Europe Economics

The Economic Impact of the Domestic Appliances Industry in Europe

Report for the European Committee of Domestic Equipment Manufacturers (CECED)

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Executive Summary

The domestic appliances sector, which makes devices ranging in size from refrigerators and dishwashers to smaller, portable appliances like vacuum cleaners and electric shavers, has (along with many other economic sectors) been under considerable economic pressure in recent years, with:

- a decline in turnover from around €52bn in 2008 to €44bn in 2012, with a recovery to €48bn in 2013;
- a decline in employment from 231,000 in 2009 to 211,000 in 2012; and
- increasing regulatory demands, such as requirements to improve energy efficiency rapidly over time.

However the sector remains an important part of the EU economy. There are 3,600 firms in the sector and, while it is dominated by large firms, the share accounted for by SMEs (around 20 per cent) is larger than in comparable sectors such as consumer electronics or the automotive industry. It produced 121m devices and had a turnover of €48bn in 2013.

It directly employed around 211,000 in the EU28 in 2012, more than three times the number employed in the manufacture of consumer electronics, for example. The contribution to employment is particularly large in Germany, Italy, Poland and – outside the EU – Turkey, where major manufacturers are based. It is a significant contributor to net exports for those economies, although the EU is a net importer overall in the sector.

It directly creates economic benefits for its stakeholders, particularly:

- Consumers. Prices in the sector have declined by around 4 per cent since 2005, while the broader price level has increased by 20 per cent. The decline in sector turnover to 2012 suggests that households are able to delay purchases at times of financial stress, smoothing the profile of other consumption.
- Workers. Wages and salaries in the sector are, at €29,500 per employee, slightly higher than in the wider manufacturing sector (€29,300 per employee), and considerably higher than in comparable sectors such as consumer electronics (€25,200 per employee).

The wider economic impacts of the sector are very significant. In this research, we have estimated the indirect effects – the impact on suppliers to the sector and those which use its output as an intermediate good – and the induced effects – the impact of factors of production in the sector and the sectors indirectly affected spending the income earned. Across the EU27 in 2011:

- Employment. The direct contribution to employment was 219,000. The direct, indirect and induced impact was 963,000.
- GDP. The value added directly in the sector was €11.3bn. The direct, indirect and induced contribution to GDP was €53.3bn.
- Wages. The direct contribution to wages was €6.2bn. The direct, indirect and induced contribution was €22.4bn.
- Government revenues. The direct contribution to tax revenues (taxes minus subsidies on production in the sector) was €650m. The direct, indirect and induced contribution to tax revenues was €14.0bn. The particularly substantial difference between the direct and total effects results from taxes generally being levied on incomes – to capital or labour, including in the sector itself – rather than production.
- Investment. The direct contribution to the consumption of fixed capital was €1.4bn. The direct, indirect and induced contribution was €4.7bn.
- Trade. Although the EU28 is a net importer of domestic appliances, EU28 exports in the sector were around €10bn in 2013. Germany is the leading European exporter in all sectors (dishwashers, vacuum

cleaners, electromechanical domestic appliances, shavers and clippers, electrothermic appliances) apart from laundry equipment and refrigerators and freezers where the largest exporters are Poland and – outside the EU – Turkey respectively.

All of that activity will also have wider social and economic impacts in the longer-term, including:

- Time saving. The use of domestic appliances can allow families to save time, or can provide new opportunities for recreation. They can thereby improve the work-life balance of European families and increase the scope for dual-employment families.
- Improved energy efficiency. There are signs that consumers are responding to sources of information like energy efficiency labels. Improvements in the energy efficiency of domestic appliances reduce consumer costs and greenhouse gas emissions. The impact is considerable given the very large base of appliances – 1.7 billion in just nine key types – which are steadily replaced over time.
- Investment in research and development. The sector's contribution to research and development spending appears to be between €1.2bn and €1.4bn a year and it deposits around 10,000 patents a year. 79 out of 124 global research and development facilities in the global domestic appliances sector are located in the EU28 or Turkey. The returns to technological innovations are generally thought to accrue mostly to consumers in the form of lower prices and/or better products.

1 Introduction

The European Committee of Domestic Equipment Manufacturers (CECED) commissioned Europe Economics to assess the social and economic impacts of the domestic appliances sector in the EU28 and its Member States, Switzerland, Norway, Russia and Turkey. As a part of their work representing the sector, they wished to understand its role and importance in European economies.

We conceive of those social and economic impacts as consisting of a wide range of benefits to the industry and those working within it, the wider economy and its consumers and wider society. The sector is first important to the businesses which make it up and their employees. The direct footprint of the sector can be seen in the products it sells and the workers it employs and to whom it pays wages.

The domestic appliances industry has an importance to the wider European economy. It represents part of a wider supply chain. Many firms will be involved in supplying domestic appliance manufacturers with components. Other firms will use domestic appliances in providing goods and services to final consumers, whether they are construction firms installing domestic appliances in new homes; retailers selling domestic appliances to consumers directly in their stores; or wholesale distributors selling them to retailers at home and abroad. In this category, we include cleaners and others using domestic appliances to provide services to their clients. All of that economic activity affects policy-relevant variables such as overall tax revenue, employment and GDP. It also provides an income to factors of production, labour and capital, which – when it is spent – will mean further economic activity, dispersed over an even wider range of sectors.

Domestic appliances have an importance to the consumers who buy them or the services which they are used to provide. Sometimes because it allows people to spend less time on domestic chores, when they would rather be working less or doing other work – paid or unpaid – and sometimes because the domestic activity itself is part of their leisure time (and more satisfying with the use of domestic appliances). As well as the value of the device's function, what they can do with it, in many cases they may also value it in aesthetic terms, as an attractive part of their home or an expression of their identity.

The work of the industry may also produce wider social benefits. Improving energy efficiency, for example, may reduce greenhouse gas emissions and thereby the negative externalities associated with greenhouse gas emissions. We therefore consider:

- The direct footprint of the sector. The nature and value of the goods it produces, the number of firms and workers in the sector, the investment it makes and the returns in terms of technological value; and the revenues it generates for the government.
- The indirect footprint of the sector. Those sectors which either supply the domestic appliances sector with intermediate goods or consume of domestic appliances as intermediate goods, either adding further value and/or distributing its products to final consumers.
- The external footprint of the sector. Imports and exports of domestic appliances. More data on trade flows is also presented in an annex to this report.
- Other benefits. Other reasons why consumers might value the output of the sector. In this section, we also consider wider benefits not captured in conventional analysis of the sector's impact on a qualitative basis.

Understanding the full range of those impacts will allow policymakers to properly balance the interests of the sector against other priorities, based on a full account of the range of stakeholders involved.

2 Direct Footprint

In this section, we consider the direct impact of the sector itself. First we define the sector and explain its supply chain, including after sales activity and disposal. Then we set out the numbers involved in the sector, both the number of firms and the number of workers. We then consider output in the sector, the value of the goods that those firms and workers produce, and wages, which will over time depend on output per worker.

2.1 Sector and supply chain definition

The domestic appliances sector is defined broadly as the manufacture of machines, usually though not necessarily electrical, used about the home. It normally excludes electronics, though many modern domestic appliances have electronic components.[1]

There are a number of uses, but the most common are:

- Cleaning clothes, dishes and other items.
- Preparing and cooking food and preparing drinks.
- Controlling the home environment, in terms of temperature and humidity.

It therefore includes the manufacture of a range of goods, including:

- Major appliances, often integrated into and sold as a part of new homes, such as:
  - washing machines and dryers;
  - dishwashers;
  - refrigerators;
  - freezers;
  - ovens; and
  - extractor fans.
- Small appliances, generally free-standing, such as:
  - fans;
  - humidifiers;
  - kettles;
  - vacuum cleaners;
  - food processors;
  - coffee machines;
  - blenders;
  - irons;
  - juicers;
  - toasters;
  - shavers; and
  - hair clippers.

[1] Electrical and electronics goods can be distinguished by their use of electricity. Electrical goods use electricity primarily as a source of power, while electronics goods use it primarily as a medium for storing or conveying information.

The definition of the sector used as the basis for the data presented in this report is from the Statistical Classification of Economic Activities in the European Community (NACE, Rev. 2). Category C27.5: Manufacture of domestic appliances "includes the manufacture of small electric appliances and electric housewares, household-type fans, household-type vacuum cleaners, electric household-type floor care machines, household-type cooking appliances, household-type laundry equipment, household-type refrigerators, upright and chest freezers, and other electrical and non-electrical household appliances, such as dishwashers, water heaters, and garbage disposal units. This group includes the manufacture of appliances with electric, gas or other fuel sources." (Eurostat, 2015)

While the sector itself is primarily understood as the manufacture of domestic appliances, and most official statistics for the sector are focused upon that activity, there is a range of other economic activity implied with their manufacture and sale. The wider supply chain includes a range of firms, such as:

- Firms that supply the domestic appliance sector. These would include components manufacturers and other electrical equipment manufacturers.
- Firms that distribute domestic appliances. This includes three categories of firms:
  - Wholesale and retail distributors of domestic appliances.
  - Construction firms and others which integrated domestic appliances into the goods they produce.
  - Cleaning contractors, public sector bodies and other organisations that use domestic appliances in the delivery of commercial services.
- Providers of after-sales services including warranties and repairs.
- Firms involved in the disposal of electrical equipment, including collection, recycling and recovery of scarce raw materials.

Most or all of the economic activity in that wider supply-chain activity should be captured in the Input-Output analysis reported in Section 3 of this report. However some of its effects may accrue to consumers or wider society in ways that are more difficult to quantify and which are considered in Section 5.

2.2 Number of firms and workers

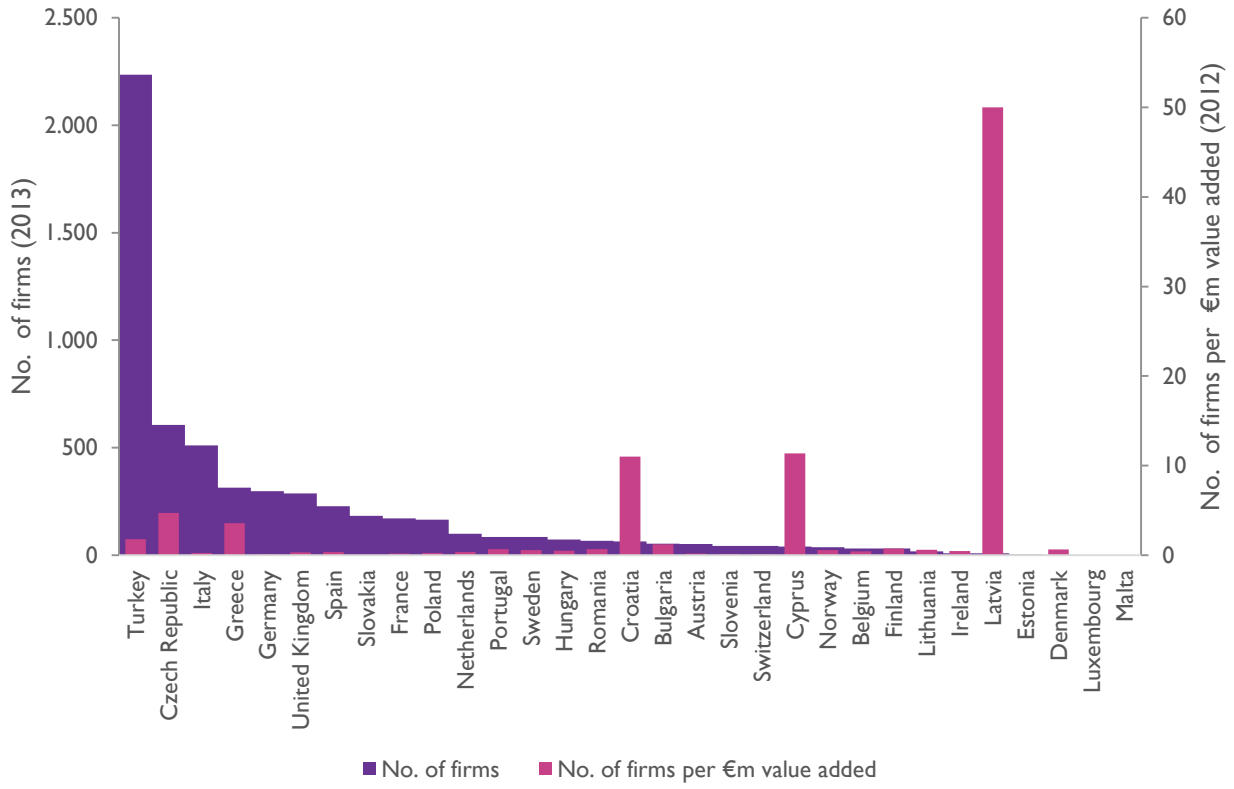
2.2.1 Firms

Across the EU28 there were over 3,600 firms that manufactured domestic appliances in 2012. This included large original equipment manufacturers (OEMs) such as Electrolux AB, BSH Hausgeräte GmbH and Indesit SpA, all of which are among the ten largest firms in the world (Ecorys, 2011). However it also includes a much larger number of smaller firms working in the sector.

Figure 2.1 shows the total number of firms and the number of firms per €1m of value added in the EU28 and several neighbouring economies. The general pattern appears to be that the larger firms operate in the EU15 economies – such as Italy, Germany and the United Kingdom – whereas the number of firms per million euros of value added is higher in less developed economies such as the Czech Republic.

This may reflect that larger OEMs with international brands are more likely to be based in the more developed economies, whereas activity in less developed member states is more likely to be focused upon a large number of smaller firms, supplying smaller markets. The number of firms per million euros of value added is particularly high in some smaller economies, notably Latvia, which may well reflect there being no substantial domestic appliance industry in those countries, and the firms active in the sector are only locating very small parts of the overall value chain there.

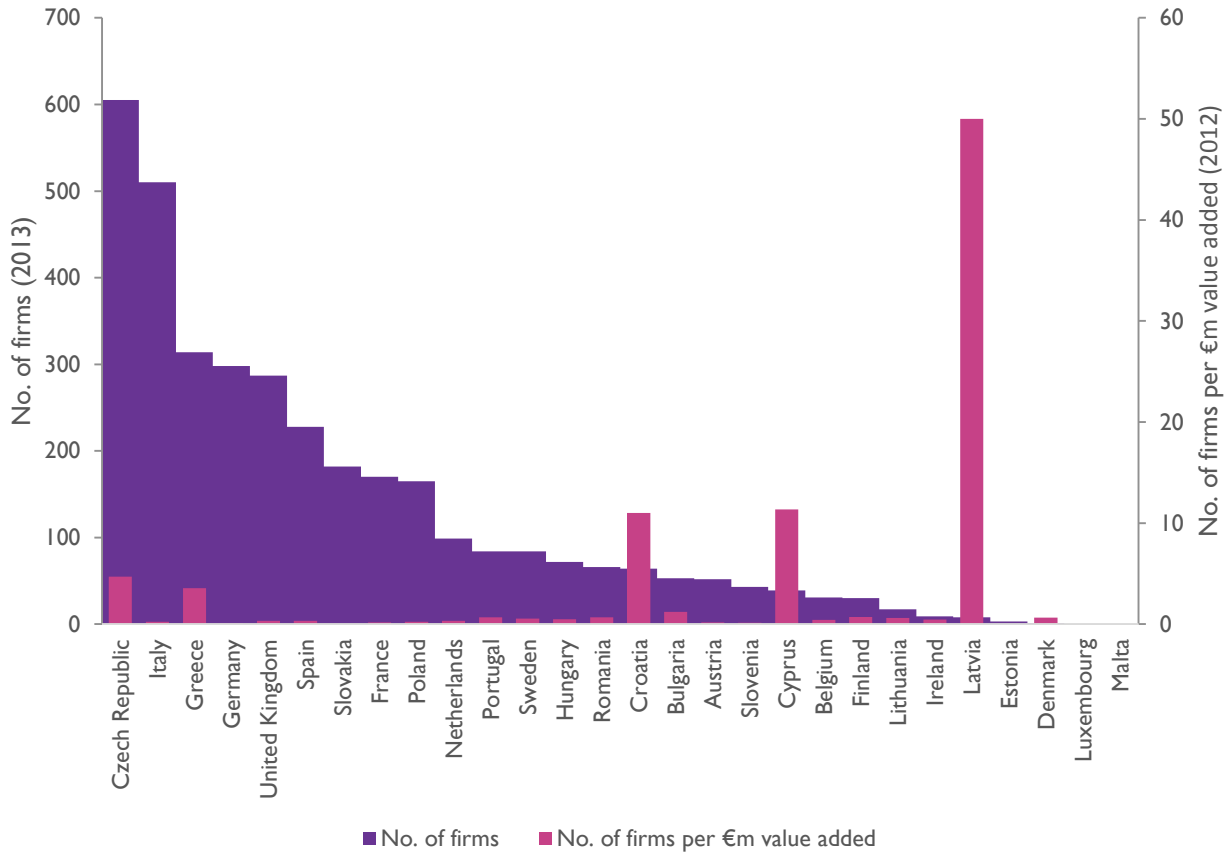
Figure 2.1: Number of firms per €1m value added, domestic appliances, selected countries



Notes: Number of firms for Bulgaria, Greece and Italy relate to 2012. For Turkey, it relates to 2009. Number of firms per value added relates to 2011 for Latvia and 2009 for Turkey. The very high number of firms per €1m of value added in Turkey may reflect definitional differences or differences in the corporate organisation of the sector in that country.

Source: Eurostat and Europe Economics calculations.

Figure 2.2: Number of firms per €1m value added, domestic appliances, EU28



Notes: Number of firms for Bulgaria, Greece and Italy relate to 2012. Number of firms per value added relates to 2011 for Latvia.
Source: Eurostat and Europe Economics calculations.

There are fewer firms per €1m value added in the manufacturing sector than in the wider business economy; fewer firms per €1m value added in the electrical equipment sector than in the wider manufacturing sector; and fewer firms per €1m value added in the domestic appliance sector than in the wider electrical equipment sector. This could reflect the capital intensity of the manufacturing sector, and the complexity of manufacturing devices, which makes a certain scale necessary. Or it could reflect consolidation in the face of very competitive market conditions.

Table 2.1: Firm size, by sector

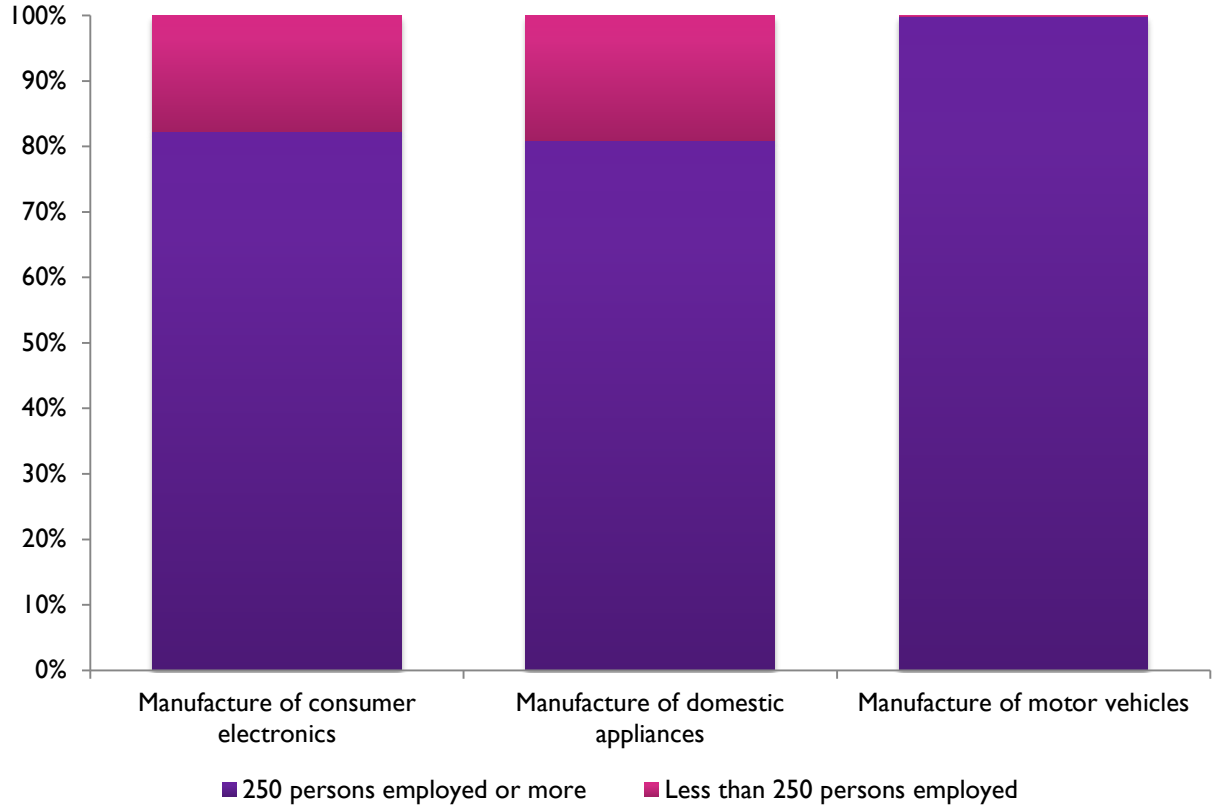
	Number of enterprises	Value added	Number of firms per €1m value added
Manufacture of domestic appliances	3,500	11,300	0.31
Manufacture of electrical equipment	51,000	86,600	0.59
Manufacturing	2,100,000	1,650,000	1.27
Total business economy, except financial and insurance activities	22,098,000	6,192,200	3.57

Source: Eurostat and Europe Economics calculations.

