



**ECONOMICS DEPARTMENT
ECONOMIC POLICY COMMITTEE**

**ECO/CPE/WP1(2005)2/ANN1
For Official Use**

Working Party No. 1 on Macroeconomic and Structural Policy Analysis

INNOVATION POLICIES: INNOVATION IN THE BUSINESS SECTOR

ANNEX 1: TABLES AND FIGURES

This document has been prepared by the Economics Department for Working Party No. 1 of the Economic Policy Committee.

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JT00179240

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ANNEX 1

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Table 1.1 Long-run effects of a one standard deviation increase in policy and framework factors¹

Measured in percentage change of the dependent variable

	Business R&D spending	Total domestic patents
Science policies and institutions		
B-index ²	-1¾	-6
Subsidies for private R&D / GDP ratio	¼	-3
Share of business funding in non-business R&D	8¼	2½
Non-business R&D / GDP ratio	7¼	3¾
IPR index	1½	8
USA real wage of researchers	-3¾	-¾
Years of education	1	¾
Economic conditions		
Profit / GDP ratio	5¼	4¼
Private sector credit / GDP ratio	-1½	-3¼
Equity financing / GDP ratio	5¾	10
Foreign R&D stock / GDP ratio	12¾	6
Openness	-5¾	-4¼
Import penetration	-¼	0
Real interest rate	-5	-2¾
Real exchange rate	-3	-1¾
Framework policies (decrease)		
Product market regulation	9	4¼
FDI restrictions	..	13
Employment protection legislation	1	6½

1. This table is taken from Table A3.8 of Annex 3. The standard deviation is the average of within-country standard deviations, and the effects of a one standard deviation increase in policy and framework factors are evaluated at the sample mean of the variables.

2. The B-index is defined as one minus the rate of tax subsidy for R&D. An increase in the B-index implies a less generous tax treatment of R&D.

Source: OECD estimates

Table 2.1 Comparison of innovation performance by various criteria, 2001¹

	Total R&D intensity	Business R&D intensity	Non-business R&D intensity	Scientists share ²	R&D employees share ²	Triadic patents (1999)	Average indicator ³
Sweden	1	1	3	3	2	2	2.0
Finland	2	2	2	5	1	4	3.7
Japan	3	3	4	2	6	3	2.7
Iceland	4	6	1	4	5	13	7.0
United States	5	4	11	1		6	4.0
Switzerland	6	5	13	7	3	1	4.7
Germany	7	7	9	8	8	5	6.7
Denmark	8	8	10	12	4	8	9.3
France	9	10	6	13	9	10	10.7
Belgium	10	9	17	9	7	9	9.3
Austria	11	11	12	10	10	11	10.7
Canada	12	14	7	14	14	15	13.7
Netherlands	13	13	8	16	12	7	12.0
United Kingdom	14	12	14	15	15	12	13.7
Norway	15	15	15	6	11	14	11.7
Australia	16	17	5	17	16	16	16.3
Ireland	17	16	20	11	13	17	15.0
Italy	18	18	18	18	17	18	18.0
Spain	19	19	19	19	18	19	19.0
Portugal	20	20	16	20	19	20	20.0
Correlation with Total R&D intensity	1	0.99	0.73	0.85	0.94	0.87	0.97

1. The comparison is based on rank orders according to the various criteria. Rankings are a rough measure of cross-country differences. A more refined measure would use deviations from the country mean expressed in multiple of the standard deviation of countries' observations around the mean. Countries in the table are ordered by decreasing level of total R&D intensity.

2. The employment of scientists and R&D personnel is expressed as a share of total dependent employment. There are no data on the R&D employee share for the United States and the ranking according to this criterion is not perfectly comparable because only 19 countries are included instead of 20.

3. The average is the simple arithmetic average of the rankings for total R&D intensity, scientist share and triadic patents.

Source: OECD Main Science and Technology Indicators database, R&D database and Patent database.

Table 2.2 Comparison of macroeconomic indicators and survey-based indicators of innovation performance, 1998-2000¹

Country	Macroeconomic indicators		CIS indicators of innovation spending and protection				CIS measures of implementation of innovation	
	Business R&D intensity (2001)	Triadic patents (1999)	<i>Proportion of firms engaging in intramural R&D</i>	<i>Innovation spending index²</i>	<i>Proportion of firms applying for a patent</i>	<i>Aggregate protection index³</i>	<i>Proportion of successful innovators</i>	<i>Share of new products in turnover</i>
Sweden	1	1			1	2	9	
Finland	2	2	1	3	4	3	8	2
Iceland	3	10	9	10	14	14	2	12
Germany	4	3	2	1	3	5	1	1
Denmark	5	5	4	5	8	10	7	7
Belgium	6	6	3	2	6	6	3	6
France	7	7	6	7	2	7	10	10
Austria	8	8			5	4	5	8
United kingdom	9	9			11	1	14	
Netherlands	10	4	5	6	9	9	6	9
Norway	11	11	7	8	7	8	12	11
Italy	12	12	10	9	10	11	11	4
Spain	13	13	11	11	12	13	13	3
Portugal	14	14	8	4	13	12	4	5
Correlation with Business R&D intensity	1.00	0.81	0.69	0.42	0.57	0.46	0.38	0.00
Correlation with triadic patents	0.81	1.00	0.91	0.65	0.75	0.64	0.27	0.18
Correlation with % successful innovators	0.38	0.27	0.45	0.61	0.06	-0.14	1.00	0.03
Correlation with share new products in turnover	0.00	0.18	0.27	0.44	0.16	0.25	0.03	1.00
Number of countries	14	14	11	11	14	14	14	12

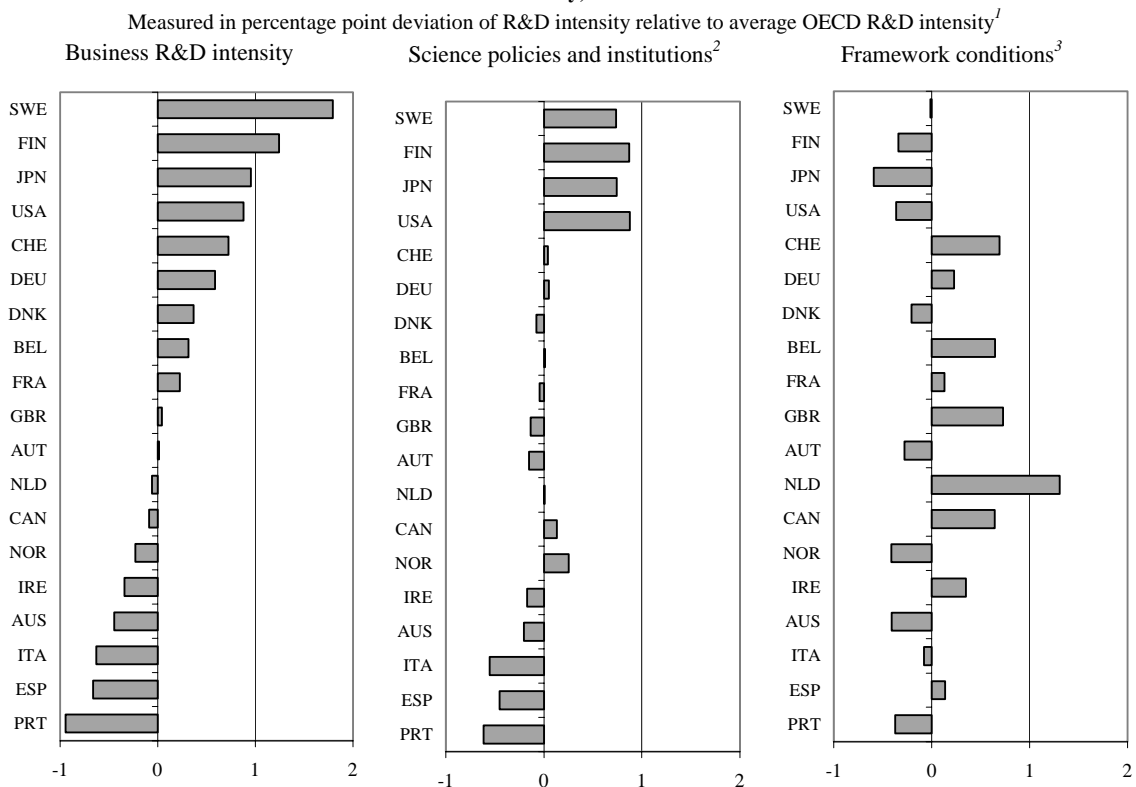
1. Care has to be taken when interpreting cross-country comparisons made with the aggregated data in CIS, as there are differences in the sample size used in the respective national components of the survey. A number of indicators (in italics) are available only for a subset of countries so that the ranks of countries cannot be directly compared across all indicators, though their rank-ordering can be compared. Countries in the table are ordered by decreasing level of business R&D intensity.

2. The innovation spending index is calculated as the arithmetic average of the proportions of firms engaging in the various types of innovation spending.

3. The aggregate protection index is calculated as the arithmetic average of the proportions of firms using the various types of protection.

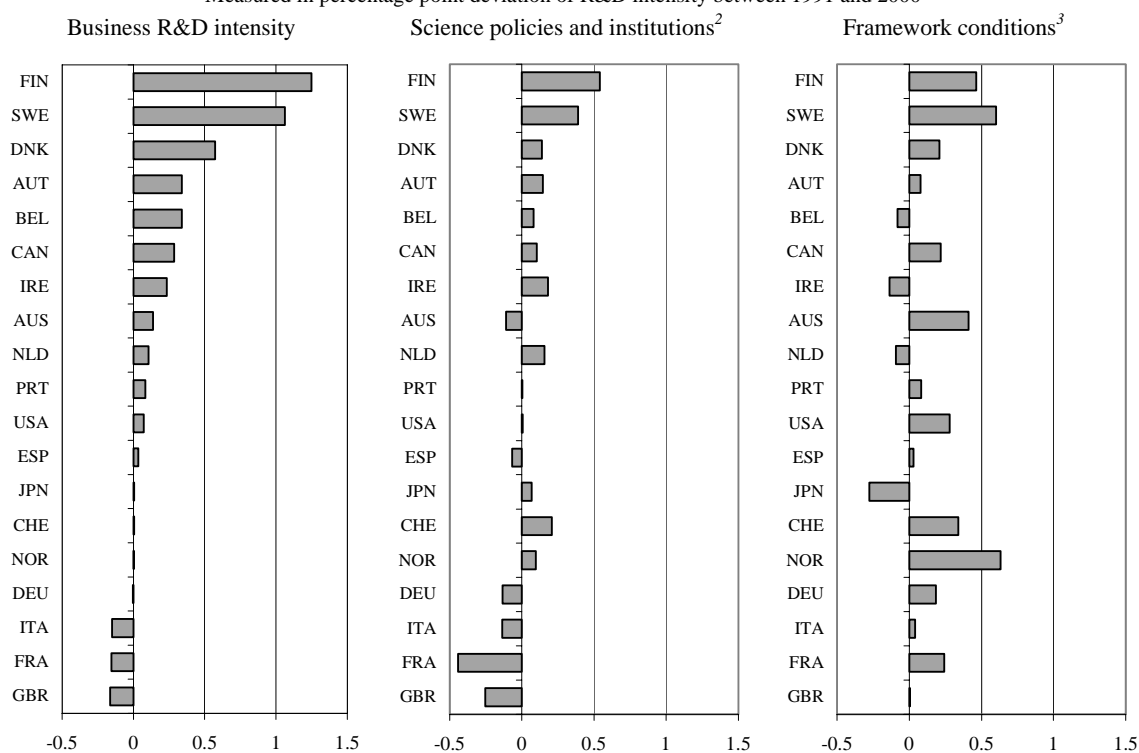
Source: OECD Main Science and Technology Indicators database, R&D database and Patent database; Community Innovation Survey 3 (European Commission).

