



I. FOCUS ON REGIONAL INNOVATION

1. Research and development expenditures
2. Personnel employed in research and development activities
3. Regional concentration of patents
4. Regional patent co-operation
5. Student enrolment in tertiary education
6. Advanced educational qualifications
7. Employment in knowledge-oriented sectors

Strong innovation generation in regions is crucial for improving the overall economic competitiveness of individual regions and achieving long-term national growth. Part I examines the main factors that spur innovation at the regional level and highlights the pattern of innovation-related activities across OECD regions. R&D expenditures and personnel are strongly correlated and concentrated in the same regions within countries, mostly capitals or important urban agglomerations. Countries with high investment in R&D at the national level tend to show higher regional disparities. Patents tend to be the outcome of the applied research carried out mainly in the private sector, although evidence suggests spillovers from theoretical research in public institutions. Proximity between innovators also seems important for technological progress and countries patenting the most co-invent mostly within their borders. Part I also examines the context in which innovative activities take place, measuring regions' innovation potential and their capacity to produce and absorb innovation. Many OECD regions are transforming their production structures from traditional to high-tech manufacturing and from less knowledge-intensive services to more specialised services. The association between a skilled labour force and the presence of universities and students shows that some regions are better equipped than others in terms of current and future stock of human capital, and in dealing with technological change.

1. RESEARCH AND DEVELOPMENT EXPENDITURES

Expenditures in research and development (R&D) are a common proxy for interpreting a region's attitude toward innovation activities. They are defined as the R&D-related expenditures performed by actors within a region. According to the *Frascati Manual, 2002*, R&D is defined as a "creative work undertaken on a systematic basis in order to increase the stock of knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications".

In 2005, R&D intensity (R&D expenditures as a percentage of GDP) was on average, about 2.3% in OECD countries. The intensity of expenditures in R&D varies significantly among OECD countries. Sweden is the country spending the most followed by Finland, Japan and Korea. Mexico, the Slovak Republic, Poland, and Turkey had the lowest R&D intensity. Finland and Iceland are the countries that between 1995 and 2005 increased the most their R&D intensity (over 60%) (Figure 1.1).

Regional differences within countries are even larger than among countries (Figure 1.2). The United States, Sweden, Finland and Korea show the largest regional disparities in R&D intensity across TL2 regions. For the United States, the State of Maryland devotes 5.8% of its GDP to R&D, while the State of Wyoming devotes only 0.45%.

Ireland, together with Greece, the Slovak Republic, Belgium and Portugal displayed minor differences in R&D intensity among regions. It appears that the countries where R&D intensity is the highest are, on average, also those displaying more internal dispersion. Often one region displays values much higher than the country average: like in Australia where the Capital Territory spends 2.3 times the country average in R&D, and in the United States, Norway and the United Kingdom where the best performing region has values two times higher than the country average.

In general R&D performed by the business sector accounts for the largest part of R&D activities in OECD regions (OECD, 2007). While the government and the higher education sectors also carry out R&D activities, business R&D is more generally closely linked to the creation of new products and production techniques. Figure 1.3 compares the regions of each country where the R&D intensity is highest showing the breakdown by performing sector. In the majority of regions the business sector performs the biggest share of R&D. The regions of Vaestsverige (Sweden), Baden-Wuerttemberg (Germany), Stredni Cechy (Czech Republic), and Zuid-Nederland (Netherlands) have more than 80% of their R&D expenditures performed by the business sector.

A different pattern is shown by the State of Maryland (United States) where 53% of R&D expenditures are performed by the public sector. A similar distribution

among sectors is followed by Lazio (Italy), and Mazowieckie (Poland), (all capital regions) where the largest part of R&D is performed by the public sector.

Definition

Gross Domestic Expenditures on R&D is the total intramural expenditure on R&D performed in the sub-national territory (region) during a given period (see *Frascati Manual*, Section 6.7.1 and Section 6.6). Intramural expenditures are all expenditures for R&D performed within a statistical unit or sector of the economy during a specific period, whatever the source of funds (see *Frascati Manual*, Section 6.2). The Gross domestic expenditure in R&D is disaggregated in four sectors: business enterprise, government, higher education and private non-profit.

