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Product Market Review 2009

Microeconomic consequences of the crisis and implications for recovery

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PRODUCT MARKET REVIEW 2009

Microeconomic Consequences of the Crisis and Implications for the Recovery

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1. EXECUTIVE SUMMARY

In the summer of 2007, a long period of rapid credit growth, low risk premiums, abundant liquidity, strong leveraging and soaring asset prices across the globe came to an end. Many of the drivers of the expansion went into reverse and, following the fall of Lehman brothers, the availability of credit from the financial sector shrank abruptly. Economic conditions elsewhere in the economy inevitably deteriorated, culminating in a sharp contraction of global economic activity in the last quarter of 2008. This pitched the EU economy into recession - the deepest, longest, broadest-based recession in its history. In 2009, GDP may fall by approximately 4% in both the EU and the euro area. In addition, the crisis is estimated to have a long lasting effect on the level of potential output and may also reduce potential growth in the future.[1]

These unprecedented macroeconomic results are the aggregate outcome of microeconomic decisions taken by firms and households. This suggests that an in-depth examination of the microeconomic consequences of the crisis is needed to improve our understanding of how decisions by consumers and producers may shape the drivers of the recovery. This first edition of DG Economic and Financial Affairs' Product Market Review is a first step in developing that in-depth understanding. It focuses on two broad sets of key questions.

Firstly, has the differentiated impact of the crisis laid the foundations for a significant reshaping of the economy, with potentially important impacts on productivity? What is the extent of restructuring that is likely to occur in the wake of the crisis and would it be mainly within or across sectors? What are the policy implications of the answers to these questions? Secondly, what impact is the crisis likely to have on the functioning of the R&D and innovation system? How significant is the loss in the stock of R&D capital compared to the baseline? What are the implications for total factor productivity growth inthe years ahead? Has the policy response been effective in mitigating this impact? What policy lessons are to be learned for the post-crisis environment?

The starting point for this analysis is an assessment of how the recession is affecting the European economy. Compared to previous recessions in the EU, a substantially wider range of industries have experienced a significant slowdown. In general, the hardest hit have been manufacturing sectors producing durable consumer goods and equipment goods, such as office machinery and computers, cars, basic metals, machinery and equipment, electrical equipment, and metal products. Among non-financial services, it is trade sectors (especially the car trade sector), transport and construction that have suffered the worst impact of the crisis, demonstrating the importance of spillovers between sectors in creating feedback loops.

This deterioration in the real economy reflects consumers' decisions to delay purchasing expensive consumer durables (often requiring credit financing) and firms' decisions to delay

[1] See: "Impact of the current economic and financial crisis on potential output", European Economy, Occasional Paper, No 49, June 2009.

replacing production equipment until there are firm signs of recovery in the economy. It also reflects that fact that some sectors are more dependent than others on financing, or on demand fuelled by financing. Producers of durable consumer goods or of capital investment goods for investment purposes are also affected by the credit 'squeeze'. By contrast, industries producing non-durable and basic necessity consumer goods such as food, pharmaceuticals and clothing have been least affected because consumers still have to purchase such necessities. The manufacturing sectors suffering most from the crisis are also often the sectors that were the most dynamic before the crisis, and this has a clear negative impact in the short term. However, evidence also points to these sectors being those with the strongest cyclical profile which limits the negative implications beyond the short term.

Interestingly, this is accompanied by an increased variation in output across sectors ('sectoral churn') as sectoral production has become much more volatile from month to month. However, this does not seem to have led to a significant change in the underlying sectoral composition of the EU economy (at a reasonably aggregated level). Services have grown in importance compared to manufacturing, but this is a long-run trend that pre-dates the crisis.

The key question for policymakers in this perspective is whether, in the longer term, the crisis will lead to significant structural shifts in the sectoral composition of the economy. This is important because, if the crisis permanently affects the sectoral composition of the economy, the allocation of resources between capital and labour across sectors would have to change, posing a formidable adjustment challenge. This has short term costs, which are higher the less easily the economy is able to adjust. In the long-term, it could also translate into a different allocation between private consumption and investment expenditure with consequences for potential growth. Moreover, differences in the distance to the productivity frontier and in total factor productivity across sectors are significant, implying that large structural shifts may also impact on economy-wide productivity.