Figure 1.1 Contribution of science policies and framework conditions to cross-country differences in business R&D intensity, 2000



1. The contributions have been calculated based on the long-run parameters from the equation reported in column 3 of Table A3.2. The OECD average refers to the unweighted geometric average of the OECD countries included in the sample (due to the logarithmic regression model).
 2. Science policies include R&D tax incentives, subsidies for private R&D, business funding of non-business R&D, non-business R&D intensity, intellectual property rights, the share of scientists in total dependent employment and absorptive capacity (capacity to understand and make use of foreign knowledge) .
 3. Framework conditions include financial factors, real interest rates, real exchange rates, foreign exposure (foreign R&D stock and openness), import penetration, and product market regulation.
 Source: OECD estimates.

Figure 1.2 Contribution of science policies and framework conditions to growth in R&D intensity, 1991-2000

Measured in percentage point deviation of R&D intensity between 1991 and 2000¹

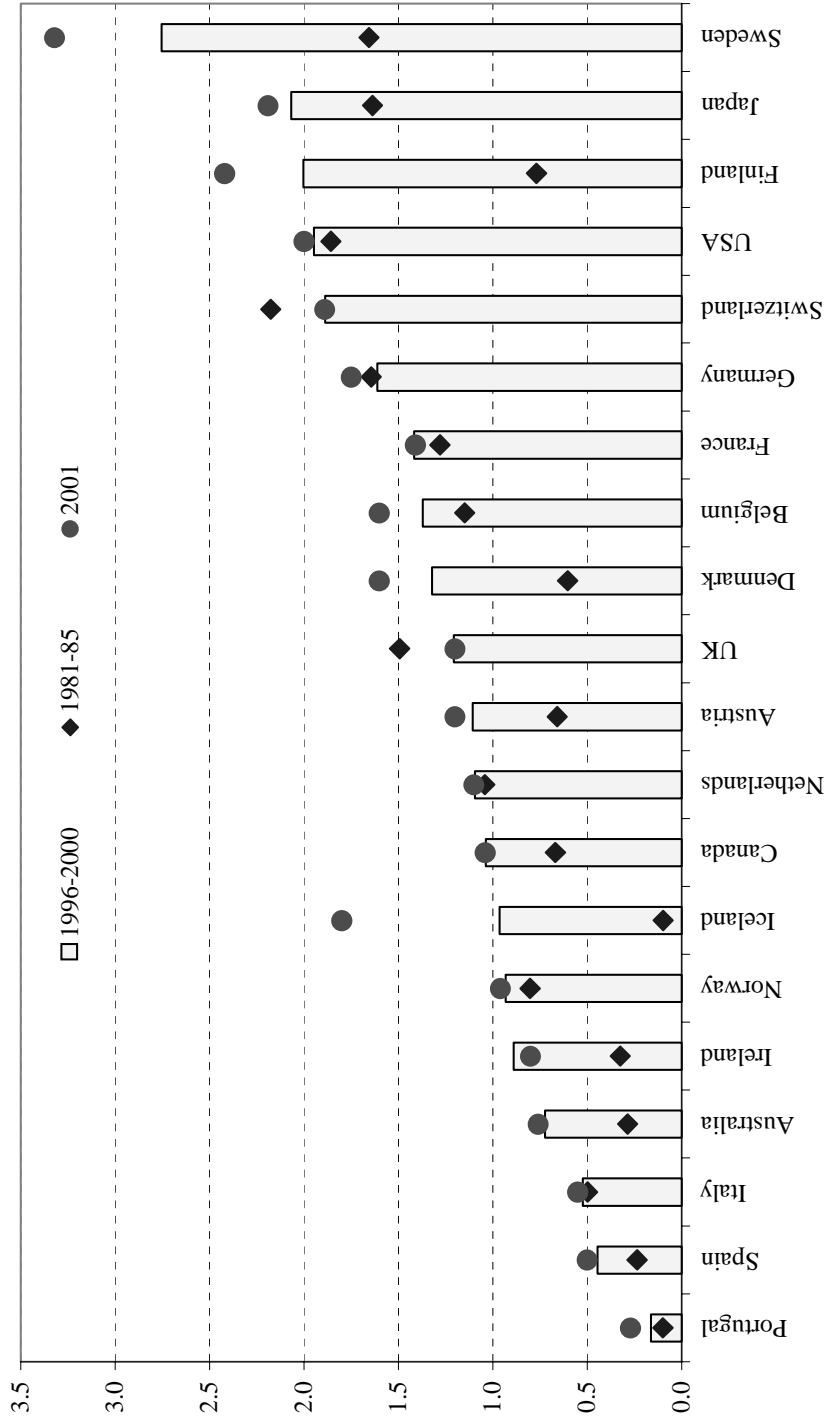
1. The contributions have been calculated based on the long-run parameters from the equations reported in column 1 of Table A3-6 and in column 3 of Table A3.2.

2. Science policies include R&D tax incentives, subsidies for private R&D, business funding of non-business R&D, non-business R&D intensity, intellectual property rights and absorptive capacity (capacity to understand and make use of foreign knowledge).

3. Framework conditions include financial factors, real interest rates, real exchange rates, foreign exposure (foreign R&D stock and openness), import penetration, product market regulation, employment protection legislation, human capital and the domestic economy-wide average wage.

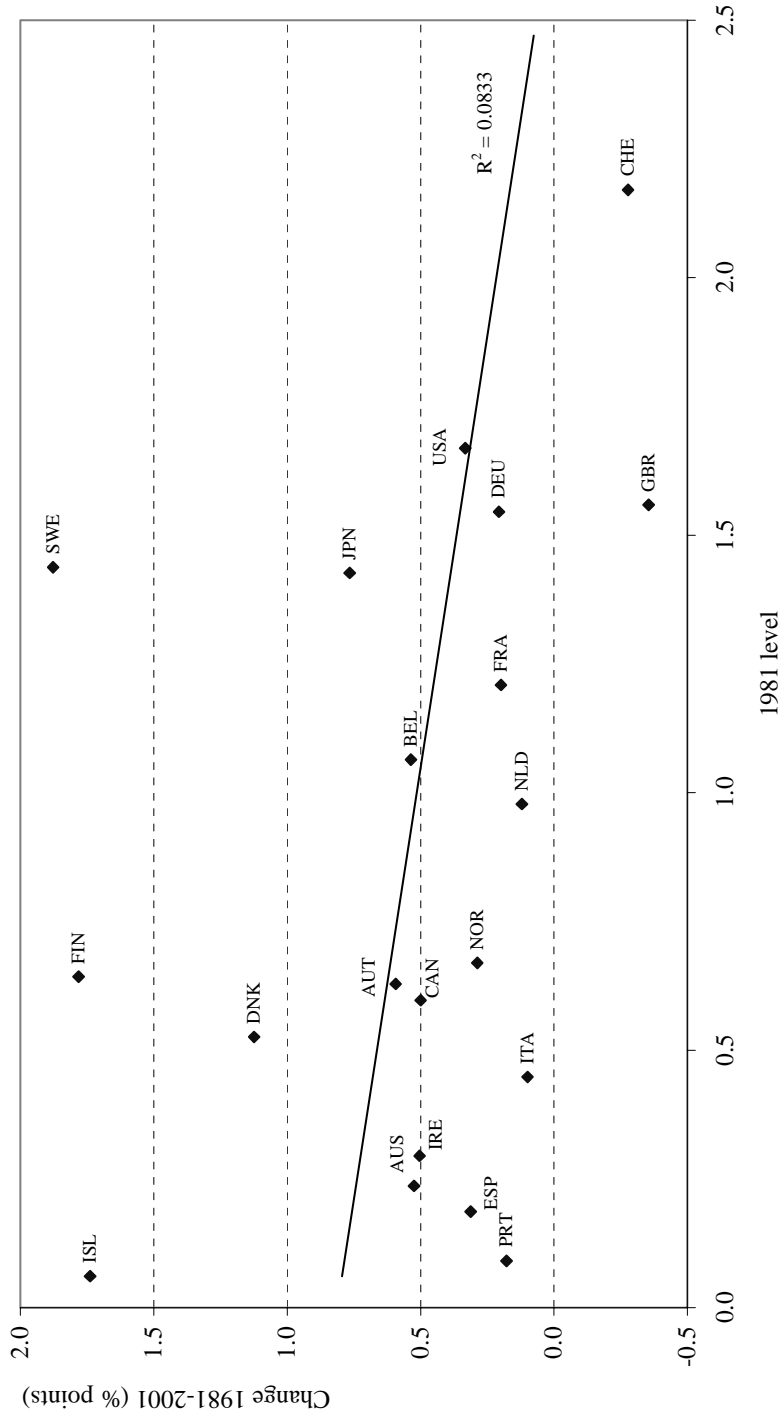
Source: OECD estimates.

Figure 2.1 Business sector R&D intensity
% of GDP, average per annum



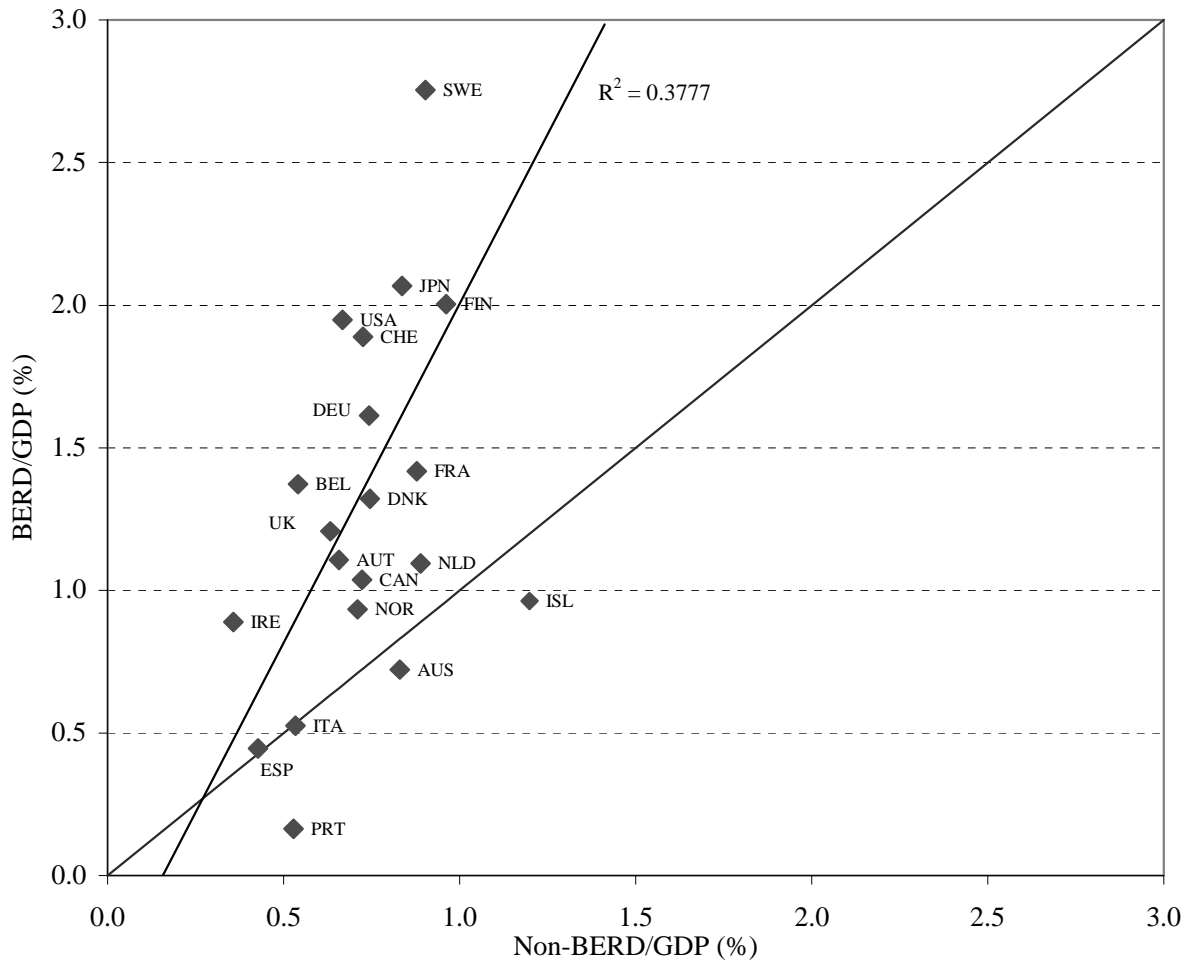
Source: OECD Main Science and Technology Indicators database and R&D database.