R&D intensity is defined as the ratio between R&D expenditures and GDP.

Source

OECD Regional Database, <http://stats.oecd.org/WBOS>, theme: Regional Statistics.

National data: OECD, Main Science and Technology Indicators Database.

See Annex B for more detailed information on data sources and country related metadata.

Reference years and territorial level

1995-2005; TL2

Data for Denmark, Iceland, Japan, Mexico, New Zealand, Switzerland and Turkey are not available at the regional level.

Further information

OECD (2007), *Science Technology and Industry Scoreboard*, OECD, Paris.

OECD (2002), *Frascati Manual*, OECD, Paris available at: www.oecd.org/sti/frascaticmanual.

Figure notes

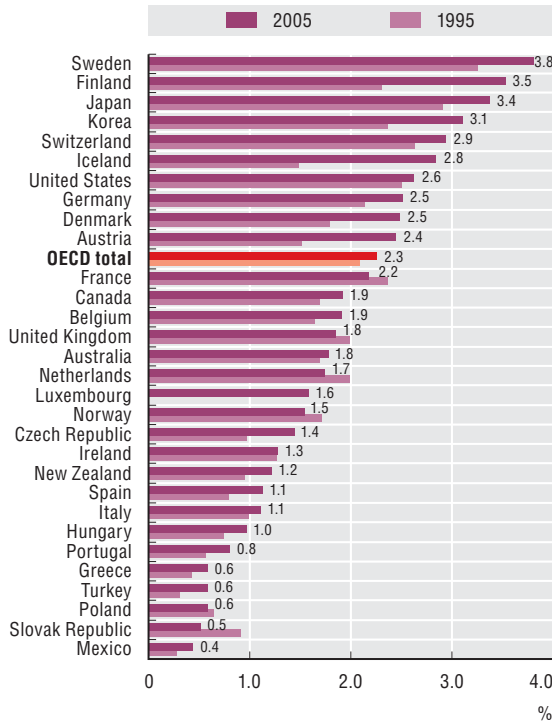
Figure 1.1: Australia and Switzerland years 1996 and 2004. Source: OECD, Main Science and Technology Indicators Database.

Figures 1.2 and 1.3: Austria and France year 2004.

1. RESEARCH AND DEVELOPMENT EXPENDITURES

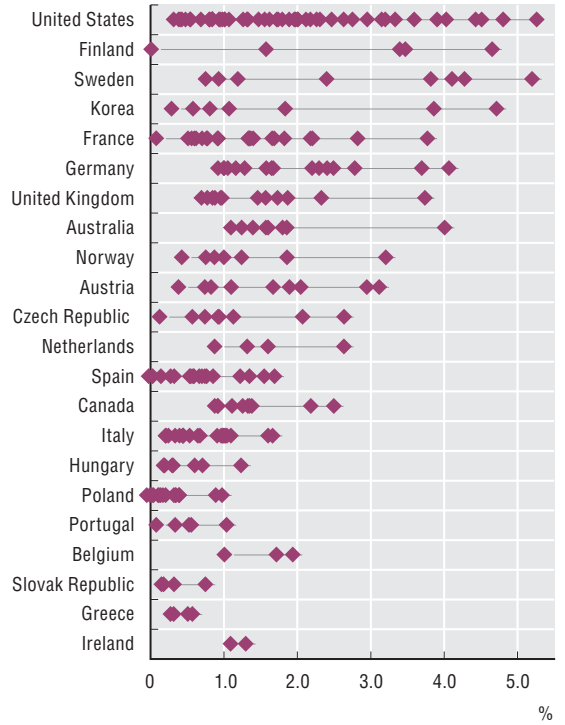
1.1 Intensity of R&D expenditures, 1995 and 2005

Sweden and Finland are the countries with the highest R&D spending.



