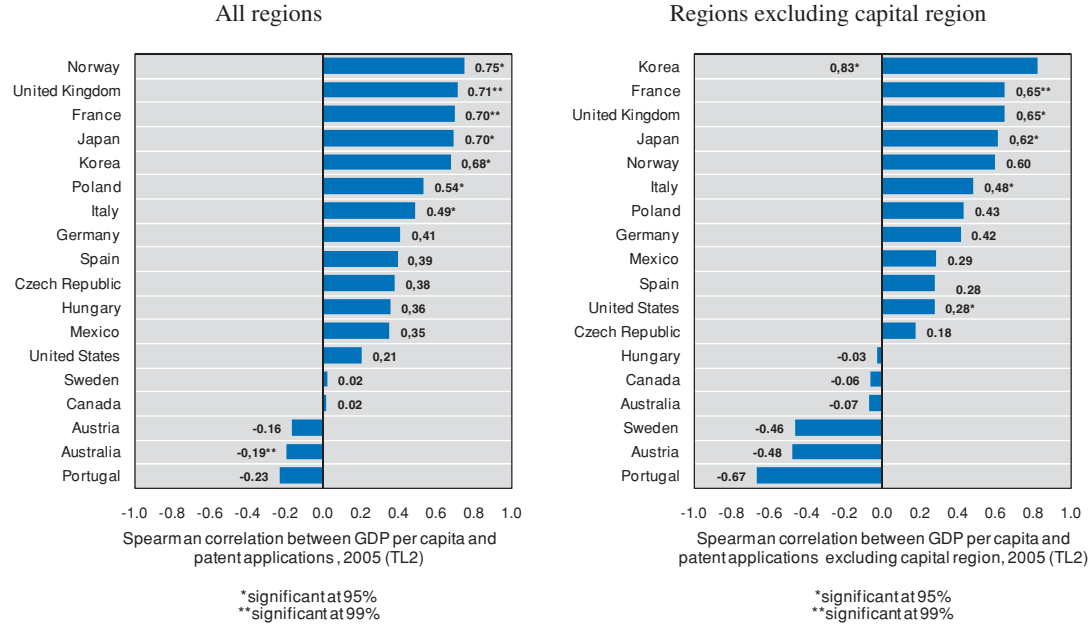
Educational attainment levels and the capacity of regions to innovate are also associated with GDP per capita levels. Regions with higher GDP per capita enjoy higher levels of tertiary education (Figure 1.8). Except in Canada, Germany and Korea, the relationship between GDP per capita and tertiary education is positive in 15 OECD countries. In several of them (France, Italy, Norway, Spain and the United States), the relationship is statistically significant. The capacity of regions to create innovation, measured through patent application, is also positively associated with GDP per capita (Figure 1.9). Nevertheless this positive relationship is not present in Australia, Austria, Canada, Hungary, Portugal and Sweden when the capital city is excluded. The direction of causality in this analysis is not clear. Additional analysis in this chapter estimates the impact of human capital and patent application on GDP per capita growth.

Figure1.8. **Spearman correlation between regional GDP per capita and percent of regional population with tertiary education, 2005 (TL2)**



*/ Significant at the 95% confidence level; **/ Significant at the 99% confidence level.
Note: See note for Figure 1.5.
Source: Own calculations using the OECD Regional Database (2008).

Figure 1.9. **Spearman correlation between regional GDP per capita and regional patent applications 2005 (TL2)**



*/ Significant at the 95% confidence level; **/ Significant at the 99% confidence level
Note: See note for Figure 1.5.
Source: Own calculations using the OECD Regional Database (2008).

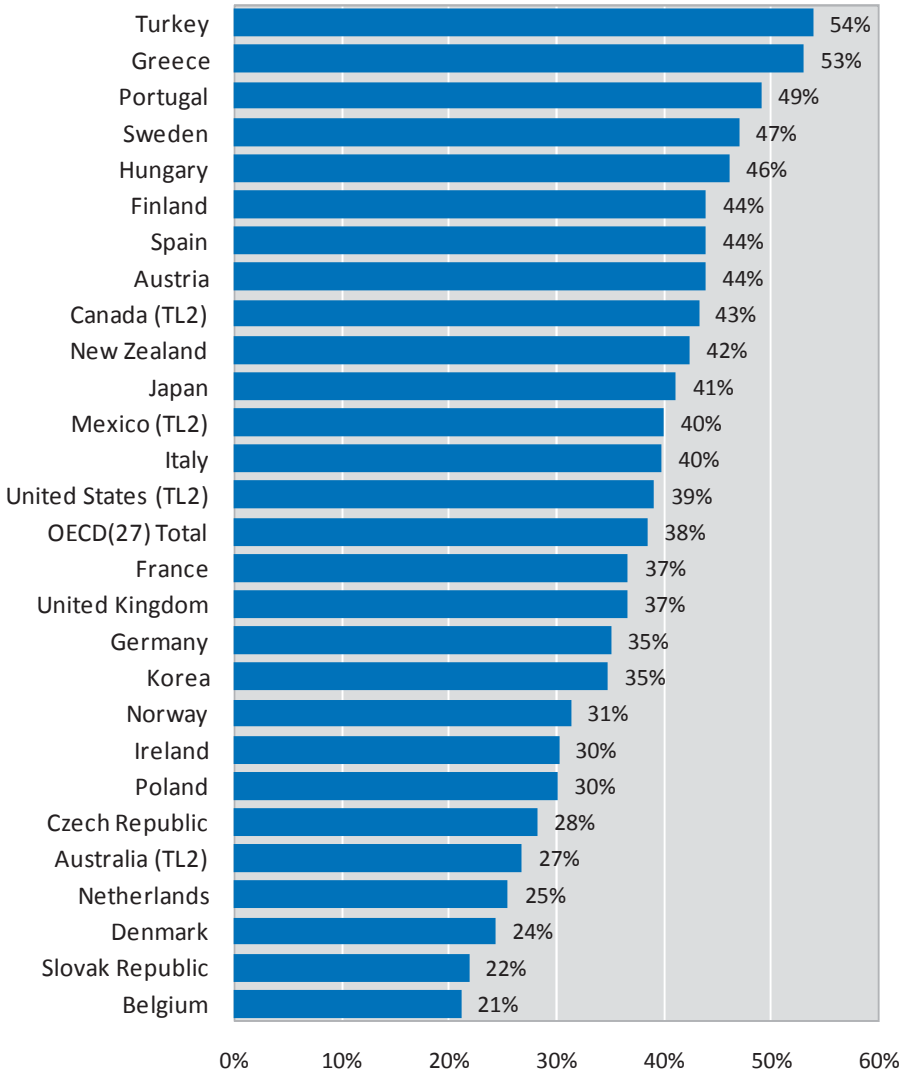
In principle, labour mobility could help reduce regional employment and unemployment imbalances, but in practice there are transaction costs to labour mobility (as discussed in Chapter 2). This is confirmed by the fact that differences in regional unemployment and employment rates persist over prolonged periods of time. Although consideration should be given to policies, such as housing, which hinder geographic labour mobility, migration will not be the ultimate cure for regional imbalances. Even where there are no legal barriers to internal migration, income differentials have persisted for many generations in some countries, suggesting that the response to wage differentials and job opportunities can be very sluggish. Migration can be detrimental to lagging regions, as the propensity to migrate is much higher among the highly skilled, depriving the region of their skills and leaving the low-skilled more dependent on local employment opportunities. Alternative strategies to make lagging regions more competitive can include attracting private capital, improving their accessibility and connectivity to other regions, and promoting endogenous growth by identifying untapped potential sources of growth.