At least over the period for which data is available, the share of the industry accounted for by SMEs has been steady at around 20 per cent with around 80 per cent accounted for by firms with 250 or more employees since 2008. It should be noted, however, that this does not preclude a trend to consolidation among the large firms which account for most of the value added in the sector.

Again the share of larger firms is higher than the wider business economy (where the share of large firms is around 44 per cent) and the wider manufacturing sector (where the share of large firms is around 61 per cent). However it is less than in other advanced manufacturing sectors to which the domestic appliances sector might be compared, with SMEs accounting for 19 per cent of turnover in the domestic appliances sector against 18 per cent in the consumer electronics sector and less than 1 per cent in the motor vehicles sector.

Figure 2.3: SME share, by sector



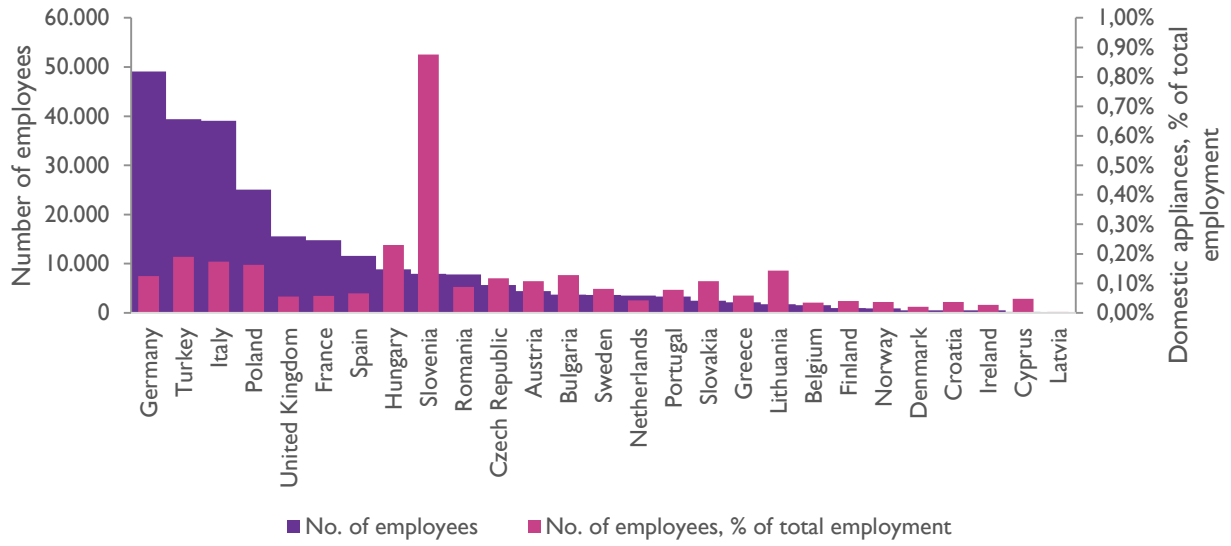
Source: Eurostat and Europe Economics calculations.

2.2.2 Employment

The number of direct employees in the domestic appliances sector in the EU28 was some 211,000 in 2012, down from around 231,000 in in 2009. The sector is considerably larger than – for example – the consumer electronics sector, which had around 66,000 direct employees across the EU28 in 2012.

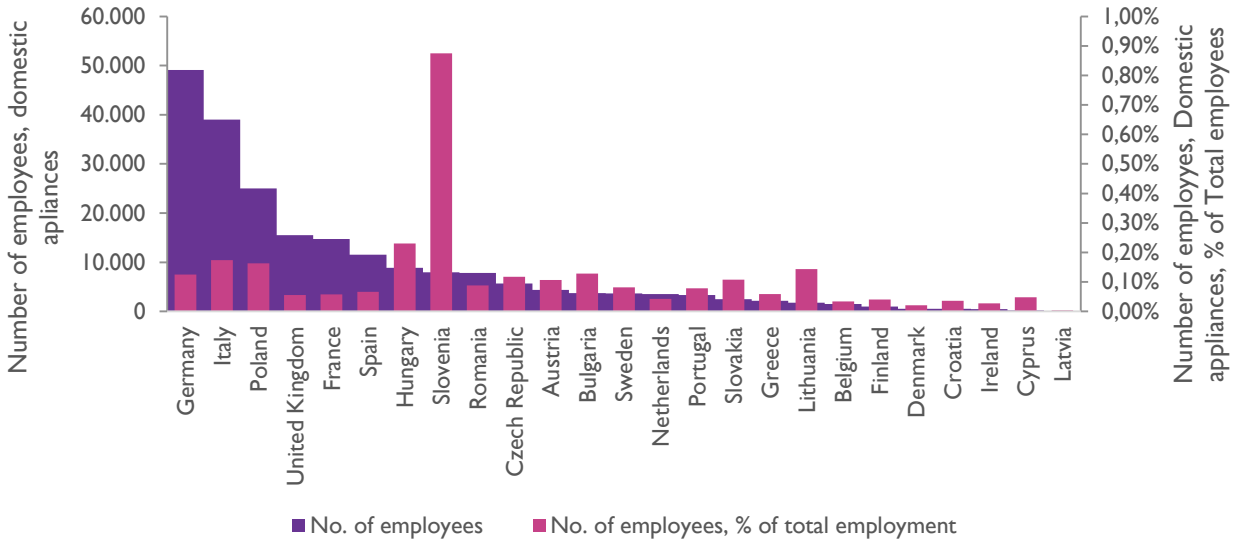
The country where the most people are directly employed in the manufacture of domestic appliances was Germany, at nearly 50,000. Of the major manufacturers, domestic appliances represented a greater share of total employment in Italy and – outside the EU – Turkey, reflecting the presence of major OEMs such as Indesit SpA in Italy and Arcelik in Turkey. There are other, smaller economies, where the number of employees as a share of total employment is larger, particularly Slovenia and Hungary.

Figure 2.4: Number of employees, domestic appliances, selected countries, 2012



Notes: UK and Turkey data relates to 2009.
Source: Eurostat and Europe Economics calculations.

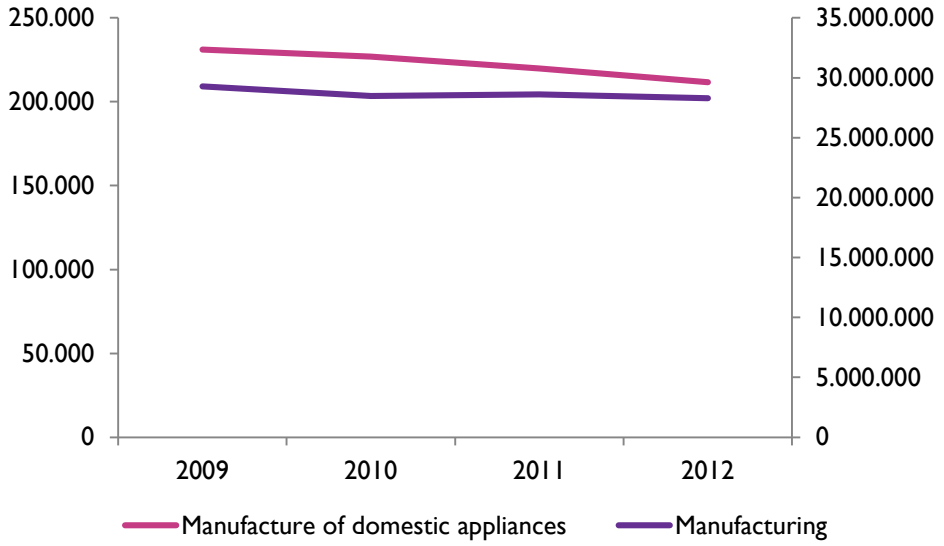
Figure 2.5: Number of employees, domestic appliances, EU28, 2012



Notes: UK data relates to 2009.
Source: Eurostat and Europe Economics calculations.

The number of employees in the domestic appliances industry has fallen in the EU28 (See Figure 2.6). There is a similar pattern in manufacturing as a whole and to some extent this will reflect broader macroeconomic circumstances, with weak growth and considerable uncertainty in a number of major European economies reducing the appetite for purchases like domestic appliances which many consumers can delay if necessary. It may also reflect rising labour productivity, meaning that consumer demand can be satisfied with lower overall employment, and competition with suppliers in developing economies outside Europe where unit labour costs are lower.

Figure 2.6: Number of employees, domestic appliances and total manufacturing, 2009-2012, EU28



Source: Eurostat and Europe Economics calculations. The earliest year for which data is available is 2009.

2.3 Output

2.3.1 Sales

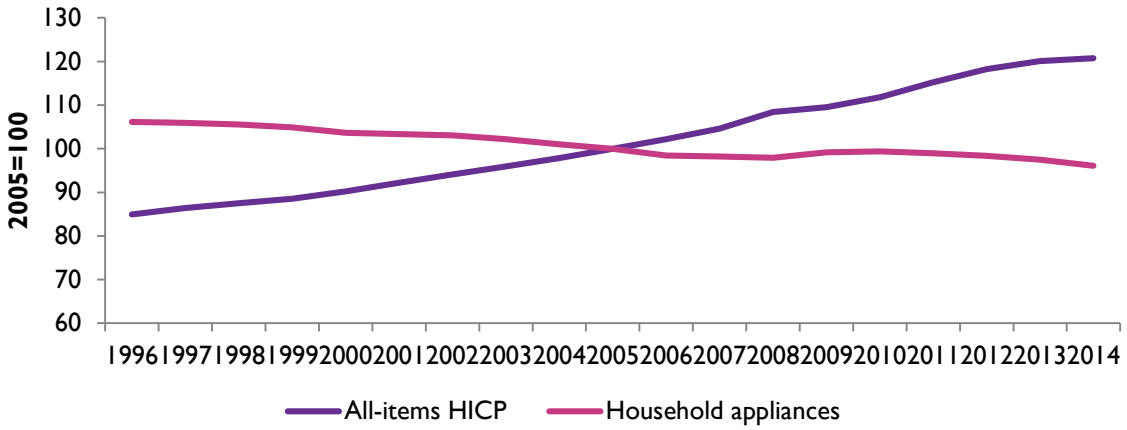
The distribution of the number of large appliances sold in each country, which will include imports but not domestic production exported to other countries, is shown in Figure 2.7. Sales broadly match the sizes of the different economies concerned.

Figure 2.7: Sales, large appliances, selected countries and country groups, 2014

Source: CECED.

The price at which domestic appliances have been sold has been steadily declining since the start of the series in 1996, by around 4 per cent since 2005, while the broader price level has increased by over 20 per cent since 2005. This is likely to reflect international competition (see the trade data in Section 4) and increases in productivity. The relative affordability of domestic appliances has broadly been increasing.

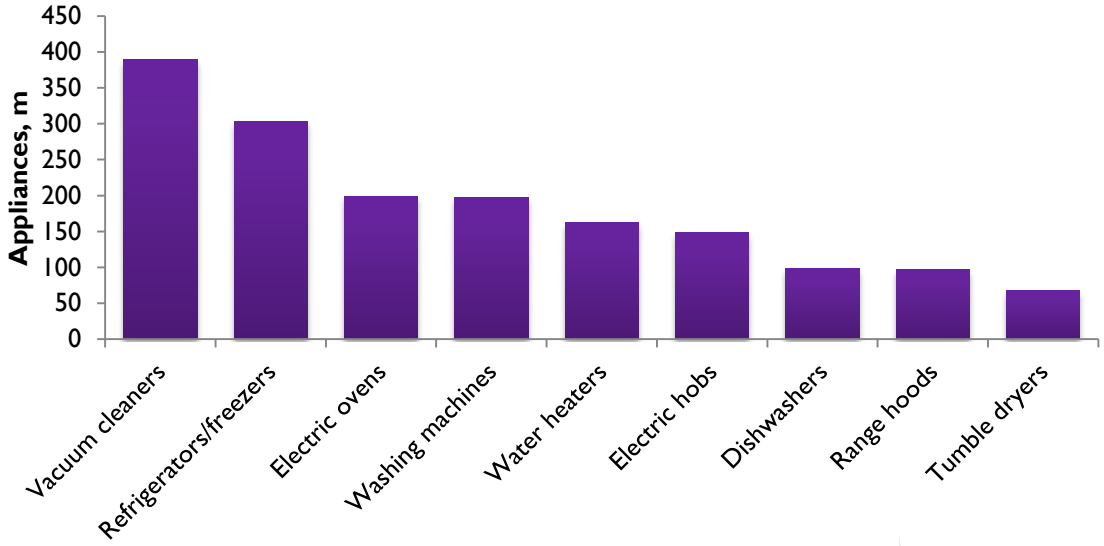
Figure 2.8: Prices, EU, household appliances versus all-items HICP



Source: Eurostat.
Note: Household appliances is not an exact match for the domestic appliances sector in the NACE hierarchy used in the rest of this report, but can also be considered a reasonable proxy for the sector. The data is for a changing set of countries, as it is based on the set of countries in the EU at each point (e.g. the EU28 in 2014, the EU27 in 2012 or the EU15 in 2003).The all-items Harmonised Index of Consumer Prices (HICP) is the standard weighted index used to measure inflation by Eurostat.

That has allowed many European consumers to purchase domestic appliances over time. The combined installed stock of nine appliance types is estimated to be 1.7 billion appliances across Europe.

Figure 2.9: Installed appliance stock, 2015



Source: Kemna, R. Ecodesign Impact Accounting, 2014.

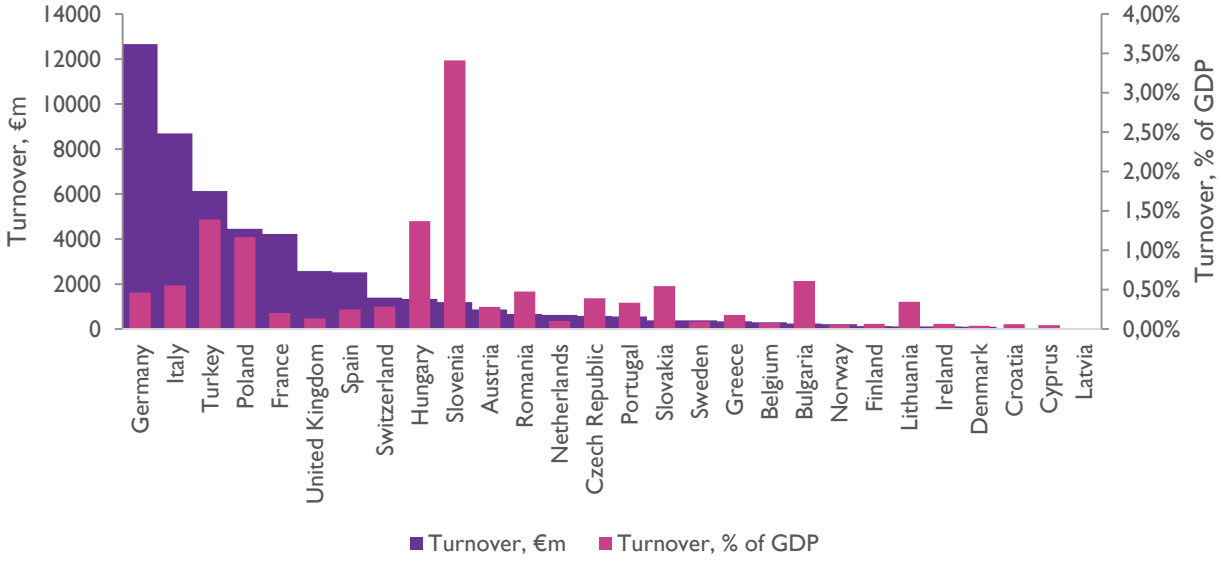
2.3.2 Turnover

Statistics collected by CECED suggest that factories in the EU28 and Turkey combined produced around 121 million appliances in 2013, of which 72 million were large appliances, 47 million were small appliances and 1.8 million were heating, ventilation and air conditioning (HVAC) appliances. This will include appliances produced both to supply domestic markets and for export.

Total turnover in the manufacture of domestic appliances across the EU28, which will include production both to supply domestic markets and for export, was €48bn in 2013 and up from around €45bn in 2011. Turnover was highest in Germany and substantial in Italy and – to a lesser extent, Poland, France and the

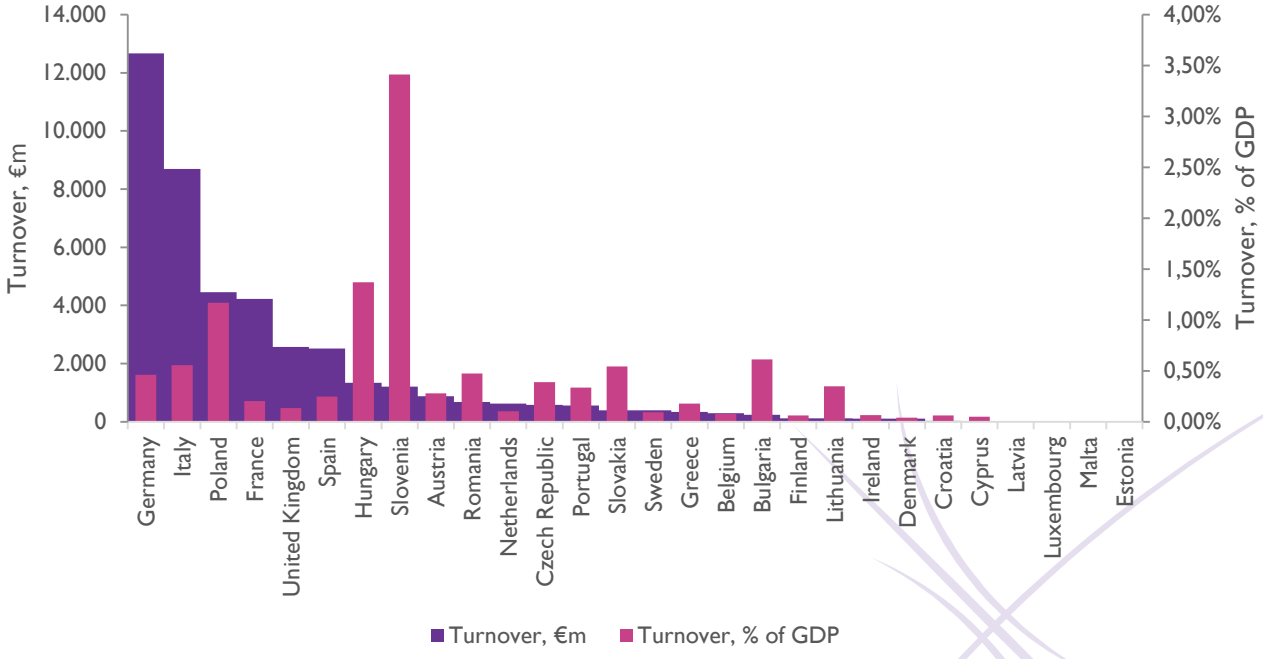
United Kingdom (and in Turkey outside the EU). The pattern is very similar to the pattern in total employment, with minimal differences. The only difference in the top ten is that Romania is in the top ten by employment, but Austria is in the top ten by turnover, which reflects higher labour productivity in Austria. Again in Hungary and Slovenia, while those economies are small producers of domestic appliances relative to Germany, Italy or Turkey, domestic appliance turnover is substantial relative to GDP.

Figure 2.10: Turnover, domestic appliances, selected countries, 2013



Notes: Italy, Poland, Netherlands, Greece and Bulgaria data relates to 2012; Latvia data relates to 2011; Turkey data relates to 2009.
Source: Eurostat; Europe Economics calculations.

Figure 2.11: Turnover, domestic appliances, EU28 countries



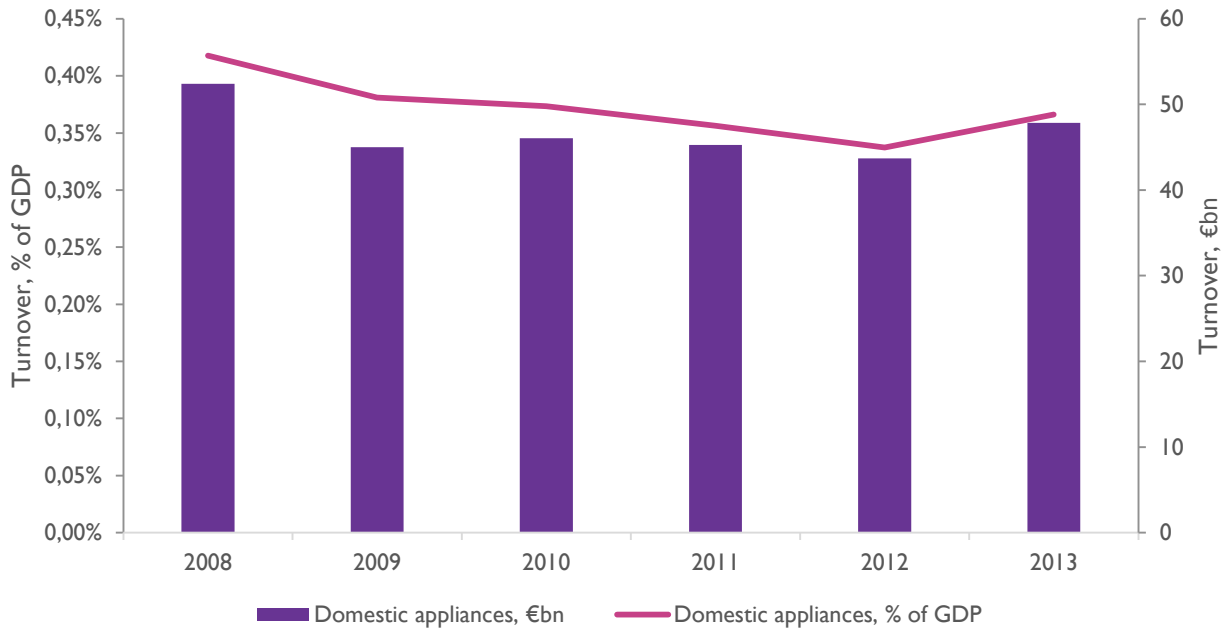
Notes: Italy, Poland, Netherlands, Greece and Bulgaria data relates to 2012; Latvia data relates to 2011.
Source: Eurostat; Europe Economics calculations.

