

Research and Development by French Firms within the European Union: Sectoral Specificities and Public Funding

Thomas Balcone, Camille Schweitzer*

Today, research and development (R&D) is a major focus for driving national growth. Since the “Lisbon Strategy” in 2000 and the “Europe 2020” strategy in 2010, the European Union (EU) has set itself the goal of devoting at least 3% of its GDP to R&D activities to ensure it remains competitive with countries such as the United States, which devoted 2.7% to research and development in 2015 (compared to 2.0% in the case of the EU). Approximately two thirds of R&D are carried out by businesses, meaning that private research carries significant weight in national research and development efforts. However, businesses vary from country to country and certain business sectors are more conducive to R&D activities than others. In other words, the sectoral structure of a country’s economy has an impact on its overall research and development effort. For example, if France had the same economic structure as Germany with a larger manufacturing sector while maintaining its sectoral levels of research and development intensity, the research and development efforts of businesses would total 2.7% (compared to the current level of 1.4%).

As well as the R&D activities that it carries out, the public sector also has an impact on business enterprise R&D through public policies and funding for private research. France is the EU country with the highest level of expenditure (as a share of GDP) on public subsidies for business enterprise R&D. However, R&D support policies are not enough by themselves to guarantee major research and development efforts.

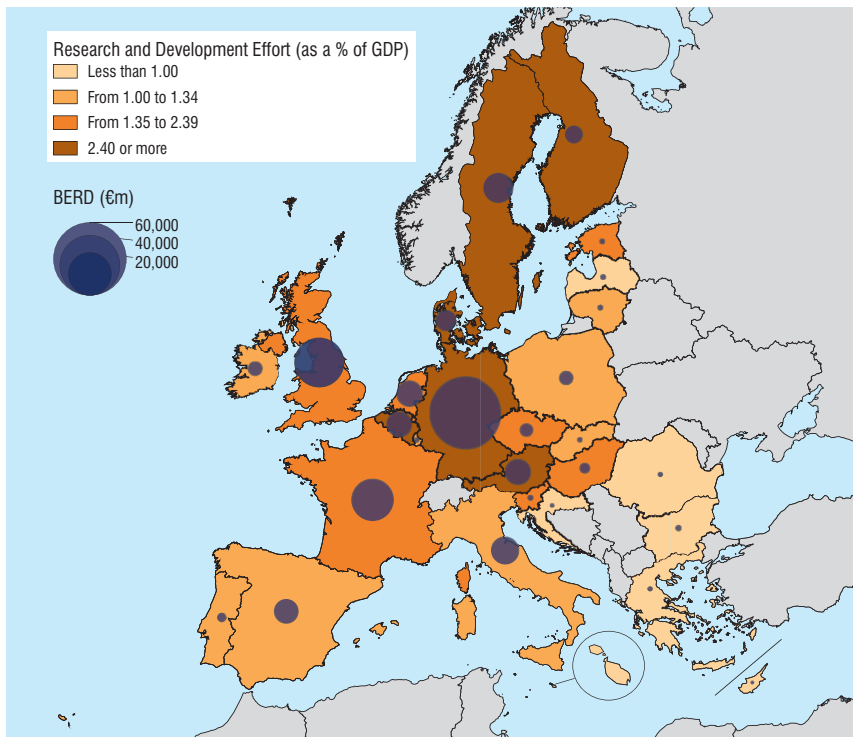
Research and development (R&D) is carried out in the two main institutional sectors of the economy: public sector agencies (research organisations, higher education institutions, non-profit institutions) and businesses. As part of the “Europe 2020” strategy, the aim is to devote 3% of **gross domestic product** (GDP) to R&D. More specifically, insofar as the goal is for two thirds of R&D work to be carried out by the private sector, private organisations play an important role in national research and development efforts. However, the activities of businesses may be more or less conducive to R&D and the relative economic importance of sectors varies from country to country.

In 2015, France Devoted 2.23% of its GDP to R&D Activities, Ranking Seventh among European Union Countries

Within the European Union (EU), R&D profiles differ widely [Testas, 2015]. While EU countries devoted on average 2.04% of their GDP to R&D in 2015, **research and development efforts** range from 0.48% in Cyprus to 3.27% in Sweden (*Figure 1*). Research and development efforts have traditionally been high in Northern European countries (2.96% in Denmark and 2.90% in Finland), as well as in Germany and Austria. France’s R&D share of GDP is lower (2.23%).

* Thomas Balcone, Camille Schweitzer, Mesri-Sies.

1. Research and Development Effort and Gross Domestic Expenditure on Research and Development by Business Enterprises in the European Union in 2015



Sources: Insee; Mesri-Sies; OECD.

Since 2007, R&D expenditure has increased in volume in almost all European countries, albeit at different rates. In France, **gross domestic expenditure on research and development** (GERD) increased on average by 2.0% per year between 2007 and 2015 at constant prices¹ (Figure 2). The growth recorded in France has been less rapid than in the EU as a whole (2.3%), with Germany (3.2%) and Austria (3.6%) in particular ranking high. The weight of firms in national R&D also varies, standing at 64% in the EU and 65% in France compared to less than 30% in Cyprus, Slovakia, Lithuania and Latvia and, at the other end, more than 70% in Ireland, Austria, Hungary, Bulgaria and Slovenia.