Significant sectoral turbulence has also occurred during past downturns reviewed in this publication but it has not durably deviated Europe's sectoral structure from its adjustment path, which tends to follow long-term trends. Whilst the severity and scope of this crisis is unparalleled in modern economic history, preliminary evidence and analysis suggests that shifts in the sectoral structure over the next few years might be smaller than many anticipate. So far there have only been limited changes in the sectoral composition of employment (on which monthly data are available) and these are not much different from what we have seen during previous recessions. This is partly because short term changes in the demand for labour are, to a large extent, reflected in hours worked rather than in persons employed. Further adjustment is still likely to come about since, in general, trends in employment lag behind those in production. Nevertheless, some indicators of sectoral shifts and churn in employment show less change in absolute terms during the trough of the 2008/2009 crisis than during the trough of the much shallower 2000/2001 recession.

It should, however, be underlined that sectors that have developed significant production overcapacity as a result of the crisis are likely to face significant consolidation challenges, especially if growth remains muted over the next few years. This may well lead to major adjustment and restructuring within the sectors concerned. Analysis suggests that this could be the case, in particular, for the basic metals industry and the car industry. By contrast, industries whose capacity utilisation rate is not far below its pre-crisis average are less likely to face the challenge of significant intra-sectoral restructuring in the future. These industries include food product manufacturing, the printing and publishing sector, refined petroleum

producers, and the manufacture of radio, TV and communication equipment. Finally, while this suggests that most of the adjustments will be intra-sectoral, there are obvious exceptions in countries experiencing the unwinding of 'bubbles' in sectors such as housing and finance.

All in all, the available data and the uncertainty about the medium term outlook imply that it is not (yet) possible to give definite answers to the key questions listed above. Nevertheless, the analysis suggests that the adjustment challenge may be qualitatively different (i.e. more “intra-sectoral” when it comes to consolidation and restructuring) and will probably have a less significant impact on the sectoral structure of the EU economy than might have been expected. Given pre-existing rigidities in labour and product markets (which make adjustment costly), this implies that the negative impacts, through this mechanism, on the future development of potential growth may be relatively muted. Of course, the outlook would be different if the economy were to slide back into recession.

For some sectors, poor performance due to the crisis may be exacerbated by problems that have been undermining market functioning for some time, certainly long before the start of the current recession. Commission services have developed a new analytical tool, market monitoring, to identify signs of possible market malfunctioning. Its use can help to single out economically important manufacturing and services sectors with possible problems that potentially undermine the functioning of the markets in which they operate. Sectors are evaluated based on indicators in three domains of market performance, namely competition, integration and innovation. Among manufacturing sectors, these appear to be car makers, machinery makers, food product and beverage producers, furniture makers and manufacturers of fabricated metal products. Note that many of these sectors are amongst those which are hit hardest by the crisis. Among services sectors, they are retail trade, hotel and restaurants, other business services and construction. In addition, market monitoring suggests that all these sectors share an apparently rather weak performance in innovation. It also indicates that the service sectors, identified as having possible problems with market functioning, often seem to display poor levels of market integration.

Policy lessons stemming from this screening stage of the market monitoring exercise are the importance of pushing ahead with reforms that improve the EU's performance in innovation, an issue returned to below, and the significance of ensuring a rapid and ambitious implementation of the Services Directive to reduce service market fragmentation. There is some urgency on both fronts. Innovation and a well-functioning internal market are essential for productivity growth, economic growth and long-run economic welfare. At the same time, weak R&D and fragmented markets are generally detrimental to consumers, workers and businesses. In addition, a well-functioning internal market could help Europe to recover faster from the crisis.

A further point of interest raised in this publication is whether the business sector measures, undertaken as part of the European Economic Recovery Plan (EERP), are likely to have longer lasting effects on growth drivers. Given the scale and the depth of policy intervention, one cannot exclude that such effects might occur and alter future growth patterns.

Of particular importance in this context are the measures aimed at individual sectors of the economy and/or designed to support R&D and innovation. One third of the measures introduced have targeted specific sectors, especially tourism, construction and motor vehicles. State aid rules have been amended for a limited period to allow Member States to introduce support measures. Naturally, Member States that were not overly constrained from a

budgetary point of view adopted measures tailored to the specific problems facing them. For example, most measures to support the automotive industry have been introduced by Member States where that industry is particularly important such as France, Germany, Spain and the UK. Meanwhile, southern Europe - Cyprus, Malta, Portugal and Greece - has focused more on supporting tourism. This is the first time since the mid-1980s that significant sectoral packages have been designed and introduced in Europe on such a scale, reversing a decade's orientation towards horizontal state aids. Every effort has been made to ensure that these measures do not unduly distort competition and that they help to achieve long-standing EU objectives such as enhancing R&D and innovation, extending ICT, improving transport links and more efficient energy use. Commission services' assessment of the crisis measures suggests that this objective has largely been achieved (see "The EU's response to support the real economy during the economic crisis: an overview of Member States' recovery measures", European Economy/Occasional Papers 51/2009). Nevertheless, such measures could hinder much needed adjustment and restructuring in the sectors they have targeted. It is therefore important to plan the credible withdrawal of these measures once growth becomes durably anchored so as to avoid longer lasting distortions in the functioning of markets.