Figure 2.2 Convergence in business sector R&D intensity



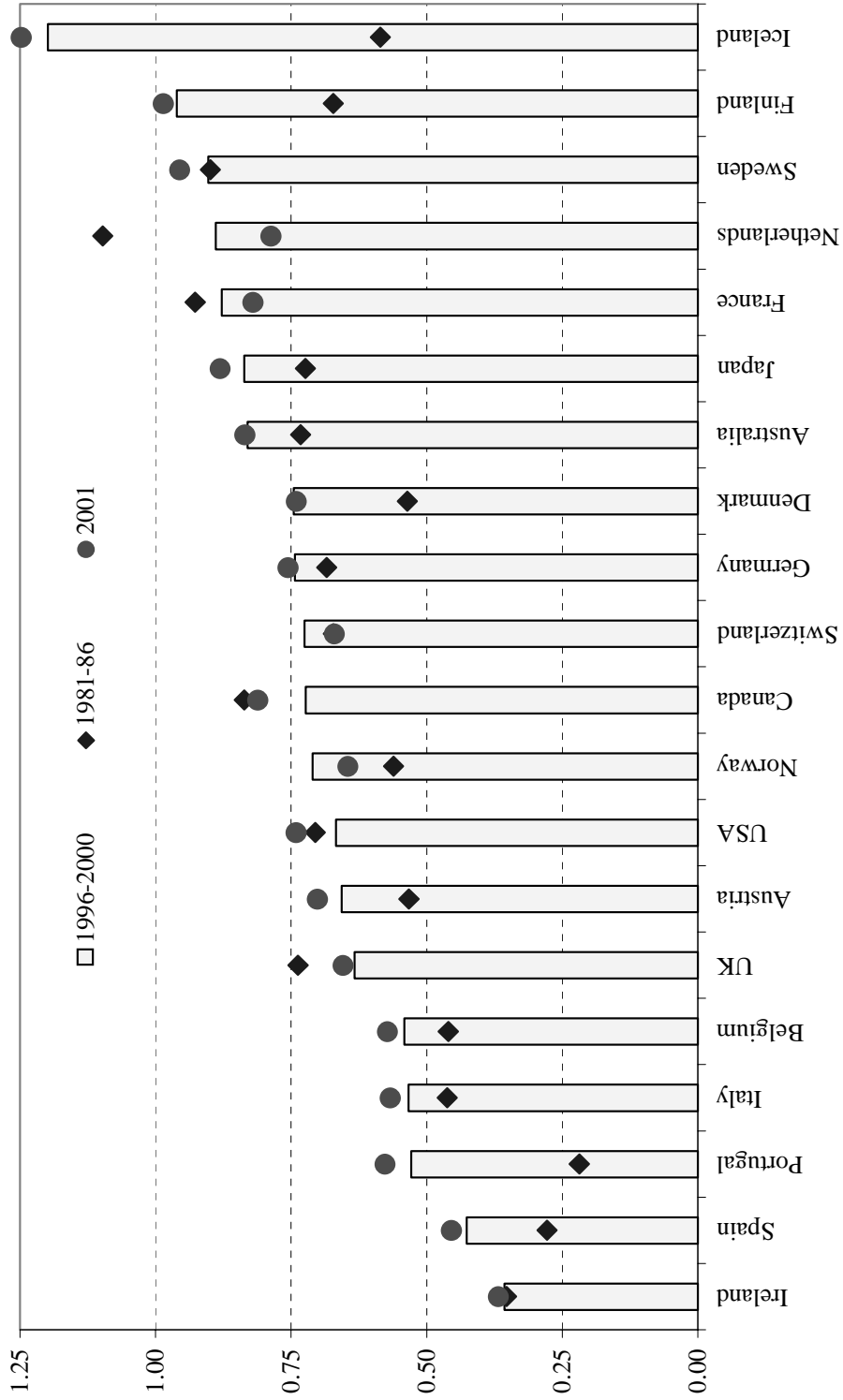
Source: OECD Main Science and Technology Indicators database and R&D database.

Figure 2.3 **Business and non-business R&D intensity,**
1996-2000¹
 Average per annum



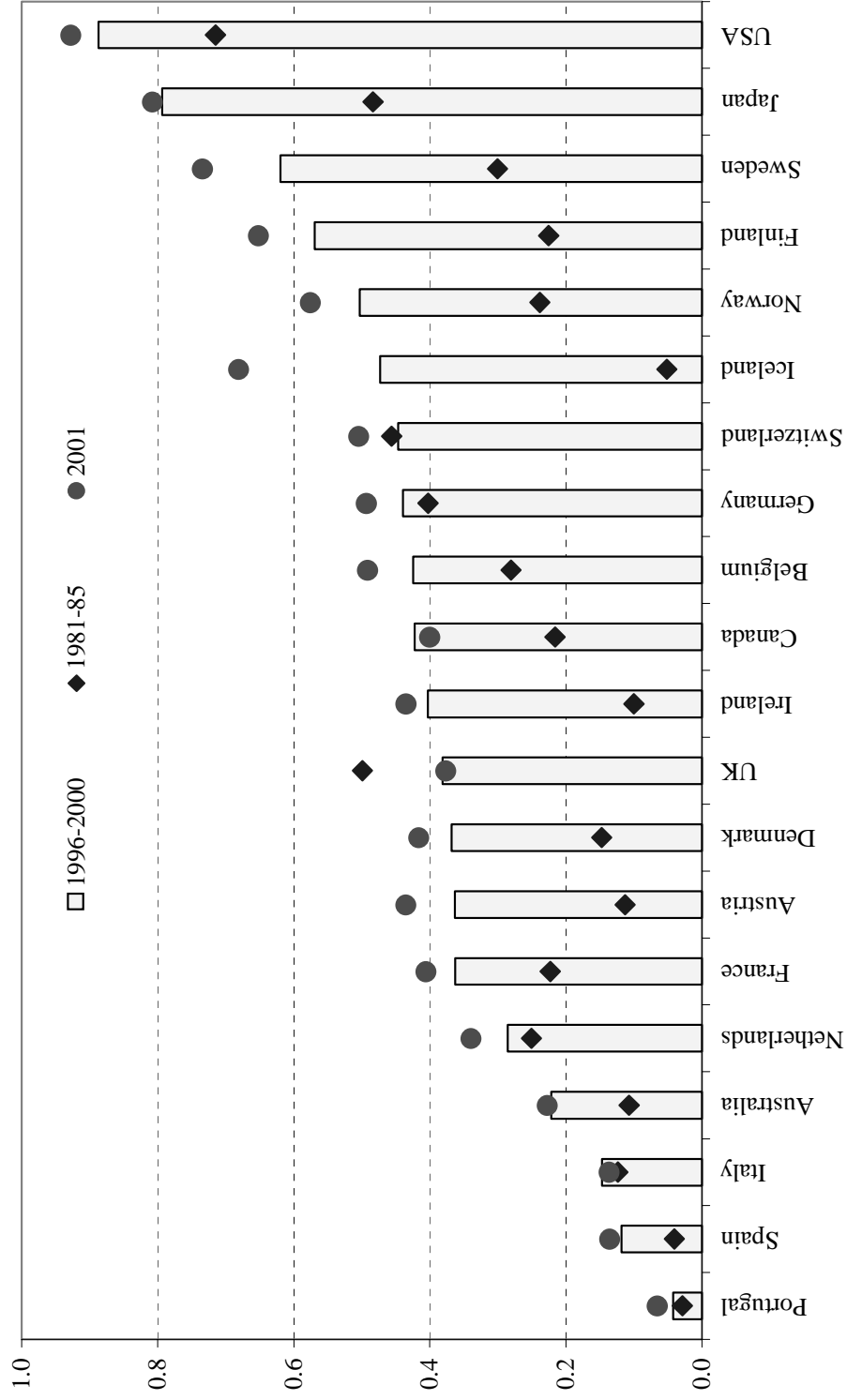
1. The regression line excludes Iceland, which is an important outlier.
 Source: OECD Main Science and Technology Indicators database and R&D database.

Figure 2.4 Non-business R&D intensity
% of GDP, average per annum



Source: OECD Main Science and Technology Indicators database and R&D database.

Figure 2.5 **Business sector researchers**
 % of total dependent employment, average per annum

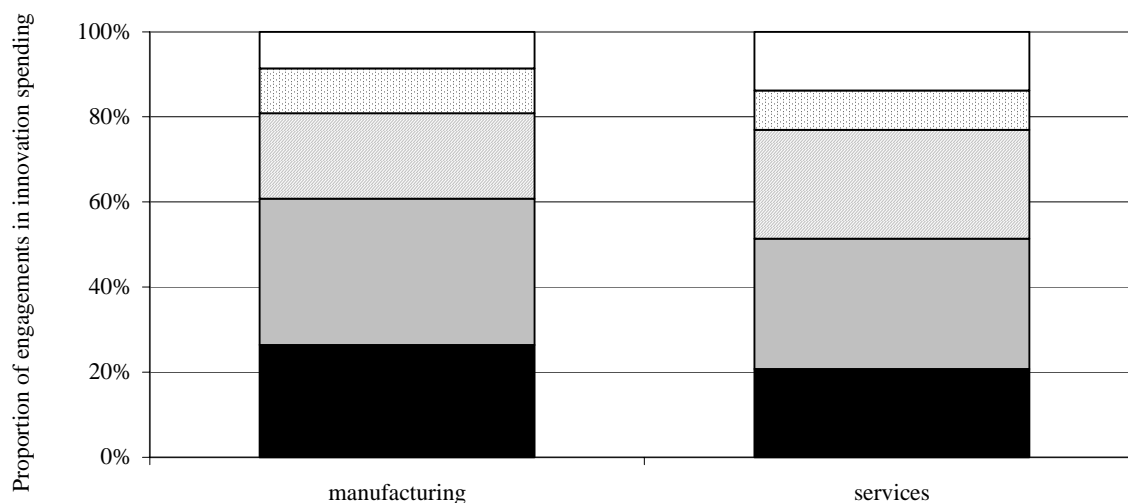


Source: OECD Main Science and Technology Indicators database and R&D database.