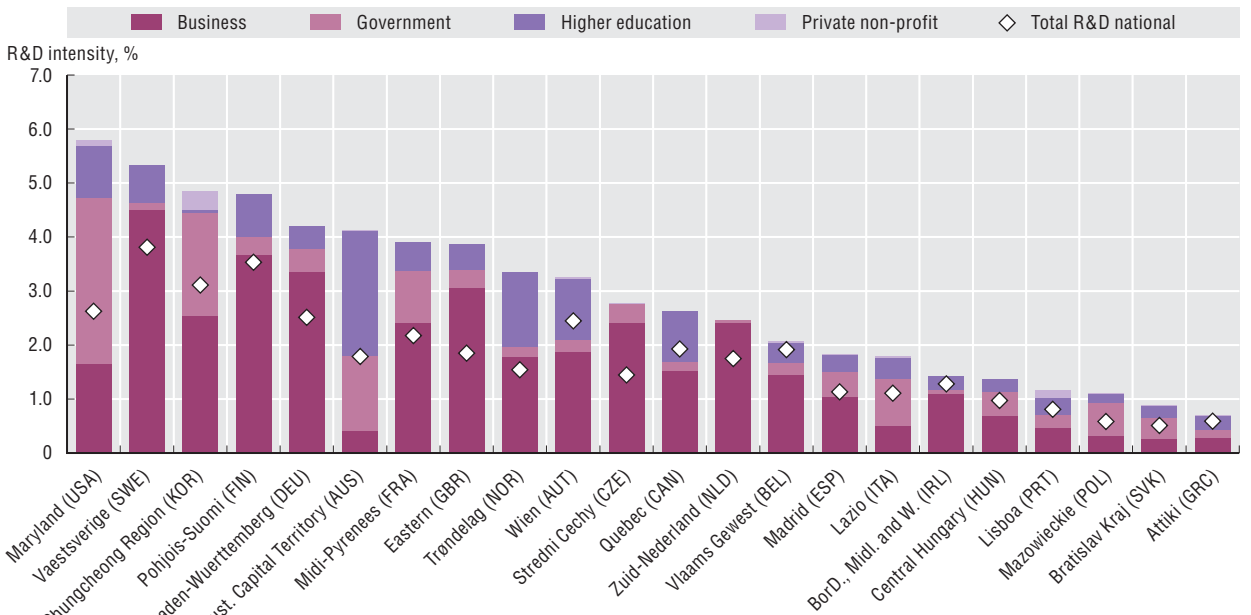
1.2 Range of TL2 regional R&D intensity, 2005

Countries with high R&D intensity display larger regional disparities.



1.3 Regions with the highest R&D intensity by sector compared to the country average, 2005 (TL2)

In the majority of regions the business sector performs the biggest share of research and development activities.