Car manufacturing is a case in point and the significant support given to this sector illustrates the challenges facing policymakers. The sector generates up to 3.5% of GDP in Germany and the Czech Republic and, in the EU as a whole, persons directly and indirectly dependent on car manufacturing represent a significant share of all manufacturing jobs. This sector has been extremely hard hit by the crisis and now struggles with overcapacity. It also shows evidence of poor market performance and depends on innovation and strategic R&D capacity for a competitive edge; car producers and their suppliers spend more on R&D than any other sector in the EU. For all these reasons and in response to the crisis, a very large share of all the EERP sectoral measures, introduced across the EU, concern both demand-side and supply-side support for the EU car industry. On the demand-side, the most salient of a host of initiatives are the temporary car scrapping schemes costing €8 billion in 2009-2010, introduced in twelve Member States to encourage the purchase of new cars to replace older ones. On the supply-side, the most prominent measures are the loans and guarantees worth approximately €10 billion that some Member States have given the automotive sector. Also important is the €5 billion partnership funded by the Community, the EIB, industry and Member States to fund research into a broad range of technologies and smart energy infrastructures.

The scrapping schemes encouraged car sales in 2009 and led to a rebound in car production in some Member States, including those without scrapping schemes but which produce cheaper, smaller cars and which benefited from cross-border effects. However, these measures were largely taken by individual Member States, with only a light coordination at European level, and this may have somewhat reduced the effectiveness of the schemes. Moreover, the current rise in demand may reflect consumers taking advantage of incentives today at the expense of future car purchases. If so, the measures may only delay inevitable restructuring. Furthermore, past experience of sectoral support shows that it can significantly and adversely affect the restructuring of the sector in question.

One legitimate issue concerning the automotive sector restructuring relates to the functioning of the supply chain that puts motor manufacturers at the centre of connections leading upstream to component suppliers and downstream to car sales distributors. Currently, many leading technologies needed to produce cleaner cars are owned and developed by upstream suppliers, but this situation could change as the suppliers have not received as much public

sectoral help as the car manufacturers. There is a risk that manufacturers are exploiting this relative financial strength to lever control of new technology development away from the suppliers, and this could have an impact on innovation incentives. Policies must ensure a sufficient degree of competition at every level of the supply chain; improving upstream suppliers' access to finance should therefore be a priority. Meanwhile, relations between distributors downstream are framed by a number of EU regulations, which are shown to have had positive effects on competition and welfare. However, large motor manufacturers have been rationalising their distribution networks and this should be closely monitored in case it has implications for competition.

This publication subsequently attempts to assess the implications of the crisis for innovation as a driver of productivity growth. Strong sectoral growth before the crisis was significantly correlated with innovation. A key risk is that the crisis will lead to a deterioration of current levels of accumulated knowledge capital and/or a slump in their growth as this would have a lasting effect on Europe's future economic growth. Unfortunately, the EU has a relatively weak R&D record; its R&D intensity lags behind the US, Japan and South Korea, primarily because of weaker private R&D. European economic policy-makers have long recognised the problem. Under the Lisbon Strategy for Growth and Jobs, an EU-wide R&D investment target was set at 3% of GDP. Moreover, R&D reforms account for a major share of the total number of reforms introduced by Member States between 2004 and 2008 under the Lisbon strategy. Finally, it explains why two thirds of Member States have stepped up public R&D spending since the crisis broke, especially through direct funding but also through tax incentives to encourage private R&D spending.