This paper is based on a limited number of countries, the aim being to provide a more detailed analysis based on the available data (Box 1). In addition to France, this study focuses on five countries:

- Germany: France is often compared to Germany, a neighbouring country and an initiator of many European policies. Germany's GERD (€89 billion) is much higher than France's (€49 billion). In terms of research and development effort, Germany is also more efficient than France, devoting

1. Hereinafter, changes are always calculated at constant prices.

Comparability and Sources

In France, data on research and development (R&D) are drawn from surveys on the resources devoted to R&D carried out by firms, public bodies, higher education institutions, university hospitals and associations carried out by the statistical service of the French Ministry of Higher Education, Research and Innovation (MESRI-SIES). Each year, the business survey covers approximately 11,500 firms (in the sense of legal units) liable to carry out R&D work in France, including all firms with R&D expenditure exceeding 0.4 billion euros and a sample of other firms. The figures for 2015 are final.

The data are governed by European regulations that require them to be collected according to harmonised concepts and practices derived from the Frascati Manual, thus allowing international comparisons.

The data for Germany, the United Kingdom, Italy,

Austria and Denmark are drawn from the Eurostat databases. Germany's BERD and direct public funding by sector of activity are drawn from data published online by the Federal Statistical Office of Germany (Statistisches Bundesamt).

The analysis by sector of activity differs from the figures usually published by the Ministry by area of research, but it is preferable in this case for international comparison purposes. This explains the greater weight of services in R&D expenditure, with firms operating in the "professional, scientific and technical" activity sector often carrying out R&D in manufacturing sectors (83% of such firms compared to 66% of the total BERD in this sector).

The aggregate examined in this dossier (BERD) is not directly comparable with the research output of the market sector calculated by the national accounts in France.

1. Document produced under the aegis of the OECD (the latest version dates from 2015).

2. <https://ec.europa.eu/eurostat/fr/data/database>

3. <https://www.stifterverband.org/wissenschaftsstatistik/publikationen>

2.91% of its GDP to R&D activities, compared to 2.23% in the case of France. The gap is particularly wide in the business sector and has increased slightly since 2007 (*Figure 3*);

- the United Kingdom: while the share of **services** in the economies of France and the United Kingdom is largely similar, the R&D activities carried out by service sector firms weigh more in the United Kingdom than in France. However, Britain's total GERD is close to France's, but has grown at a slower rate on average since 2007, with a significantly lower research and development effort in 2015 (1.67% compared to 2.23%);

- Italy: Italy ranks fourth in the EU in terms of GERD. Despite the slightly larger share of the manufacturing sector compared to France, the share devoted to the research and development effort is lower (1.34%). Since 2007, it has increased by 0.2 points, like France. This is explained by an average increase in GERD of 1%, despite an average decrease in GDP of 1% per year;

- Austria: with a research and development effort of 3.05% in 2015, Austria is the second most R&D-intensive country in the EU behind Sweden², with a particularly high proportion of business enterprise R&D. Austria's R&D expenditure has increased significantly in recent years, rising at an average rate of 3.6% per year since 2007;

- Denmark: like the other Nordic countries, its research and development effort has traditionally been high (close to 3%). The pharmaceutical industry carries significant weight, both in the economy and in terms of R&D investment.

2. An examination of the case of Sweden would have been worthwhile since it has the largest research and development effort in the EU (3.27%). However, statistical confidentiality prevents significant amounts of data by sector of activity from being used.