The evolution of demand over time will partly reflect changes in incomes, as spending on purchases of appliances is "strongly correlated to average national income levels", with consumers in poorer countries

spending less per item. There are substantial differences unrelated to income levels with respect to some kinds of appliance, however, such as coffee machines (Ecorys, 2011).

Figure 2.12 shows turnover in domestic appliances for the EU28 from 2008-2013. As can be seen from the chart, turnover fell both in absolute terms and as a share of national income from 2008 to 2012. This can probably be attributed to overall weaknesses in European economies, leading to lower levels of income and greater uncertainty over future incomes, potentially causing consumers to delay purchases of appliances and attempt to use older products for longer before replacing them. While there are various estimates of the normal life-cycle for domestic appliances, it can clearly vary depending on the individual consumer's circumstances to some degree.

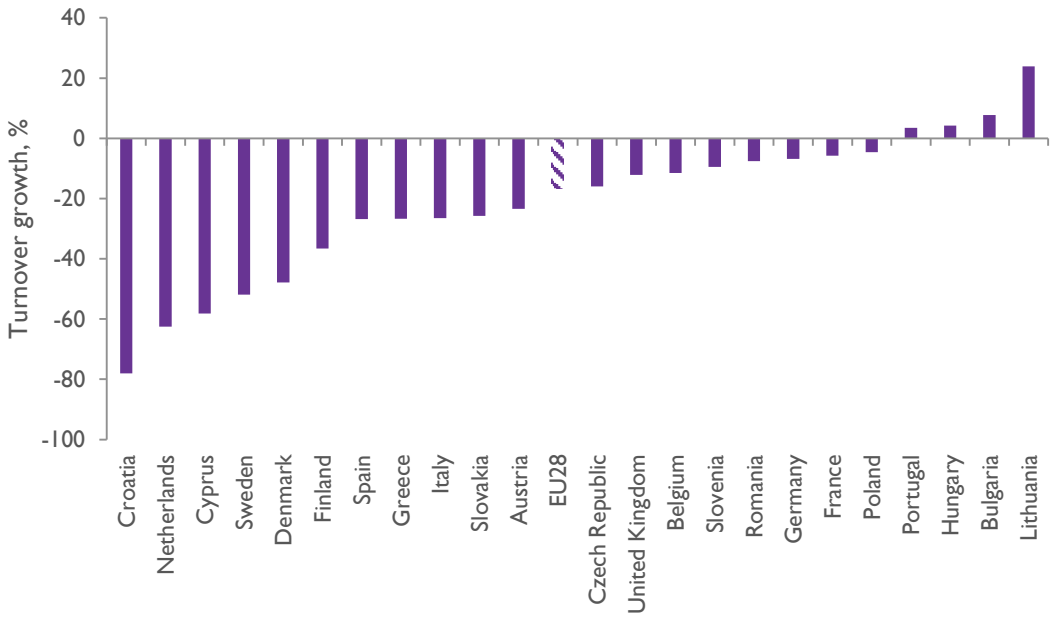
Figure 2.12: Turnover, Domestic appliances, 2008-2013, EU28



Source: Eurostat and Europe Economics calculations.

In terms of the pattern between countries, the biggest outlier is Lithuania, where total turnover has increased substantially, but that increase is from a relatively small base. All of the major manufacturers in the EU28 have seen declines in production, though the declines in Germany and Poland have been smaller and those economies are therefore responsible for a rising share of overall domestic appliance production. That might be explained by Germany's macroeconomic performance being less bad since 2010 than elsewhere in the Eurozone and in Poland's case by its relatively low unit labour costs.

Figure 2.13 Growth (+), contraction (-) in domestic appliances turnover, 2008-2012

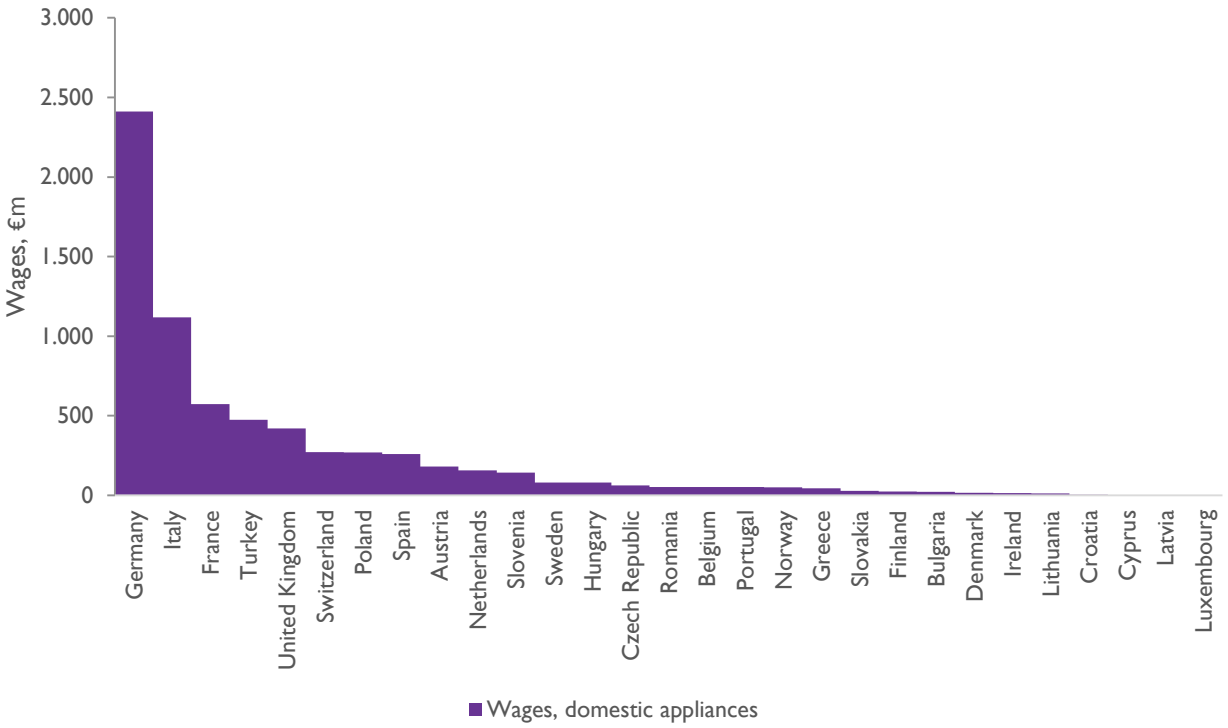


Notes: Data unavailable for the period for Ireland, Norway and Switzerland.
Source: Eurostat and Europe Economics calculations.

2.3.3 Wages and salaries

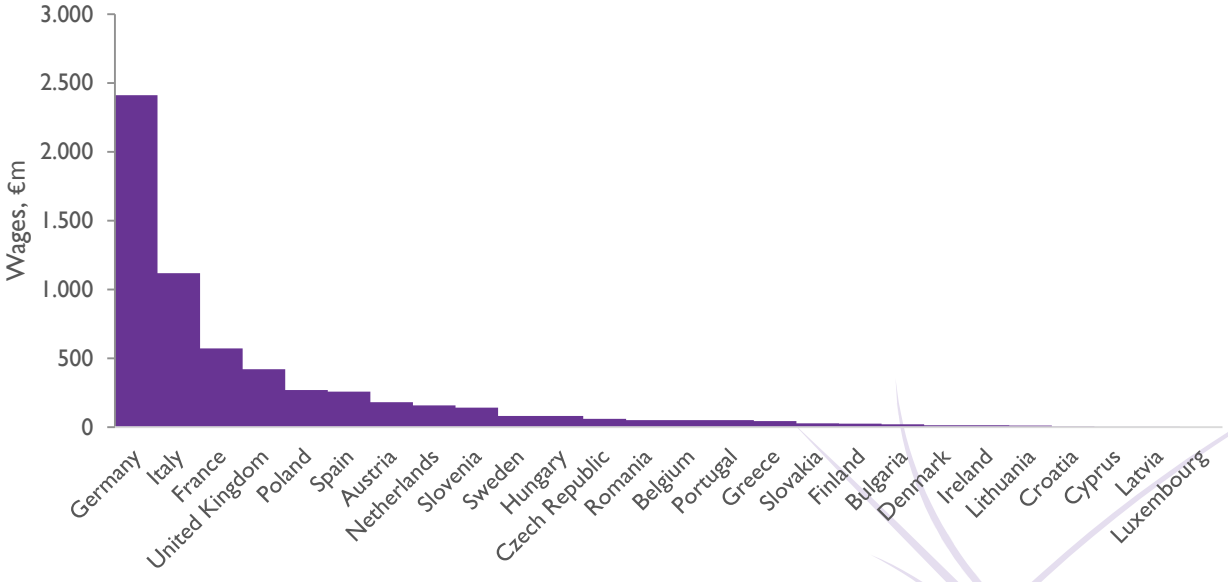
The pattern for wages is similar to that for output, except to the extent that the total paid is considerably higher in a number of economies with relatively high unit labour costs – like France, the United Kingdom and Switzerland – relative to others such as Poland where unit labour costs are generally lower. This suggests that those economies have specialised in activity within the sector which can command relatively high wages, such as design, in order to continue to be able to attract capital despite higher costs.

Figure 2.14: Wages and salaries, domestic appliances, selected countries, 2013



Notes: Bulgaria, Estonia, Greece, Italy, Netherlands and Poland data relates to 2012. Latvia relates to 2011 and Turkey relates to 2009. Data unavailable for Malta and Estonia
Source: Eurostat; Europe Economics calculations.

Figure 2.15: Wages and salaries, domestic appliances, EU28, 2013



Notes: Bulgaria, Estonia, Greece, Italy, Netherlands and Poland data relates to 2012. Latvia relates to 2011. Data unavailable for Malta and Estonia
Source: Eurostat; Europe Economics calculations.

That pattern can be seen in wages per employee, where wages in domestic appliances broadly reflect wages in the wider economy (which might be taken to represent the likely level of wages available in alternative employment, given limited labour mobility within Europe). The EU28 average for wages per employee was around €30,000 in 2012. Wages and salaries per employee in the sector are generally higher not just than

the wider economy, but the wider manufacturing sector and comparable sectors such as the manufacture of consumer electronics.

Table 2.2: Wages, domestic appliances versus comparable sectors, EU28

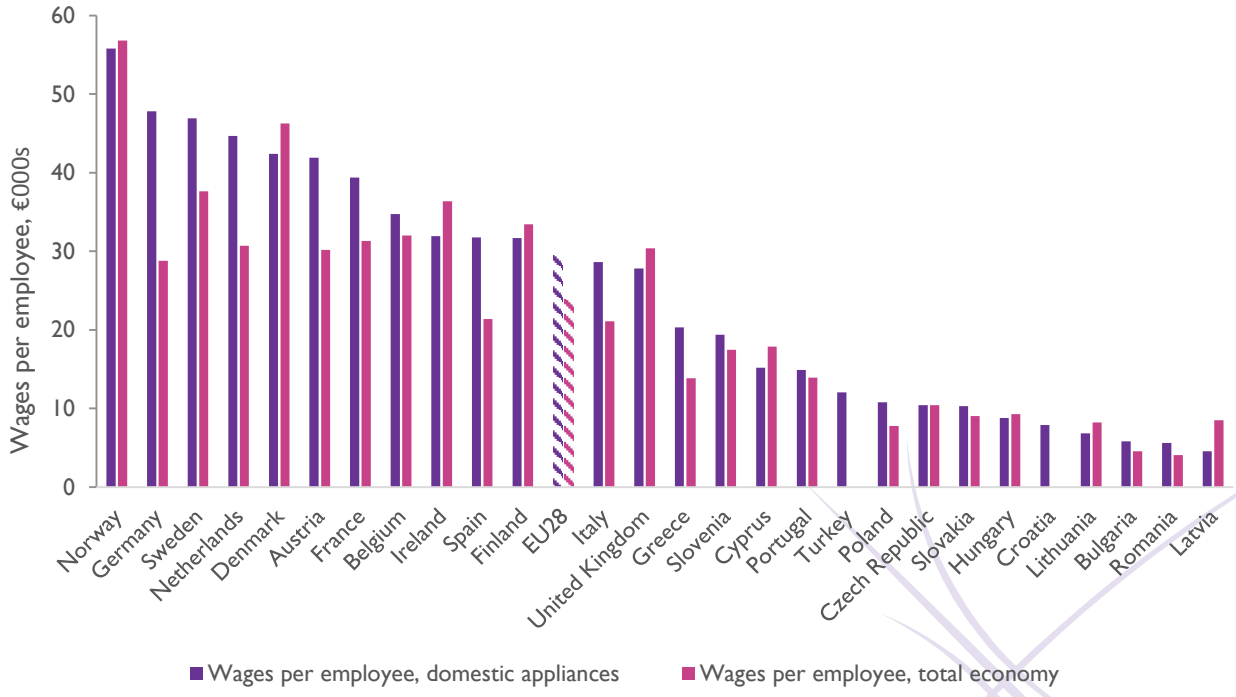
	Wages and salaries, €m	Number of employees	Wages and salaries per employee, €
Manufacturing	830,000	28,300,000	29,329
Manufacture of consumer electronics	1,664	66,100	25,180
Manufacture of domestic appliances	6,245	211,600	29,514

Source: Eurostat and Europe Economics calculations.

The disparity in Germany is particularly pronounced: employees in the domestic appliances sector are considerably better paid than in the wider economy. That might reflect that the work being done in the domestic appliances sector in Germany requires a particularly substantial skill-set. The data here is not adjusted for the skill mix in the sector in each country. Wages in the domestic appliances sector are generally higher than in the wider economy for those Member States in which most production is located.

The largest manufacturer of domestic appliances for which the sector pays less than the wider economy is the United Kingdom. This may reflect high wages in a highly-specialised labour market – London as an international financial centre – distorting the wider average relative to domestic appliances or that the work being done in the United Kingdom requires fewer skills than are required in other UK sectors. Other countries where the domestic appliances sector pays below the whole economy average are economies with generally very high wages and a very small domestic appliances sector (e.g. Norway).

Figure 2.16: Wages per employee, 2012



Notes: Employee data for Luxemburg, Malta, Estonia and Switzerland is missing. UK and Turkey data relate to 2009; Latvia data relates to 2011. Data for the total economy in Turkey is missing.
Source: Eurostat and Europe Economics calculations.

3 Indirect Footprint

In Section 2 we explored the direct impacts of the domestic appliances sector in terms of variables such as the number of staff employed within the sector or the gross value added it generates. But the impact of the sector goes beyond these direct impacts. In terms of the production of goods and services, the domestic appliance sector is a supplier of intermediate goods to a number of sectors, such as construction – in order to outfit new homes – and public sector bodies and other organisation which manage residential accommodation. Those sectors use domestic appliances in the production of goods and services for final consumers and add value themselves in the process. These are known as the forward linkages.[2]

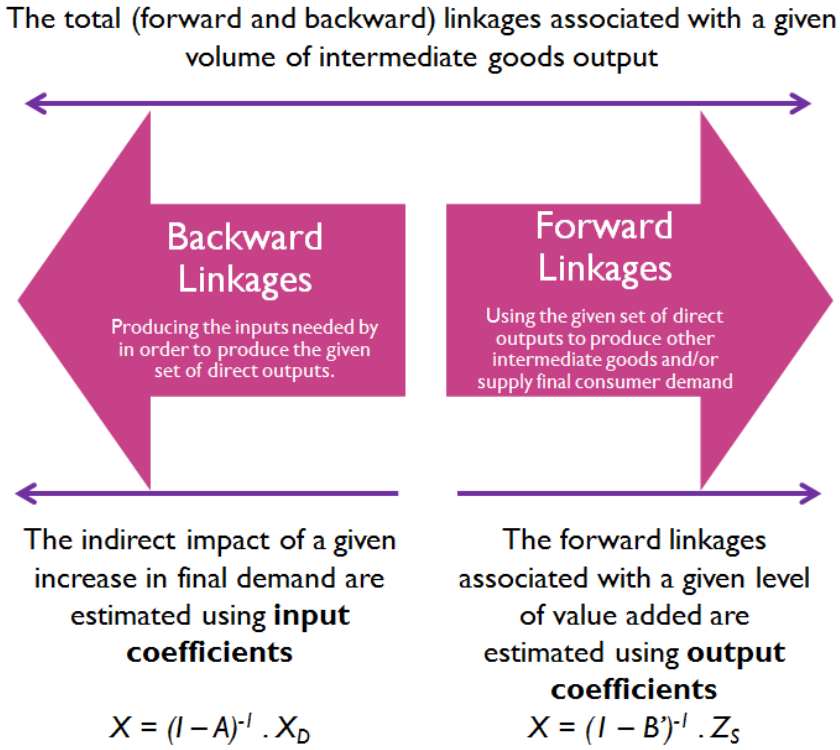
It is also a consumer of intermediate goods produced by a range of sectors. This will include components produced by the wider electrical equipment sector but also a range of other goods and services, such as finance and insurance, which are needed in order to do business. The domestic appliances sector uses the outputs from this sector and then itself adds value in the production of goods for final consumers. These are known as the backward linkages.

The forward and backward linkages combined are known as the indirect effects of the industry, the extent to which output in other sectors either supplies the domestic appliances sector or distributes its products onwards towards final consumers. The indirect effects of the domestic appliances sector include output in both those sectors which directly supply or consume the output of the domestic appliances sector and output in those sectors which do so indirectly throughout the supply chain.

Another way to think about the distinction between the direct impacts of the sector and its indirect effects is in terms of employment: the direct employment impact is those staff employed within the sector; the employment forward linkages are those staff whose jobs are made possible by domestic appliances; the employment backward linkages are those staff whose work is required in order to meet the demands of the domestic appliances sector.

[2] In studies which aim to estimate the likely impact of stimulus policies in an economy far from full employment, there are a number of concerns with the validity of Input-Output analysis: the reliance on fixed linear relationships assumes no change in production technologies; the model assumes that economies are not close to full employment, otherwise the additional resources required to produce extra output would simply not be available; and the supply-driven model that is needed in order to assess impacts based on forward linkages does not have robust microeconomic foundations. However, in this study, we are not seeking to study the likely impact of a particular policy, or an expansion or contraction in the domestic appliances sector, but instead to study the overall scale of the indirect activity associated with the sector. Those theoretical objections are less important

Figure 3.1: I-O linkages



In order to estimate the scale of those forward and backward linkages, we use a method known as Input-Output (I-O) analysis. I-O analysis is based upon a general-equilibrium model that links various sectors in the economy through fixed linear relationships between the output of a sector and the inputs it requires from other sectors. The different linkages and the coefficients that are used to calculate them are shown in Figure 3.1, but there is more detail on the methodological choices for this section in the Appendix.

It is important to note at this stage, however that the I-O tables used to estimate the indirect effects are based upon a limited number of sectors and we had to use the relationship to other sectors of the wider electrical equipment sector (C27) as a proxy for the domestic appliances sector (C27.5). In order to ensure that the effects are scaled to reflect the actual size of the domestic appliances sector, we have then applied the resulting multipliers to the actual level of value added in the domestic appliances sector in the most recent year for which data is available.

The direct and indirect impacts are still not the total footprint of the sector. There are also the induced effects. These arise as the higher direct and indirect output boosts earnings for the various factors of production (in particular, capital and labour) in the sectors affected. Those additional earnings are then spent, which creates additional demand. Re-expressing the intuition once again in terms of employment, the direct employment impacts are those employed within the sector; the indirect employment impacts are those whose jobs are made possible by the outputs of the sector or made necessary by the demands of the sector; and the induced employment impacts are those jobs that exist in order to meet the consumption and investment choices made by the recipients of wages and profits from the activity in the sector itself or the activity generated by the forwards and backwards linkages.

In this section, we will estimate the direct, indirect and induced impact of the sector on a range of policy-relevant variables: employment; GDP; wages; government revenues; investment; and investment in R & D in particular. We refer to the sum of the indirect and induced impacts as the "indirect footprint".

3.1 Employment

The direct contribution to employment was 219,000 across the EU27 in 2011. The total direct and indirect contribution to employment of the domestic appliance industry was 465,000 and the direct, indirect and induced contribution to employment was 963,000.[3]

The largest indirect contributions to employment are in Italy and Poland, which suggests that more of the supply chain for domestic appliance production in those countries is located there and therefore captured within the domestic economy. Intermediate goods consumed by the sector are relatively likely to have been produced by Italian or Polish workers and the goods are relatively likely to be sold in Italy or Poland, by their retailers, reflecting that these economies are less exposed to international trade than – for example – Germany where international brands mean that its goods are more likely to be sold abroad and are integrated into global supply chains.