The Commission services estimate that, after strong growth in 2008, business R&D spending may contract in 2009-2010, potentially by more than 6%. However, Member States' significant public R&D investments are estimated to compensate for about half of this contraction in private R&D spending. Although this is expected to significantly mitigate the fall in overall R&D expenditure, public sector funding can only partly substitute for private sector expenditure. It is also important to note that almost half of the gap between the US and EU private sector R&D intensity is caused by the relatively unfavourable composition of the EU economy with its relatively heavy emphasis on medium technology activities. With constrained public finances and deleveraging expected to continue in the financial system for some time, EU policies supporting the recovery should focus on improving framework conditions for private sector R&D. This relates both to the general business environment and to reforms of the regulatory conditions governing R&D and innovation in Europe. A good business environment is crucial since it facilitates the emergence and growth of new innovative companies which are an essential engine for productivity growth. This is an area where Europe performs far worse than the US. Reforms of conditions governing R&D are equally important since there are many regulatory barriers in the R&D and innovation system that curtail expansion in Europe. R&D regulatory reform should address both horizontal and sectoral challenges. One important horizontal issue is the impossibility in Europe of obtaining a valid patent enforceable throughout the EU-27. This discourages European businesses and puts them at a severe disadvantage compared to international competitors, so a breakthrough must be achieved on this issue. However, it is also crucial to examine the particular regulatory frameworks governing specific sectors since these can significantly condition the extent to which a sector engages in R&D.

The EU's pharmaceutical industry is a good example, not only because it is highly regulated, but also because it tops the league of worldwide R&D investors yet has been losing ground to

international competitors in innovation. It is important to future EU prosperity that this trend reverses. Establishing a more efficient Europe-wide system of intellectual property rights would help the industry enormously. Pharmaceutical-specific regulatory reform is also crucial, aiming in particular to improve the information flows and co-ordination between pricing and reimbursement authorities. The lack of a truly integrated Internal Market in this sector comes at a clear cost in terms of innovation, productivity and growth. This all, in turn, underlines the importance of addressing pre-existing weaknesses in individual sectors - weaknesses which have been identified by the market monitoring approach. It also explains why a strong emphasis on the structural reform agenda would be particularly welcome at this juncture.

To sum up, the assessment presented in this first edition of the Product Market Review has arrived at three important conclusions:

- First, while there is likely to be a considerable amount of consolidation and restructuring within hard hit sectors, the crisis may lead to a less radical change in the European economy's sectoral structure than might have been expected. The bulk of the adjustments would appear to be within sectors, with the obvious exception of countries experiencing the unwinding of "bubbles" in sectors such as housing and finance. A corollary of this is that the pre-crisis market performance problems in certain sectors would therefore be the main priorities, so the pre-crisis microeconomic policy reform agenda remains very relevant. Another corollary is the importance of developing systematic evidence-based instruments, such as market monitoring, to analyse structural microeconomic problems that have macroeconomic impacts, in order to identify more precisely reforms that could improve the situation;

- Second, although European governments have succeeded in combating the worst effects of the crisis on product markets, access to these support measures varies within product chains and from one Member States to another. There are therefore good reasons to be concerned about the potentially harmful medium-term consequences of these policies. If they are unduly left in place, they could impair the efficient functioning of the Internal Market and may hinder necessary adjustments, thus harming potential growth in the EU. The urgent definition of an exit strategy for product market measures is therefore essential as is its rapid implementation as soon as robust growth resumes. At the same time, it looks likely that there will be much more intra-sectoral than cross-sectoral restructuring, and this suggests that short term labour market measures could be less distortive, provided all companies in the sectors concerned have comparable access. This has potentially important implications for the sequencing of the phasing out of short term product and labour market measures;

- Third, substantial public sector support for R&D and innovation in the crisis appears to have significantly limited the damage to R&D stock and innovation capital. However, given constrained public finances, the emphasis will now have to shift towards measures that improve framework conditions, both of a horizontal and sector-specific nature.

2. THE IMPACT OF THE CRISIS ON THE INDUSTRIAL STRUCTURE OF THE EU ECONOMY: FIRST ASSESSMENT AND POSSIBLE CONSEQUENCES

The global economic crisis has had an impact on the EU that is unprecedented in EU economic history. The initial acute liquidity shortage among financial institutions became a crisis with the default of Lehman Brothers in September 2008 which caused confidence around the world to collapse and stock markets to plunge. After that, the EU economy shrank faster than at any time since the 1930s as tight connections within the financial system and strongly integrated supply chains in global product markets allowed financial distress to spread quickly through to the real economy, hitting business investment and household demand. The EU's real GDP is projected to shrink by some 4% in 2009, the sharpest contraction in its history. While there are early signs of economic recovery – the sharp decline in EU economic activity has halted, financial markets have stabilised, and confidence is improving – nonetheless the recovery remains fragile, not least because demand is expected to remain depressed as deleveraging across the economy continues.