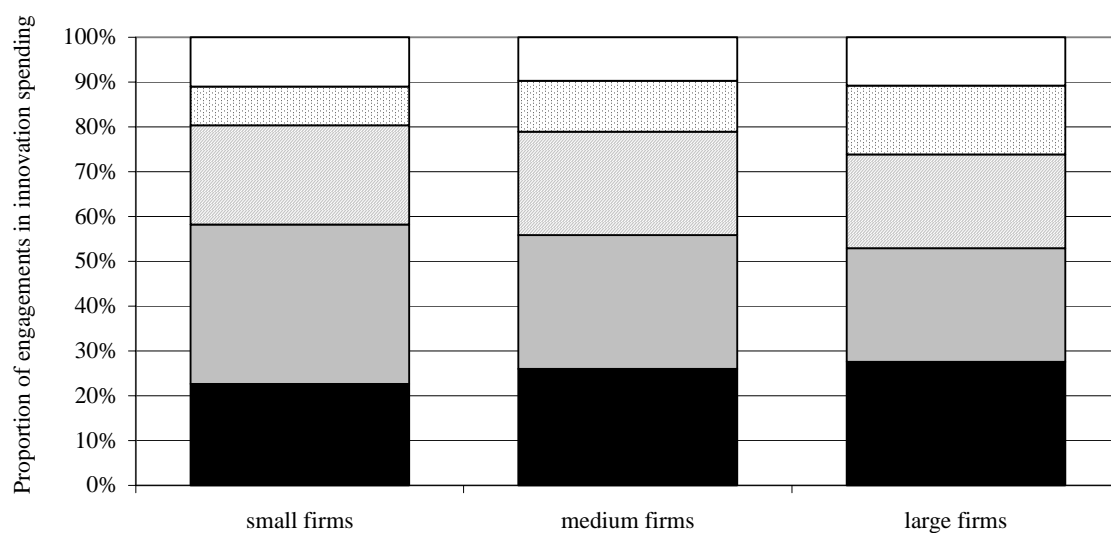
Figure 2.6. **Composition of innovation spending**¹
Community Innovation Survey countries, 1998-2000

■ intramural R&D □ machinery ▨ training □ extramural R&D □ external knowledge

Panel A: **Manufacturing versus services**²



Panel B: **By firm size**³



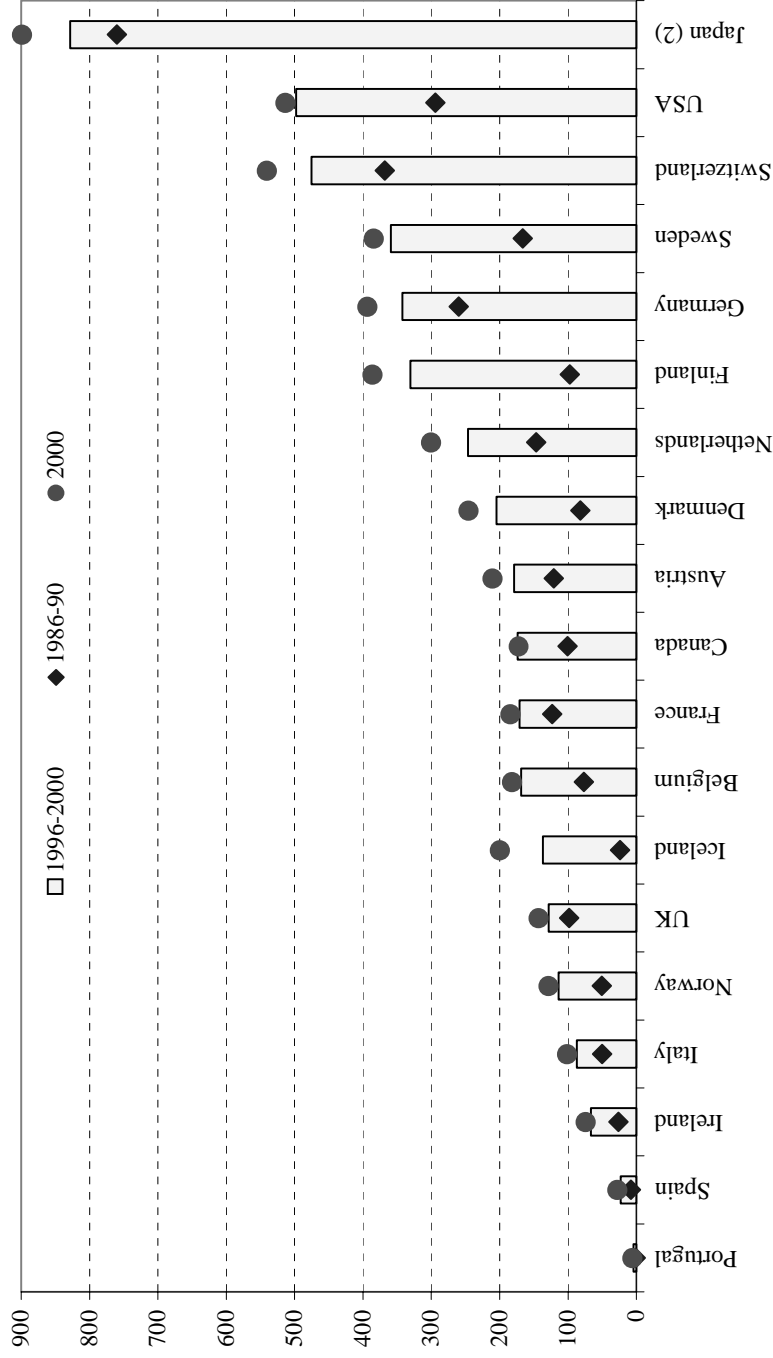
1. The proportion of engagements in innovation spending is calculated as the ratio of the proportion of firms engaging in a specific type of innovation spending to the sum of the proportions of firms engaging in the various types of innovation spending. Firms can engage in multiple forms of spending.

2. The sectoral aggregates are calculated by taking a weighted average of the individual countries' observations for the sector and using as country weight the country's share in the total population of firms working in the sector in all included countries.

3. The size class aggregates are calculated by taking a weighted average of the individual countries' observations for the size class and using as country weight the country's share in the total population of firms working in the size class in all included countries.

Source: Community Innovation Survey 3 (European Commission).

Figure 2.7 Total patents per million of working age population¹
Average per annum; residency of inventor

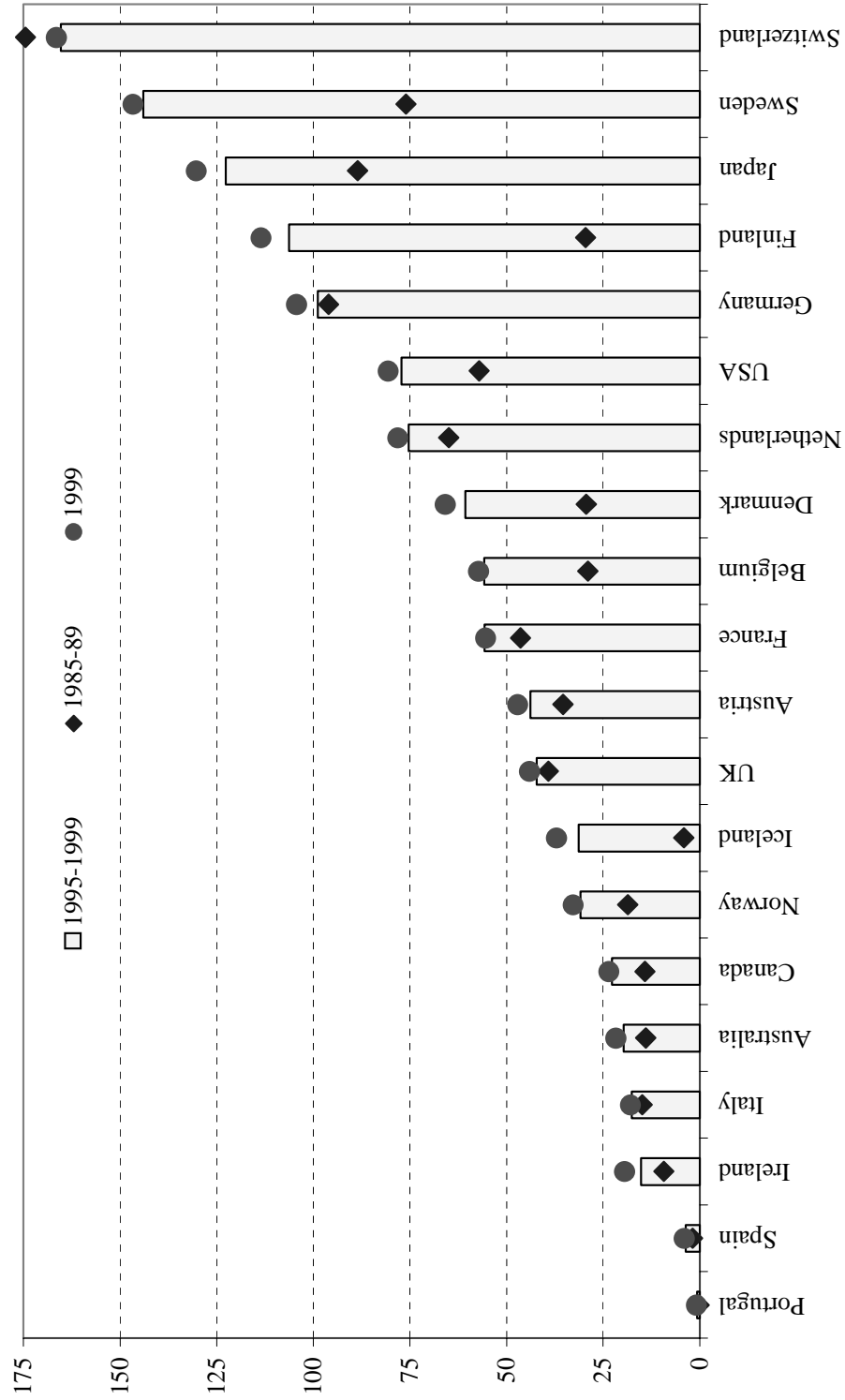


1. Total patents are patent applications at the EPO for European countries, patent applications at the JPO for Japan, and patent grants (based on priority dates) at the USPTO for the United States and Canada. Australia is not included in the figure because comparable data on patent applications at the Australian patent office were not readily available.

2. As explained in Section 2.3 of the main text, the level of patent applications at the JPO is much larger because a different application has to be filed for each claim. The patent applications for Japan were divided by five to fit the scale of the figure. Their level is not comparable with the level of patent applications of other countries.

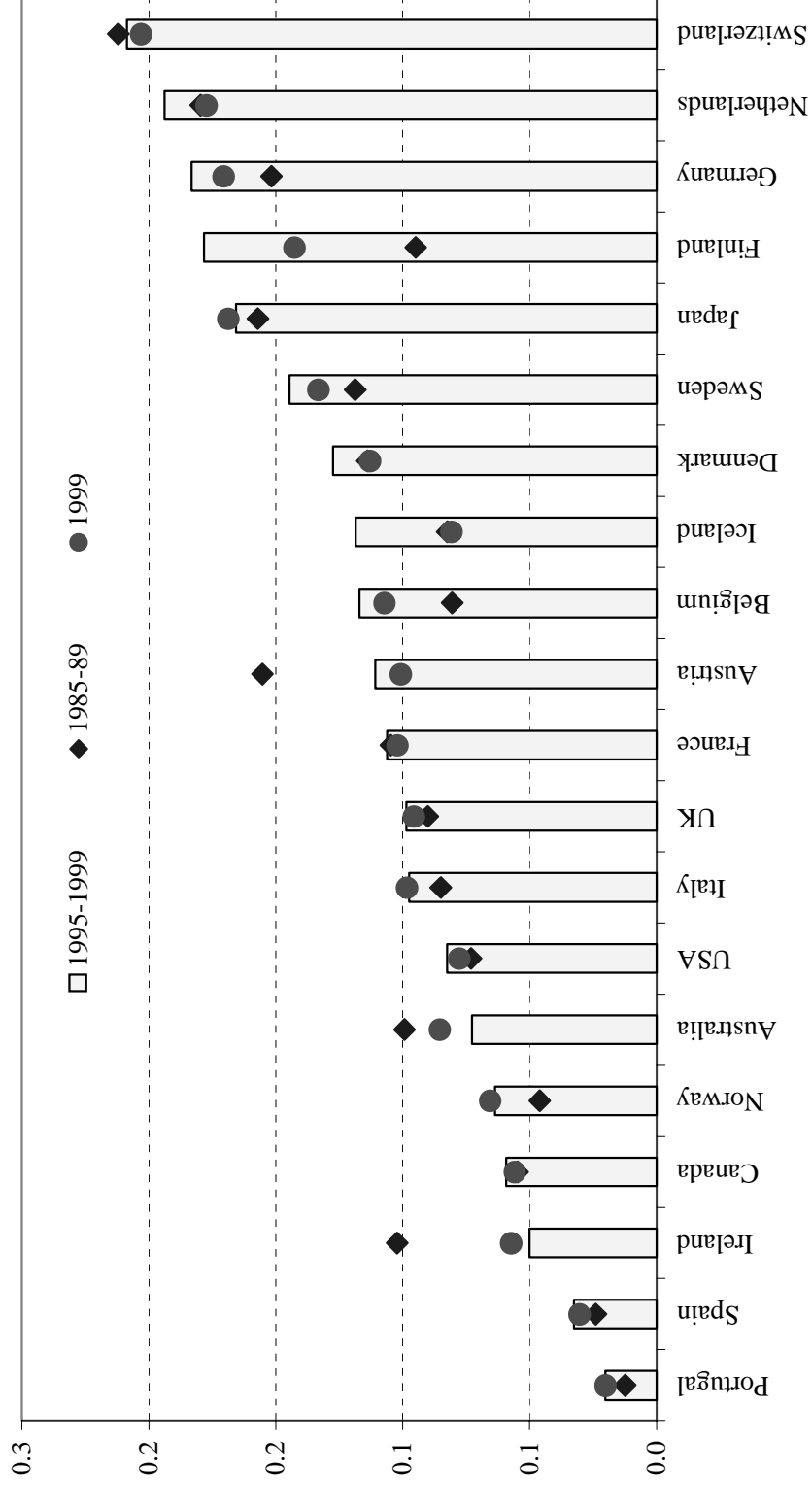
Source: OECD Patent database; JPO and Maskus and McDaniel (1999) for data on Japan.