Concentration drives growth, but private benefits can bring societal costs

The inequalities described above are an outcome of several processes, of which the most significant is concentration of economic activity. In approximately half of OECD countries more than 40% of the national GDP is produced in less than 10% of all regions (Figure 1.10). These account for a small share of the country's surface and a high share of its population. The geographic concentration of economic activity occurs mainly because of the benefits associated with "economies of agglomeration". People want to live where firms, and therefore job opportunities, are concentrated. For their part, firms want to locate where demand, and therefore population, is large, where they know will have a deep labour market to draw from, and where suppliers and buyers in their industry are located. New economic geography theories explain why and how agglomerations become increasingly attractive (Box 1.1). These factors have resulted in strong concentrations of certain activities in specific locations – sectoral specialisations and clustering. They have also led to the concentration of innovation, with patenting activity being, in general, even more strongly concentrated than output (OECD, 2009a).

Concentration in output is closely related to urbanisation processes. For the first time in history, the population of cities is exceeding that of the countryside, and the largest cities in the world are no longer located in the richest countries. Even in developing countries, where agriculture remains the dominant economic activity, people flock to the biggest cities despite their low standards of housing and sanitation, and often high levels of poverty and crime. Since they do this of their own free will, it must be assumed that they believe that they will be better off in the city than in the rural areas. In rich countries, moving to the largest cities involves higher prices for accommodation, possibly longer and more tedious commutes, and possible difficulties in finding and keeping the high-paid jobs that attract migrants in the first place. Nevertheless, these are costs that are willingly paid by the increasing numbers of people who can afford to do so. In 2005, one-third of the OECD population lived in large urban regions, *i.e.* TL3 regions with populations exceeding 1.5 million inhabitants (Figure 1.11).

Figure 1.10. **Share of national GDP contributed by the wealthiest 10% of TL3 regions, 2005**



Note: Where TL3 data are unavailable, TL2 data is used instead.

Source: OECD (2009) *Regions at a Glance,* OECD Publishing, Paris.

Box 1.1. New economic geography theories

New economic geography (NEG) theories analyse the circular or cumulative causation that drives increasing concentration. They explain why consumers and firms tend to agglomerate together in specific geographic areas, a phenomenon already noted and analysed by Alfred Marshall in 1890. Studies of this kind include Perroux's notion of "growth poles" (1955), Myrdal's analysis of "circular and cumulative causation" (1957), and Hirschman's concept of "forward and backward linkage"' (1958). The NEG formalises these cumulative causation mechanisms into a mathematical analytical framework (Krugman, 1991). Agglomeration economies occur when a firm enjoys increasing returns to scale in a particular place, either because of the presence of natural advantages (*i.e.* natural resources, location etc.), monopolistic protection, political reasons (*e.g.* the decision to create a capital city) or any other reason. The presence of increasing returns to scale induces other firms to locate there, as well as people in search of higher wages, job opportunities and culture.

There are a number of inter-connected mechanisms that work to produce agglomeration economies:

- Sharing of indivisible facilities such as local public goods or facilities, particular to a place, that serve several individuals or firms. Some examples are laboratories, universities and other large facilities that cannot belong to one particular agent but where some exclusion is implicit in their provision.

- Gains from the wider variety of input suppliers that can be sustained by a larger final-goods industry, that is, the presence of spillovers along with forward and backward linkages allows firms to purchase intermediate inputs at lower cost.

- Gains from the narrower specialisation that can be sustained with higher production levels. Several firms specialise in producing complementary products, reducing overall production costs.

- Risk reduction: if there are market shocks, firms can adjust to changes in demand as they have access to a deep and broad labour market that allows them to expand or contract their demand for labour.

- Matching mechanisms by which agglomeration improves the expected quality of matches between firms and workers, so both are better able to find a better match for their needs. Similarly, an increase in the number of agents in the labour market improves the probability of matching.

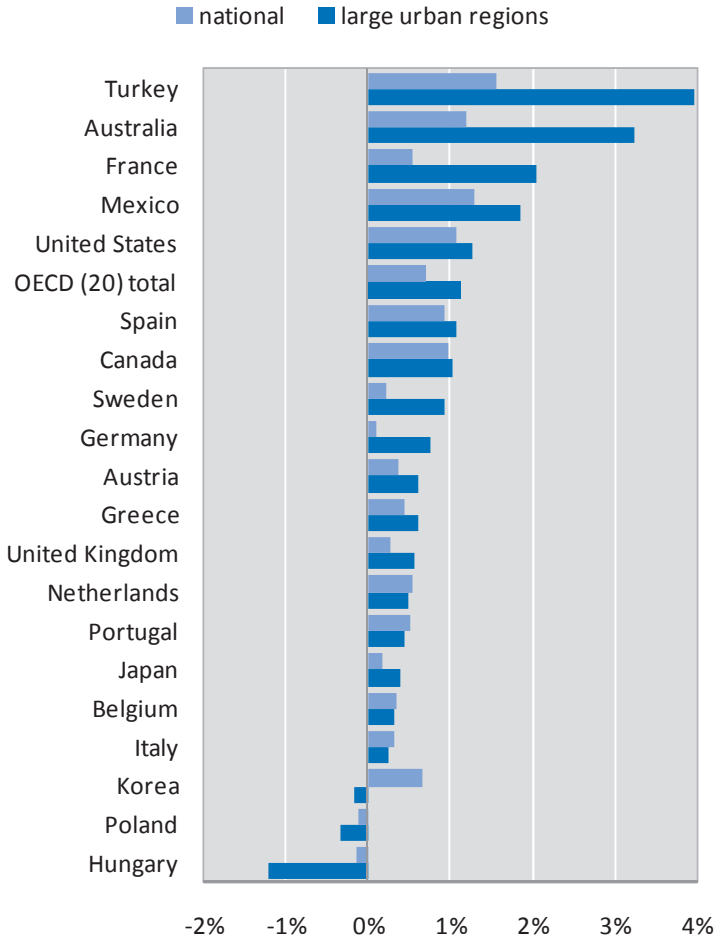
- Learning mechanisms based on the generation, diffusion, and accumulation of knowledge; these refer not only to learning about technologies, but also how to acquire the skills.

Source: OECD and various sources including Krugman, P. (1991), "Increasing Returns and Economic Geography", The Journal of Political Economy, Vol. 99, No.3, pp. 483-99.