2. R&D Profile of European Union Countries in 2015

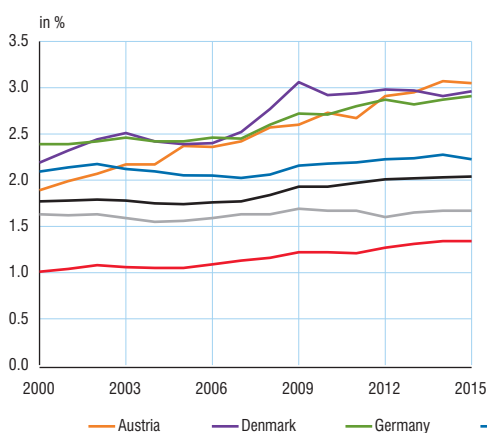
	GERD (€m)	Research and development effort (in %)	Average annual change in GERD between 2007 and 2015 (in %)	BERD (€m)	Business enterprise research and development effort (in %)	Public sector research and development effort (in %)	Business enterprise share in GERD (in %)	Share of the manufacturing sector in the economy ¹ (in %)	Share of services in the economy ¹ (in %)
Germany	88,782	2.91	3.2	60,952	2.00	0.91	69	23	69
France	48,959	2.23	2.0	31,665	1.44	0.79	65	12	78
United Kingdom	43,574	1.67	1.3	28,775	1.10	0.57	66	10	79
Italy	22,157	1.34	1.1	12,886	0.78	0.56	58	16	74
Sweden	14,663	3.27	1.4	10,218	2.28	0.99	70	15	74
Netherlands	13,696	1.98	2.6	7,669	1.11	0.87	56	12	78
Spain	13,172	1.22	-0.6	6,920	0.64	0.58	53	14	74
Austria	10,499	3.05	3.6	7,498	2.18	0.87	71	19	71
Belgium	10,118	2.47	4.5	7,076	1.72	0.74	70	14	77
Denmark	8,038	2.96	2.3	5,139	1.89	1.07	64	14	76
Finland	6,071	2.90	-2.4	4,047	1.93	0.97	67	17	70
Poland	4,317	1.00	11.0	2,010	0.47	0.54	47	20	63
Czech Rep	3,250	1.93	6.1	1,765	1.05	0.88	54	27	60
Ireland	3,133	1.19	3.2	2,233	0.85	0.34	71	37	58
Portugal	2,234	1.24	0.6	1,037	0.58	0.67	46	14	75
Greece	1,704	0.97	2.7	562	0.32	0.65	33	9	80
Hungary	1,511	1.36	5.1	1,110	1.00	0.36	73	24	64
Slovakia	927	1.18	15.3	259	0.33	0.85	28	22	62
Slovenia	853	2.20	5.3	651	1.67	0.52	76	23	65
Romania	782	0.49	1.2	344	0.21	0.27	44	22	61
Luxembourg	662	1.27	-1.2	342	0.66	0.62	52	5	87
Bulgaria	435	0.96	12.1	319	0.70	0.26	73	16	67
Lithuania	390	1.04	4.2	107	0.29	0.76	27	19	66
Croatia	375	0.84	-0.2	192	0.43	0.41	51	15	70
Estonia	303	1.47	3.9	139	0.68	0.79	46	16	69
Latvia	152	0.63	0.8	38	0.15	0.47	25	12	74
Cyprus	85	0.48	1.7	19	0.11	0.37	23	5	87
Malta	71	0.75	7.9	37	0.39	0.36	51	9	85
EU	301 793	2.04	2.3	194 113	1.31	0.73	64	16	74

1. In terms of value added.

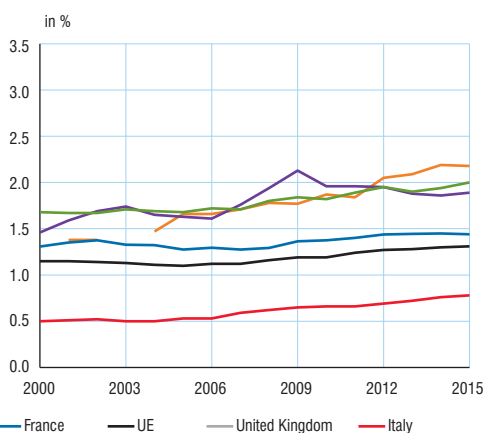
Sources: Eurostat; Insee; Mesri-Sies.

3. Changes in the Overall Research and Development Effort and Business Enterprise Research and Development Efforts since 2000 in the Countries Studied and in the European Union

a. Overall research and development effort (GERD/GDP)



b. Business enterprise research and development efforts (BERD/GDP)



Noted: Data not available for business enterprise research and development efforts in Austria for the years 2000 and 2003.

Sources: Eurostat; Insee; Mesri-Sies.

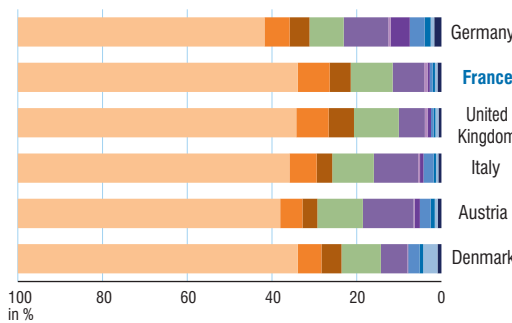
While R&D Expenditure in Germany is Concentrated in the Manufacturing Sector, its Sectoral Distribution is more Balanced in France

Among the countries that devote a significant share of its GDP to the research and development effort (close to 3%), business enterprise R&D ranks top (69% in Germany) and therefore plays a major role. However, the business activities may be more or less conducive to R&D and countries often have different economic structures³.