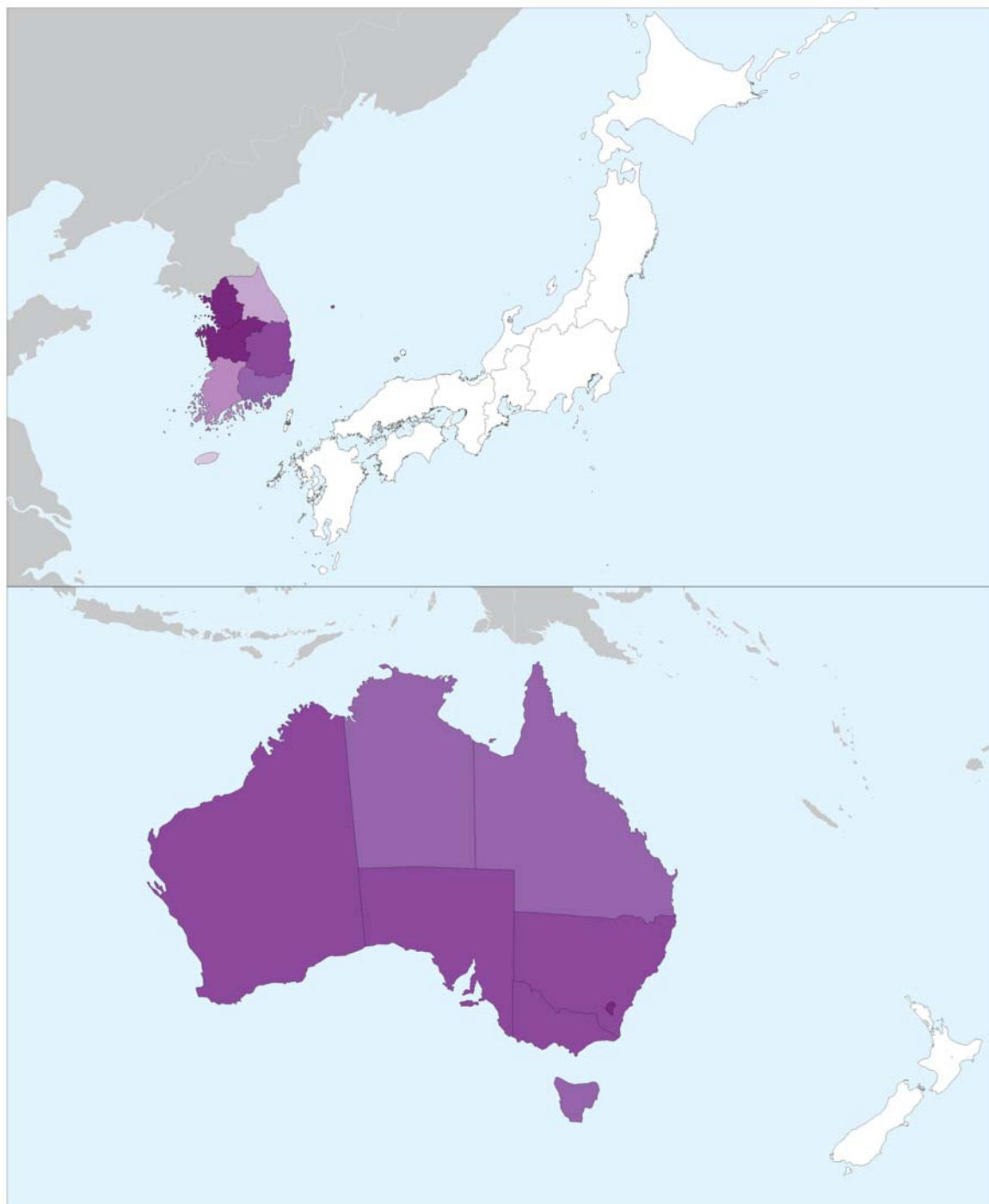



1. RESEARCH AND DEVELOPMENT EXPENDITURES

1.4 R&D intensity: Asia and Oceania

R&D as percentage of GDP, TL2 regions, 2005

- Higher than 2.5%
- Between 2.5% and 1.7%
- Between 1.7% and 1.2%
- Between 1.2% and 0.9%
- Between 0.9% and 0.6%
- Lower than 0.6%
- Data not available