The largest induced contribution to employment was in Turkey. That reflects an economy where net saving and imports are low relative to national income. The income earned by direct and indirect factors of production is therefore more likely to be spent on goods and services made in Turkey by other Turkish workers and a given increase in GDP is associated with a larger increase in employment (as GDP per worker is lower).

Note that the EU27 estimates in this and subsequent tables in this section are higher than the sum of the EU27 countries added together (the "EU27 total of individual figures" row). That is because the estimates for the individual countries do not capture important cross linkages between the different economies. For example, a German firm might buy components from another firm in France and that would be captured as an indirect effect in the EU27 estimate but not in the German or French estimates individually and therefore not in the sum total for the EU27 countries. Those linkages therefore capture the extent to which the supply chain is integrated across the Single Market.

[3] Many of the results in this section refer to the EU27 – i.e. the EU27 minus Croatia – as the data predates the existence of the EU28. The year for the I-O analysis varies by country, there is more detail in Appendix B, but is generally 2011 and is the latest year for which data is available.

Figure 3.2: Direct, indirect and induced impacts, employment, selected countries, 2011

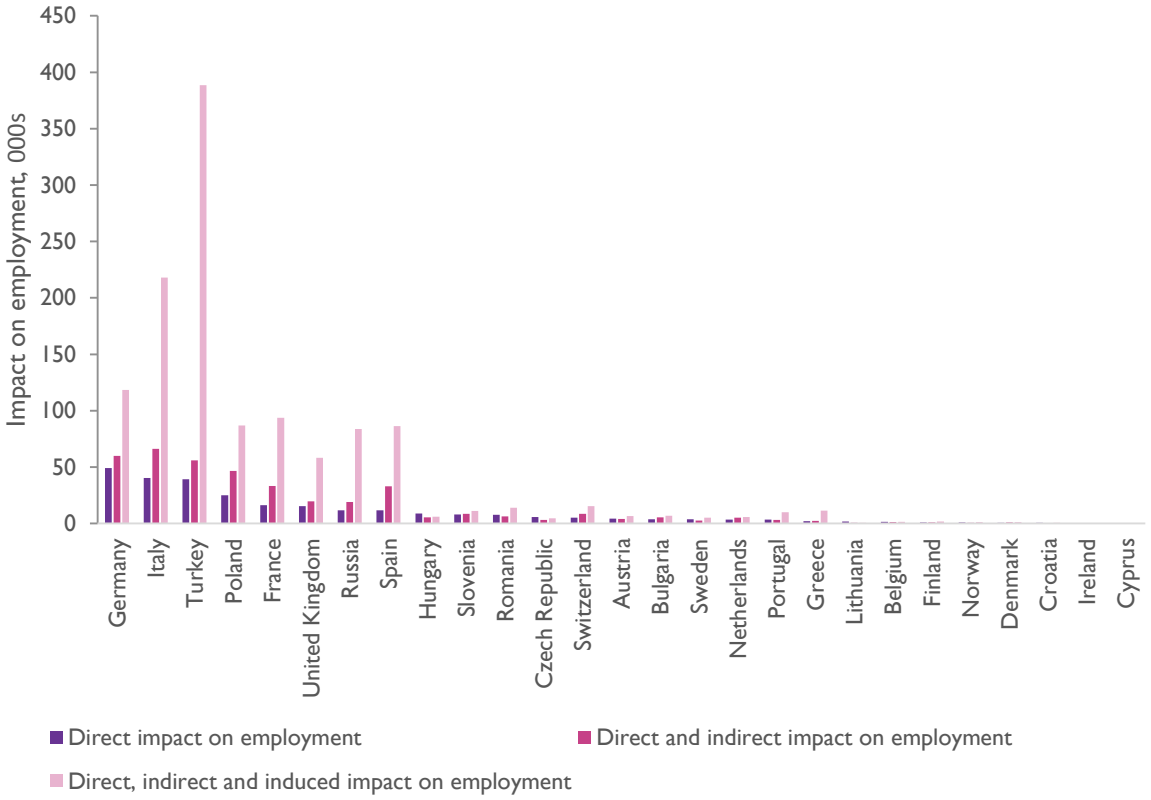


Figure 3.3: Direct, indirect and induced impacts, employment, EU 28 countries, 2011

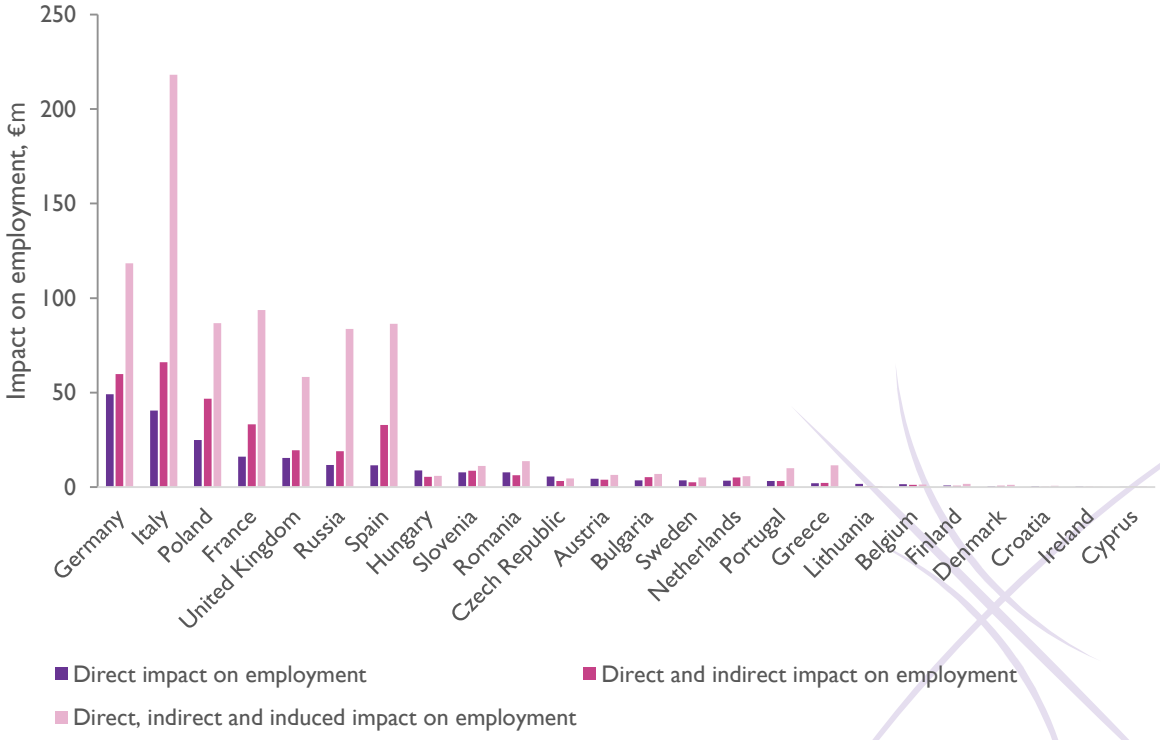


Table 3.1: Direct, indirect and induced impact on number of employees, 2011, 000s

Country	Direct impact on employment	Direct and indirect impact on employment	Direct, indirect and induced impact on employment
EU27	219	465	963
Of which			
Austria	4	4	6
Belgium	2	1	1
Bulgaria	4	5	7
Cyprus	0	0	0
Czech Republic	6	3	5
Denmark	1	1	1
Finland	1	1	2
France	16	33	94
Germany	49	60	118
Greece	2	2	12
Hungary	9	6	6
Ireland	0	0	0
Italy	41	66	218
Lithuania	2	1	1
Netherlands	4	5	6
Poland	25	47	87
Portugal	3	3	10
Romania	8	6	14
Slovenia	8	9	11
Spain	12	33	86
Sweden	4	3	5
United Kingdom	16	20	58
EU27 total of individual figures	*214*	*308*	*749*
Croatia	1	0	1
Norway	1	1	1
Russia	12	19	84
Switzerland	5	8	15
Turkey	39	56	389

Note: the EU27 total of individual figures does not match the EU27 estimate in the first row of this table as it does not capture cross-linkages between different economies.

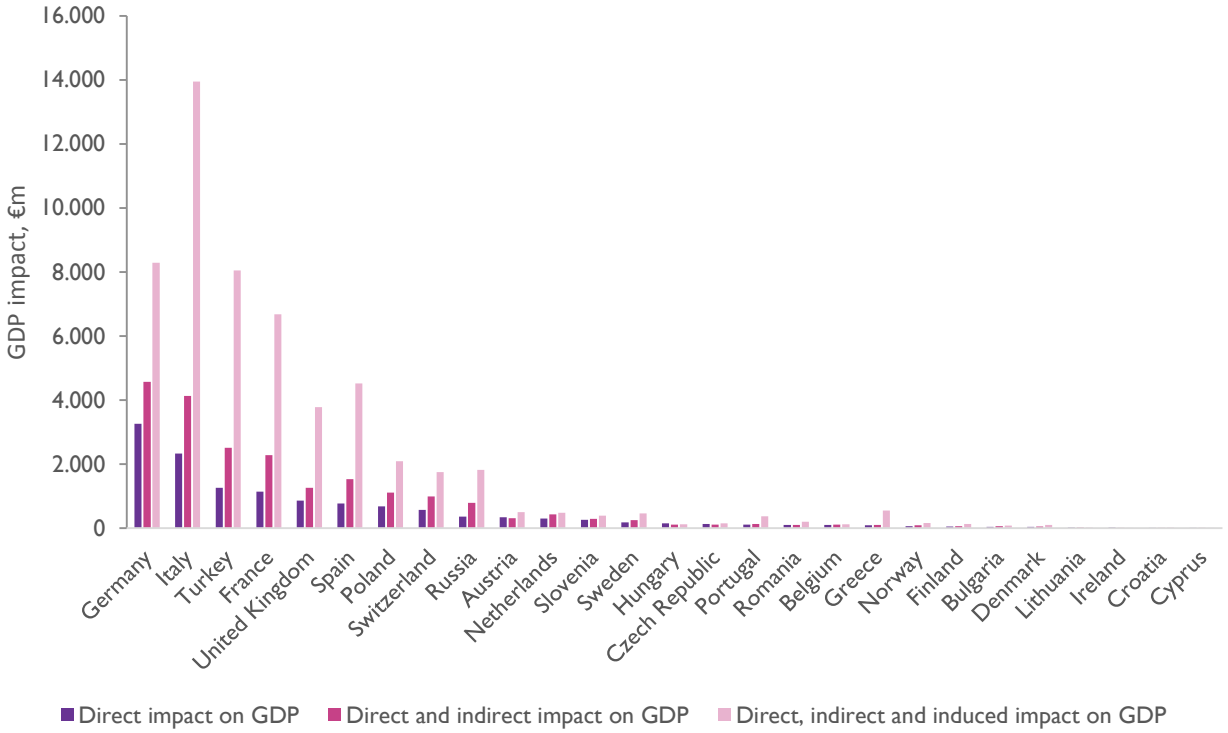
3.2 GDP

The direct and indirect impact on GDP was €25bn for the EU27 in 2011 and the direct, indirect and induced impact was €53bn.[4]

The estimated impact on GDP by country is shown in Figure 3.4. The largest impacts are seen in the larger economies, which reflects both the scale of output in many of those economies but also that they capture more of the indirect and induced effects (as resulting intermediate or consumer demand is more likely to be satisfied by domestic industry).

Those economies where income per capita is higher also show greater GDP effects, relative to others where incomes are lower, than employment effects. This simply reflects those economies where unit labour costs are generally higher specialising in activities where productivity is higher, high enough to justify firms paying those higher costs. Those locations might be attractive for such activity for a range of reasons, including lower costs for other inputs such as energy and the level of education and skills available in the workforce.

Figure 3.4: Direct, indirect and induced impacts, GDP, selected countries, 2011



[4] Note that contributions to GDP will tend to be significantly lower than sector turnover as the contribution to GDP will be the value that the sector adds, and related to production minus inputs, whereas turnover is gross of inputs.

Figure 3.5: Direct, indirect and induced impacts, GDP, EU28 countries, 2011

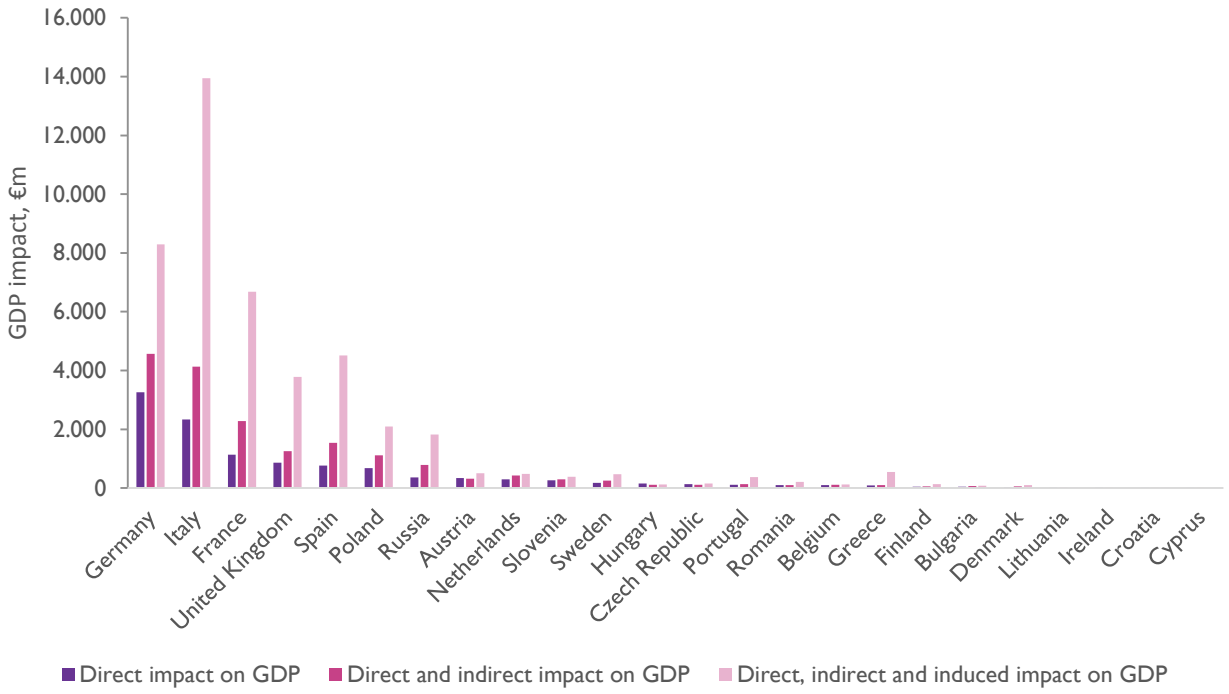


Table 3.2: Direct, indirect and induced impacts on GDP, €m, 2011

Country	Direct impact on GDP	Direct and indirect impact on GDP	Direct, indirect and induced impact on GDP
EU27	11,300	25,176	53,339
Of which			
Austria	344	314	504
Belgium	102	111	126
Bulgaria	44	63	82
Cyprus	4	6	14
Czech Republic	134	116	157
Denmark	39	57	101
Finland	50	59	136
France	1,139	2,278	6,681
Germany	3,265	4,569	8,293
Greece	88	106	549
Hungary	153	111	125
Ireland	20	13	15
Italy	2,334	4,127	13,944
Lithuania	27	22	25
Netherlands	301	432	481
Poland	684	1,114	2,094
Portugal	112	128	370

Country	Direct impact on GDP	Direct and indirect impact on GDP	Direct, indirect and induced impact on GDP
Romania	106	101	207
Slovenia	261	293	389
Spain	769	1,536	4,518
Sweden	182	256	468
United Kingdom	861	1,259	3,782
EU27 total of individual figures	*11,018*	*17,073*	*43,059*
Croatia	6	9	19
Norway	65	88	167
Russia	365	788	1,823
Switzerland	572	989	1,757
Turkey	1,263	2,509	8,046

Note: the EU27 total of individual figures does not match the EU27 estimate in the first row of this table as it does not capture cross-linkages between different economies.

3.3 Wages

The direct and indirect contribution to wages and salaries in the EU27 was around €11.5bn in 2011, while the direct, indirect and induced contribution was around €22.4bn. The pattern of results is similar to that for the contribution to GDP in that economies with higher incomes per worker show more substantial effects relative to other economies than they do for employment.

The estimate for Germany shows that the direct contribution to wages is higher than the direct and indirect contribution to wages, an anomalous finding which results from the direct effects being based on reported wages in the domestic appliances sector and the direct and indirect effects being estimated based on the electrical equipment sector as a whole. Wages are clearly lower for the wider electrical equipment sector than for the domestic appliances sector to such a degree that the addition of indirect effects does not outweigh the difference in the resulting estimate for wages in the domestic appliances sector itself.

Figure 3.6: Direct, indirect and induced impacts on wages, selected countries, 2011

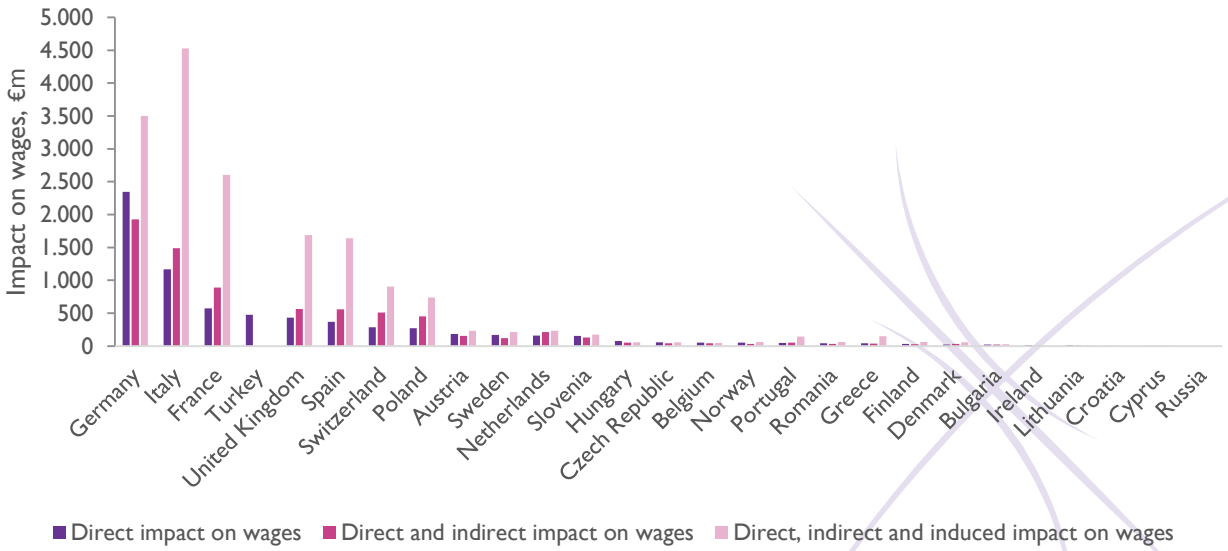


Figure 3.7: Direct, indirect and induced impacts on wages, EU28 countries, 2011

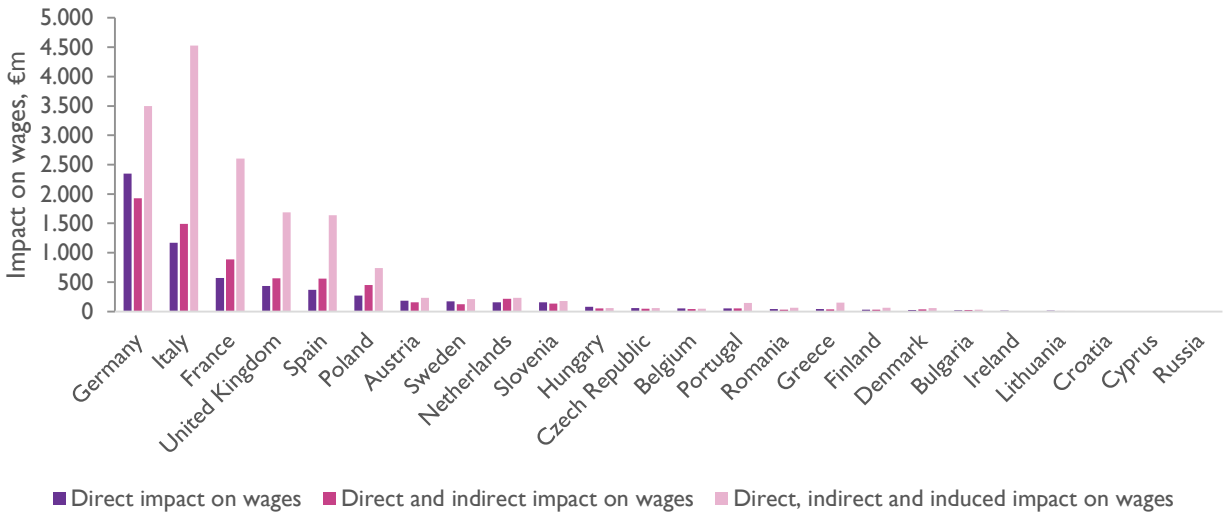


Table 3.3: Direct, indirect and induced impacts on wages, €m, 2011

Country	Direct impact on wages	Direct and indirect impact on wages	Direct, indirect and induced impact on wages
EU27	6,200	11,536	22,448
Of which			
Austria	184	156	233
Belgium	53	43	49
Bulgaria	22	24	30
Cyprus	3	2	5
Czech Republic	59	44	58
Denmark	23	35	57
Finland	31	30	62
France	572	888	2,604
Germany	2,347	1,927	3,498
Greece	44	36	150
Hungary	78	51	56
Ireland	16	5	6
Italy	1,169	1,491	4,526
Lithuania	12	9	10
Netherlands	158	213	233
Poland	270	450	738
Portugal	50	55	144
Romania	44	33	62
Slovenia	154	132	175
Spain	367	557	1,639
Sweden	172	123	211

United Kingdom	432	562	1,689
EU27 total of individual figures	*6,258*	*6,868*	*16,235*
Croatia	4	0	0
Norway	51	32	61
Russia	0	0	0
Switzerland	285	511	907
Turkey	475	0	0

Notes: Wage data by NACE category is not available for Turkey, Russia and Croatia. The direct impact on wages corresponds to 2009 for the UK. The EU27 total of individual figures does not match the EU27 estimate in the first row of this table as it does not capture cross-linkages between different economies.