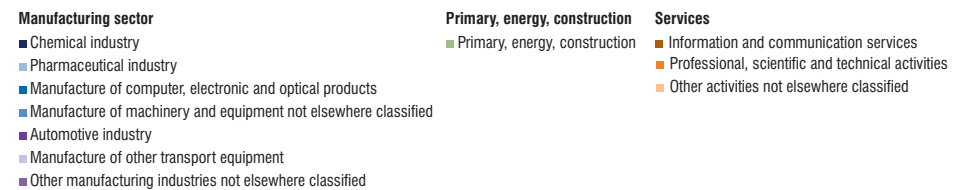
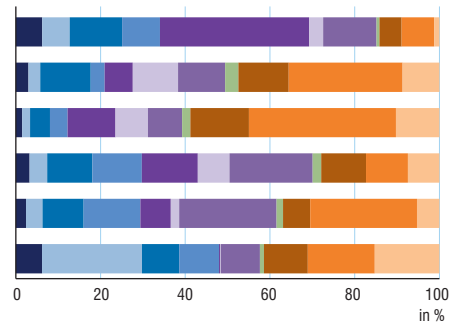
While the manufacturing sector makes up only a small percentage of the economies of the countries studied (ranging from 10% of value added in the United Kingdom to 23% in Germany), the bulk of R&D activities are carried out in this sector (Figure 4). Since 2007, value added in the manufacturing sector has declined in the countries studied (-3% in France), except in Germany where it has increased by 7%. GERD by business enterprises (BERD) in this sector has increased in all the countries studied, particularly in Germany (22%), except in France where it has stood still. As for the service sector, its significant weight in the economy and its low share of BERD is explained in part by the “other activities not elsewhere classified” category, which includes a range of activities with high economic value added but whose lower technological content equates to low research and development intensity⁴. Between 2007 and 2015, value added in the service sector increased in all the countries studied (between +7% and +11%), except in Italy. R&D expenditure in this sector increased significantly, from 21% in Italy to 69% in Austria (+44% in France).

4. Sectoral Distribution of Value Added and BERD in the Countries Studied in 2015

a. Value added by sector of activity



b. BERD by sector of activity



Sources: Eurostat; Insee; Mesri-Sies.

3. For the purposes of international comparison (Box 1), the analysis is conducted based on the main activity branch and not according to the area of research (as is commonly the case in the publications of the French Ministry of Higher Education, Research and Innovation).

4. Activities include trade, accommodation, real estate activities, administrative and support service activities, social work, art and entertainment, corresponding to sections G-I, K-L, N-T of the Statistical Classification of Economic Activities in the European Community (NACE). The value added of administrations (between 10% and 13% of the total) has been retained to ensure exhaustiveness and comparability between countries.

Only UK businesses carry out more R&D in service activities (59%) than in manufacturing, mostly in the professional, scientific and technical activity sector (which includes the “research and development” activity sector). The highest rate of R&D in manufacturing is found in Germany (85% of the BERD), where the importance of the manufacturing sector in the economy is greater than in any other country. Manufacturing research and development is particularly intensive in the automotive industry, with major groups such as Audi, BMW and Mercedes. The automotive industry accounts for 5% of the German economy and 35% of business R&D expenditure, or €21 billion. In France, the automotive industry represents just 1% of the economy and 7% of R&D expenditure, or 2 billion euros. Between 2007 and 2015, the value added generated by the automotive industry increased by 29% in Germany, while BERD in the sector grew by 40%. Despite having a higher level of **research and development intensity**, the value added of the French automotive industry decreased by 37% over the same period (with vehicle production in 2015 totalling just 65% of France's national production in 2007, a decline explained by the significant relocation of production).

France is characterised by a balance between the manufacturing and service sectors in the structure of its business R&D activities: in 2015, 49% of R&D was carried out in the manufacturing sector and 47% in service activities. Aerospace manufacturing is a particularly important manufacturing activity in France in terms of BERD and is included in other transport equipment, accounting for nearly 10% of business R&D expenditure, or just over 3 billion euros, due to the presence of major groups such as Airbus and Safran. This is far higher than in the other countries studied.

In Italy, R&D is not concentrated in any particular activity sector. In Austria, 37% of R&D is carried out in services, the majority of which (68%) is in the field of professional, scientific and technical activities. As for Denmark, the pharmaceutical industry is the key driver of business R&D (24%), with the Novo Nordisk group in particular providing a major contribution.

France is Characterised by a Small Number of Highly R&D-Intensive Manufacturing Sectors, such as the manufacture of computer, electronic and optical products

It is important to relate business R&D expenditure to the structure of the economy. Doing so provides a basis for calculating **sectoral research and development intensity**, defined as the share of the sector's value added that is reinvested in R&D. Overall, French firms devote 1.6% of their value added to R&D activities. The proportion is higher in Austria (2.4%), Germany (2.2%) and Denmark (2.2%). Since 2007, overall research and development intensity has increased by 0.5 points in Austria, 0.3 points in Germany, 0.2 points in France and the United Kingdom and 0.1 points in Italy⁶.

In France, firms involved in the manufacture of computer, electronic and optical products devote 33% of their value added to R&D activities (*Figure 5*). Furthermore, while the automotive industry receives a far greater share of R&D expenditure in German firms, French firms operating in this sector devote a slightly higher proportion of their value added to R&D (20% compared to 17%). Moreover, since 2007 there has been little change in research and development intensity in this sector in Germany, while a gain of more than 8 points has been recorded in France, in particular due to continued R&D expenditure amid a decline in value added. In services, measuring R&D is a difficult task. The sector has traditionally been less R&D-intensive than the manufacturing sector. For example, in France, service firms devote 1.0% of their value added to R&D activities, compared to 0.5% in Germany and 1.3% in Austria. By comparison, French manufacturing firms devote 6.9% of their value added to R&D activities, compared to 8.2%