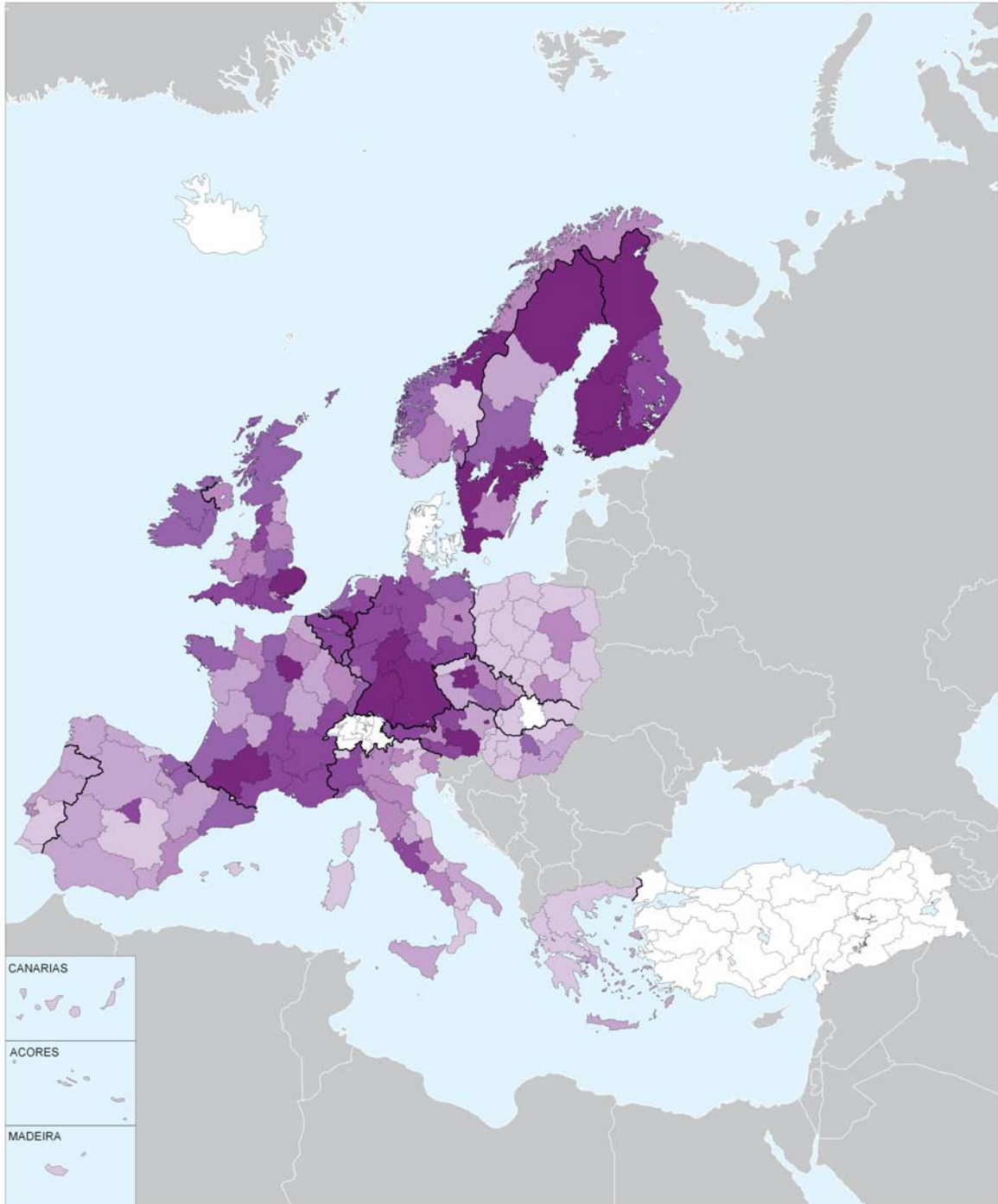
StatLink  <http://dx.doi.org/10.1787/524400472448>

1. RESEARCH AND DEVELOPMENT EXPENDITURES

1.5 R&D intensity: Europe

R&D as percentage of GDP, TL2 regions, 2005

- Higher than 2.5%
- Between 2.5% and 1.7%
- Between 1.7% and 1.2%
- Between 1.2% and 0.9%
- Between 0.9% and 0.6%
- Lower than 0.6%
- Data not available