Figure 2.8 Triadic patents per million of working age population
Average per annum; residency of inventor



Source: OECD Patent database.

Figure 2.9 Triadic patents per million of business R&D spending
 2000 PPP-adjusted R&D spending, average per annum

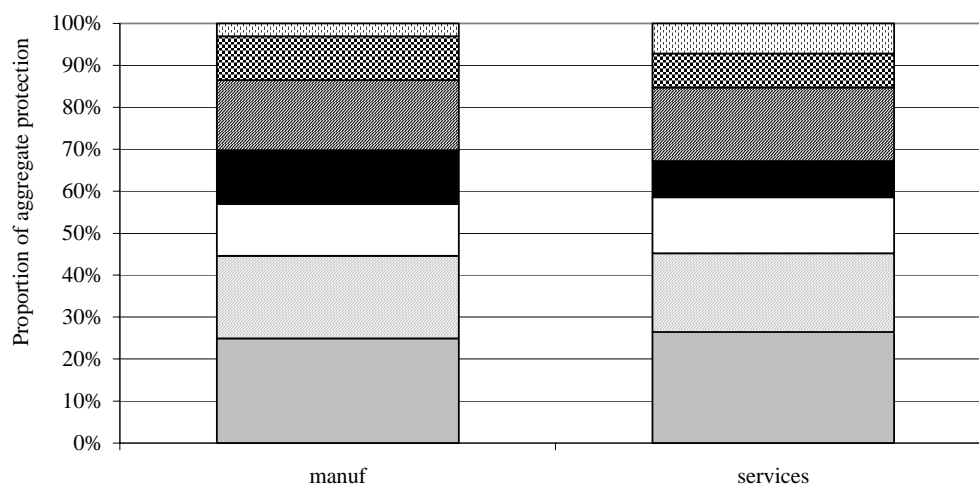


Source: OECD Patent database.

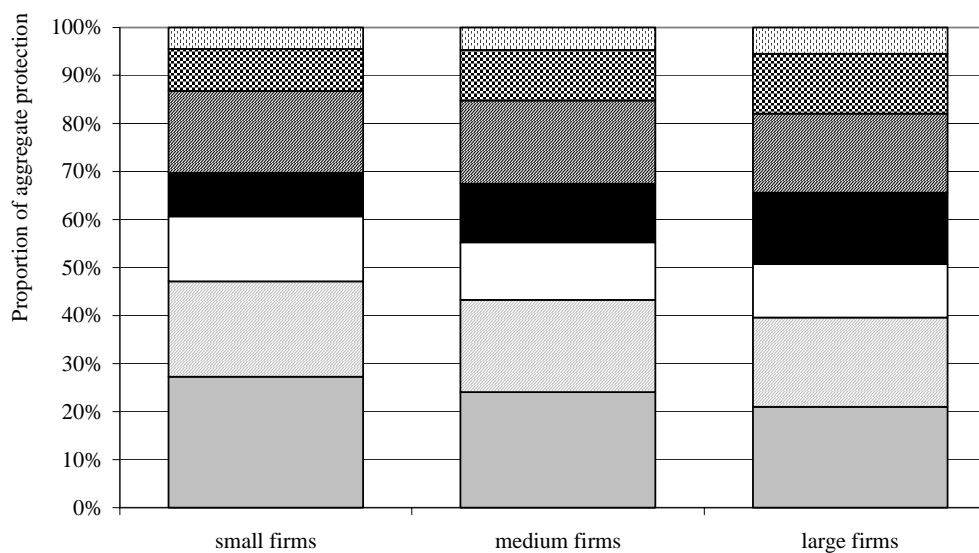
Figure 2.10 **Choice of protection method**¹
Community Innovation Survey countries, 1998-2000

■ lead time □ secrecy □ complexity ■ patent ▨ trademark ▩ design registration ▩ copyright

Panel A: **Manufacturing versus services**²



Panel B: **By firm size**³



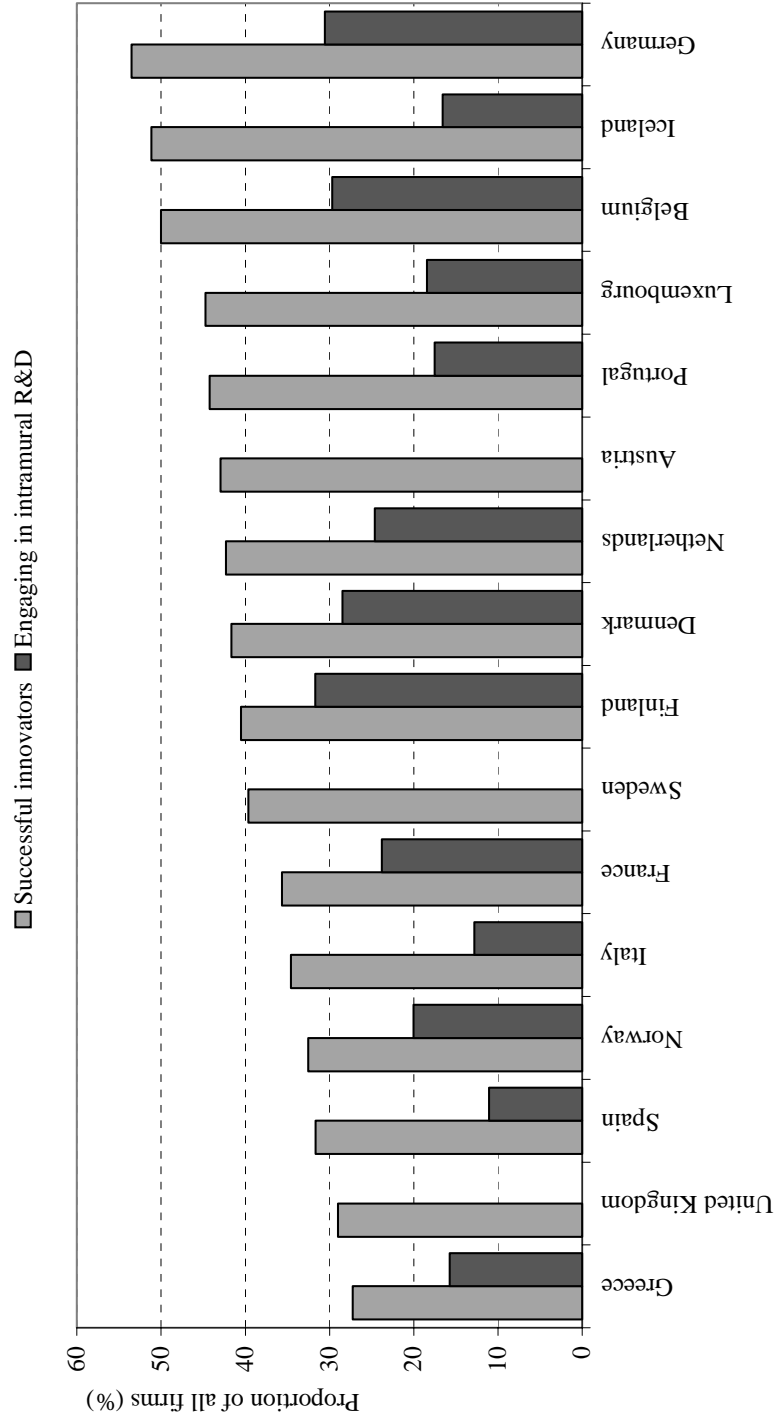
1. The proportion of a specific type of protection in aggregate protection is calculated as the ratio of the proportion of firms using this specific type of protection to the sum of the proportions of firms using the various types of protection. Firms can use different forms of protection.

2. The sectoral aggregates are calculated by taking a weighted average of the individual countries' observations for the sector and using as country weight the country's share in the total population of firms working in the sector in all included countries.

3. The size class aggregates are calculated by taking a weighted average of the individual countries' observations for the size class and using as country weight the country's share in the total population of firms working in the size class in all included countries.

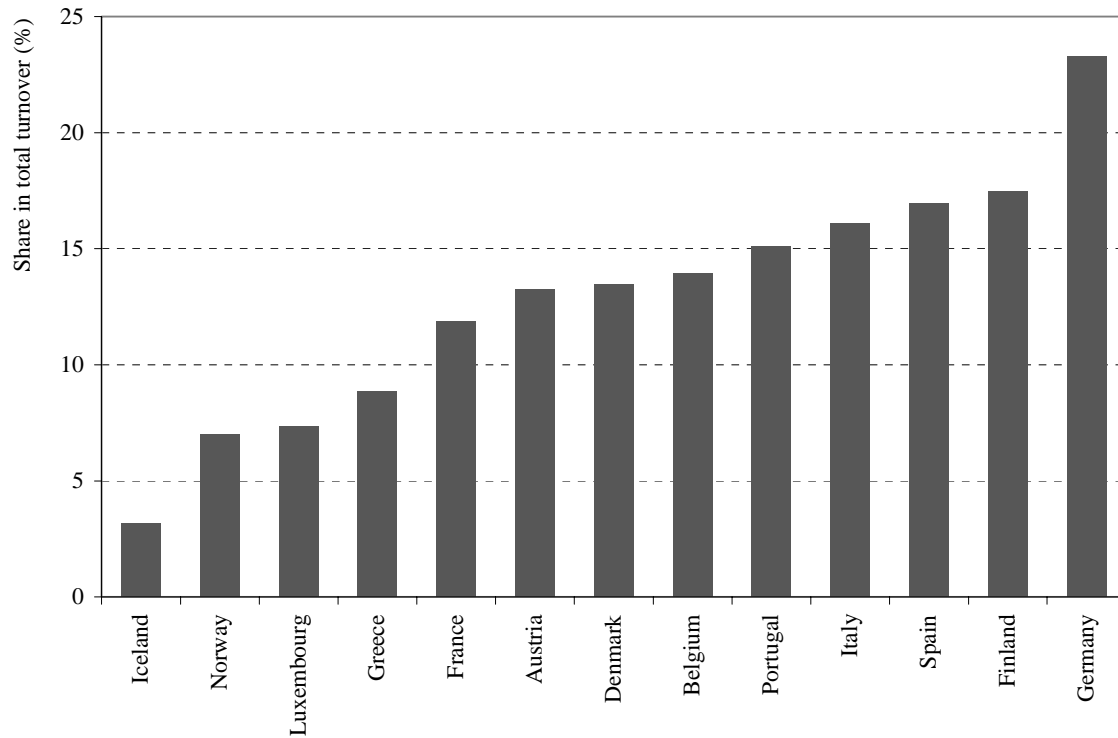
Source: Community Innovation Survey 3 (European Commission).

Figure 2.11 Comparison of countries' innovative performance by various measures, 1998-2000¹



1. Care has to be taken when interpreting cross-country comparisons made with the aggregated data in CIS, as there are differences in the sample size used in the respective national components of the survey. For Austria, Sweden, and the United Kingdom, no data are available on the proportion of firms which engage in intramural R&D
 Source: Community Innovation Survey 3 (European Commission).