However, the benefits associated with economies of agglomeration are not unlimited; cities can reach a point where they no longer provide increasing returns and become less competitive. New economic geography theory predicts that further concentration is not always the most desirable outcome; external economies of scale are overtaken by the external diseconomies of congestion. Encouraging even more concentration under these conditions will not yield higher per capita GDP growth rates. Comparing levels of GDP

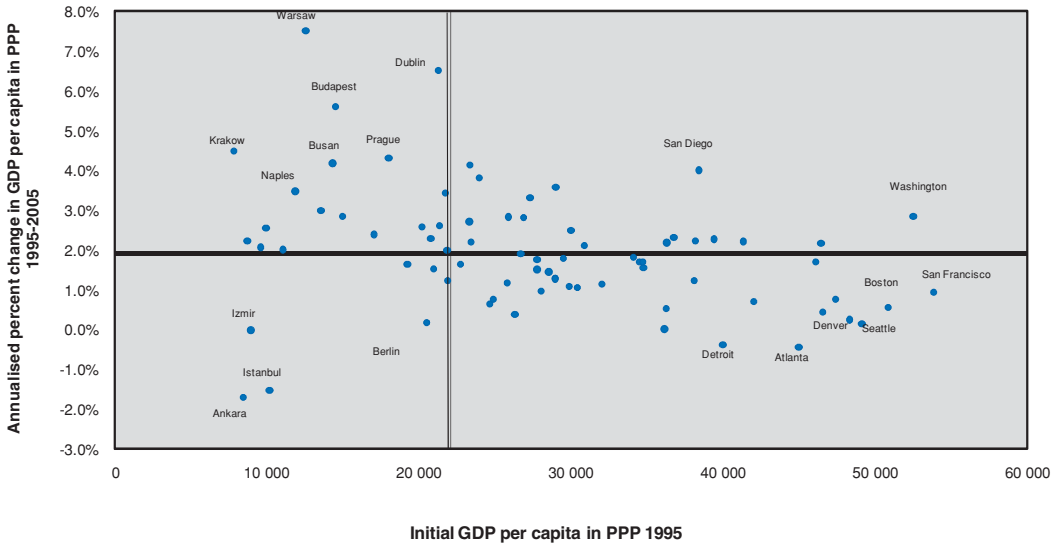
and growth rates of urban areas with more than 1.5 million inhabitants with national and OECD averages over five year and ten year periods reveals that although metro-regions usually have higher than average per capita GDP, in most cases they have not experienced higher than average national growth rates. Figure 1.12 displays the growth rates and initial levels of GDP per capita in 78 metro-regions, benchmarked to the OECD's average annual growth rate over the last decade and its initial level of GDP per capita. Out of the sample of 78 metro-regions, only 49% grew on average faster than the OECD average national annual growth rate, and only 45% grew faster than their national averages.

Figure 1.11. **Annual percentage change in national populations and in populations living in large urban TL3 regions, 1995 to 2005**



Source: OECD (2009) *Regions at a Glance*, OECD Publishing, Paris.

Figure 1.12. **Initial GDP per capita and annual average growth rates in GDP per capita among 78 metro-regions, 1995 and 2005**



Note: Coverage: due to data limitations, the time period is shorter in several metro-regions: Canada (one year of data: 2003-2004), New Zealand (three years: 2000-2003), the United States (three years: 2001-2004), Turkey (six years 1995-2001), Mexico (nine years: 1995-2004) and in the rest it is 1995-2005. GDP expresseded in terms of purchasing power parity (PPP).

Source: Own calculations based on a sample of urban areas where labour markets are self-contained and population was above 1.5 million people.

The negative externalities of large concentrations in urban areas raise the question of whether the costs borne by society as a whole are becoming unsustainable. The externalities include high transportation costs (*e.g.* congested streets), loss of productivity from long commuting times, higher health costs and the impact on global warming. As externalities, they are not internalised by firms and households, and may only show up as a direct cost in the long term. The manifestation of these different types of costs varies among cities but OECD analysis has highlighted a negative correlation between city size and GDP per capita above a threshold of 6-7 million inhabitants (OECD, 2006). One hypothesis for this is that the relationship between dynamism and city size probably follows an inverted U-curve, due to increasing negative externalities (OECD, 2006). This has led to debate as to whether increasing concentration leads to the "privatisation of benefits and socialisation of costs".

Public intervention could help augment economies of agglomeration and prevent or delay their decline. As labour markets display asymmetry of information between those searching for a job and those hiring, public employment offices and other types of institutional support may help improve the functioning of local labour markets. As well as a freer flow of information, linkages among firms require a good transportation system that allows products to be exchanged cheaply. Knowledge will only "spill over" across a region if there are appropriate mechanisms (networks, physical spaces, etc.) for people to exchange ideas on a daily basis. Such spaces are unlikely to be provided solely by the private sector. As concentration is not the only condition for agglomeration economies, it

is not surprising that very large urban areas such as Mexico City, Istanbul or Seoul, but also more advanced cities like Milan, are unable to fully exploit the benefits of concentration.

Growth in "unexpected" places makes a big contribution to national prosperity

There is a tendency to assume that growth is led by the core, high GDP regions and that these regions generate the lion's share of new wealth. Yet, in more than half of OECD countries, the region with the highest GDP per capita contributed less than 25% to national growth between 1995 and 2005 (Table 1.2). The contribution of lagging regions (defined by those regions with a GDP per capita below the national average) was significantly higher than the contribution of the regions with the highest GDP in 85% of OECD countries, and it was higher than the contribution of above-average regions in almost half the countries (Table 1.2). In the Slovak Republic, the Czech Republic and Australia, lagging regions contributed more than 60% of the overall national growth during that decade (Figure 1.13).

If it is accepted that the objective of regional development policy is to help each region maximise its comparative advantage then it is possible to have growth in diverse regions that does not lead to convergence in economic output across all regions. The specific mix of industries and labour skills differs between rural and urban regions; thus the returns to labour and the level of GDP per capita can vary considerably across regions. Analysis shows that within OECD countries some rural regions have higher rates of growth than urban regions. These regions have found ways to exploit their resource endowment and economic opportunities in an efficient manner. High rates of growth may be associated with specific fixed resources such as a scenic environment or highly productive arable land that is not found elsewhere. Rural regions adjacent to urban regions are also often able to take advantage of their proximity. A number of industries, such as warehousing and large scale manufacturing, often favour centrally located rural regions since they offer low cost land, proximity to a large pool of labour and relatively high accessibility. The foreign-owned automobile manufacturers in the United States generally choose locations outside medium-sized urban centres for assembly plant locations since they offer the best combination of access to transport infrastructure, large parcels of land and an adequate labour pool.