6. Data not available for Denmark.

5. Sectoral Research and Development Intensity in 2015

in %

	Germany	France	United Kingdom	Italy	Austria	Denmark
Manufacturing sector	8.2	6.9	4.8	3.8	8.1	8.8
Chemical industry	8.1	5.2	2.7	3.8	6.4	14.5
Pharmaceutical industry	17.2	7.5	3.2	6.2	13.9	15.2
Manufacture of computer, electronic and optical products	19.4	33.1	12.7	16.6	24.6	22.0
Manufacture of machinery and equipment not elsewhere classified.	5.7	8.3	8.4	4.3	12.9	7.7
Automotive industry	17.3	20.1	17.4	13.9	14.1	3.4
Manufacture of other transport equipment	13.0	20.9	15.0	14.8	20.2	5.5
Other manufacturing industries not elsewhere classified	2.7	2.4	1.6	1.6	4.6	3.2
Primary, energy, construction	0.2	0.5	0.2	0.2	0.3	0.2
Services	0.5	1.0	0.9	0.3	1.3	1.2
Information and communication services	2.5	3.8	2.9	2.5	4.5	4.8
<i>of which telecommunications</i>	0.7	3.3	2.3	1.8	1.3	1.5
<i>of which IT activities and information services</i>	4.1	3.9	4.4	3.6	6.9	7.2
Professional, scientific and technical activities	2.9	5.8	5.6	1.3	11.7	6.1
Other activities not elsewhere classified	0.0	0.2	0.2	0.1	0.2	0.5
All	2.2	1.6	1.2	0.9	2.4	2.2

Sources: Eurostat; Insee; Mesri-Sies.

in Germany and 8.1% in Austria. The “professional, scientific and technical activity” sector is particularly R&D-intensive, especially in Austria (11.7%), not least it includes research centres and covers many services to the manufacturing sector. Apart from in Italy, the sector has seen an increase in its R&D intensity since 2007 (+0.7 points in France and +1.3 points in Germany).

If France had the Same Economic Structure as Germany, the Business Enterprise Research and Development Effort Would Stand at 2.74%

A highly R&D-intensive sector devotes a significant share of its value added to research, thus contributing to a significant national research and development effort. However, the significance of the contribution will depend on the share of the sector in the economy. A major sector of the national economy has a significant impact on the overall research and development effort. In other cases, the impact is limited. Therefore, sectoral research and development intensity and the importance of each sector in the economy need to be studied together in order to understand the contribution of firms to national R&D (*Box 2*).

For example, the fact that the research and development effort of firms in Germany is 0.6 points higher than in France (*Figure 6*) is mainly due to an economic structural effect (+1.3 points). Germany's economic structure is more favourable to significant research and development efforts since highly R&D-intensive activities play a more important role. This is particularly true of the automotive industry, with a structuring effect of 0.7 points. On the other hand, the intensity effect has a negative impact on Germany's business enterprise research and development effort compared to France, in both the service sector (-0.4 points) and the manufacturing sector (-0.1 points).

The research and development effort of firms operating in the United Kingdom and Italy is lower than in France (by 0.3 and 0.7 points respectively). The difference in economic structure with France has no impact on the United Kingdom since the importance of services in the

Breakdown of the Research and Development Effort Between the Structuring Effect of the Economy and the Sectoral Research and Development Intensity Effect

The research and development effort of firms based in France, noted $RDE(Fra)$, is provided by the following relationship::

$$RDE(Fra) = \frac{BERD(Fra)}{GDP(Fra)}$$

BERD can be broken down into the different activity headings (sector or main line of business). The overall research and development effort thus corresponds to the sum of the research and development efforts of each activity heading and can be rewritten as follows:

$$RDE(Fra) = \sum_{item \in NACE} \frac{AV_{item}(Fra)}{GDP(Fra)} \times RDI_{item}(Fra) \quad (1)$$

Where :

– $AV_{item}(Fra)$; is the value added generated by firms based in France in the NACE heading considered,

$$– RDI_{item}(Fra) = \frac{BERD_{item}(Fra)}{AV_{item}(Fra)}$$

is the research and development intensity of a heading for France

International Comparisons

From relationship (1), the difference between the research and development effort of a country (for example Germany) and the research and development effort of France can be broken

down into a “structural” effect, an “intensity” effect and a “residual” effect. I » :

$$RDE(Ger) - RDE(Fra) = effect_{structural}(Ger vs Fra) + effect_{intensity}(Ger vs Fra) + effect_{residual}(Ger vs Fra)$$

The different effects are written as follows:

– the “structural” effect:

$$effect_{structural}(Ger vs Fra) = RDE_{eco_structure_Ger}(Fra) - RDE(Fra)$$

where $RDE_{eco_structure_Ger}(Fra)$ is the research and development effort of France if it had the same economic structure as Germany.

– the “intensity effect:

$$effect_{intensity}(Ger vs Fra) = RDE_{RDI_Ger}(Fra) - RDE(Fra)$$

where $RDE_{RDI_Ger}(Fra)$ is the research and development effort of France if it had the same levels of research and development intensity as Germany.