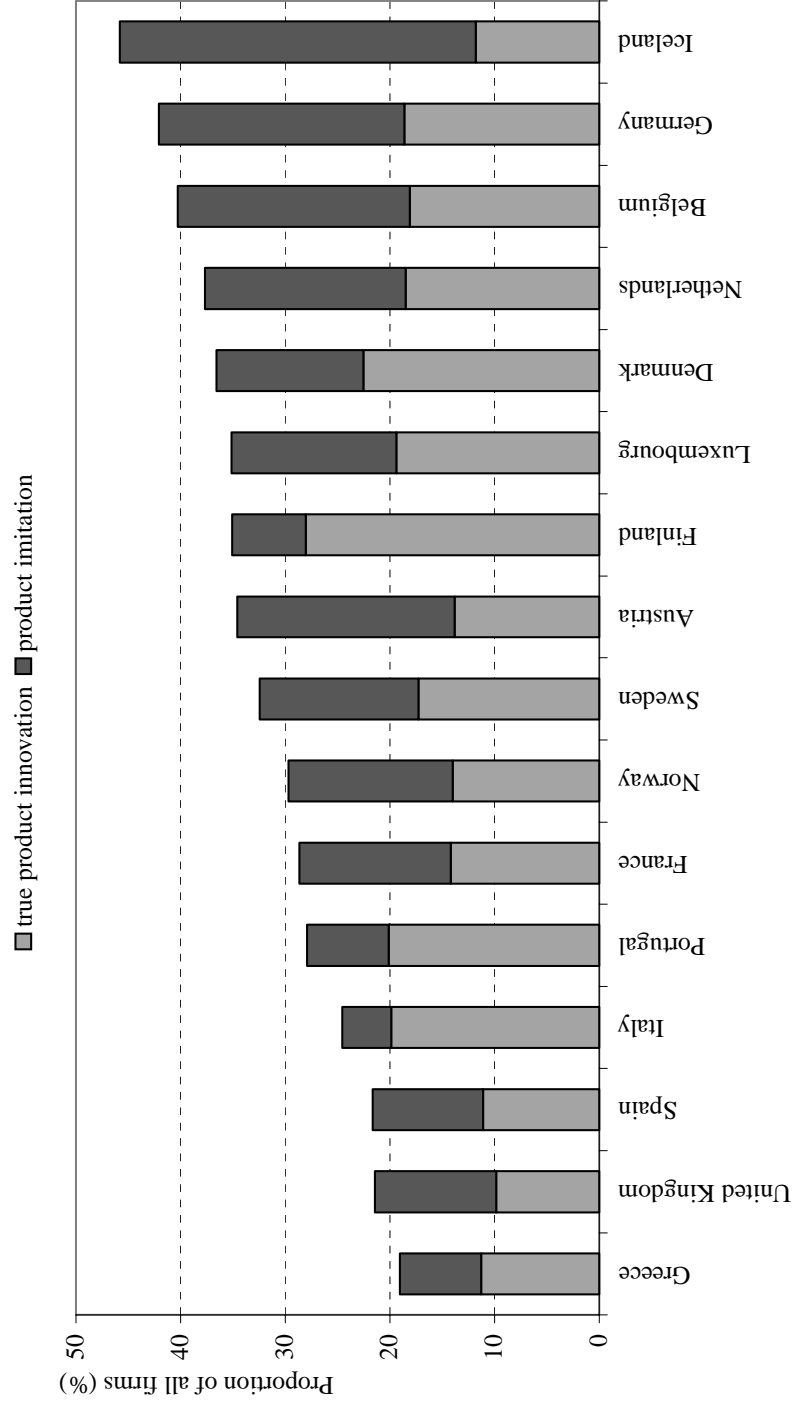
Figure 2.12 Share of new products in turnover¹
1998-2000



1. Care has to be taken when interpreting cross-country comparisons made with the aggregated data in CIS, as there are differences in the sample size used in the respective national components of the survey.

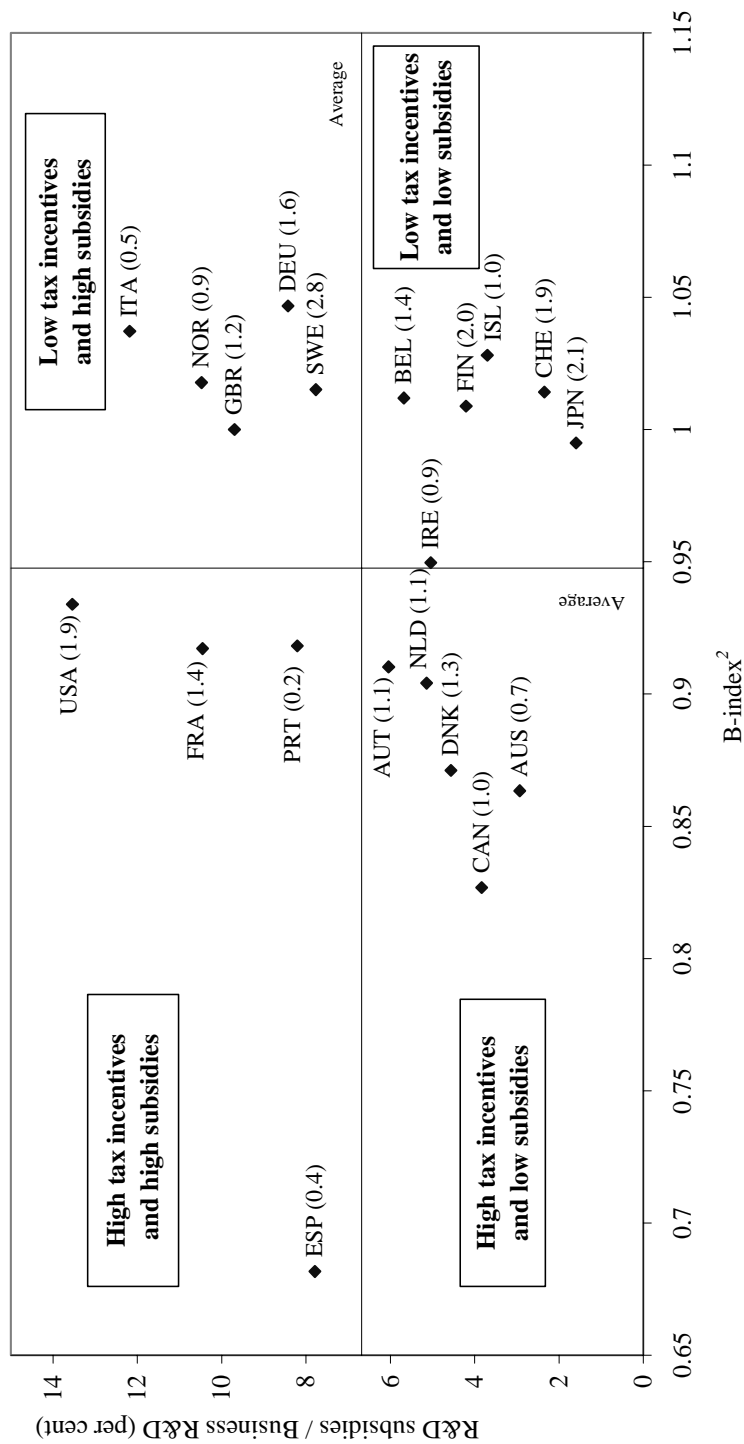
Source: Community Innovation Survey 3 (European Commission).

Figure 2.13 Pure innovation and imitation¹
1998-2000



1. Care has to be taken when interpreting cross-country comparisons made with the aggregated data in CIS, as there are differences in the sample size used in the respective national components of the survey. Pure innovation refers to the proportion of firms which have introduced a product new to the market. Imitation refers to the proportion of firms which have introduced a product new to the enterprise but not new to the market. Data on the distinction between pure innovation and imitation are available only for product innovations, and not for process innovations. *Source:* Community Innovation Survey 3 (European Commission).

Figure 3.1 The state of tax and subsidisation policies
Average per annum, 1996-2000

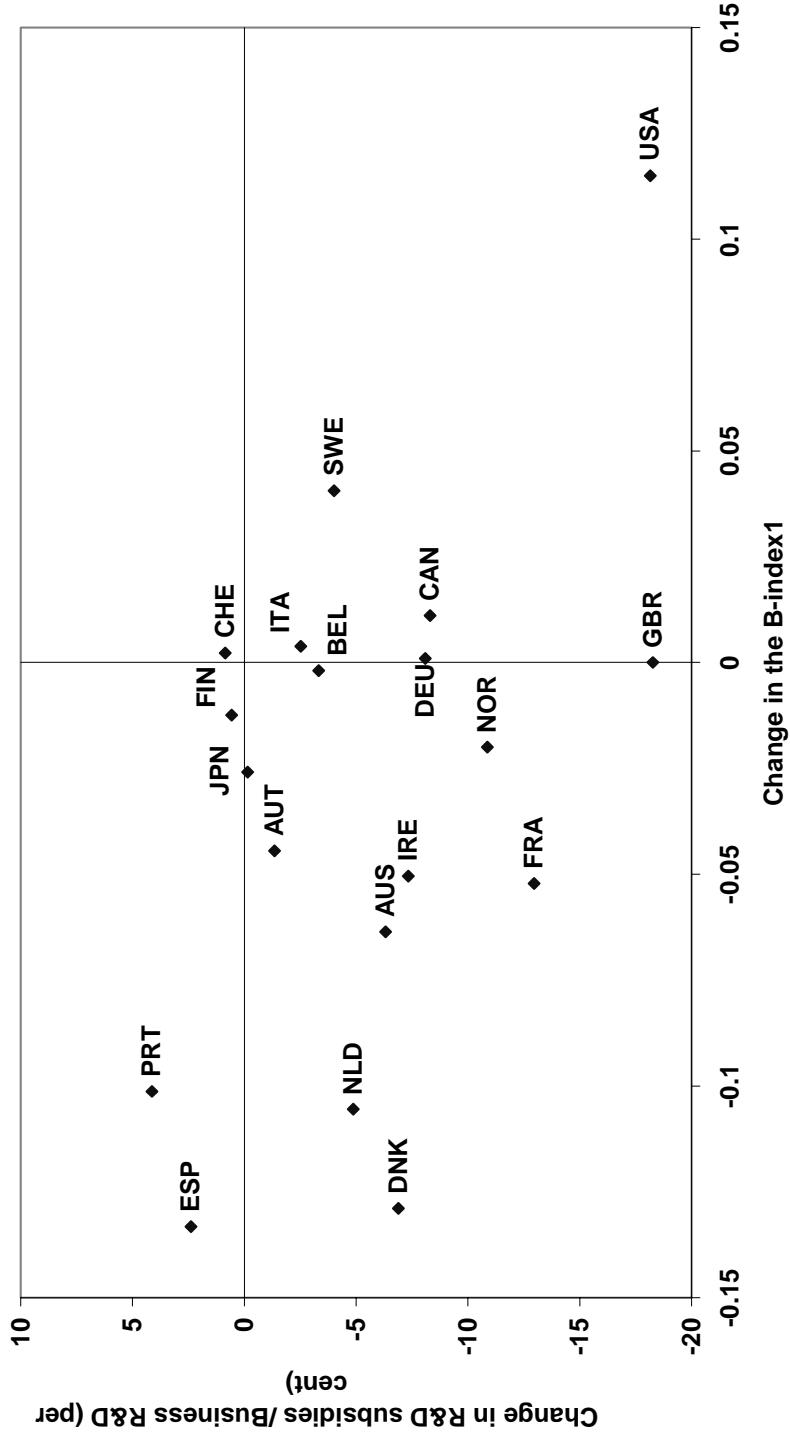


1. The numbers in parentheses are the average business R&D intensities in 1996-2000.

2. The B-index is defined as one minus the rate of tax subsidy for R&D.

Source: OECD Main Science and Technology Indicators database for data on R&D subsidies; OECD, STI/EAS Division for data on the B-index.