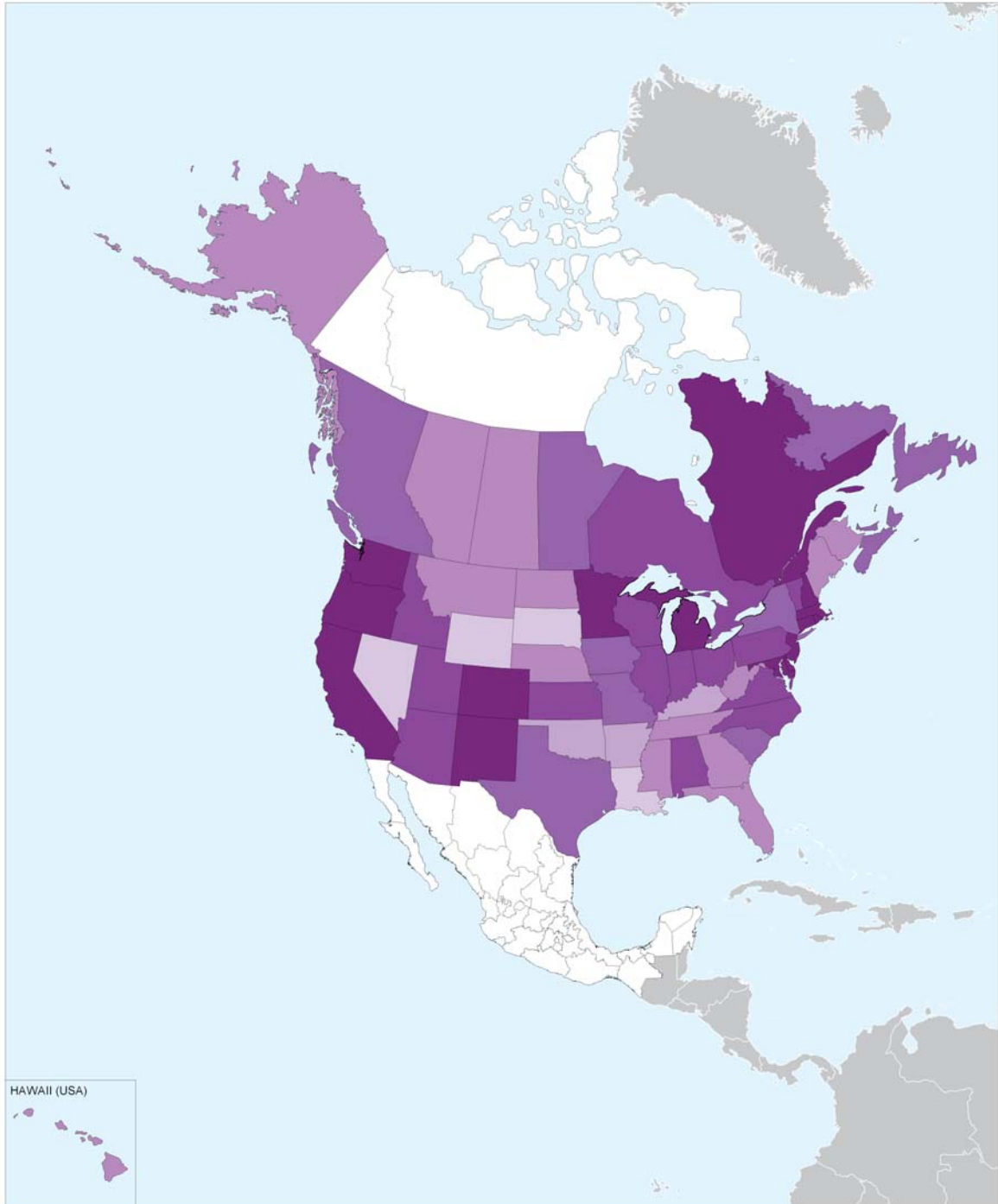
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1. RESEARCH AND DEVELOPMENT EXPENDITURES

1.6 R&D intensity: North America

R&D as percentage of GDP, TL2 regions, 2005

- Higher than 2.5%
- Between 2.5% and 1.7%
- Between 1.7% and 1.2%
- Between 1.2% and 0.9%
- Between 0.9% and 0.6%
- Lower than 0.6%
- Data not available



StatLink  <http://dx.doi.org/10.1787/524400472448>

R&D expenditures and patenting activity: The linear model

It is often assumed that greater investment in basic R&D will lead to greater applied research and to an increase in the number of inventions. This linear perception of the innovation process places localised R&D investment as the key factor behind technological progress and eventually, economic growth. The implications of this approach are that the higher the investment in R&D, the higher the innovative capacity and the higher the economic growth.