– the “residual effect”:

$$effect_{residual}(Ger vs Fra) = \sum_{item \in NACE} \left[\frac{AV_{item}(Ger)}{GDP(Ger)} - \frac{AV_{item}(Fra)}{GDP(Fra)} \right] \times [RDI_{item}(Ger) - RDI_{item}(Fra)]$$

economy is almost the same in both countries. In Italy, it has only a small impact (+0.1 points). The differences are due to significantly lower levels of sectoral intensity in the United Kingdom and Italy compared to France. On the other hand, the gap between France and Austria results from both economic structural and R&D intensity effects. Austria, where the private research and development effort is among the highest in Europe, has an economic structure more favourable to R&D-intensive sectors (+0.3 points) and a higher R&D intensity (+0,4 points). In Denmark, the structural and intensity effects contribute very little to the gap with France: the research and development effort of firms in Denmark is 0.4 points higher than in France, and the residual effect is 0.3 points.

6. Breakdown of the Gap between Business Enterprise Research and Development Efforts in France and Business Enterprise Research and Development Efforts in the Other EU Countries Studied

	Research and development effort (in %)	Breakdown of the gap (in points)	Deviation from French research and development effort (in percentage points)		
			Structural effect	Intensity effect	Residual effect
Germany	2.00	0.56	1.29	- 0.48	- 0.26
Manufacturing sector	1.71	0.98	1.40	- 0.11	- 0.31
Services	0.28	- 0.39	- 0.10	- 0.35	0.06
United Kingdom	1.10	- 0.34	0.00	- 0.35	0.01
Manufacturing sector	0.43	- 0.29	- 0.05	- 0.27	0.03
Services	0.65	- 0.02	0.04	- 0.05	- 0.02
Italy	0.78	- 0.66	0.12	- 0.74	- 0.05
Manufacturing sector	0.55	- 0.18	0.21	- 0.29	- 0.10
Services	0.22	- 0.46	- 0.09	- 0.42	0.06
Austria	2.18	0.73	0.32	0.43	- 0.02
Manufacturing sector	1.33	0.61	0.49	0.03	0.09
Services	0.80	0.13	- 0.17	0.41	- 0.12
Denmark	1.89	0.45	0.06	0.06	0.33
Manufacturing sector	1.09	0.36	0.18	- 0.11	0.30
Services	0.78	0.11	- 0.12	0.20	0.03

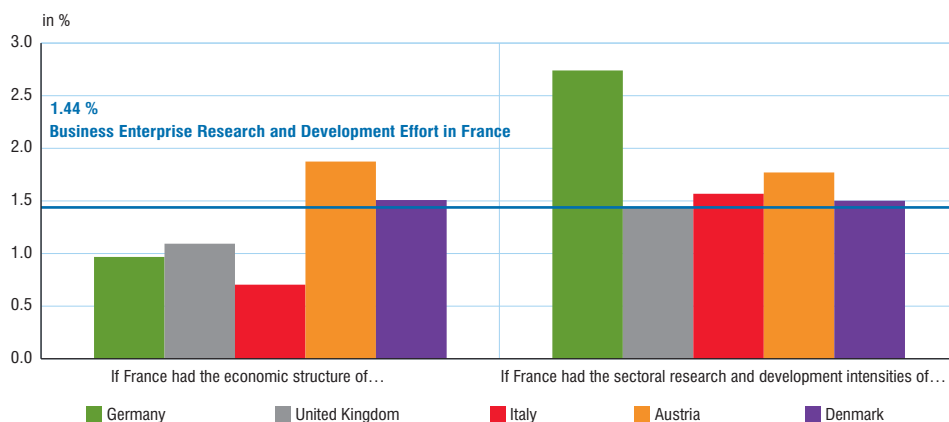
Reading Note: private research and development effort in Germany is 2.00%, 0.56 points higher than in France. This difference is explained by a structural effect of around +1.29 points, an intensity effect of -0.48 points and a residual effect of -0.26 points.

Notes: see the methodology presented in Box 2.

Sources: Eurostat; Insee; Federal Statistical Office of Germany (Statistisches Bundesamt); Mesri-Sies.

With Germany's economic structure, the research and development effort of French firms would be 1.3 points higher, i.e. 2.74% of GDP compared to 1.44% with the French economic structure (Figure 7). Similarly, if France had the same economic structure as Italy, Austria or Denmark while maintaining its levels of sectoral research and development intensity, the business enterprise R&D effort would be higher (1.57%, 1.77% and 1.50%, respectively). The economic structure of the United Kingdom is no more conducive to R&D activities than that of France.

7. Business Enterprise R&D Efforts under the Economic Structure of the Countries Studied and Sectoral R&D Intensities in 2015



Reading Note: if France had the same economic structure as Germany, its business enterprise research and development efforts would total 2.74% (research and development efforts of French firms + German structuring effect).

Sources: Eurostat; Insee; Federal Statistical Office of Germany (Statistisches Bundesamt); Mesri-Sies.