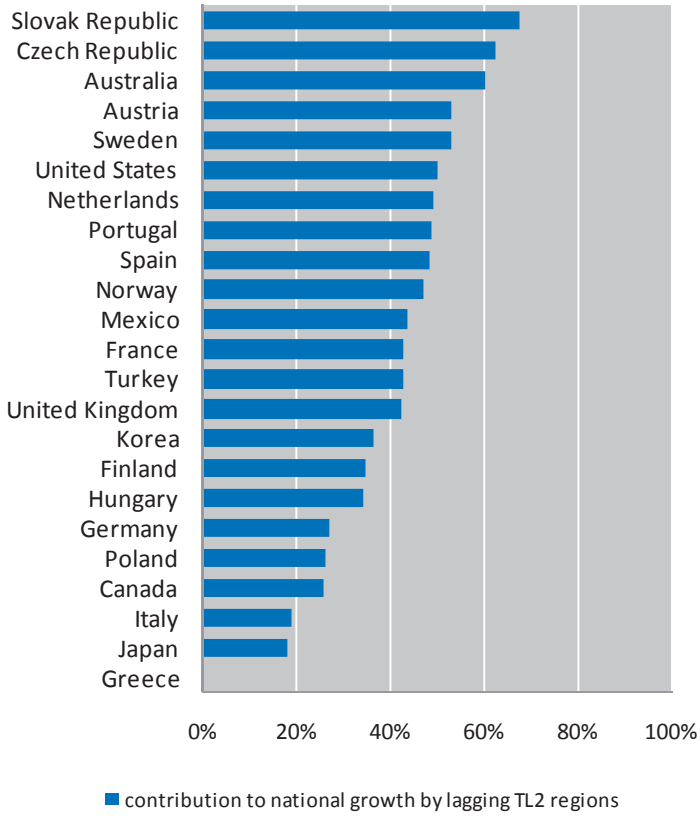
The implications are that bringing about convergence is less important than improving the performance of all regions. Indeed, looking at patterns of growth, it is sometimes difficult to find evidence that convergence is uniformly associated with improved national economic performance. Although convergence and divergence are rarely smooth processes, it is possible to class countries into those where, on average, regional disparities have narrowed over time: Austria, Belgium, France, Germany, Italy, Korea, Netherlands, Norway, Portugal, Spain, Turkey; those where differentials have widened: Australia, Czech Republic, Finland, Greece, Hungary, Ireland, Poland, Slovak Republic, Switzerland, Sweden, Mexico the United Kingdom, the United States; and those where little overall change is evident: Canada, Denmark, Japan (see Table 1.3 and country notes in Chapter 4. It is interesting, too, that with some exceptions, countries with diverging regional income disparities tend to have faster real national GDP growth rates (Table 1.3). This finding is taken up below in the discussion of regional GDP *growth* differentials and policy responses.

Table 1.2. **Annual average contribution to national GDP and share of GDP of (i) the richest region; (ii) lagging regions; and (iii) regions above the national average in GDP per capita, 1995-2005**

		contribution to national growth					share of contribuiton to national growth and GDP share							
	# of TL2 regions	national GDP growth	richest region	regions below av	regions below 75%	regions above av.	richest region contrib.	richest region GDP share	regions below av. contrib.	regions below av. GDP share	regions below 75% contrib.	regions below 75% GDP share	regions above av. contrib.	regions above av. GDP share
Australia	8	4.1%	0.1%	2.5%	0.0%	1.6%	2%	2%	60%	60%	0%	0%	40%	40%
Austria	9	1.4%	0.3%	0.7%	0.0%	0.7%	24%	28%	53%	52%	3%	2%	47%	48%
Canada	12	3.8%	0.0%	1.0%	0.1%	2.9%	1%	0%	26%	35%	2%	2%	74%	65%
Czech Republic	8	2.9%	1.1%	1.8%	0.0%	1.1%	38%	20%	62%	80%	0%	0%	38%	20%
Finland	5	3.2%	0.0%	1.1%	0.0%	2.1%	1%	1%	35%	45%	0%	0%	65%	55%
France	22	2.3%	0.7%	1.0%	0.0%	1.3%	30%	28%	43%	43%	0%	0%	57%	57%
Germany	16	1.4%	0.1%	0.4%	0.2%	1.0%	5%	4%	27%	29%	14%	11%	73%	71%
Greece	4	1.6%	1.9%	-0.3%	0.0%	1.9%	116%	38%	-16%	62%	0%	0%	116%	38%
Hungary	7	5.0%	2.8%	1.7%	0.0%	3.3%	56%	41%	34%	49%	0%	0%	66%	51%
Italy	21	0.8%	0.0%	0.2%	0.1%	0.7%	0%	1%	19%	25%	16%	20%	81%	75%
Japan	10	1.4%	0.7%	0.3%	0.0%	1.2%	52%	41%	18%	23%	1%	1%	82%	77%
Korea	7	5.1%	0.9%	1.9%	0.0%	3.3%	17%	17%	36%	35%	0%	0%	64%	65%
Mexico	32	4.1%	0.8%	1.8%	0.9%	2.3%	19%	23%	44%	48%	23%	25%	56%	52%
Netherlands	4	1.7%	0.9%	0.9%	0.0%	0.9%	51%	51%	49%	49%	0%	0%	51%	51%
Norway	7	3.4%	1.3%	1.6%	0.0%	1.8%	39%	30%	47%	56%	0%	0%	53%	44%
Poland	16	5.2%	1.6%	1.3%	0.0%	3.8%	30%	17%	26%	30%	0%	0%	74%	70%
Portugal	7	2.2%	0.9%	1.1%	0.0%	1.1%	40%	36%	49%	58%	0%	0%	51%	42%
Slovak Republic	4	5.1%	1.7%	3.4%	1.8%	1.7%	33%	25%	67%	75%	36%	42%	33%	25%
Spain	19	3.8%	0.8%	1.8%	0.1%	2.0%	20%	17%	48%	50%	1%	2%	52%	50%
Sweden	8	3.4%	1.4%	1.8%	0.0%	1.6%	42%	25%	53%	67%	0%	0%	47%	33%
Turkey	26	2.0%	0.2%	0.9%	0.4%	1.2%	12%	7%	43%	31%	21%	13%	57%	69%
United Kingdom	12	3.2%	0.8%	1.4%	0.0%	1.9%	25%	17%	42%	51%	0%	0%	58%	49%
United States	51	3.3%	0.0%	1.7%	0.1%	1.7%	1%	1%	50%	49%	2%	2%	50%	51%

Regions below the average are those regions with an initial (1995) GDP per capita below the national average, and *vice versa*.
The GDP share is computed for the initial year 1995. Countries with fewer than four TL2 regions (Denmark, Iceland, Ireland and Luxembourg) are not included.
The contribution to national growth of each region depends on the growth rate of each region and their overall size (*i.e.* share of GDP).
Chapter 4 maps the contribution of TL2 regions to national growth for OECD countries.
Source: Own calculations using data from OECD (2008) Regional Database.

Figure 1.13. **Contribution to national growth by TL2 regions with a GDP per capita below the national average, 1995-2005**



The contribution to national growth of each region depends on the growth rate of each region and its overall size (*i.e.* share of GDP).

Source: Own calculations using data from OECD (2008) Regional Database.

Even though economic activity tends to concentrate in specific areas, especially in large cities, labour productivity and GDP per capita growth rates are not necessarily higher in areas of concentration. In fact, they tend to be more evenly spread-out across the territory, especially growth rates. For instance, in Spain the regions with the highest density of output – Madrid, Barcelona and Vizcaya – are also generally the most productive regions. However, they are not the most dynamic Spanish regions in terms of GDP per capita growth (with the exception of Vizcaya). There are higher pockets of growth in the southern regions of Badajoz, Almeria, Cadiz, Huelva and Malaga (Figure 1.14).