A crucial issue, in the context of the crisis, is to determine how difficult and sluggish the recovery turns out to be. The extent to which the recession causes a significant reshaping of the economy is affected by the ease of adjustment which is in turn influenced by problems that existed prior to the crisis. Economic adjustment is always difficult, and it is more difficult the more adjustment is needed. Skill sets and capital stocks reflect a country's industrial structure and if the crisis causes that structure to change, then there can be a significant mismatch between the existing skills sets and capital stock and the needs of the new industrial structure. It is therefore important to find indications on the extent to which there will be adjustment across sectors or within sectors; the latter is less burdensome and difficult than the former, although the challenges can still be formidable. Sub-sectors may rise or fall, implying adjustments to capital stocks and skill sets within a sector, which are likely to be easier than adjustments across sectors. From a long-term perspective, sectoral functioning in the advent of the crisis can give insights into its consequences. Pre-existing problems may have been exacerbated by the crisis thereby curtailing the rebound and thus prolonging the economic downturn. It is important to try to find out what restructuring challenge the EU faces because different challenges call for different policy responses. Targeted measures may be necessary to overcome specific long term problems. This chapter tries to offer some early evidence to indicate what may happen in terms of industrial restructuring in the wake of the crisis given both short and long term developments.

2.1. Sectoral performance in the current crisis

The aim of this sub-section is to examine short-term developments across the whole range of EU industries in order to determine which sectors have been hardest hit during the current slowdown and which sectors have been relatively unaffected. However, these findings should be put into perspective as some sectors are typically more pro-cyclical than others. It is therefore also important to compare the performance of industries during the current downturn with their performance in previous slowdowns in order to distinguish elements which are common to all recessions from those which are specific to the current crisis. It is the latter which are likely to produce long-lasting shifts in consumer preferences and business models that may change the allocation of resources across sectors.

The following sections explain the current downturn from a sectoral perspective. They analyse the extent to which market performance is related to growth before and during the current crisis, examine possible structural changes stemming from the recession and look at structural changes in individual industries by identifying possible structural breaks in the industrial production series.

Over the period 1990-2009, the EU economy experienced three significant downturns: in 1992-1993, 2001 and 2008-2009. Figure 2-1 shows the monthly production index and the recessionary phases over this period for industry as a whole.[2] The turning points are identified using the Bry-Boschan method[3], but with the data used here, it is premature to identify a turning point which would indicate the end of the current recession. Nevertheless, Figure 2-1 provides a reference framework for analysing the sectoral characteristics of the current downturn and some of the changes it may cause.

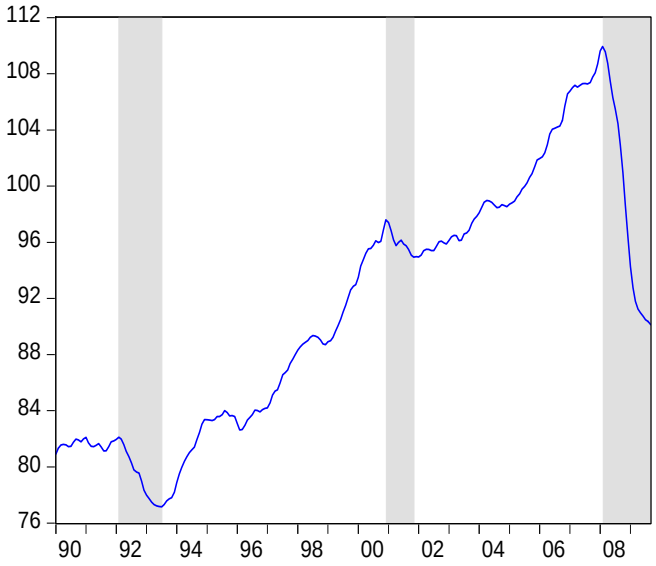
Over this period, the severity of the 2008-2009 industrial recession is unprecedented, although its duration looks likely to be similar to the one in 1992-1993. More precisely, the 1992-1993 recession lasted seventeen months, the 2001 downturn continued for eleven months and the latest recession began nineteen months prior to September 2009, which is the last month for which data are available. The latest indicators point towards a recovery of economic activity. For example, the Economic Sentiment Indicator (ESI)[4], which has gained 25.6 points in the last seven months, shows successive improvements in both the EU and the euro area since March 2009.

[2] More precisely, this aggregate encompasses: mining, manufacturing, electricity and construction.

[3] See Bry, Gerhard and Charlotte Boschan (1971). The method was applied using the *brybos* routine from the Grocer econometric toolbox, running under Scilab (www.scilab.org).

[4] ESI is a composite indicator of the components of confidence indicators for industry, services, consumers, construction and retail trade. These indicators are based on the opinions of businesses and consumers. ESI has a long-term mean of 100. See European Commission Business and Consumer Survey results at http://www.ec.europa.eu/economy_finance/bcs.