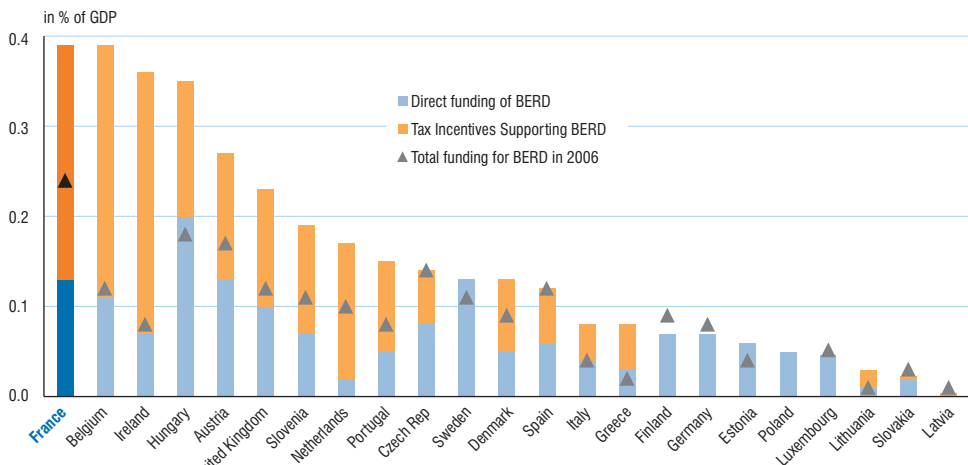
Conversely, with the economic structure of France and the levels of sectoral research and development intensity found in Germany, the United Kingdom or Italy, the business enterprise R&D effort would be lower (0.97%, 1.09% and 0.71% respectively). It would be higher with the sectoral research and development intensity of Austria (1.86%) or Denmark (1.50%). In other words, the conclusions drawn in 2012 on the 2009 data [Le Ru, 2012] are also true in 2018 in relation to the 2015 data.

France is the European Union Country with the Highest Level of Expenditure (as a Share of GDP) on Public Funding for Business Enterprise R&D

To have an impact on business enterprise R&D efforts, governments can resort to public policies, for example by introducing tax incentives, subsidies or partnerships [Organisation for Economic Co-operation and Development, 2018]. Public policies of this kind aim to increase business enterprise R&D expenditure and, therefore, business research and development intensity. France is the European Union country that spends the most (as a share of GDP) on public aid for business enterprise R&D (0.39%) (Figure 8): in 2015, nearly 2.9 billion euros were paid directly to firms in the form of direct subsidies or through subcontracting or collaborative work, while 5.7 billion euros were refunded through the **research tax credit** (in French, **crédit d'impôt recherche**, or CIR) scheme. While levels of direct public funding are equivalent to the levels seen in 2006 (2.8 billion euros), the reform of the CIR introduced in 2008 has enabled many more firms to benefit from this tax incentive mechanism. France operates other tax schemes, including the young innovative companies (in French, **jeunes entreprises innovantes**, or JEI) scheme introduced in 2004, albeit on a smaller scale.

Public aid is also relatively high in Austria (0.27% of GDP) and the United Kingdom (0.23%), and is split equally between direct funding and tax incentives. Public aid accounts for a smaller share in Denmark and Italy, although both forms of aid coexist. By contrast, in Germany, there is no R&D tax incentive scheme such as the CIR available to firms, and just 0.07% of GDP was devoted to direct public funding for business enterprise R&D in 2015.

8. Public Funding of BERD in 2006 and 2015



Coverage: EU OECD member countries in 2018.

Reading Note: in 2015 in France, direct public funding of BERD represented 0.13% of GDP, while tax incentives represented 0.26%, giving a total of 0.39% (compared to 0.24% in 2006).

Notes: the data on R&D tax incentives are not available for Sweden and Poland. 2014 data for Belgium, Ireland, United Kingdom, Sweden and Greece.

Sources: Mesri-Sies; OECD, R&D Tax Incentive Indicators.

9. Direct Public Funding for Business Enterprise R&D by Sector of Activity in 2015

	Direct public funding (in €M)					Proportion of BERD funded directly by the public sector (in %)				
	France	Germany	United Kingdom	Italy	Austria	France	Germany	United Kingdom	Italy	Austria
Manufacturing sector	2,215	1,036	1,189	403	464	14.2	2.0	10.5	4.5	10.0
Manufacturing sector	26	54	5	4	18	2.7	1.4	1.1	0.8	10.2
Chemical industry	7	...	...	9	28	0.8	...	...	1.7	9.6
Pharmaceutical industry	176	...	...	28	19	25.2	...	...	7.7	10.3
Manufacture of computer, electronic and optical products	629	218	188	33	92	16.7	2.9	13.8	2.4	12.7
Manufacture of machinery and equipment not elsewhere classified.	42	114	266	17	100	4.1	2.1	22.2	1.1	9.9
Automotive industry	32	144	12	73	60	1.5	0.7	0.4	4.3	11.1
Manufacture of other transport equipment	1,237	159	281	195	15	36.5	7.9	12.7	20.2	10.1
Other manufacturing industries not elsewhere classified	66	207	39	46	131	2.3	3.0	2.3	2.1	8.5
Primary, energy, construction	20	40	...	6	12	2.0	9.7	...	2.4	10.0
Services	675	961	...	342	426	4.5	11.1	...	9.5	15.4
Information and communication	174	170	155	93	56	4.6	5.3	3.9	6.8	11.6
Professional, scientific and technical activities	421	684	1,066	138	326	4.9	14.6	10.7	10.8	17.2
Other activities not elsewhere classified	80	107	...	111	44	2.9	14.1	...	11.7	11.2
All	2,910	2,037	2,473	751	901	9.2	3.3	8.6	5.8	12.0