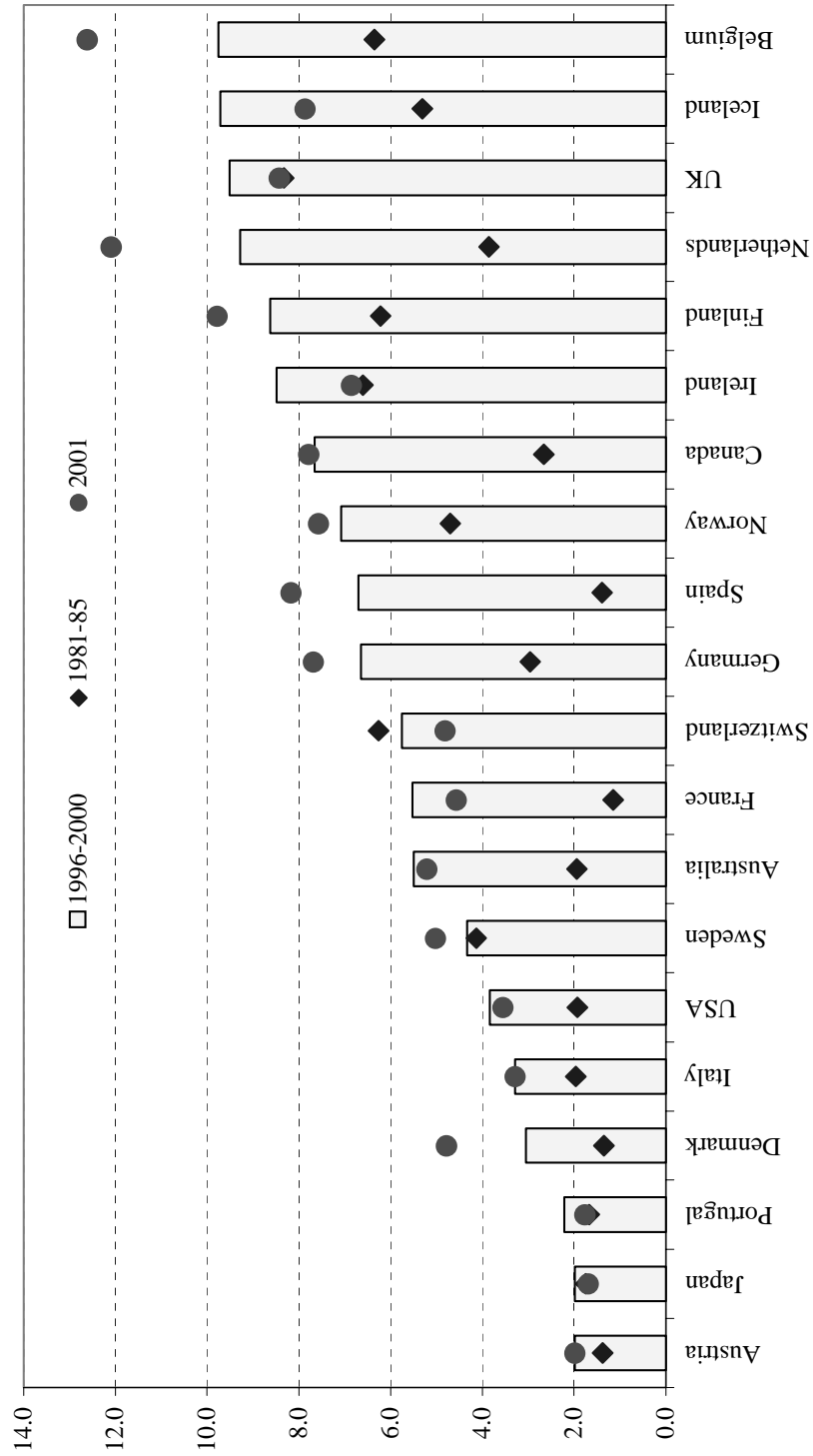
Figure 3.2 Changes in tax and subsidisation policies
Average per annum 1996-2000 versus Average per annum 1981-1985



1. The B-index is defined as one minus the rate of tax subsidy for R&D.

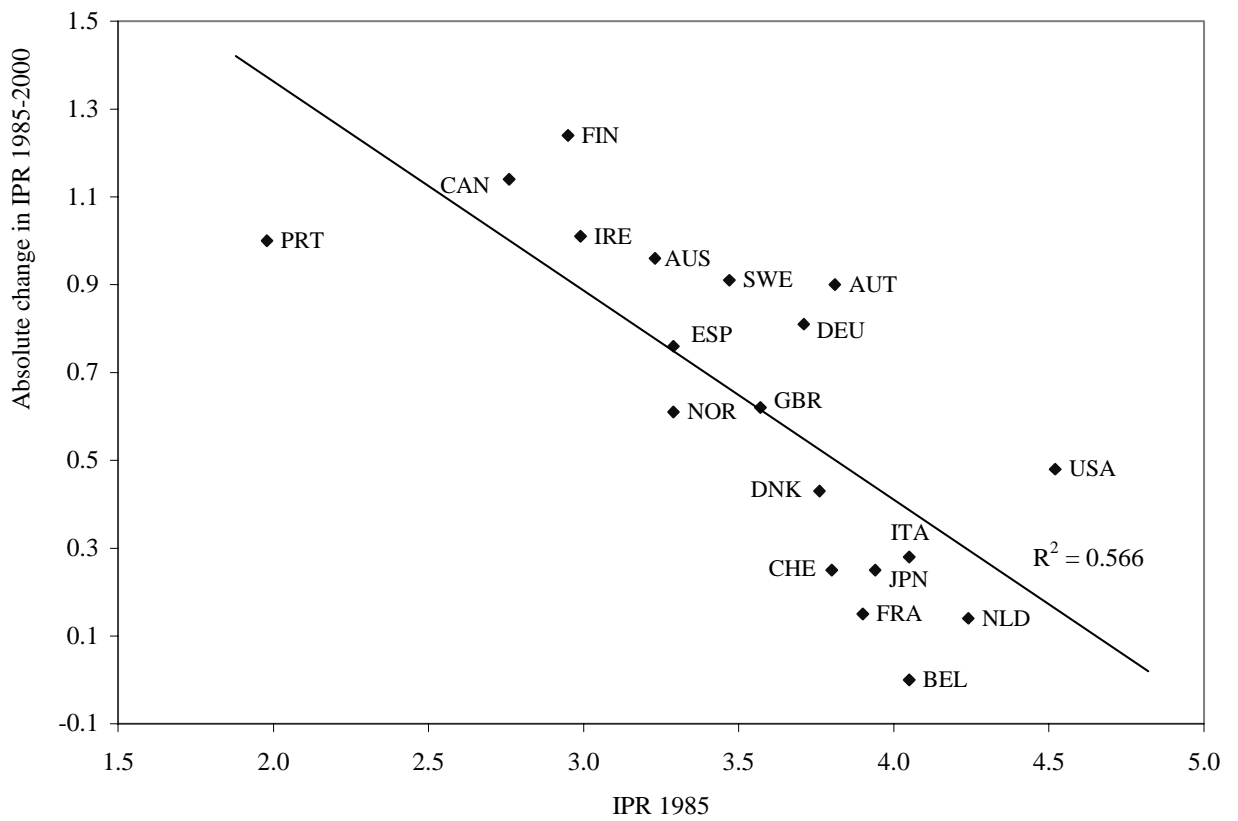
Source: OECD Main Science and Technology Indicators database for data on R&D subsidies; OECD, STI/EAS Division for data on the B-index.

Figure 3.3 Business funding of non-business sector R&D¹
% points, average per annum



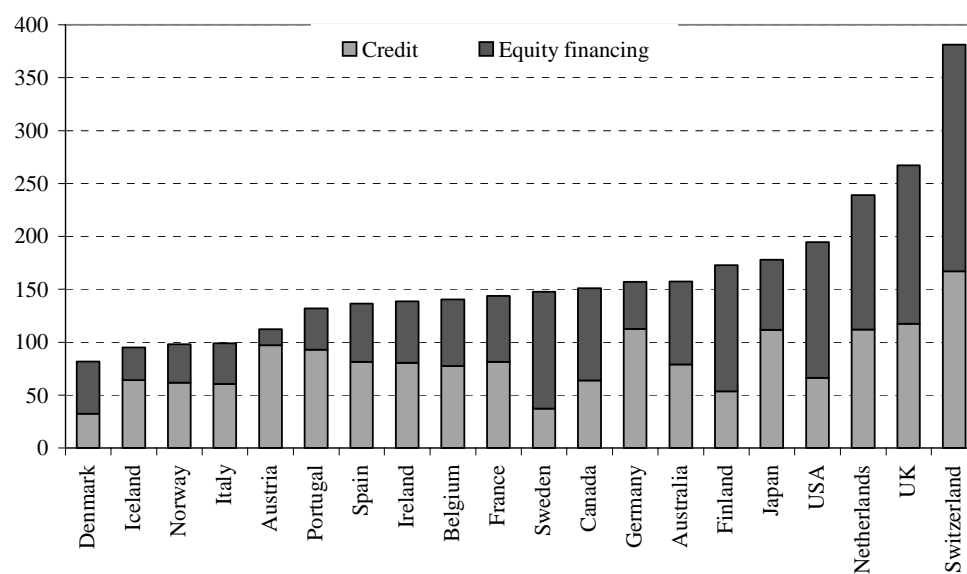
1. The last observed value is 2000 instead of 2001 for Australia, Ireland, and Switzerland; for Italy, the last observed value is 1996.
Source: OECD Main Science and Technology Indicators database.

Figure 3.4 Convergence in intellectual property rights (Park index)
1985-2000

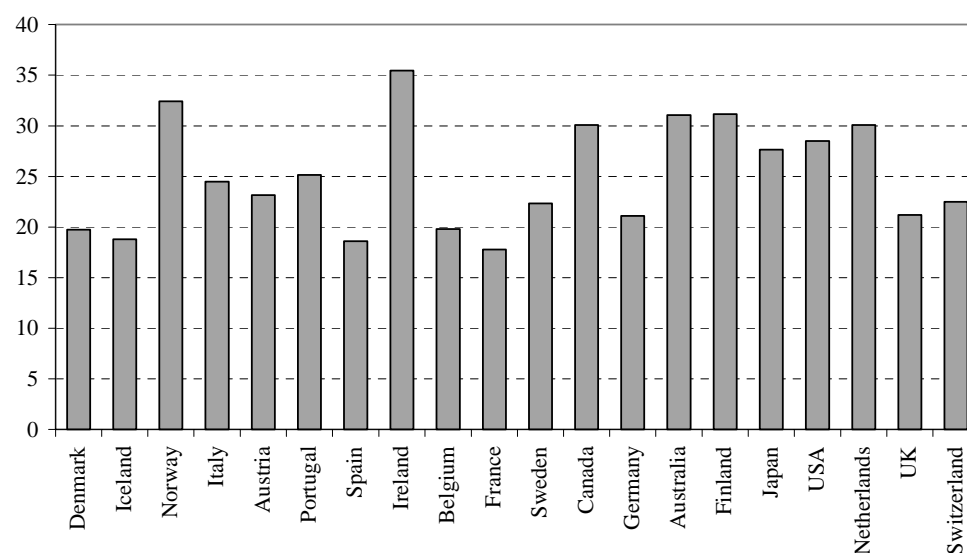


Source: Park and Wagh (2002) and Ginarte and Park (1997).