3.4 Government revenues

The direct and indirect impact contribution to government revenues (taxes minus subsidies on production in the sector and in its forward and backward linkages) in the EU27 is around €1.5bn whereas the direct, indirect and induced impact is around €14bn (all taxes on the incomes and consumption of factors of production in the sector). The induced effects are considerably higher, reflecting that, in many countries, taxes levied on labour incomes and consumption are considerably greater than the net taxes levied on production (which sometimes receives tax relief for activity such as research and development). The pattern between different countries is also very different. It reflects the overall ratio of tax to GDP and differences in labour earnings between different economies more than any different in the domestic appliances sector.

The results for Switzerland and Russia are higher than might be expected. That results from differences in the data available, which meant that the result for Russia had to be estimated – for the direct, indirect and induced effects – on the basis of the overall tax to GDP ratio, rather than the specific taxes on production that were used in the estimates for most other significant economies and which were generally lower.

Figure 3.8: Direct, indirect and induced impacts on taxes, selected countries, 2011

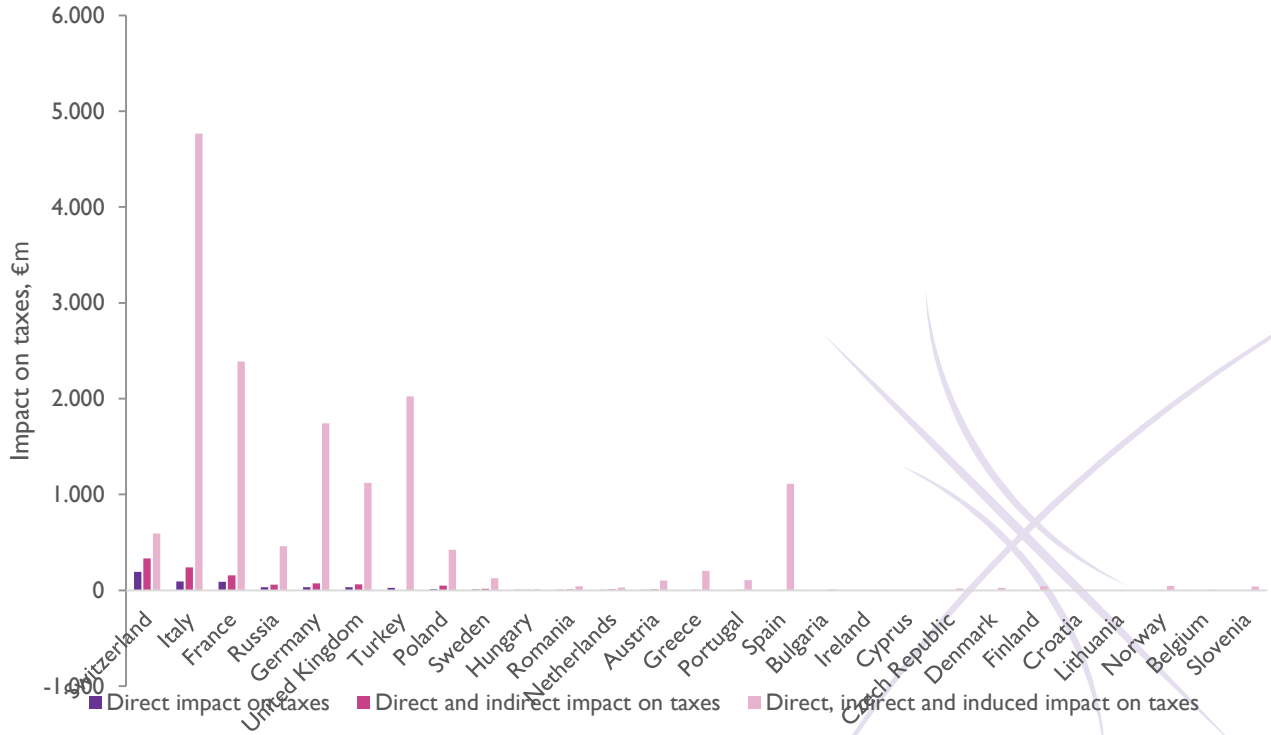


Figure 3.9: Direct, indirect and induced impacts on taxes, EU28 countries, 2011

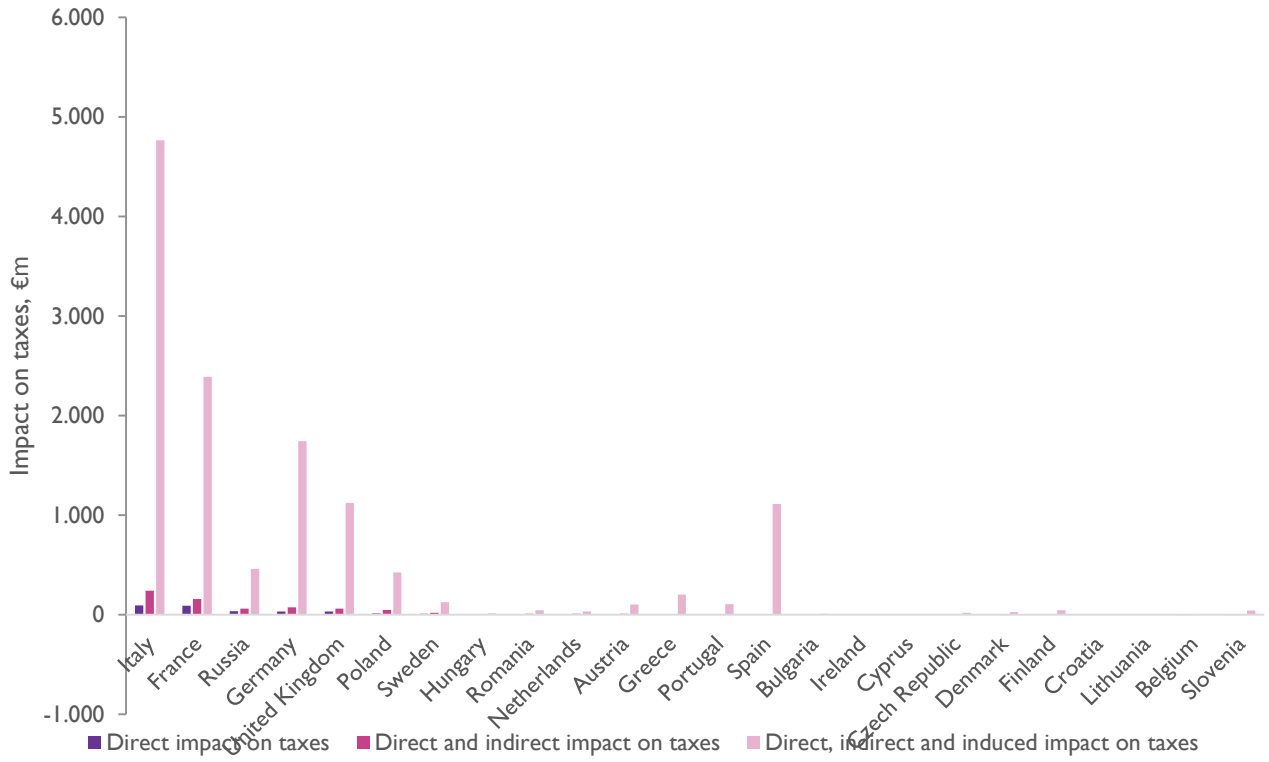


Table 3.4: Direct, indirect and induced impacts on tax revenues, €m, 2011

Country	Direct impact on taxes	Direct and indirect impact on taxes	Direct, indirect and induced impact on taxes
EU27	646	1,468	14,028
Of which			
Austria	4	8	101
Belgium	-4	-1	7
Bulgaria	2	4	10
Cyprus	0	0	3
Czech Republic	0	2	19
Denmark	0	0	24
Finland	0	1	43
France	90	156	2,388
Germany	32	74	1,742
Greece	4	6	202
Hungary	6	5	11
Ireland	1	1	1
Italy	92	239	4,764
Lithuania	0	0	1
Netherlands	5	7	30
Poland	12	48	424

Country	Direct impact on taxes	Direct and indirect impact on taxes	Direct, indirect and induced impact on taxes
Portugal	2	6	105
Romania	6	7	43
Slovenia	-5	-3	40
Spain	2	2	1,111
Sweden	9	17	125
United Kingdom	31	61	1,121
EU27 total of individual figures	*288*	*640*	*12,316*
Croatia	0	0	4
Norway	-1	0	45
Russia	34	61	460
Switzerland	193	334	594
Turkey	27	-3	2,024

3.5 Investment

The direct and indirect contribution to investment across the EU27 was around €4.1bn in 2011 and the direct, indirect and induced contribution was around €4.7bn in the same year. This represents the consumption of fixed capital: assets which the sector uses to produce appliances such as factories and machinery, the value of which may be spread over a large volume of production and multiple years. The largest contributions to investment broadly matched the pattern in terms of the contribution to employment or GDP.

However the impacts in the Netherlands and Slovenia were considerably higher, which implies that the domestic appliances sector, or at least the electrical equipment sector used as a proxy, are considerably more capital intensive in those countries than elsewhere. There is more detail on that sub-sectoral breakdown in the next section and more information about the method for the different multipliers in Appendix A.

Figure 3.10: Direct, indirect and induced impacts on investment, selected countries, 2011

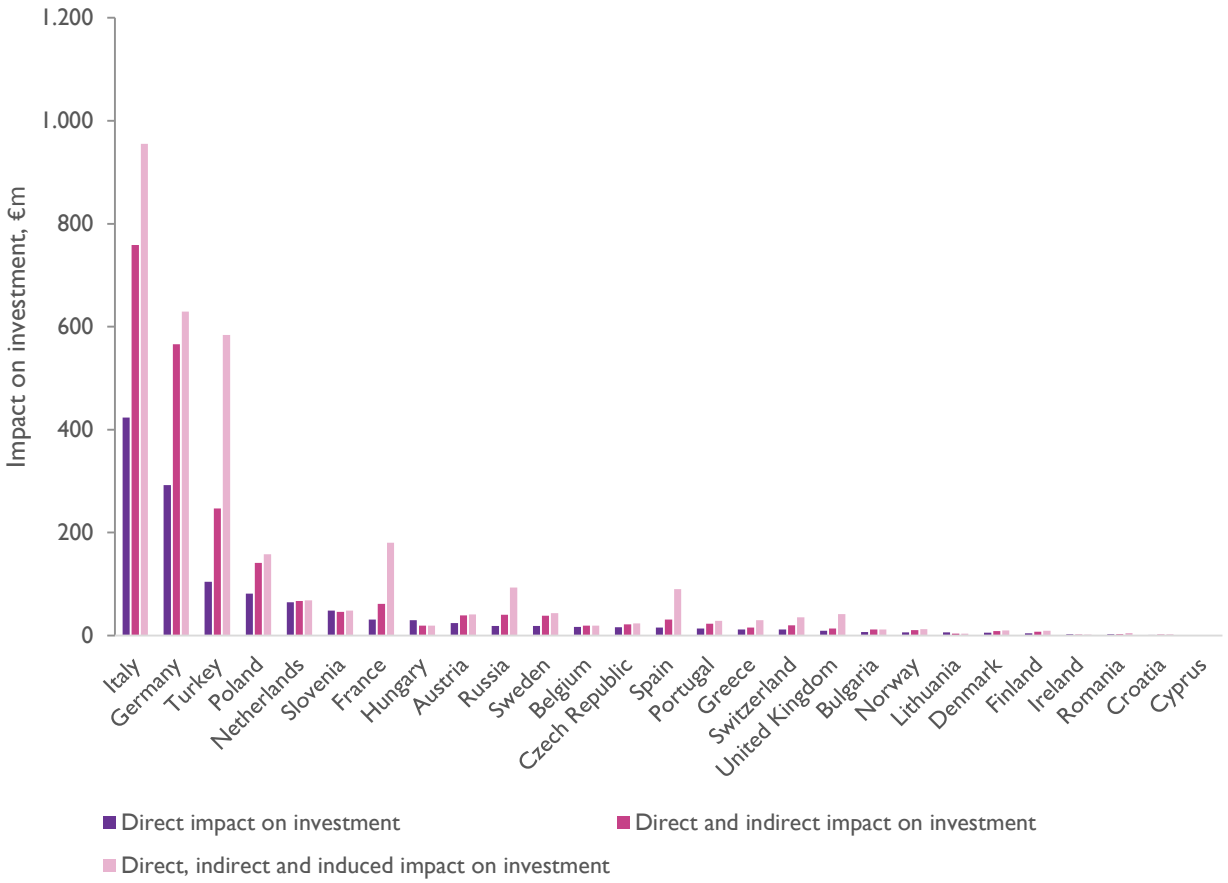


Figure 3.11: Direct, indirect and induced impacts on investment, EU28 countries, 2011

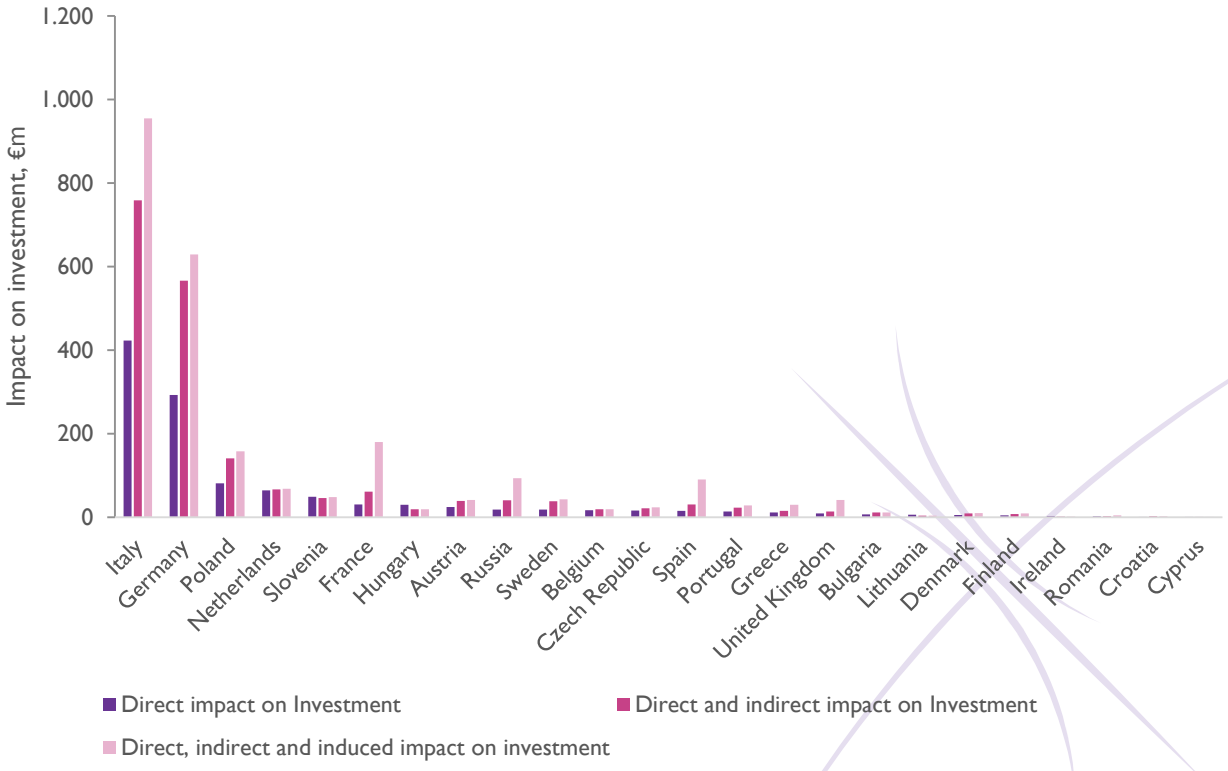


Table 3.5: Direct, indirect and induced impacts on investment, €m, 2011

Country	Direct impact on Investment	Direct and indirect impact on Investment	Direct, indirect and induced impact on Investment
EU27	1,405	4,141	4,704
Of which			
Austria	24	39	41
Belgium	17	19	19
Bulgaria	7	11	12
Cyprus	0	0	0
Czech Republic	16	22	23
Denmark	5	9	10
Finland	4	8	9
France	31	62	180
Germany	292	566	629
Greece	12	16	30
Hungary	30	19	19
Ireland	3	2	2
Italy	423	759	955
Lithuania	6	4	4
Netherlands	64	67	68
Poland	81	141	158
Portugal	13	23	29
Romania	2	2	5
Slovenia	49	46	48
Spain	15	31	90
Sweden	18	38	43
United Kingdom	9	14	42
EU27 total of individual figures	*1,123*	*1,895*	*2,416*
Croatia	1	2	2
Norway	6	10	12
Russia	19	40	93
Switzerland	11	20	35
Turkey	104	247	584

3.6 Research and development

The direct and indirect contribution to external research and development activity across the EU27 was around €700m and the direct, indirect and induced contribution was around €1.2bn.

It is important to note that this relates only to consumption of scientific research and development services. There will also be substantial less formal research and development activity going on within firms.

The contribution of European firms to global research and development activity is particularly significant. CECED statistics suggest that 79 out of 124 global research and development facilities in the domestic appliances sector are located in the EU28 or Turkey.

An alternative means of estimating investment in research and development is to estimate research and development spending as a percentage of turnover for a number of major firms from their annual accounts and then scale that up to the wider sector. Typical research and development spending seems to be around 3 per cent of turnover which, multiplied by the sector's €48bn annual turnover, implies annual research and development spending of around €1.4bn. This suggests that while the estimates above, produced using input-output analysis, might be conservative, they represent a reasonable approximation to the true value.

The pattern in the consumption of scientific research and development services between countries varies considerably from that for other indirect impacts such as those on GDP and overall investment. This may reflect that scientific research and development activity is a much more concentrated niche, which does not necessarily take place in the same location where the wider supply chain is located. It may reflect the location of very specific centres of academic excellence.

However, like the pattern for investment, it may also reflect differences in the make-up of the electrical equipment sector used as a proxy for the I-O analysis on which these estimates are based. The sectoral breakdown within electrical equipment for the EU27 and those countries showing relatively high investment or research and development activity is shown in Table 3.6 below.

The most notable difference is that components such as electric motors and distribution and control apparatus are a larger share of the electrical equipment sector in the EU as a whole. By contrast, domestic appliances are a larger share of the sector in those economies showing high fixed capital and research and development services consumption.

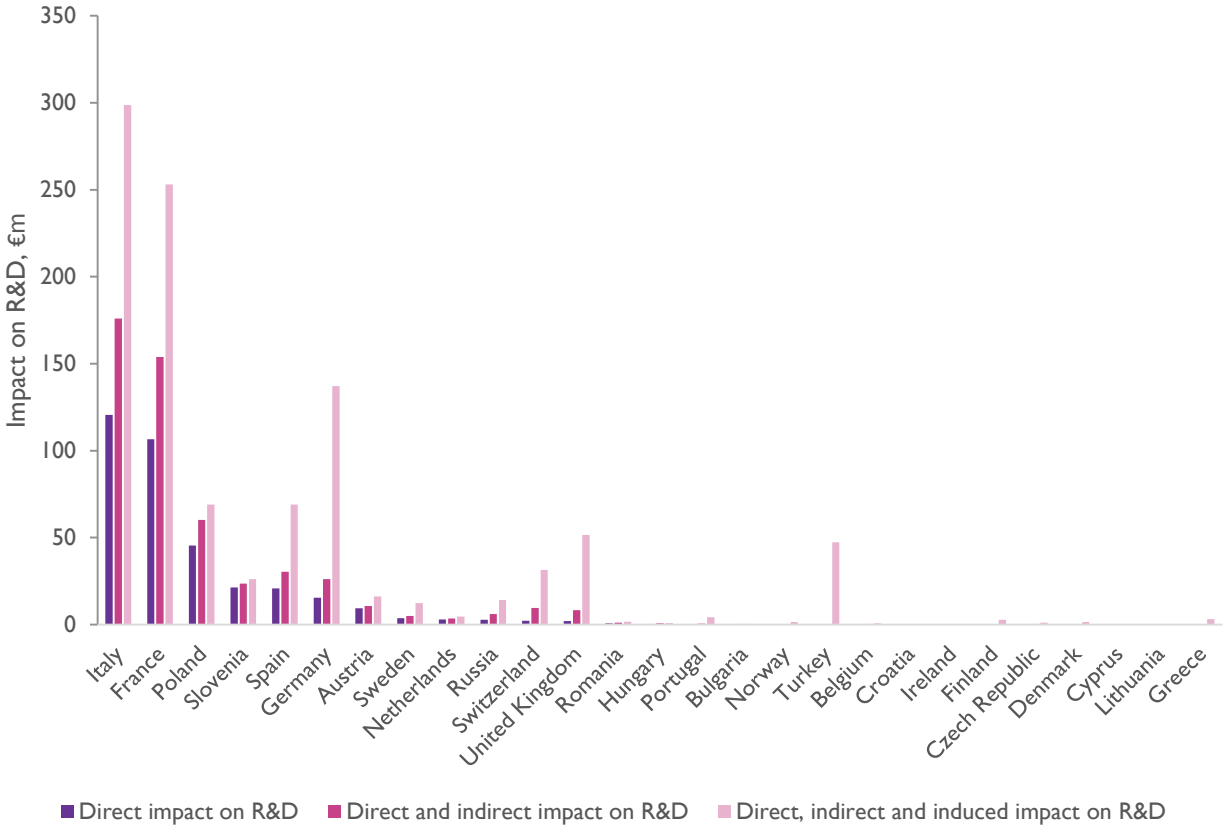
If those countries where the domestic appliances sector is a relatively large proportion of the electrical equipment sector have a relatively capital- and research-intensive electrical sector as a whole, then we can safely assume that the domestic appliance sector is more capital- and research-intensive than the wider sector. Given that we have used the electrical equipment sector as a proxy for our I-O analysis, it is fair to assume that our estimates for investment, research and development (given investment will tend to increase labour productivity) and wages are conservative and the true value may be higher.