Table 1.3. **National growth rates in converging and diverging countries**

Converging			Diverging		
	Time period	Av. yr. growth		Time period	Av. yr. growth
Norway	1980-2005	2.9%	United States*	1970-2007**	3.1%
Spain	1980-2007	3.0%	Norway	1980-2005	2.9%
Portgual	1980-2007	2.6%	Greece	1980-2007	2.2%
Italy	1980-2007	1.8%	Ireland	1980-2007	5.4%
Austria	1980-2007	2.3%	Finland*	1980-2007	2.7%
France	1980-2007	2.1%	United Kingdom	1980-2007	2.6%
Netherlands	1980-2007	2.5%	Switzerland	1980-2007	1.7%
Belgium	1980-2007	2.1%	Sweden	1980-2007	2.3%
Korea	1985-2005	6.6%	Australia*	1981-2007	3.3%
Turkey	1990-2001	2.8%	Slovak Republic	1992-2007**	4.9%
Germany	1991-2007	1.5%	Hungary	1991-2007**	2.9%
			Czech Republic	1990-2007	2.0%
			Poland	1990-2007	3.9%
			Mexico*	1993-2005	2.8%
min		**1.5%**	**min**		**1.7%**
max		**6.6%**	**max**		**5.4%**
median		**2.5%**	**median**		**2.9%**
average		**2.7%**	**average**		**3.1%**

Note: GDP expressed at constant 2000 prices.

*Inequality over the entire period increased in the four countries. In Finland and in Mexico inequality increased at the beginning of the period and there was no visible trend afterwards. In Australia inequality increased at the end of the period; in the United States it both increased and declined.

** National data available in OECD.Stat cover a shorter period than data used at regional level.

Source: OECD.Stat and own calculations using data from Cambridge Econometrics.

Similarly, in Poland the territories with the highest density of output – Warszawa, Poznan, Krakow, Lodz and Wroclaw – also display the highest levels of productivity in the country, but not necessary the highest growth rates (Figure 1.15).

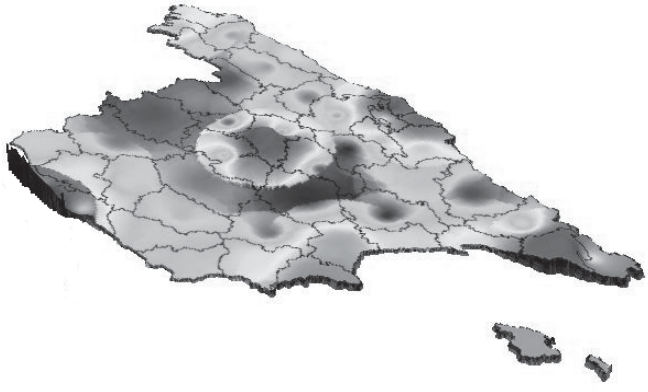
In Germany, Mexico and Korea, the territories with the highest economic density do not necessarily have the highest level of productivity. For example, in Germany output is mostly concentrated in the city-regions of Hamburg, Berlin, Bremen Dusseldorf, Dortmund, Cologne and Stuttgart. While Hamburg, Bremen and Stuttgart are amongst the highest productivity regions in Germany, Cologne, Dortmund and Berlin are not. Furthermore, in terms of GDP per capita growth none of the city-regions is amongst the top 20 German performing regions (Figure 1.16).

In Mexico, Distrito Federal and its outskirts concentrate the highest density of output, while the most productive regions are both northern (Nuevo Leon, Campeche, and Chihuahua) and southern (Quintana Roo and Coahuila). Furthermore, in terms of GDP per capita growth, Distrito Federal and its outskirts are amongst the lowest performing Mexican regions, while pockets of growth seem to occur across the entire Mexican territory, and especially in the south and north (Figure 1.17).

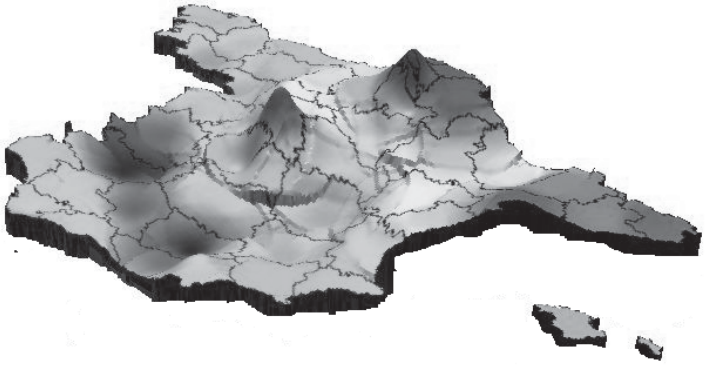
In Korea, the economy is concentrated mostly in Seoul and its surrounding region Incheon, whilst the southern region of Ulsan has the highest productivity, along with the predominantly rural regions Chungcheongnam-do, Jeollanam-do and Gyeonsangbuk-do. These latter three regions are amongst the highest performing Korean regions in terms of GDP per capita growth (Figure 1.18).

Figure 1.14. **3-D mapping of different economic indicators for regions in Spain**

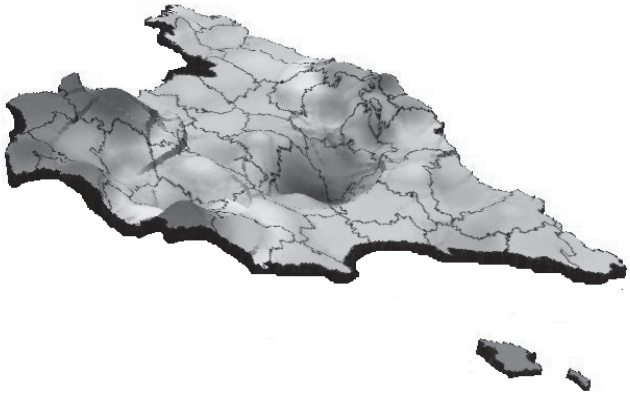
GDP per square kilometre



GDP per worker



GDP per capita annual growth



Note: GDP and GDP per worker data are for 2005, and the growth of GDP per capita is the annual average over 1995-2005.

Source: Own calculations using data from OECD (2008) Regional Database.

Figure 1.15. **3-D mapping of different economic indicators for regions in Poland**

GDP per square kilometre

GDP per worker

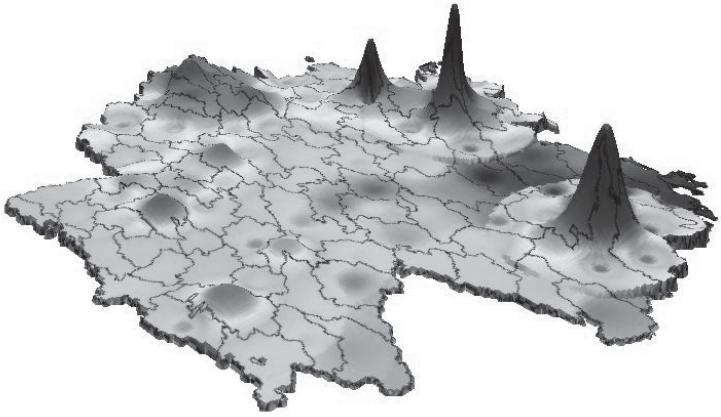
GDP per capita annual growth

Note: GDP and GDP per worker data are for 2005, and the growth of GDP per capita is the annual average over 1995-2005.