Figure 2-1: Downturns in EU-27 industry (1990-2009)

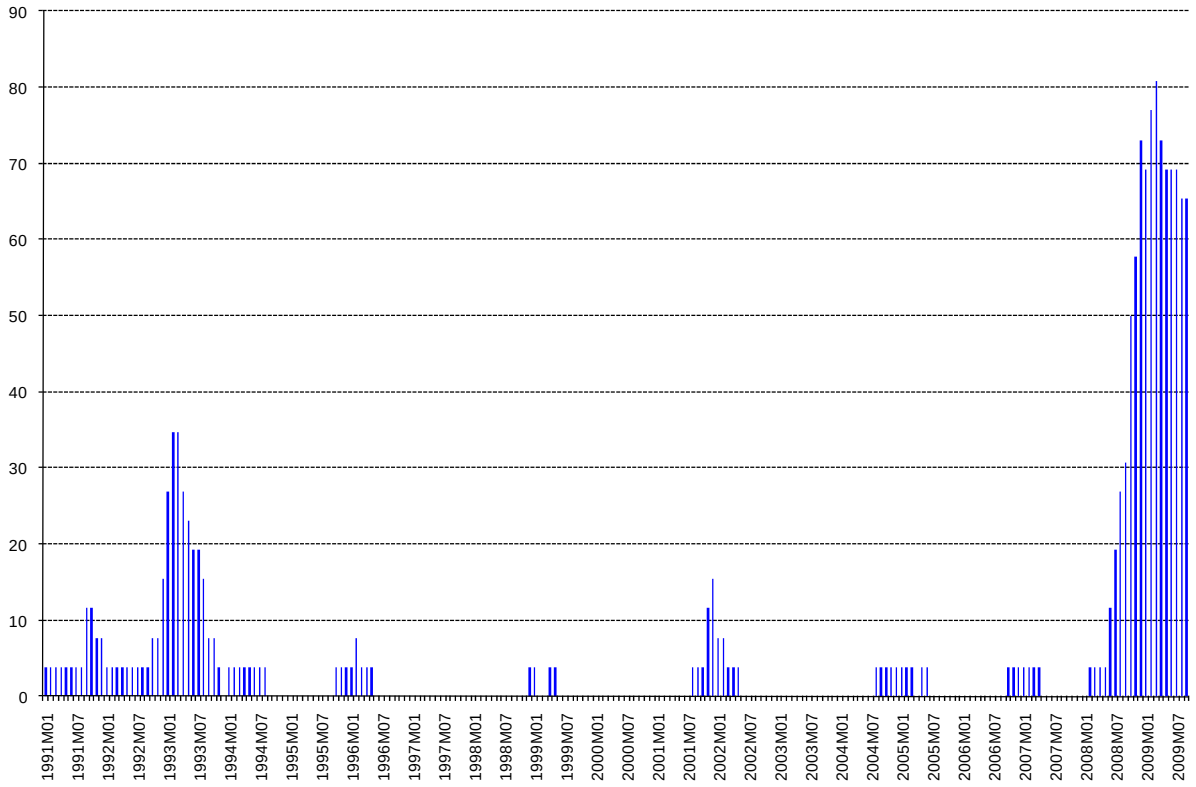


Source: Commission services using Eurostat data

From a sectoral perspective, the depth of the current crisis is reflected in the substantially higher percentage of industries showing very low growth rates, compared to those in the 1992-1993 and 2001 economic slowdowns, see Figure 2-2.[5] A second emerging feature is that there was a peak in the number of industries with very low growth rates in March 2009 and a subsequent decrease (from 81% to 65%), which coincides with the stabilisation of the manufacturing production index over the six months, from April to September 2009.

[5] Figure 2-2 shows the percentage of all manufacturing industries which exhibit, in each month, very low growth rates of less than 'mean – 2 standard deviations'. The mean and standard deviations used to calculate the lower band (which served as a threshold) are those corresponding to the period prior to the 2008-2009 crisis. This crisis is particularly strong and the idea is to calculate the parameters of the distribution that correspond to 'normal' times and to use the months of the crisis as 'out of sample' observations. The number of sectors considered is 26, corresponding to 2-digit manufacturing industries of NACE Rev.2.

Figure 2-2: Percentage of manufacturing industries with very low growth rates



Very low growth rates are defined as those lower than "Mean – 2 Standard Deviations" over the period prior to the 2008-2009 crisis.