As shown in Figure 1.7, the expenditures performed by the business sector and the number of Patent Co-operation Treaty (PCT) applications (see Chapter 3), have a very high correlation in OECD regions (the correlation coefficient being 0.93). The regions where the business enterprise sector spends more in R&D activities tend to innovate more. A positive association is found also between the expenditures performed by the government sector and the number of PCT patent applications (Figure 1.8). However, the correlation coefficient is smaller (0.63) meaning that the association between the two variables is less strong.

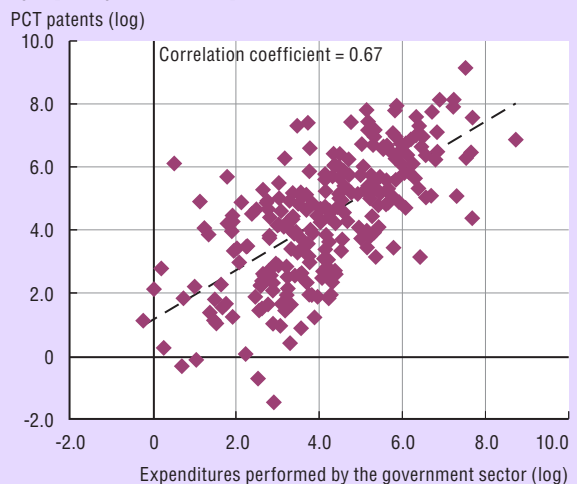
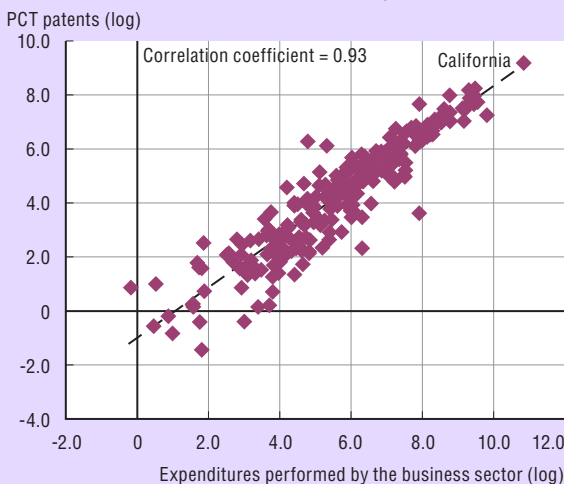
The business enterprise sector tends to concentrate more on applied research which, being directed primarily towards a specific practical aim or objective, more frequently generates a patentable result. The type of research carried out by the government sector is more directed toward basic research, which is more theoretical and experimental work undertaken primarily to acquire new knowledge without a particular application or use in view (*Frascati Manual*, 2002).

The linear model remains popular for its simplicity and powerful explanatory capacity: regions that invest more in R&D generally tend to innovate more. At the same time, by focusing on local R&D the linear model completely overlooks key factors about how regional innovation is actually generated. These factors are related to the context, both economic and institutional, in which innovation takes place and to the potential for territories to assimilate innovation being produced elsewhere.

1.7 Correlation between business sector R&D expenditures and PCT patent applications¹ (TL2)

1.8 Correlation between government sector R&D expenditures and PCT patent application¹ (TL2)

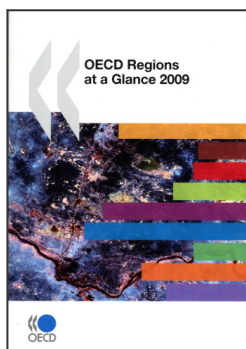
Research carried out by the business sector more frequently generates a patentable result.



1. Average of the two years, 2000 and 2005 (Australia, Greece, Norway and Sweden 1999 and 2005, Austria 1998 and 2004, the Czech Republic 2001 and 2005, France 2000 and 2004, Ireland 2002 and 2005).

Expenditures data for Denmark, Iceland, Japan, Mexico, New Zealand, Switzerland and Turkey are not available at the regional level.

StatLink <http://dx.doi.org/10.1787/523568211073>



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