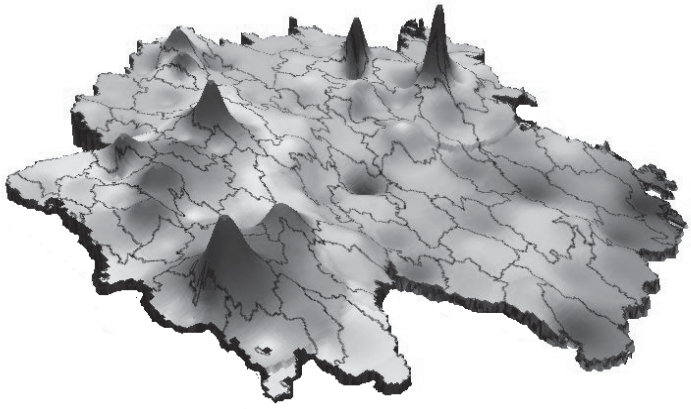
Source: Own calculations using data from OECD (2008) Regional Database.

Figure 1.16. **3-D mapping of different economic indicators for regions in Germany**

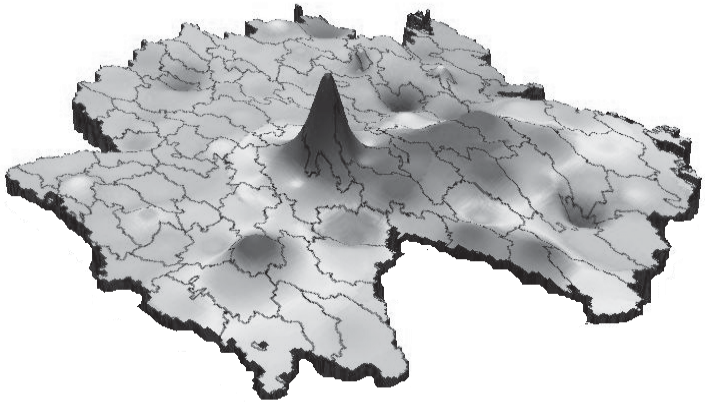
GDP per square kilometre



GDP per worker



GDP per capita annual growth



Note: GDP and GDP per worker data are for 2005, and the growth of GDP per capita is the annual average over 1995-2005.

Source: Own calculations using data from OECD (2008) Regional Database.

Figure 1.17. **3-D mapping of different economic indicators for regions in Mexico**

GDP per square kilometre

GDP per worker

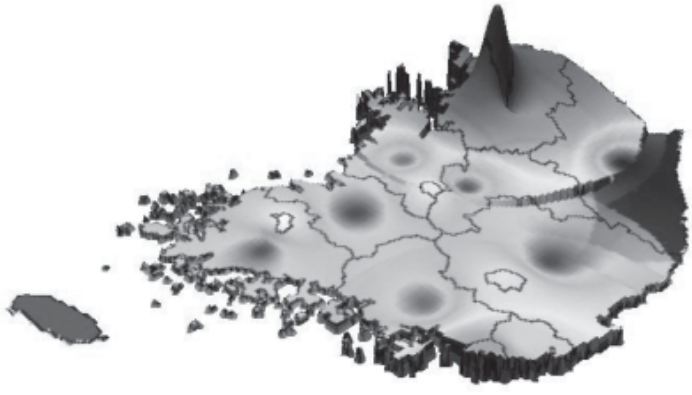
GDP per capita annual growth

Note: GDP and GDP per worker data are for 2005, and the growth of GDP per capita is the annual average over 1993-2004

Source: Own calculations using data from OECD (2008), Regional Database.

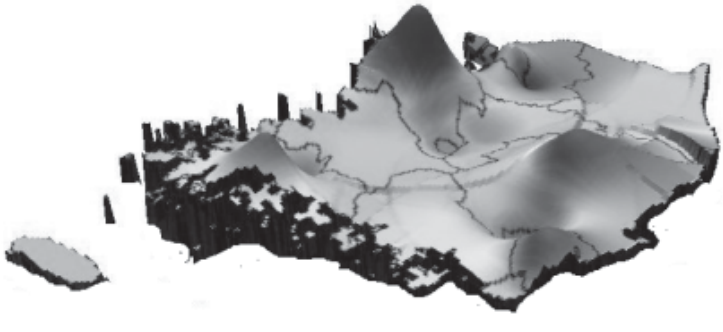
Figure 1.18. **3-D mapping of different economic indicators for regions in Korea**

GDP per square kilometre



GDP per worker

GDP per capita annual growth



Note: GDP and GDP per worker data are for 2005, and the growth of GDP per capita is the annual average over 1995-2005.

Source: Own calculations using data from OECD (2008) Regional Database.

In sum, there is no unique pattern of sustainable growth. Concentration of economic activity does not necessarily yield higher levels of productivity or higher growth rates. Opportunities for growth exist in all types of regions across the entire territory and will depend on how well the region is capable of mobilising its assets to make full use of its growth potential.

Why do some regions grow faster than others? Evidence from a regional growth model

Econometric analysis can shed some light on the factors that influence regional economic growth. The model used here explores the sources of regional growth using a variety of techniques (Box 1.2). As many of the variables of interest – institutions and systems – change very slowly over time, and often do not have easily quantifiable values, the particular analytic technique usually employed is a panel data approach. This approach requires a large number of observations for the econometric model to produce useful results, but has the advantage that the results can throw light on whether different growth factors are significant only in combination, or whether they are independently significant.

The first explanatory variable is included to test for convergence or divergence of regional income. A negative sign in this variable signals that relatively poorer regions are growing faster than the others, and therefore a process of convergence is under way. Conversely, a positive sign indicates that richer regions are growing faster and thus regional GDP is diverging. This convergence or divergence trend depends on a series of variables that determine growth. A number of variables have been introduced to model physical capital, human capital and innovation:

- Capital stock: uses a measure of infrastructure (motorways) because data at the regional level are not available.
- Human capital: educational attainment for primary schooling and for tertiary education.
- Innovation: patents and research and development (R&D) expenditures. Several variables that reflect expenditure in R&D were included, such as those carried out by the government, the private sector, higher education institutions, and non-profit organisations.

In addition to economic growth theory variables, employment rates were used as a proxy for the proper functioning of labour markets. Since data on all variables of interest are not available for all regions, several were estimated. The values and significance of the estimated coefficients are reported in Table 1.4.

Convergence is visible across OECD regions, but only when key assets and investments are in place. Using the full sample for the period 1995-2005, the model suggests that some convergence did take place across OECD regions, but that this depended on a series of factors.

Box 1.2. **Explanation of the regional growth model using a cross-section approach**

The model that is tested is:

$$\frac{1}{T}\ln\left(\frac{GPD_{t+T}}{GDP_t}\right)=\alpha+\beta_1\ln(InitialY_t)+\beta_2\ln(Infrast_t)+\beta_3\ln(PrimEdu_t)+\beta_4\ln(TertEdu_t)+$$
$$+\beta_5(EmplRate_t)+\beta_6\ln(Patents_t)+\beta_7\ln(R\&DTotal_t)+\beta_8\ln(R\&DBUS_t)+\beta_9\ln(R\&DGOV_t)$$
$$+\beta_{10}\ln(R\&DHE_t)+\beta_{11}\ln(AggAg_t)+\beta_{12}\ln(AggMan_t)+\beta_{13}\ln(AggFin_t)+\beta_{14}\ln(MktAccess_t)$$
$$+\beta_{15}\ln(DistMkts_t)+u_t$$

where t = 1995 and T=9, and annual average per capita GDP growth rates are regressed on:

- $Initial\ Y_t$ =initial GDP per capita
- $Infrast_t$ =motorway density defined by kilometres of motorway to population
- $Prim\ Edu_t$ =primary educational attainments
- $Tert\ Edu_t$ =tertiary educational attainments
- $Empl\ Rate_t$ =initial year employment rates
- $Patents_t$ =patent applications
- $R\ \&\ D\ Total_t$ =total research and development expenditures
- $R\ \&\ D\ BUS_t$ =research and development expenditures carried out by firms
- $R\ \&\ D\ GOV_t$ =research and development expenditures carried out by the government
- $R\ \&\ D\ HE_t$ =research and development expenditures carried out by higher education institutions
- $Agg\ Ag_t$ =agglomeration economies in agriculture defined by the size of the sector (*i.e.* employment in agriculture) multiplied by the index of specialisation (see endnote 3) in agriculture
- $Agg\ Man_t$ =agglomeration economies in agriculture defined by the size of the sector (*i.e.* employment in manufacturing) multiplied by the index of specialisation (see endnote 3) in manufacturing

Source: OECD (2009), *How Regions Grow: Trends and Analysis,* OECD Publishing, Paris.

Infrastructure is the foundation of regional development and has been the target of significant investment through regional policies over the past decades. However, at least in OECD economies, improvements in infrastructure do not lead automatically to higher growth; investment in infrastructure needs to be combined with improvements in

education and innovation (Models 6-7). One possible explanation for this is that investment in public infrastructure does not stimulate growth in the absence of workers with higher levels of education and innovation activity. This suggests that it could be productive to co-ordinate policies for building human capital, enhancing innovation and providing infrastructure.

Table 1.4. **OLS cross section results for regional economic growth in OECD TL2 regions, 1995-2005**

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Constant	0.0268	0.0013	0.1695	0.1553	0.1582	0.1934	0.193	0.3014	0.2972	0.104	-0.0126
	(2.65)**	(0.11)	(11.54)**	(9.06)**	(9.33)**	(6.44)**	(5.08)**	(6.27)**	(9.62)**	(1.46)	(-0.32)
Initial Y	-0.0006	0.0012	-0.0122	-0.0097	-0.0094	-0.015	-0.0152	-0.0261	-0.026	-0.0214	-0.0047
	(-0.59)	(0.95)	(-9.45)**	(-6.21)**	(-5.95)**	(-5.39)**	(-4.14)**	(-6.18)**	(-8.6)**	(-5.04)**	(-1.2)
Infrast	---	0.0075	---	0.0093	0.0132	0.0156	0.02	0.0155	0.0172	0.0148	0.0284
		(0.86)		(1.36)	(1.92)	(1.99)*	(2.31)*	(1.89)	(2.21)*	(1.89)	(3.23)**
Prim Edu	---	---	-0.0096	-0.0126	-0.0129	-0.0035	-0.004	-0.0075	-0.0079	-0.0091	---
			(-9.72)**	(-11.03)**	(-11.46)**	(-3.55)**	(-2.93)**	(-5.06)**	(-5.42)**	(-6.36)**	
Tert Edu	---	---	0.0076	0.0091	0.0097	---	---	0.0089	0.0087	0.0096	0.0067
			(8.79)**	(9.31)**	(9.81)**			(6.42)**	(6.83)**	(7.13)**	(4.58)**
Empl Rate	---	---	---	---	-0.0205	---	---	---	---	---	---
					(-2.37)**						
Patents	---	---	---	---	---	0.0015	---	---	---	---	---
						(2.5)**					
R&D Total	---	---	---	---	---	---	0.0019	-0.0007	---	-0.0009	---
							(1.71)	(-0.47)		(-0.6)	
R&D BUS	---	---	---	---	---	---	---	---	---	---	-0.0026
											(-2.3)*
R&D GOV	---	---	---	---	---	---	---	---	---	---	0.0028
											(2.98)**
R&D HE	---	---	---	---	---	---	---	---	---	---	-0.0078
											(-5.81)**
Agg Ag	---	---	---	---	---	---	---	-0.0014	-0.0009	-0.001	---
								(-2.04)*	(-1.41)	(-1.65)	
Agg Man	---	---	---	---	---	---	---	-0.0047	-0.0052	-0.0028	---
								(-2.89)**	(-3.62)**	(-1.77)	
Agg Fin	---	---	---	---	---	---	---	0.0029	0.0031	0.0014	0.0015
								(2.02)*	(2.32)*	(0.96)	(1.03)
Mkt Access	---	---	---	---	---	---	---	0.0002	0.0009	---	0.0013
								(0.39)	(1.75)		(2.19)*
Dist Mkts	---	---	---	---	---	---	---	---	---	0.0333	---
										(3.67)**	
R^2	0.0011	0.0082	0.2916	0.3235	0.3451	0.1652	0.1515	0.4712	0.4728	0.5111	0.4014
Adj R^2	-0.002	0.0019	0.2989	0.3134	0.3329	0.1505	0.1338	0.442	0.4493	0.4841	0.3717
F	0.35	1.29	40.93**	32.16**	28.24**	11.23**	8.57**	16.14**	20.17**	18.94**	13.5**
N	333	315	292	274	274	232	197	173	189	173	170

*/ Significant at the 95% confidence level; **/ Significant at the 99% confidence level

Countries missing as the model grows in variables due to lack of complete data (mainly on R&D expenditure): model 1- Iceland; model 2- Australia, New Zealand and Norway; model 3- Denmark, Iceland, Japan and Turkey; models 4 & 5- Australia, Denmark, Iceland, Japan, New Zealand, Norway, and Turkey; model 6- Australia, Denmark, Iceland, Japan, New Zealand, Norway, Switzerland and Turkey; model 7- Australia, Belgium, Denmark, Iceland, Ireland, Japan, Mexico, New Zealand, Norway, Sweden, Switzerland and Turkey; model 8, 9 & 10- Australia, Belgium Denmark, Germany, Iceland, Ireland, Japan, New Zealand, Mexico, Norway, Sweden, Switzerland and Turkey.

Note: For technical explanation of the differences between the models as well as additional models of growth see How Regions Grow: Trends and Analysis.

Source: OECD (2009), *How Regions Grow: Trends and Analysis*, OECD Publishing, Paris.

Human capital investment supports growth in all types of region, with particularly high returns for some levels of education and in some types of region. In terms of human capital, only the level of primary schooling is negatively associated with growth, while a high level of tertiary education improves regional performance. Thus, infrastructure provision along with tertiary education promotes growth. One possible explanation for the estimated negative relationship between growth and employment rates is that regions

with lower employment rates are not fully exploiting their labour resources and therefore have great untapped production possibilities. With appropriate policies, regional economies could tap into those dormant resources and achieve higher growth rates. In the longer term, however, the spur to growth of the more intensive use of labour resources will eventually cease once they are fully utilised. Thereafter, growth will have to come from other sources.