Source: Commission services using Eurostat data

To characterise the downturns from a sectoral perspective two aspects are analysed here. The first is the churn in production caused by the crisis; the second is the contribution of the various sectors to overall industrial growth.

To capture turbulence in sectoral activity and to measure the extent to which this is intensified at times of a crisis, we have used the Lilien index[6], which is based on the growth rates of sectors compared to the overall growth rate. More precisely, the index[7] is defined as follows:

$$I = \left[\sum_{i=1}^{n} S_{P,i} \left(\frac{\Delta P_i}{P_i} - \frac{\Delta P}{P} \right)^2 \right]^{\frac{1}{2}}$$

where:

S_{Pi} is the share of sector i in total production in $t-12$

[6] Lillien, David M. (1982)

[7] The index takes the value zero when growth (in %) is equal in all sectors. As growth becomes more heterogeneous (varying from sector to sector), churn is more intensive and the index takes higher values.

P_i is production in sector i

P is total production

Δ refers to a change relative to the same month of the previous year $t/t-12$

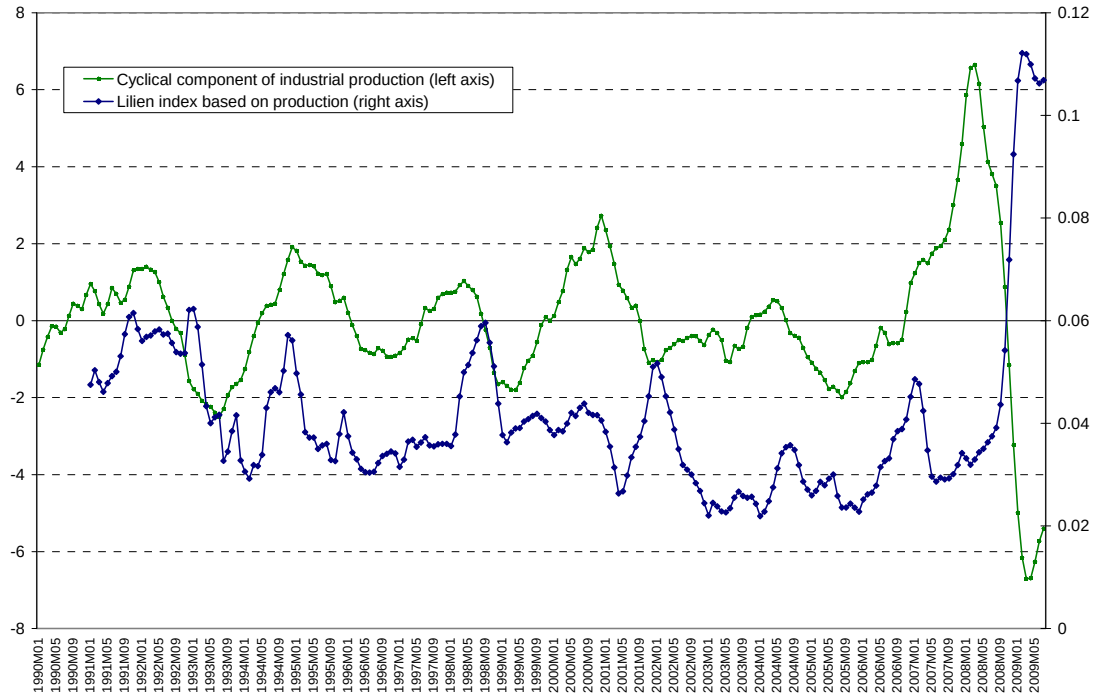
Thus the index is a measure of the dispersion of growth rates. Furthermore, it should be noted that the growth rates calculated are for each 12-month period (t on $t-12$) and therefore, as calculated here, the index captures short-term turbulence in sectoral growth rather than long-term structural change. A long term view of the evolution of this index for manufacturing production is given in Figure 2-3.[8] To examine the behaviour of the index, this graph also shows an indicator of the industrial cycle.[9] The Lilien index is negatively correlated with the cycle, where deviations of industrial production above the trend are associated with lower production churn.[10] This is particularly apparent for the 2001 and 2009 downturns, in which turbulence in industrial production accelerates during the recession phases of these two years but is less clear for 1993 where the correlation of the two indicators is less obvious. The most salient feature is the strong increase in the value of the index during the last two years, from July 2007 to July 2009.

[8] The sectors used are defined in terms of NACE Rev.2 2-digit items.

[9] Calculated as the deviations of industrial production from the Hodrick-Prescott filter trend.