Figure 4.1 Financial factors
Panel A: Financial development / GDP¹
 Average 1996-2000, in per cent



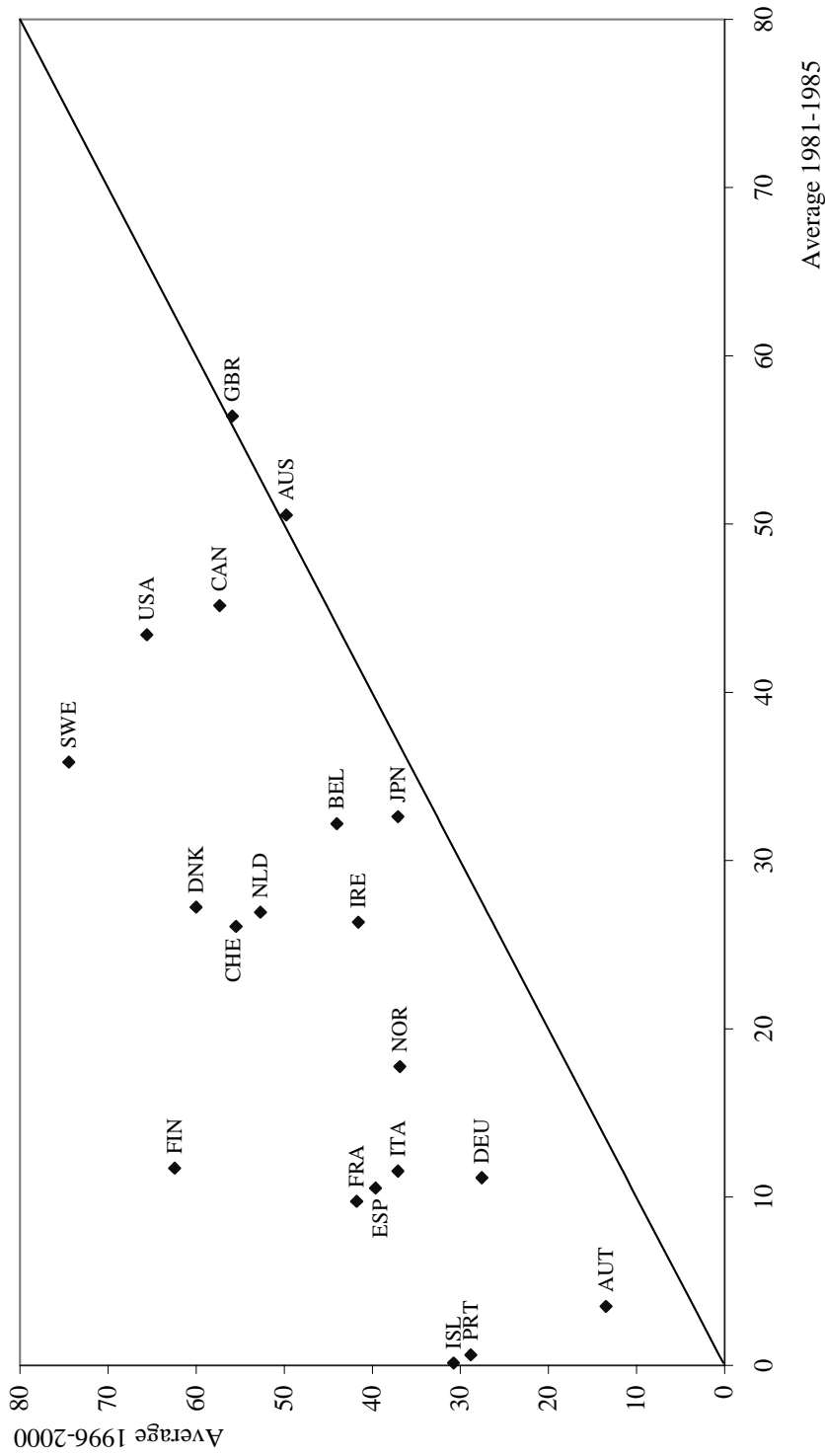
Panel B: Profits / GDP
 Average 1996-2000, in per cent



1. Financial development is defined as the sum of credit and equity financing. Credit refers to private credit by deposit money banks. Equity financing refers to the stock market capitalisation.

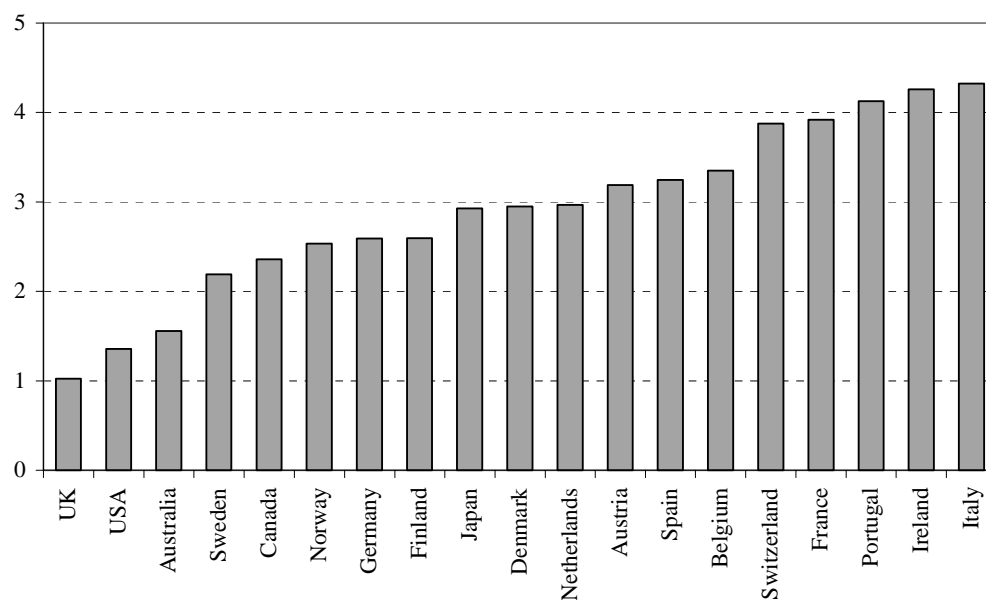
Source: World Bank Financial Development and Structure database for data on financial development and OECD Analytical database for data on profits.

Figure 4.2 Evolution of the share of equity financing in financial development¹
Average per annum 1996-2000 versus Average per annum 1981-1985

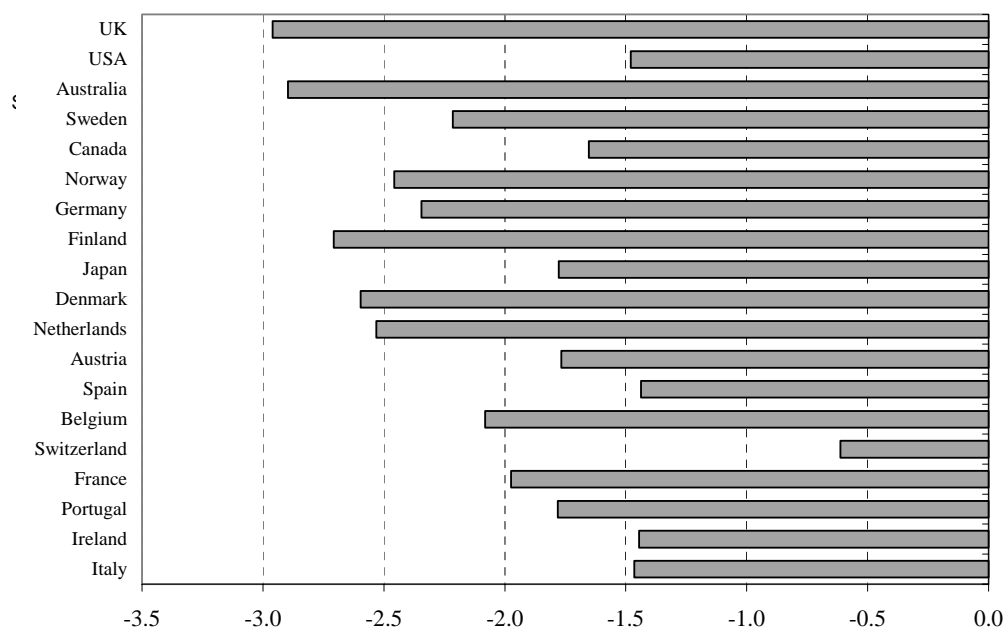


1. Financial development is defined as the sum of credit and equity financing. Equity financing refers to the stock market capitalisation.
Source: World Bank Financial Development and Structure database.

Figure 4.3 PMR index¹
 Panel A: Cross-country comparison in 1998

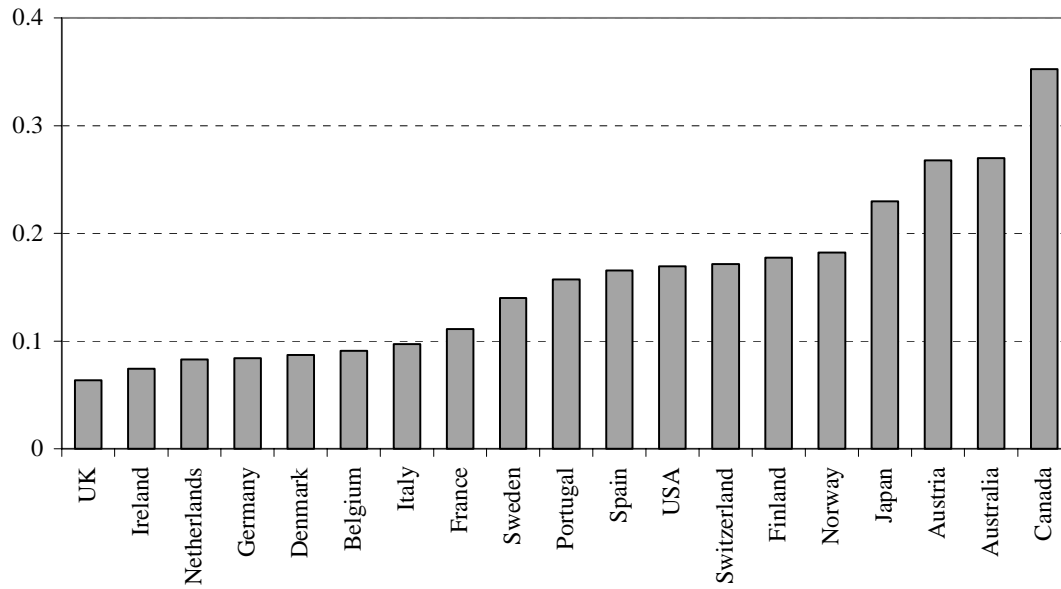


Panel B: Change between 1985 and 1998

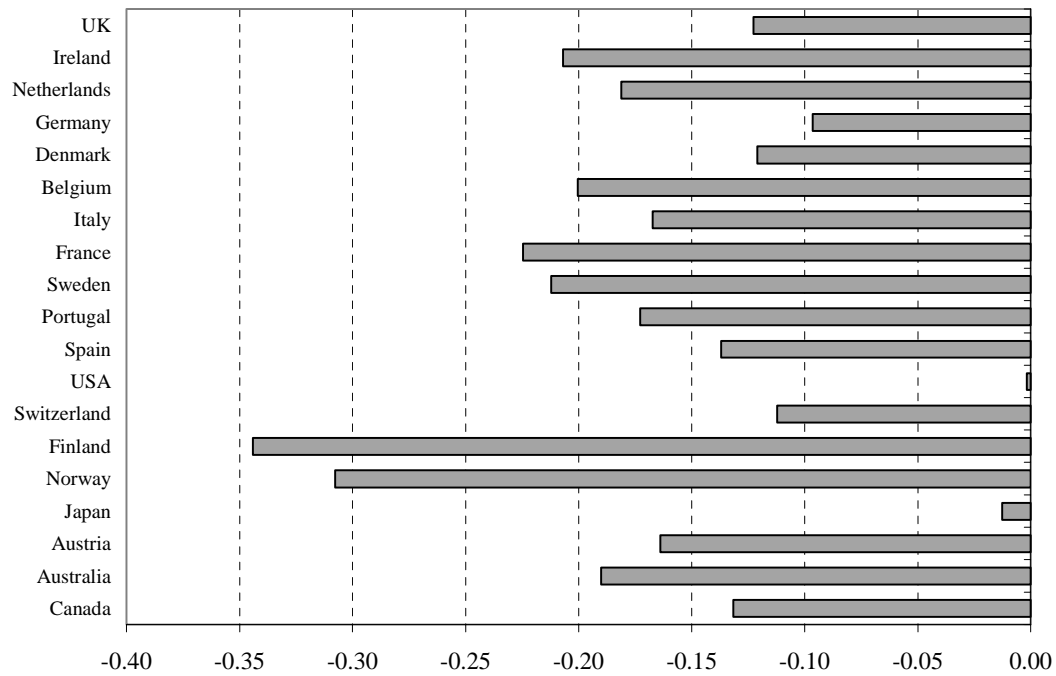


1. This OECD index of product market regulation covers 7 non-manufacturing sectors for which time-series data are available.
 Source: Nicoletti and Scarpetta (2003).

Figure 4.4 Index of FDI restrictions
Panel A: Level in 1998



Panel B: Change between 1985 and 1998



Source: Golub (2003).