Reading Note: in 2015 in France, direct public funding for the manufacturing sector totalled €2.2 billion. In other words, 14% of BERD in the manufacturing sector is funded directly by the public sector.

Notes: for the United Kingdom, the data refer to 2014. The data for Denmark are not available.

Sources: Eurostat; Federal Statistical Office of Germany (Statistisches Bundesamt); Mesri-Sies; OECD.

A significant proportion of BERD is directly financed from public funds in Austria (12%), France and the United Kingdom (9%) (Figure 9). The proportion is lower in Germany (3% of BERD) and Italy (6%).

In each country, the distribution of direct public funding between the different activity sectors of firms provides an insight into public policy priorities. Austria directly grants more public funds to services (15% of BERD) than to the manufacturing sector (10%), although both sectors are heavily funded. In France, a greater proportion of direct public funding is dedicated to manufacturing activities (14%), which are more R&D-intensive, than to service activities (4%). The opposite is true in Germany, where services are subsidised at a rate of 11%, compared to just 2% for manufacturing. In France, a significant proportion of direct public funding is devoted to the "manufacturing of other transport equipment" (1.2 billion euros) sector, notably the aerospace industry (95%). The industry is characterised by a high level of research and development intensity and is strategic for the State, particularly in the field of defence. More than a third of BERD in the aerospace industry (38%) is directly funded by the government.

In all the countries studied, between 10% and 20% of R&D expenditure in the professional, scientific and technical activity sector, which includes specialist R&D firms, is subsidised. In France, the subsidy rate is just 5%. In addition, all service sectors are funded by the public sector at a similar level, albeit at a much lower level than in Austria, Germany and Italy.

In other words, France differs from the other countries studied since it is characterised by a far greater commitment to encouraging research and development activities in manufacturing sectors. However, its policy to support R&D in manufacturing activities conducive to R&D is not enough by itself to guarantee a high level of research and development effort. ■

Definitions

Research tax credit (in French, *crédit d'impôt recherche*, or CIR): tax measure designed to incentivise R&D and, since 2013, innovation. The CIR is deducted from the tax due by the firm for the year in which the expenses were incurred. The incentive was reformed in 2008 and is now based on the amount of eligible expenditure, making it more attractive to businesses. The CIR base consists of three types of expenses: research and development (R&D) expenditure, collection expenditure and, since 2013, innovation expenditure. In this dossier, only the R&D element of the CIR scheme is considered.

Gross domestic expenditure on research and development (GERD): financial resources (national and foreign) used in carrying out R&D activities on the national territory (metropolitan and overseas France in the case of France) by government – the State (GOVERD), higher education (HERD) and associations (PNPERD) – and by the business enterprise sector (**BERD**). GERD includes current expenditure (wage bill of R&D personnel and operating expenses) and capital expenditure (purchase of equipment necessary for R&D).

Research and development effort: share of GDP devoted to R&D expenditure (GERD/GDP ratio).

Public funding of business enterprise R&D: direct public funding derived from the survey on the resources devoted to R&D in the business sector (payments made by government agencies directly to firms for the purpose of carrying out R&D activities, for example R&D work carried out by firms in response to orders from a government agency or as part of government R&D support programmes) and indirect public funding (tax schemes – here, research tax credit only in the case of France).

Research and development intensity of a sector or branch: share of the value added of the sector or branch allocated to R&D activities in that sector or branch.

Gross domestic product (GDP): sum of the gross value added of the different institutional sectors or branches of activity, plus taxes less subsidies on products (which are not allocated to sectors and branches of activity).

Services: in this paper, the term is used to refer to tertiary activities in the broadest sense and includes:
– the market services sector (trade, transport, financial activities, services to businesses, services to private individuals, accommodation and food service activities, real estate activities, information and communication services);

– the non-market services sector (public administration, education, human health, social work).

Value added: balancing item of the production account. It is calculated as the value of production less intermediate consumption. The value added data are calculated by INSEE.

For further information

Le Ru N., « Un déficit d'effort de recherche des entreprises françaises ? Comparaison France-Allemagne », *Note d'information* n° 12.09, MESR-DGESIP-DGRI-SIES, July 2012.

Organisation for Economic Co-operation and Development (OECD), *Measuring Tax Support for R&D and Innovation*, 2018.

Testas A., « Les efforts de recherche en Union européenne », *Note d'information* n° 15.03, MENESR-SIES, July 2015.