Innovation is clearly important and its influence would be clearer if more sensitive indicators (*e.g.*, on non-R&D driven innovation) were available. Innovation activity (to date measured by patents) has a positive impact on regional growth over a five and a ten year period (Model 6 in Table 1.4). Some factors are clearly more important than others in determining the innovation performance of a region. Policy makers need to know which "input" factors have the clearest impact on innovation and, in turn, where public investment will have the greatest impact. Our estimation of the knowledge production function for OECD regions suggests very large disparities in innovation outcomes and a spatially concentrated innovation map. In general the results confirm that:

- Human capital is the strongest determinant of innovation. There is a strong positive relationship between educational attainment at tertiary level and economic growth, measured in terms of patenting activity.
- Investing in R&D has a positive effect on patent activity in all categories considered: R&D expenditures by business, the public sector, higher education institutions and the private non-profit sector.
- The number of R&D personnel has a smaller impact on patenting than expenditures.
- The presence of knowledge-intensive services and high-tech manufacturing enhances regional innovation (measured as patent applications).
- The presence of economies of agglomeration only has a positive influence on innovation in the case of financial intermediation. Where there is no agglomeration economy, patenting activity is reduced.

In general, the results highlight the influence of the main theoretical factors that promote innovation – the usual list of "hard" inputs such as education, research investment and so on. The strength of the relationship confirms that it would be worth investing in these policy areas to achieve innovative, commercially viable products and processes. Although there are clear limitations to an approach that focuses on patents as a proxy for innovation output, the concentration of patenting and its links with other variables do suggest some spatial "logic" governing the distribution of innovation outcomes. Technology and innovation are fostered in favourable environments. These favourable environments certainly offer material advantages for innovators, whether they are on the scientific research or enterprise side. For example, the research confirms a close link between R&D expenditure and patenting activity. There is also a close link between the number of R&D personnel per thousand workers and patenting. These correlations are robust even after controlling for such things as industry sector. There is also a link between patenting and educational attainment, which suggests that levels of public investment in education and especially in science and engineering disciplines will promote innovation activity. The principal weakness of the approach, however, is that a sizeable minority of OECD regions have very low or approaching zero values for key indicators (such as R&D investment or patenting activity) and as such the analysis does

not provide clear orientations for them. More work is needed to improve the sensitivity of sub-national indicators in order to capture the breadth of innovation activities in firms that public policy seeks to target.

Box 1.3. **Summarising the results from the growth model and related analysis**

Additional econometric models using the OECD Regional Database (see OECD, 2009a) have looked at the evolution of regional economies from different angles and using different breakdowns of the available data. The results of this research can be summarised as follows:

- Human capital and innovation positively influence regional growth as endogenous growth theories suggest.
- Elements from new economic geography theories, such as agglomeration economies, are also relevant and reveal that there is a strong spatial content to growth.
- Infrastructure is a necessary but not sufficient condition for growth, but is only relevant if human capital and innovation are present.

The results suggest that in order to promote regional growth, policy makers should develop a comprehensive regional policy which not only links regions through infrastructure investments, but also fosters human capital, thereby facilitating innovation. The risk of a partial vision of regional policy is of creating a leaking, instead of a linking, process. A partial policy could provide only infrastructure, or lead to "brain-drain" if only human capital is promoted. Our models seem to bear this out.

The second type of analysis is based on dynamic econometric modeling through panel data analysis which allows for our spatial analysis to interact with time. The results of all these sets of models confirm the vast majority of results obtained in our cross-section models (OECD, 2009b). However, a deeper analysis reveals that:

- Infrastructure and human capital require three years to positively influence growth.
- Innovation is a longer-term process and only has a positive effect on regional growth after five years.

A third type of analysis is based on a knowledge production function that relates innovation input variables such as human capital and research and development (R&D) to innovation outcomes such as patenting activity (OECD, 2009b). The results show that:

- Human capital has a strong impact on regional growth both directly (see previous analysis) and indirectly through patenting.
- R&D is an indirect determinant of growth through its impact on patenting activity.
- Geographic space plays a role in determining innovation in these models as agglomeration economies emerge as a determinant.

The final analysis is dedicated to spatial econometrics, through which we find that the performance of neighbouring regions strongly determines the performance of any given region in the OECD (OECD, 2009b). This spatial aspect of growth also confirms that infrastructure and human capital drive economic expansion. These results suggest that as capital and talent concentrate they tend to positively influence growth in neighbouring regions – and *vice versa*. However, innovation remains a highly local element that does not necessarily influence growth in neighbouring regions.

Source: OECD (2009b), *How Regions Grow: Trends and Analysis,* OECD Publishing, Paris.

Conclusion

Regional development depends on the interplay between physical capital, human capital and the business environment. The results of the analysis show the benefits of strong interaction between different types of regional assets. Discerning which factors will result in regions becoming more productive and competitive is crucial for ensuring their future prosperity, attracting investment and retaining their best workers. Educational attainment is an important enabling factor. While public investment in infrastructure has a positive effect on regional growth, the effect is much stronger when educational attainment is high. As the determining factors of regional performance appear to be mutually reinforcing, this underlines the importance of a cross-sectoral approach to policy formulation and delivery. Our results also suggest that the effects of investment in human capital and on infrastructure typically take about three years to emerge.

A key rationale for a renewed regional policy is that simple concentration of resources in one place does not necessarily translate into agglomeration benefits. Such benefits depend on the existence of a pooled labour market, backward and forward linkages among firms, and knowledge spillovers. The key appears to be how assets are used, how different stakeholders interact and how synergies are exploited in different types of regions. This underlines the importance of integrated regional development policy strategies that cut across sectors and that are based on inclusive governance arrangements.

Notes

1. Tthe Gini Index is defined as

$$G = 1 + \frac{1}{N} - \frac{2}{mN^2}\sum_{i=1}^{N}(N - i + 1)\, y_i \qquad \text{(A.6)}$$

where regions are ranked in ascending order of y_i

2. Let y_i be the income (GDP) of region *i*, for *i* = 1,…,*N*, and *m* the arithmetic mean income. The Atkinson Index is:

$$A(c) = 1 - \frac{\left[\frac{1}{N}\sum_{i=1}^{N} y_i^{1-c}\right]^{\frac{1}{1-c}}}{m} \quad \text{for } c > 0 \text{ and } c \neq 1$$

$$A(1) = 1 - \frac{\frac{1}{N}\sum_{i=1}^{N}\log(y_i)}{m} \quad \text{for } c = 1$$

3. Let y_i be the income (GDP) of region i, for i = 1,…,N, and m the arithmetic mean income. The General Entropy is defined as

$$GE(c) = \frac{1}{c(1-c)}\left[\frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i}{m}\right)^c - 1\right] \quad \text{for } c \neq 0 \text{ and } c \neq 1$$

$$GE(1) = \frac{1}{N}\sum_{i=1}^{N}\frac{y_i}{m}\log\left(\frac{y_i}{m}\right) \quad \text{for } c = 1$$

$$GE(0) = \frac{1}{N}\sum_{i=1}^{N}\log\left(\frac{m}{y_i}\right) \quad \text{for } c = 0$$

4. This figure is obtained by regressing the log of GDP per capita relative to its national value to the log of employment rates relative to the national value for 92 TL2 regions for the year 2005. The estimated coefficient value is 0.283 with a t-value of 2.30 (*i.e.* statistically significant at a 90% confidence interval).

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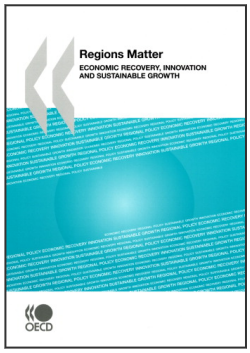

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