Table 3.6: Electrical equipment breakdown, 2011, selected economies

% of electrical equipment	Electric motors, generators, transformers and electricity distribution and control apparatus	Batteries and accumulators	Wiring and wiring devices	Lighting equipment	Domestic appliances
EU27	49%	2%	14%	10%	13%
Spain	42%	4%	11%	11%	22%
France	37%	3%	23%	14%	15%
Netherlands	27%	-	11%	29%	17%
Slovenia	34%	4%	4%	11%	36%

Source: Eurostat and Europe Economics calculations.

Figure 3.12: Direct, indirect and induced impacts on R&D, selected countries, 2011



Note: R & D was not a specific category in the I-O tables for Russia and Cyprus. The overall ratio of R & D activity to national income was therefore used instead, as for the induced effect in the rest of the sample, which may mean those estimates are less reliable.

Figure 3.13: Direct, indirect and induced impacts on R&D, EU28 countries, 2011

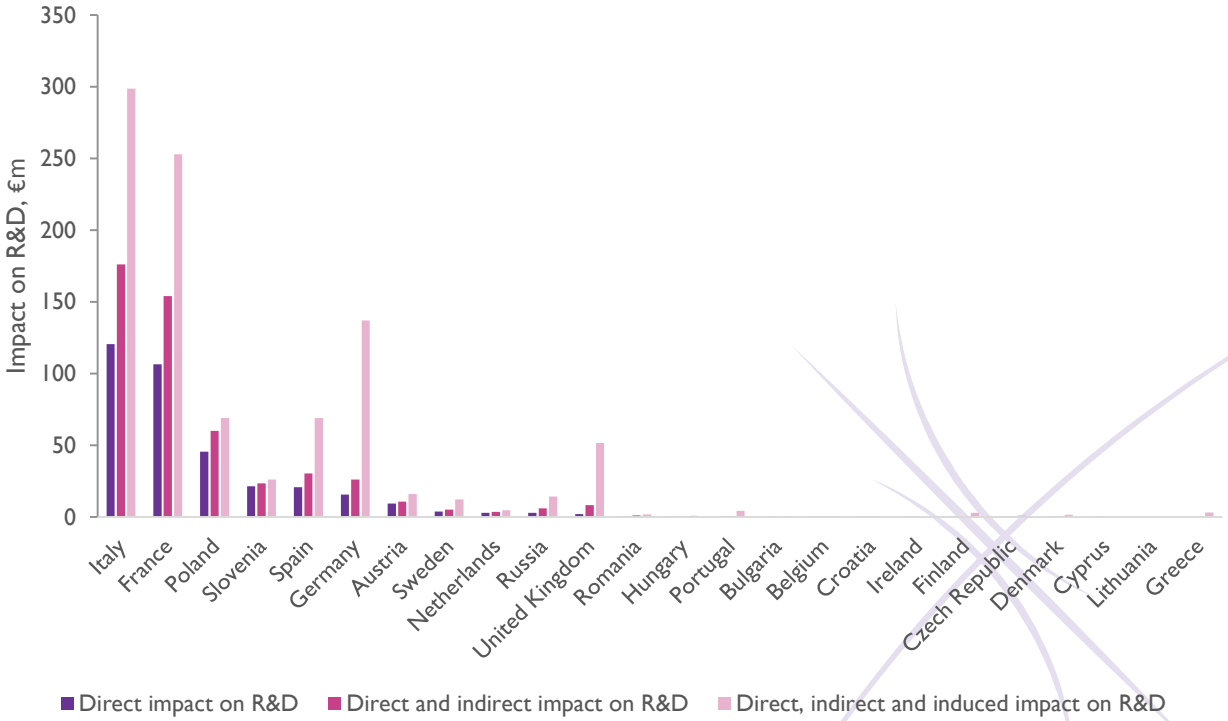


Table 3.7: Direct, indirect and induced impacts on Research and Development (R&D), €m, 2011

Country	Direct impact on R&D	Direct and indirect impact on R&D	Direct, indirect and induced impact on R&D
EU27	358	671	1,248
Of which			
Austria	9	11	16
Belgium	0	0	1
Bulgaria	0	0	0
Cyprus	0	0	0
Czech Republic	0	0	1
Denmark	0	0	2
Finland	0	0	3
France	107	154	253
Germany	16	26	137
Greece	0	0	3
Hungary	0	1	1
Ireland	0	0	0
Italy	121	176	299
Lithuania	0	0	0
Netherlands	3	4	5
Poland	45	60	69
Portugal	0	1	4
Romania	1	1	2
Slovenia	21	24	26
Spain	21	30	69
Sweden	4	5	12
United Kingdom	2	8	52
EU27 total of individual figures	*351*	*502*	*955*
Croatia	0	0	0
Norway	0	0	2
Russia	3	6	14
Switzerland	2	10	32
Turkey	0	0	47

4 External Footprint

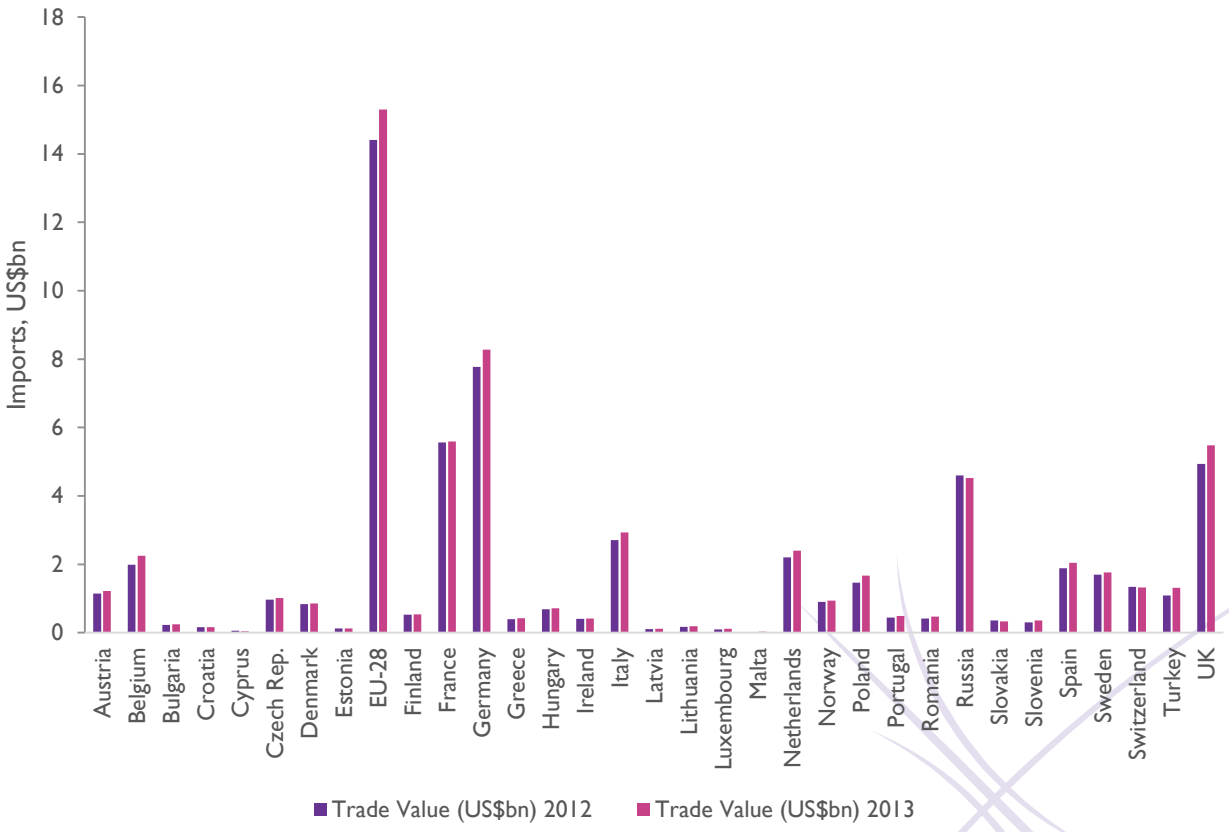
While there are national brands with domestic appliances to a greater extent than in other categories such as electronics, brands which can sell in their domestic markets but which are not exported on a significant scale, there is a considerable external trade as well. We summarise key features of trade in this section.

4.1 Imports

Imports of domestic appliances broadly match the scale of the economies concerned. The four largest importers are also the four largest economies in the EU28 and the smaller economies (particularly those with very small populations) import considerably less. Volumes have increased somewhat across the board.

It is important to note that the sum of imports to the different Member States is considerably greater than imports to the EU28. This reflects that a transaction will be treated as an import to Germany if it is bought from France, whereas the same transaction will not be counted as an import to the EU28. The EU28 represents imports from outside the Single Market.

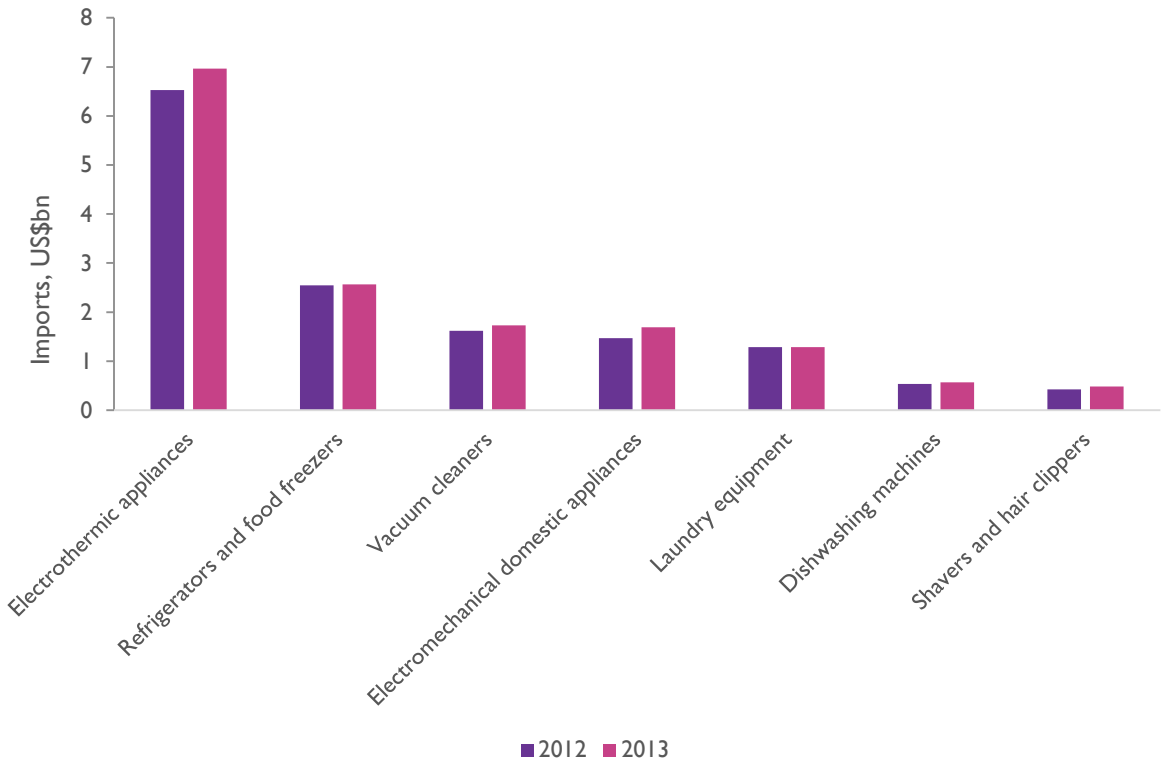
Figure 4.1: Imports, domestic appliances, by country



Source: Comtrade.

In terms of the different sub-sectors, the most important is electrothermic appliances (e.g. microwave or other electrical ovens).

Figure 4.2: Imports, domestic appliances, EU28, by sector



Source: Comtrade.

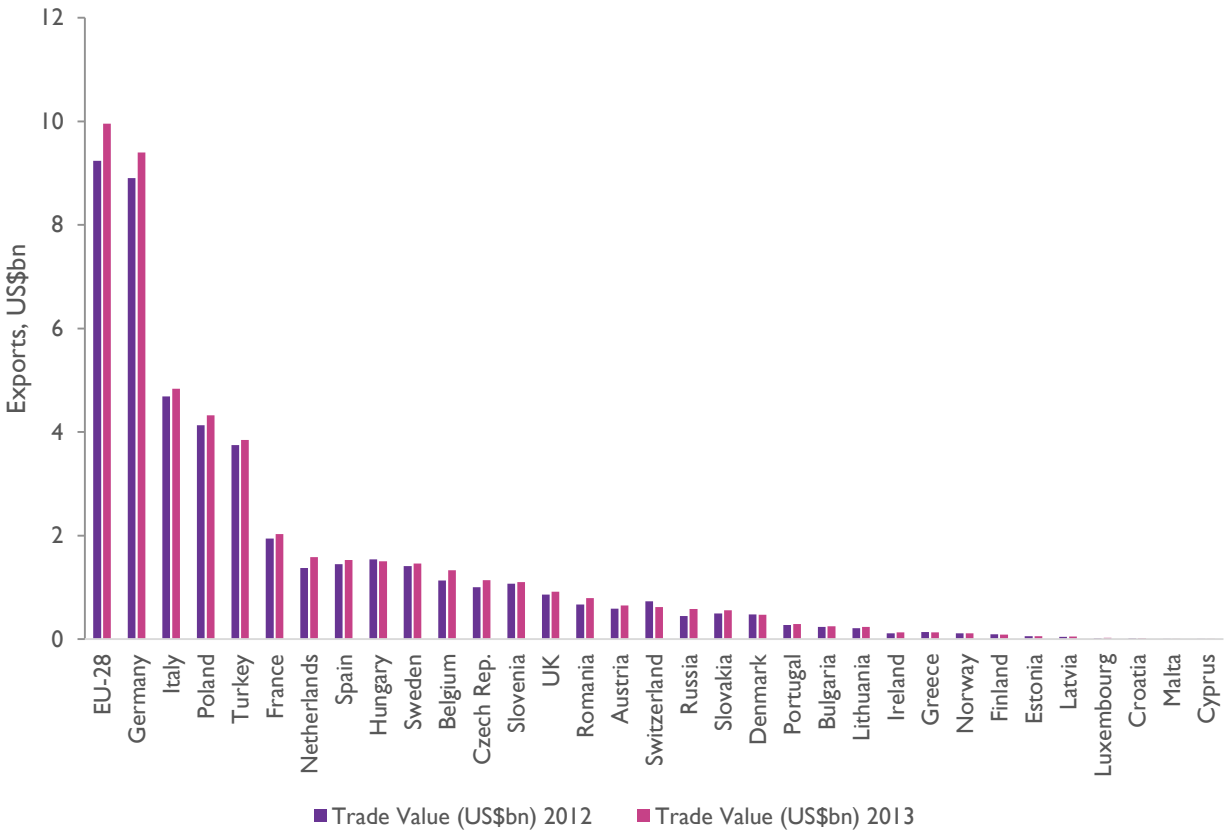
For the refrigerators and freezers sector, in particular, the main importers are the UK and France, followed by Germany. For dishwashers, the main importers are again France, Germany and the UK. Other than that, Germany is the largest importer, as it is for domestic appliances as a whole.

For almost all of the European countries analysed, China is one of the top ten sources of domestic appliance imports. For the EU28 as a whole in 2013, China was the source for 62 percent of total domestic appliances imports. It is important to note that this may overstate the actual degree to which the value is added in the sector in China. Many appliances may be assembled in China (and their total value counted as an import when they are brought to Europe), but that might only represent a small share of the total value added through the value chain, which may be dominated by designers, components manufacturers, distributors or retailers elsewhere (including in Europe). That effect has been observed in the electronics sector, with one study looking at the different contributions to the value added embodied in an iPhone (Yuqing & Detert, 2010). The second biggest volume of imports comes from Turkey, responsible for 18 percent of total EU imports.

4.2 Exports

Germany is the largest European exporter of domestic appliances, followed by Italy, Poland and Turkey. The pattern therefore broadly matches that for output, suggesting that propensity to export is similar between the major producers of domestic appliances.

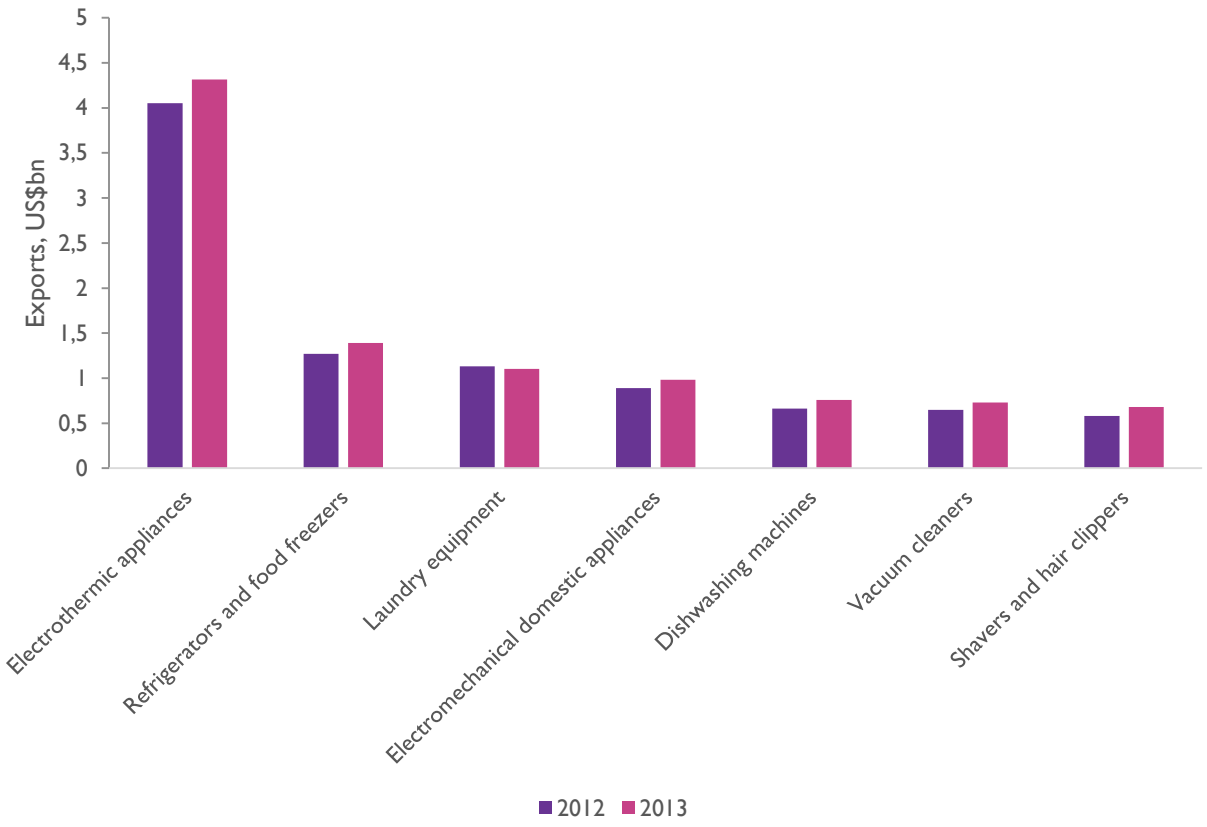
Figure 4.3: Exports, domestic appliances, by country



Source: Comtrade.

The categories of domestic appliance which account for the largest shares of imports also account for the largest shares of exports: electrothermic appliances and refrigerators and freezers. This reflects that these are simply larger categories by trade value overall, rather than necessarily reflecting a particular comparative advantage (or lack of it) in a certain type of appliance.

Figure 4.4: Exports, domestic appliances EU28, by sector



Source: Comtrade.

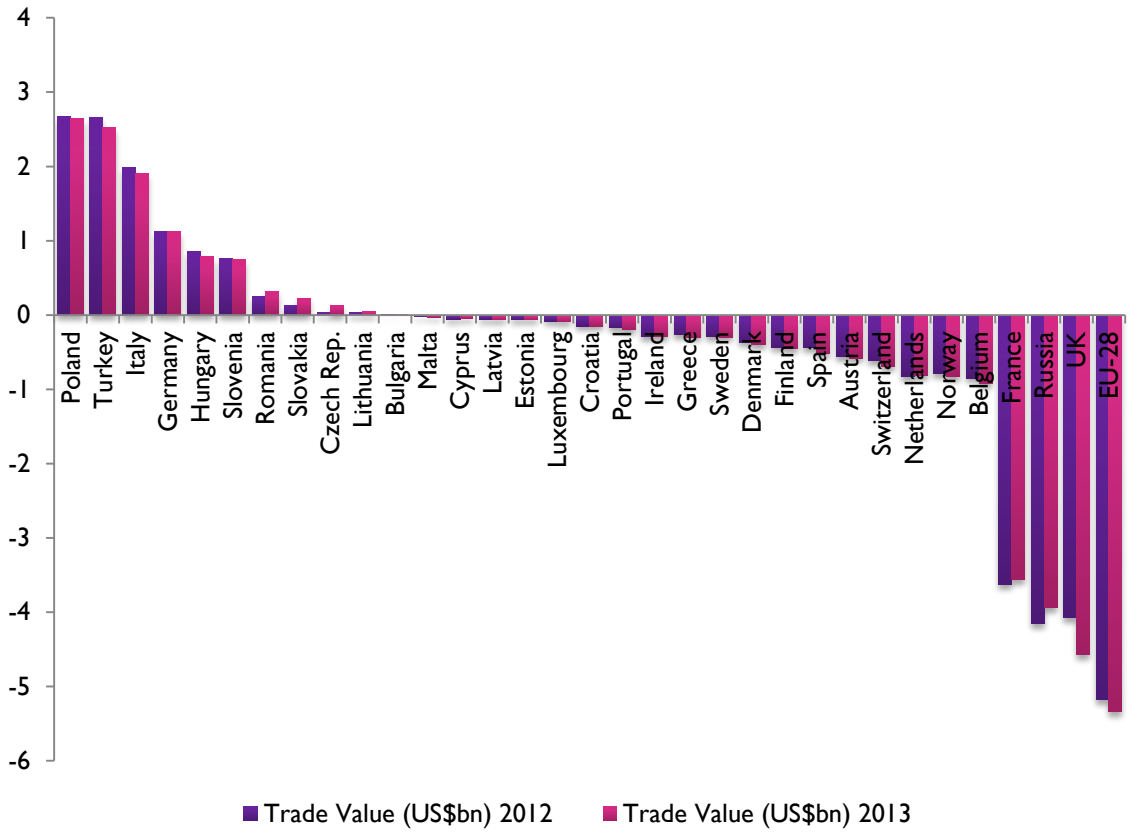
The leading European exporter of electrothermic appliances is Germany, followed by Italy and France. Germany is the leading exporter in all sectors (dishwashers, vacuum cleaners, electromechanical domestic appliances, shavers and clippers, electrothermic appliances) apart from laundry equipment and refrigerators and freezers where the largest exporters are Poland and Turkey respectively.

The most important destination for EU28 domestic appliance exports was Russia, accounting for around 22 percent of total EU exports of domestic appliances. The second largest export partner is the US, accounting for 11 percent of total EU domestic appliances export volume. There is considerable variation between different countries in the countries to which they export with, for example, Austria exporting considerably more to Germany than other economies and Ireland exporting considerably more to the United Kingdom. Those examples strongly suggest that the pattern of domestic appliance trade fits with a conventional understanding, as embodied in a gravity model, with the volume of trade determined by the size of the partner economy and its geographical proximity. Again, there is more detail on the breakdown of exports by sector and partner country in the trade annex.

4.3 Balance

Most European countries are net importers of domestic appliances. The main exceptions are the major manufacturers of domestic appliances, where production takes place for major OEM brands, Germany and Italy, and those countries with relatively low unit labour costs: Turkey and the newer EU Member States. The largest net importers are the Russia and the high income Western and Northern EU Member States.

Figure 4.5: Trade balance (Net Exports) of Domestic appliances by country and EU-28

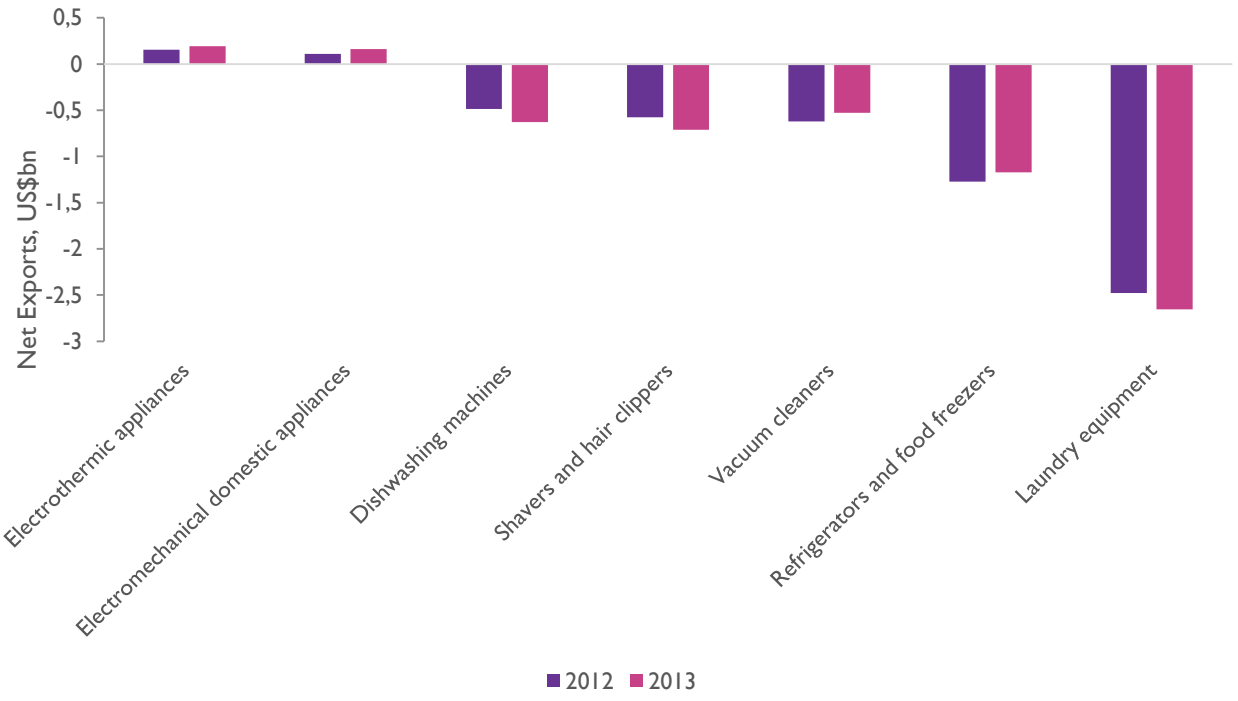


Source: Comtrade.

The EU28 as a whole is also a net importer of most of the domestic appliance categories.

The largest net exporter in laundry equipment industry is Poland; in refrigerators and freezers it is Turkey; and in the shavers and hair clippers industry, it is the Netherlands. In the electromechanical appliances, dishwashers and vacuum cleaners sectors, the largest net exporter is Germany whereas for electrothermic appliances, the largest net exporter is Italy.

Figure 4.6: Trade Balance (Net Exports) of the main domestic appliances sectors in the EU-28



Source: Comtrade.

5 Other Benefits

5.1 Energy efficiency

Improvements in energy efficiency over time reduce consumer costs and greenhouse gas emissions in the energy sector.

There have been considerable efforts to minimise the environmental impact of the production and use of domestic appliances. Those efforts have included regulations and voluntary measures such as energy efficiency labels. There are signs that consumers are responding to that information, and that manufacturers are responding, and "the vast majority of refrigerators and washing machines sold across the EU belong to the A or A+ categories of energy efficiency" (Ecorys, 2011). This appears to be particularly the case in Germany, Italy and the new EU Member States:

> For refrigerators, while 'A' efficiency graded appliances account for the majority of sales in most countries, higher graded appliances ('A+' and 'A++') account for more than half the market in Italy and Germany. More surprisingly, these countries are followed by Slovakia, Poland and the Czech Republic, with Romania also highly ranked. This pattern of a large market share of higher graded appliances among new Member States can also be observed for washing machines; with the four previously mentioned countries, together with Slovenia among the 10 countries having the largest share of higher graded appliances.

There is likely to be greater control over energy efficiency standards for domestic production within Europe, though higher standards need to be balanced against the potential to raise consumer purchase costs or inhibit the competitiveness of domestic production. Similar standards in the United States have resulted in significant reductions in energy use, greenhouse gas emissions and costs to consumers (Meyers, McMahon, & McNeil, 2005). However they have also resulted in consolidation of the domestic industry and increased entry from foreign manufacturers (Samuels, 1997).

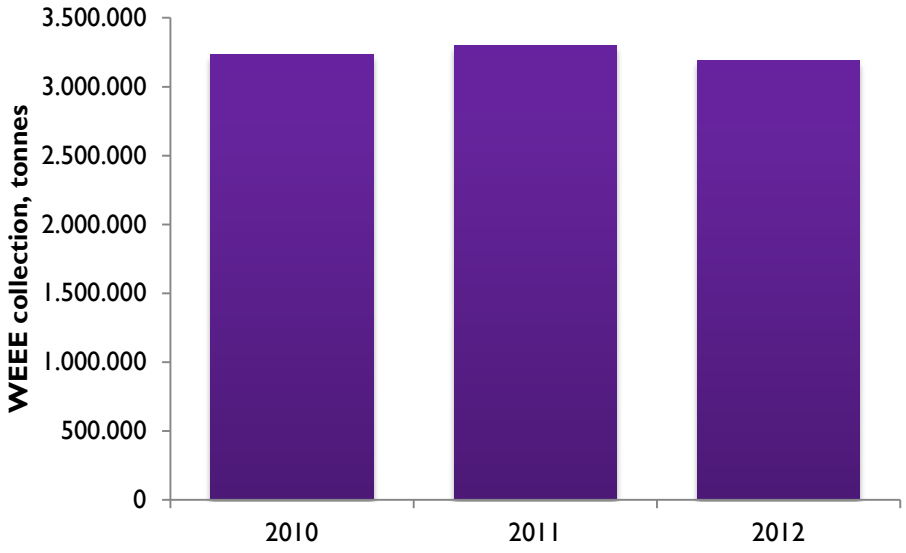
In the international market for domestic appliances, an OECD working paper has highlighted a lack of harmonisation (this will cover markets outside the EU) regarding efficiency requirements and testing procedures (Steenblik, Vaughan, & Waide, 2006). It explores the feasibility of various trade policy measures of differentiating goods based on energy efficiencies and imposing different tariff bands accordingly. As the reductions in import tariffs will be based on the energy efficiency of different appliances, un-harmonised testing procedures can create confusion and function as barriers to trade.

5.2 Recycling

Under the Waste Electrical and Electronic Equipment Directive (2002/96/EC) there are collection, recycling and recovery targets for all kinds of electrical and electronics goods. Manufacturers and distributors are responsible for the disposal of waste equipment, with private households able to return it free of charge. The targets for recovery rates have since been substantially revised upwards. The volumes collected and recycled will also vary over time with sales, as people are most likely to discard old appliances when they buy new ones. 3.2m tonnes were reported to have been collected in 2012 under the directive.[5]

[5] This data is from the WEEE Forum Key Figures Report and covers 95.9 per cent of the relevant population, the EU28 plus Norway and Switzerland.

Figure 5.1: WEEE collection, tonnes



Source: WEEE Forum Key Figures Report.

The intention of the regulation is to prevent potential harms from equipment not disposed of properly, which might contain hazardous materials (this is also controlled through restrictions on the use of certain substances in electrical and equipment, under "RoHS" – restriction on the use of certain hazardous substances in electrical and electronic equipment – Directive, 2002/95/EC), and improve the rates at which scarce natural resources are recovered.

While the directives have been found to reduce the environmental impact of the sector, in terms of avoiding the use of hazardous substances like mercury, research in 2008 for the European Commission found that the RoHS directive was leading to high costs and that "the share of compliance costs in total costs to comply with RoHS is much higher compared to the share of technical costs" as the administrative burden is "relatively large", particularly for SMEs (Arcadis, 2008). There is clearly a potential for regulation of this sort to hinder firm growth and therefore sector competitiveness. The report recommends action to streamline the rules:

Total costs to comply with RoHS can be split up into compliance costs and technical costs. Compliance costs consist of costs of training and information measures, costs of collecting and reviewing information, costs related to exemption procedures and monetary losses related to RoHS compliance (e.g. turnover loss, obsolete components). On the other hand, technical costs to phase-out RoHS substances consist of capital expenditure, R&D expenditure and operating expenditure.

Compliance costs make up 67% of all costs made to comply; the share of technical costs amounts to 33%. Within the future yearly costs to stay RoHS compliant, the share of technical costs drops to 12%, whereas compliance costs reach a level of 88% of total costs. As most technical costs (capital and R&D expenditure) are made in the past to comply with RoHS, the remaining future yearly costs consist mainly of the operating expenditure, such as increased purchasing costs of materials or higher energy costs, related to the substitution of RoHS substances.

Options for revising the RoHS Directive should therefore be concentrated on ways to lower annual future compliance costs, which is linked with options aimed at an efficient monitoring and enforcement regime to limit free-riders.

Despite that common regulation, recycling rates still vary substantially across the EU.

Figure 5.2: Recycling rate, electrical and electronic goods, 2012

Source: Eurostat.
Note: Italy, Greece, Spain and Cyprus represent values in 2010.

5.3 Time saving

The use of domestic appliances can generally be expected to save time. When consumers first gain access to domestic appliances and substitute, for example, using a dishwasher for manually washing dishes they save time. They may then save further time with, for example, a more effective vacuum cleaner or a more reliable washing machine which requires less attention from the user. The time saved can then either mean increased labour or increased leisure and either could have macroeconomic consequences, as the technology-augmentation of leisure time can affect a conventional growth model.

The effect on time use may be more complex than it initially appears, however. In a unique Australian survey (Bittman, Rice, & Wajcman, 2004), it was found that the use of domestic appliances did not affect the number of hours spent on house work; the same amount of time was spent in the kitchen or doing laundry with or without the use of domestic appliances. There appeared to be a gender division though, with men saving time with dishwashers and deep freezers, while women did not, although outdoor household equipment increased men's work hours at home (men were more likely to be responsible for outdoor tasks, like moving a lawn).

The complication may simply be that household appliances increasingly blur the line between leisure and work at home. Cooking might increasingly move from domestic labour to a leisure activity (in the same way that, for some people, playing a musical instrument is a paid work activity, for others it is a leisure activity). This seems particularly likely given that the survey is a cross-sectional examination of different households, and those with more domestic appliances may be expressing a preference for engaging in greater domestic work, either as work to increase the standard of the domestic environment or as a form of leisure.

Besides an increase in the availability of quality time, there might also be a range of other social benefits associated with domestic appliances. Cooking at home, for example, may be associated with the construction of social bonds within and outside the family. Time-saving might also make more time for other activities that contribute more to family bonding than house work. They might also defuse tensions within the household over the extent to which such activity is the responsibility of one member of the household or another (on average, having a husband creates an extra seven hours a week of housework for women, but having a wife saves men from about an hour of housework a week (University of Michigan, 2008)). People often underestimate their own contribution to housework and differ over the contribution made by different family members (Achen & Stafford, 2005).

Such contributions to family cohesion might be difficult to measure, and there does not appear to be an existing literature on this function, but it could be an important part of why some domestic appliances are bought. They may be an appropriate subject for further research.

5.4 Research and development

The relative research- and investment-intensity of domestic appliances, relative to the wider electric equipment sector, observed in Section 3.6 implies that the sector is associated with a considerable volume of research which is conducted and then embodied in the capital stock (leading to practical learning about the merits of different technologies which can enable further innovation). This can be expected to increase productivity over time, increasing wages.

It is well-understood in the economics literature that there are a range of positive externalities associated with research and development spending. There are a range of potential benefits which might not be captured by the innovator, such as:

- Future innovators in the sector might be able to learn from and develop further innovations of their own more easily. This may be particularly true if any intellectual property rights are narrowly conceived and it is relatively easy to develop an incremental improvement, or if intellectual property rights are weakly enforced.
- There may be knowledge spillovers to other sectors. Technologies may be developed by domestic appliances firms that are useful in – for example – the transport sector, but domestic appliances firms may be poorly placed to exploit those innovations. This is particularly likely in those areas where a number of sectors are confronting similar challenges, such as the need to develop broadly better, but particularly more efficient, electric motors. Any innovation in the domestic appliances sector may quickly find applications in sectors as remote as the electric cars and a domestic appliance manufacturer may not be able to capture that benefit.
- The benefits may be captured by consumers, particularly if patents are ineffective or only in place for a short time, in enhanced consumer welfare (better products, lower prices for the same products, or lower prices for better products). There have clearly been considerable innovations in the domestic appliances sector over time. Nordhaus (2004) found that "only a minuscule fraction of the social returns from technological advances over the 1948-2001 period were captured by producers, indicating that most of the benefits of technological change are passed on to consumers rather than captured by producers." He found that 98 per cent of the benefits of innovation were captured by consumers. This may well include the price trend shown in Figure 2.8, but also changes in quality and the feature set.

Those externalities lead to the common assumption that there is an under-supply of research activity and an increase is likely to be welfare enhancing over time.

One interesting recent development is the 3D printer and other technological changes which could make it economically feasible – in the near or very near future (or in some cases even already) – to produce highly customised variants of domestic appliances with very short production runs. That has the potential to

revolutionise the process of innovation in this sector. Devices could reflect very specific needs of consumers — a freezer that fits in precisely that awkward gap; a dishwasher with a space for that huge casserole dish you got as a wedding present. Or they could reflect very specific tastes or identifications consumers wished to express — a cappuccino machine where the froth comes out with a Liverpool Football Club logo; or a fridge that plays Jingle Bells when it is opened on Christmas Day.

Another current-to-near-term development is the ongoing integration of domestic appliances with the internet and mobile communications, allowing consumers to instruct their washing machines to start, their heating systems to warm the house whilst the consumer is still on the way home, and so on. Much of the relevant technology for this is already available but future consumer take-up could be much greater than has been achieved so far, creating a wide range of additional benefits to consumers.

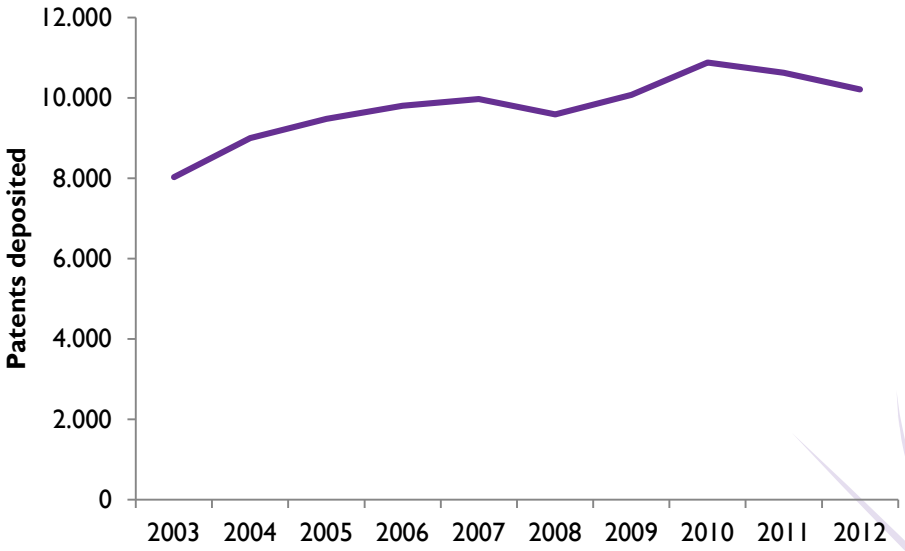
5.4.1 Intellectual property

Research and development is facilitated by a range of intellectual property rights that are of particular importance in the domestic appliances sector, including:

- Design Rights. While there are some domestic appliances which have a relatively 'generic' design, there are others which are highly iconic (such as the Bialetti coffee machine in Italy). Those designs might be protected with design rights, though the registration of design rights can often be patchy.
- Patents. Technological innovations can often be protected by patents. Those patents can be valuable, either helping a firm to gain or protect its market share or to increase their earnings through the licensing of the patent.

The European domestic appliances industry is making increasing use of patents over time, protecting the results of the sector's research and development activity.

Figure 5.3: Domestic appliances, patents deposited



Source: CECED.

One interesting issue in this area is the question of whether 3D printing might make the current suite of property rights relevant to domestic appliances unenforceable, much as internet downloading and file sharing made unenforceable the intellectual property rights previous generations associated with recorded music. That is an active area of current economics research.

6 Conclusions

Despite the challenges facing European manufacturers in an internationally competitive market, the domestic appliances industry employs substantial numbers of people both directly and indirectly, in the wider value chain. Those workers make a substantial contribution to GDP and tax revenue. The sector also contributes to Europe's future prosperity through substantial investment and research and development activity.

Overall, our research finds that:

- The turnover of the domestic appliances sector was €48bn in the EU28 in 2013. In many economies, this turnover was spread over hundreds or thousands of firms. The largest number of firms was in Turkey, at 2,000, whereas the sector was more concentrated in more mature economies.
- The sector made a direct and indirect contribution to EU27 GDP of around €25bn and a direct, indirect and induced contribution to EU27 GDP of around €53bn in 2011.
- Around 465,000 worked in the sector, directly and indirectly across the EU27 in 2011. The direct, indirect and induced contribution to employment was around 963,000. The direct and indirect contribution to wages was around €11.5bn, whereas the direct, indirect and induced contribution was around €22.4bn.
- The total contribution to tax revenues, including the direct, indirect and induced contributions, was around €14bn across the EU27. The tax revenues were dominated by the induced effect, the effect of those working – directly or indirectly – in the domestic appliances sector spending their incomes in the wider economy.
- The direct and indirect contribution to investment in the EU27 was around €1.2bn in 2011 and the direct, indirect and induced contribution to investment was around €1.4bn. Including induced effects, there was a €700m direct and indirect contribution to research and development activity and a €1.2bn contribution to research and development activity.

While the sector is particularly concentrated in the larger manufacturing economies, such as Germany, Italy and France, and lower cost locations, particularly Turkey and Poland, there is substantial economic activity relating to domestic appliance production taking place in most European economies.

7 Bibliography

Achen, A. C., & Stafford, F. P. (2005). *Data Quality of Housework Hours in the Panel Study of Income Dynamics: Who Really Does the Dishes?* Michigan: Institute for Social Research.

Arcadis. (2008). *Study on RoHS and WEEE Directives.* Brussels: DG Enterprise and Industry.

Bittman, M., Rice, J. M., & Wajcman, J. (2004). Appliances and their impact: the ownership of domestic technology and time spent on household work. *The British Journal of Sociology*.

Ecorys. (2009). *Study on the Competitiveness of the EU Gas Appliances Sector.* Rotterdam: DG Enterprise & Industry.

Ecorys. (2011). *Study on the Competitiveness of EU electrical and electronics goods markets with a focus on pricing and pricing strategies.* Rotterdam: DG Enterprise and Industry.

Eurostat. (2015). *Statistical Classification of Economic Activities in the European Community (NACE, Rev. 2)*. Retrieved January 28, 2015, from RAMON - Reference and Management of Nomenclatures.

Meyers, S., McMahon, J., & McNeil, M. (2005). *Realized and Prospective Impacts of U.S. Energy Efficiency Standards for Residential Appliances.* Berkeley, CA: Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory.

Nordhaus, W. (2004). *Schumpeterian Profits in the American Economy: Theory and Measurement.* NBER.

Samuels, C. (1997). Impact of U.S. Energy Efficiency Requirements on Appliance Industry. In P. Bertoldi, A. Ricci, & H. B. Wajer, *Energy Efficiency in Household Appliances* (pp. 66-76). Berlin: Springer.

Steenblik, R., Vaughan, S., & Waide, P. (2006). *Can Energy-Efficient Electrical Appliances be considered "Environmental Goods"?* Paris: OECD.

University of Michigan. (2008). *Exactly How Much Housework Does A Husband Create?* Michigan: ScienceDaily.

Whitegoods Trade Association. (2010). *How Long Should An Appliance Last.* London.

Yuqing, X., & Detert, N. (2010). *How the iPhone Widens the United States Trade Deficit with the People's Republic of China.* Japan: ADBI Institute.

Europe Economics

8 Appendix A: Methods

8.1 Background

Most Input-Output analysis is based upon the static input-output system developed by Wassily Leontief in the 1930s. Leontief's model is based upon fixed, linear production functions and sets out the output needed from each industry in order to satisfy a given vector of final demand:

For illustrative purposes, assume that the economy has three sectors: agriculture, industry and services. There are two factor inputs: labour and capital. The end uses for the products of each sector are summarised in one quantity vector called final demand (in a more complicated model, this would be broken down into household consumption expenditure, government consumption expenditure, gross fixed capital formation and net exports).

In this simplistic model, the production of any sector can be looked at by use – the produce is used as inputs by any or all of the three sectors, and is sold to final demand. The entire economy may be summarised in the following three equations.

$$X_{AA} + X_{AI} + X_{AS} + X_{AD} = X_A$$
$$X_{IA} + X_{II} + X_{IS} + X_{ID} = X_I$$
$$X_{SA} + X_{SI} + X_{SS} + X_{SD} = X_S$$

Here:

- Sectors are represented by the following subscripts: A = agriculture, I = industry, S = services;
- X_{ij} is the intermediate demand for the produce of sector i by sector j, where $i, j \in \{A, I, S\}$;
- X_{iD} is the final demand for the produce of sector i;
- X_i is the total production of sector i; and
- all units are in money terms.

The assumption of fixed coefficients is interpreted in the following way. Take the industry sector. It needs to use X_{AI} of the produce of the agriculture sector to produce X_I of final produce. Consequently, it needs $\frac{X_{AI}}{X_I}$ worth of the agricultural produce to produce product worth one unit of currency. The assumption is that a_{AI} is the fixed technical coefficient of intermediate consumption that provides one link between the industry and agriculture sectors – regardless of the amount that the industry sector produces this proportion would remain constant. Similar intermediate consumption coefficients may be calculated for links between each pair of sectors.

$$a_{ij} = \frac{X_{ij}}{X_j} \; for \; i, j = A, I, S$$

The system of equations can then be represented in terms of the fixed technical coefficients, the total production of each sector and the final demand facing each sector as follows.

$$a_{AA}X_A + a_{AI}X_I + a_{AS}X_S + X_{AD} = X_A$$
$$a_{IA}X_A + a_{II}X_I + a_{IS}X_S + X_{ID} = X_I$$
$$a_{SA}X_A + a_{SI}X_I + a_{SS}X_S + X_{SD} = X_S$$

Using matrix notation, this may be re-written as follows.

$$\begin{bmatrix} a_{AA} & a_{AI} & a_{AS} \\ a_{IA} & a_{II} & a_{IS} \\ a_{SA} & a_{SI} & a_{SS} \end{bmatrix} \begin{bmatrix} X_A \\ X_I \\ X_S \end{bmatrix} + \begin{bmatrix} X_{AD} \\ X_{ID} \\ X_{SD} \end{bmatrix} = \begin{bmatrix} X_A \\ X_I \\ X_S \end{bmatrix} \Rightarrow \boldsymbol{A \cdot X + X_D = X}$$

8.2 Change in final demand

With this set up, it now becomes possible to analyse the effects on the economy when the final demand changes for the produce of a certain sector. The problem is straightforward – we have a new set of final demands X_{iD} (contained in the vector$\boldsymbol{X_D}$) and a set of technical coefficients a_{ij} (which are contained in the matrix $\boldsymbol{A}$) that are known. We need to know what the total produce of each sector should now be, i.e. we need to find the X_is (contained in the vector $\boldsymbol{X}$). In terms of the three-equation set up, the problem is simple – there are three equations with three unknown variables to solve for. Simple algebraic manipulation leads us to the new final outputs.

For computational reasons, it is easier to work with matrices, as in actual models the number of sectors is much higher than three, and algebraic manipulation becomes harder. Thus, in matrix terms, the solution is given by manipulation of the basic set-up equation.

$$\boldsymbol{X = (I - A)^{-1} \cdot X_D}$$

Here

- $\boldsymbol{I}$ is an identity matrix with 1 along the diagonal and 0 elsewhere; and
- $\boldsymbol{(I - A)^{-1}}$ is the inverse of the matrix $\boldsymbol{(I - A)}$

There are a number of reservations over that approach, in particular:

- The assumption of a fixed, linear production function excludes the possibility that firms can substitute other inputs or that there are increasing or decreasing returns to scale.
- The assumption that inputs can respond freely to final demand (the only exogenous variable) in the model is only plausible if none of those inputs are scarce and the economy is therefore not close to full employment.

However, demand-driven I-O analysis does provide an understanding of the backward linkages between industries and, in the short-term, the demand-driven input-output approach also gives an understanding of the likely effects of policies such as Keynesian stimulus programmes.

8.3 Change in supply

The supply-driven application of I-O analysis demands some differences in approach and has a different set of limitations to demand-driven analysis.

There is a corresponding supply-driven quantity model analogous to the demand-driven model set out above. The model uses output coefficients, which are distribution parameters products reflecting market shares, rather than the input coefficients described above and used in demand-driven I-O analysis, which reflect production functions or cost structures of activities. Those output coefficients are calculated by dividing each entry of the input-output table by the corresponding row total.

An output coefficient model then takes the following form:

$$\boldsymbol{B' \cdot X + Z_S = X}$$
$$\boldsymbol{(I - B') \cdot X = Z_S}$$
$$\boldsymbol{X = (I - B')^{-1} \cdot Z_S}$$

Here

- $\boldsymbol{B'}$ is a transposed matrix of output coefficients for intermediates;

- $\boldsymbol{I}$ is an identity matrix with 1 along the diagonal and 0 elsewhere; and
- $\boldsymbol{Z_S}$ is a new set of primary inputs or value added for intermediate sectors.

There are further limitations on the use of supply-driven I-O models though as they are often thought to "lack a proper microeconomic foundation". However that shortcoming mainly relates to studies of the impacts of policy shocks, where a "straightforward use of the model" is seen as inappropriate. Even critical analysis suggests that "using the supply-driven model as a descriptive device to indicate the strength of forward linkages is justified".

That is how we need to understand the results obtained in this study: as an indication of the backward and forward linkages of the domestic appliance sector in European economies; the scale of the economic activity associated with domestic appliance production. Further research would be needed in order to understand how the economic activity associated with domestic appliance production might increase or decrease in response to any change in activity in the sector.

8.4 Direct, indirect and induced effects

In I-O analysis, changes in output result from three kinds of effect:

- Direct effect: If a sector produces more output, either in response to final demand in a demand-driven model or as an exogenous input in a supply-driven model. It results in additions to GDP, employment, income, taxes, and other policy relevant variables.
- Indirect effect: These are caused by all sectors adjusting outputs to allow for an increase in demand for intermediate inputs that would accompany any increase in output by any sector. The model described above captures indirect effects.
- Induced effect: Increases in production mean increased incomes for those providing the factors of production (investors providing capital; workers providing labour). As they spend those higher incomes, that creates an increase in final demand and therefore a further increase in production. Induced effects cannot be calculated using I-O tables because the household sector is regarded as extraneous. We have calculated these effects indirectly using data on income multipliers. To do this, we first estimated income multipliers based on savings and import rates. We then multiplied the GDP effects (excluding induced effects) by the income multipliers to arrive at the total effects (including induced effects). It should be noted that this analysis was conducted only at the whole economy level, not at the sector level.

8.5 Estimating policy relevant multipliers

Once the new total outputs have been calculated, and the backward and forward linkage estimates combined, the effects on several macro variables may be obtained:

- GDP effects: We first calculated the proportion of output in each sector that represents additional value creation. We then multiplied that by the increase in output in each sector. As GDP is simply the sum total of all goods and services produced in the economy, the new GDP is obtained by adding up the increased value added in each sector.
- Employment effects: We multiplied the change in output in each sector by the number of employees it takes to produce one currency unit worth of produce. This is a fixed coefficient, and can be calculated using initial production and initial employment. Initial employment was generally available from Eurostat and other sources based on the same NACE categories as the I-O tables. The induced effect was estimated by multiplying the induced effect on GDP by the ratio of employment to GDP in each Member State.
- Wage effects: We multiplied the change in output in each sector by the amount paid in wages for each currency unit worth of produce. This is a fixed coefficient, and can be calculated using initial production and initial wages. Initial wage data was often available based on the same NACE categories as the I-O tables. The induced effect was estimated by multiplying the induced effect on GDP by the

ratio of wages to GDP in each Member State. In those cases where initial wage data by NACE category was not available, we have also multiplied the indirect impact on GDP by the whole economy ratio of wages to GDP.

- Tax effects: We multiplied the change in output in each sector by the taxes (minus subsidies) on products and other net taxes on production for each currency unit worth of produce. This is a fixed coefficient, and can be calculated using initial production and initial taxes. Initial tax data was normally available in the I-O tables. The induced effect was estimated by multiplying the induced effect on GDP by the ratio of tax revenue to GDP in each Member State. In those cases where tax data was not available in the I-O tables, we have also multiplied the indirect impact on GDP by the whole economy ratio of tax revenues to GDP.
- Research and development effects: One of the sectors in the Input-Output tables is "scientific research and development services". The increase in research and development spending is measured by the increase in output in that sector. While this may not measure every activity which would commonly be understood as research and development, it will provide a reasonable conservative estimate. In those cases where scientific research data was not available in the I-O tables, we have also multiplied the indirect impact on GDP by the whole economy ratio of R&D to GDP
- Investment effects. We multiplied the change in output in each sector by consumption of fixed capital for each currency unit worth of produce. This is a fixed coefficient, and can be calculated using initial production and initial fixed capital consumption. Initial fixed capital consumption data was normally available in the I-O tables. The induced effect was estimated by multiplying the induced effect on GDP by the ratio of gross fixed capital formation to GDP in each Member State. In those cases where fixed capital formation data was not available in the I-O tables, we have also multiplied the indirect impact on GDP by the whole economy ratio of gross fixed capital formation to GDP.

9 Appendix B: Sources

This Appendix details the data sources used for all the analysis in the report.

9.1 Input-output tables

For the input output analysis, data was mainly collected form Eurostat's[6] Structural Business Statistics database, with the exception of Switzerland, Cyprus and Russia for which the input-output tables were taken from Swiss Federal Statistics Office[7] and WIOD[8] respectively. The domestic input-output tables were used for countries, where available, based on the NACE 1 or NACE 2 categories. Table 9.1 below shows the data sources and the input output tables used for all the countries analysed in the report. Countries where the value added figure for domestic appliances is zero (Estonia, Luxemburg, Malta and Latvia) or negative (Slovakia) were not included in the analysis.

Table 9.1: Data sources for Input-output tables

Country Name	Country Code	Input-Output Table	Data Source	Year
EU27	EU	Domestic	Eurostat	2009
Austria	AT	Domestic	Eurostat	2010
Belgium	BE	Domestic	Eurostat	2010
Bulgaria	BG	Domestic	Eurostat	2010
Switzerland	CH	Total[9]	Swiss Federal Statistics Office	2008
Cyprus	CY	Domestic	WIOD	2011
Czech Republic	CZ	Domestic	Eurostat	2010
Germany	DE	Domestic	Eurostat	2010
Estonia	EE	Domestic	Eurostat	2010
Greece	EL	Domestic	Eurostat	2010
Finland	FI	Domestic	Eurostat	2011
France	FR	Domestic	Eurostat	2010
Hungary	HU	Domestic	Eurostat	2010
Ireland	IE	Domestic	Eurostat	2010
Italy	IT	Domestic	Eurostat	2010
Lithuania	LT	Domestic	Eurostat	2010
Luxembourg	LU	Total	Eurostat	2007
Malta	MT	N/A[10]		

6 http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/.
7 http://www.bfs.admin.ch/bfs/portal/en/index.html.
8 http://www.wiod.org/new_site/database/niots.htm.
9 Imports were subtracted from the total supply of goods. Hence, the analysis above in the report only includes domestic output.
10 Data not available.

Country Name	Country Code	Input-Output Table	Data Source	Year
Netherlands	NL	Domestic	Eurostat	2010
Norway	NO	Domestic	Eurostat	2011
Poland	PL	Domestic	Eurostat	2010
Portugal	PT	Domestic	Eurostat	2008
Romania	RO	Domestic	Eurostat	2010
Sweden	SE	Domestic	Eurostat	2010
Slovenia	SI	Domestic	Eurostat	2010
Slovakia	SK	Domestic	Eurostat	2010
United Kingdom	UK	Domestic	Eurostat	2010
Denmark	DK	Domestic	Eurostat	2007
Spain	ES	Domestic	Eurostat	2005
Croatia	HR	Domestic	Eurostat	2004
Latvia	LV	Domestic	Eurostat	1998
Turkey	TR	Domestic	Eurostat	2002
Russia	RS	Total	WIOD	2011

As stated in the report earlier, the input output tables do not disaggregate to the domestic appliances category (C27.5) and hence the electrical equipment category (C27) is used as a proxy to estimate the impact of domestic appliances for all the countries. The exception to this is Switzerland where the most relevant category available is machinery and equipment. There is Eurostat data on value added in the Swiss domestic appliances sector and we have used that to estimate the impacts on the basis of I-O multipliers.

Some of the countries had missing values for wages and salaries, number of employees and consumption of fixed capital and scientific research and development. The Table 9.2 below names these countries. In most cases, those countries are included on the basis of whole economy ratios of – for example – wages to national income. In some cases, however, countries had to be excluded from some analysis.

Table 9.2: Countries with missing wages and consumption of fixed capital

Number	Countries with Missing Wages and Salaries data	Countries with Missing Fixed Consumption of Capital data	Countries with missing Employment data	Countries with missing R&D data
1	France	France	Turkey	Cyprus
2	Belgium	Estonia	Russia	Russia
3	Germany	Romania	Cyprus	
4	Ireland	United Kingdom		
5	Estonia	Switzerland		
6	Luxemburg	Russia		
7	Slovenia	Cyprus		
8	United Kingdom			

Number	Countries with Missing Wages and Salaries data	Countries with Missing Fixed Consumption of Capital data	Countries with missing Employment data	Countries with missing R&D data
9	Norway			
10	Turkey			
11	Croatia			
12	Switzerland			
13	Russia			
14	Latvia			
15	Cyprus			

9.2 Value added

Value added figures for the domestic appliances industry were taken for the most recent year available. Missing values were filled with data from other sources such as OECD. Table 9.3 below details the data used for value added in each country.

Table 9.3: Value added in the domestic appliances sector

Country Name	Country Code	Value added, million €	Data Source	Year
EU27	EU	11,300	Eurostat	2011
Austria	AT	344	Eurostat	2012
Belgium	BE	102	Eurostat	2012
Bulgaria	BG	44	Eurostat	2012
Switzerland	CH	572	Eurostat	2012
Cyprus	CY	4	Eurostat	2012
Czech Republic	CZ	134	Eurostat	2012
Germany	DE	3,265	Eurostat	2012
Estonia	EE	0	Eurostat	2012
Greece	EL	88	Eurostat	2012
Finland	FI	50	Eurostat	2012
France	FR	1,139	Eurostat	2011
Hungary	HU	151	Eurostat	2012
Ireland	IE	20	Eurostat	2012
Italy	IT	2,334	Eurostat	2011
Lithuania	LT	27	Eurostat	2012
Luxembourg	LU	0	Eurostat	2011
Malta	MT	0	Eurostat	2009
Netherlands	NL	301	Eurostat	2012
Norway	NO	65	Eurostat	2012
Poland	PL	684	Eurostat	2012

Country Name	Country Code	Value added, million €	Data Source	Year
Portugal	PT	112	Eurostat	2012
Romania	RO	106	Eurostat	2012
Sweden	SE	182	Eurostat	2012
Slovenia	SI	261	Eurostat	2012
Slovakia	SK	-42	Eurostat	2012
United Kingdom	UK	861	Eurostat	2012
Denmark	DK	39	Eurostat	2012
Spain	ES	769	Eurostat	2012
Croatia	HR	6	Eurostat	2012
Latvia	LV	0	Eurostat	2011
Turkey	TR	1,263	Eurostat	2009
Russia	RS	484	OECD	2010

Note: For Russia, Value added is in million US$.

9.3 Macro variables

Macro variables, used to estimate the induced effects, were taken for the same year as the value added figure. In cases where the data was missing for the specific year in question, we used the most recent available data instead. Similar to the I-O tables, the data for the macro variables was collected from Eurostat. Where the data was missing in Eurostat, other sources were consulted including the OECD and World Bank.

For all the countries except Croatia, Turkey and Russia, the macro variables used came from Eurostat. For Croatia and Turkey, where the variables were missing, we got data from World Bank where as for Russia, most of the data came from OECD.

Table 9.4: Macro variables and data sources

Variable	Data Source	Year
Number of Employees, 000	Russia: World Bank. Rest of the countries: Eurostat	Same as value added figure for all the countries
Net saving, % of GDP	Croatia, Turkey, Russia: World Bank; Rest of the countries: Eurostat	Romania: 2011; Rest of the countries: same as value added figure
Imports of goods and services, % GDP	Russia: OECD; Rest of the countries: Eurostat	Same as value added figure for all the countries
Government revenue, % GDP	Turkey and Russia, OECD; Rest of the countries: Eurostat	Same as value added figure for all the countries
Gross fixed capital formation, %GDP	Russia: OECD; Rest of the countries: Eurostat	Same as value added figure for all the countries
Investment in R & D, % GDP	Russia: OECD; Rest of the countries: Eurostat	Switzerland: 2008, Rest of the countries: same as value added figure

Variable	Data Source	Year
Nominal GDP, million NAC	Russia: World Bank, Rest of the countries: Eurostat	Same as value added figure for all the countries
Consumption of fixed capital, % of GDP	Russia and Turkey: OECD; Rest of the countries: Eurostat	Same as value added figure for all the countries
Compensation of employees, % of GDP	Russia and Turkey: World Bank; Rest of the countries: Eurostat	Same as value added figure for all the countries
Wages, million NAC	Missing values for Croatia, Turkey and Russia; For rest of the countries, data comes from Eurostat	Same as value added figure for all the countries
Wages, % of GDP	Missing values for Croatia, Turkey and Russia; For rest of the countries, data comes from Eurostat	Same as value added figure for all the countries