[10] The correlation coefficient is -0.41, although it is largely influenced by extreme values of the cyclical components, particularly those corresponding to the cycle troughs. In other words, production churn is particularly high in recessions and no particular correlation pattern is found for the rest of the observations.

Figure 2-3: Lilien index and cyclical profile of EU manufacturing industry



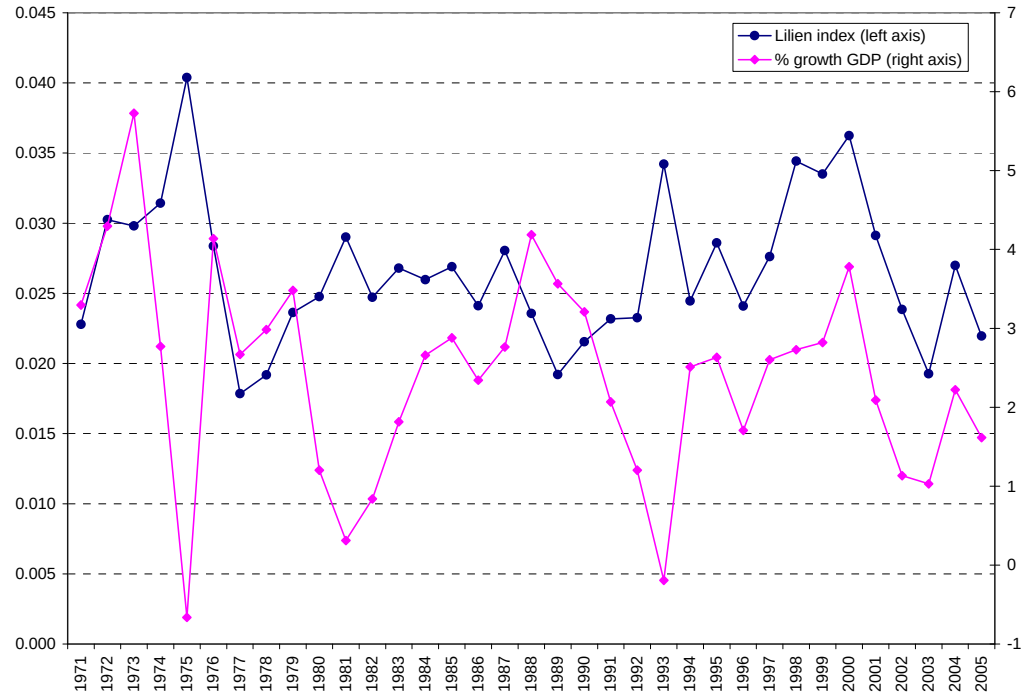
Source: Commission services using Eurostat data

While the above results show interesting stylised facts, they refer only to manufacturing. It is also very important to produce an analysis of churn encompassing all sectors of the economy, even if comparable data are less available. Due to data issues, this analysis is carried out first for the EU-15, covering the period 1970-2005[11], and second for the EU-27, covering the period 2000-2009.

The data for EU-15 allow for the examination of developments in sectoral churn prior to 2008 and particularly in the context of the 1993 downturn. Figure 2-4 shows the Lilien index and the GDP growth rate. It confirms the cyclical pattern of the sectoral churn, which increases in times of recession. As above, the index is calculated on a year-to-year basis, where the share of sectors corresponds to the one in the previous year ($t-1$).

[11] This source was chosen to cover a long period encompassing several downturns (1975, 1981, 1993 and 2003), although this implies a limited geographical coverage (EU-15) and a time coverage only until 2005. Unfortunately, more recent data covering all sectors of the economy, with sufficient detail, are not available.

Figure 2-4: EU-15 Lilien index and GDP growth (whole economy)



Source: Commission services using EU KLEMS data

A more recent picture of developments in sectoral churn, encompassing a larger range of sectors than manufacturing, can be provided using employment data: changes in the sectoral allocation of value-added also imply a reallocation of labour inputs between sectors over time. The results presented below are based on monthly values of the Lilien index[12], which allow developments in turbulence to be tracked from January 2000 to June 2009.[13] The value of the index shows a significant increase since June 2008 (see Figure 2-5). However, it does not reach the level of January 2001, the first month for which the index is available.

In interpreting these developments, three considerations must be borne in mind. First, the demand for labour is measured in terms of the number of persons employed. In a recession, short-term changes in the demand for labour are mainly reflected in the number of hours worked rather than in the number of persons employed. Changes in the number of persons employed are less volatile and are based on businesses' longer-term expectations. The value of the index will thus be lower than if based on the number of hours worked. Nevertheless, the results will capture better the process of reallocating resources.

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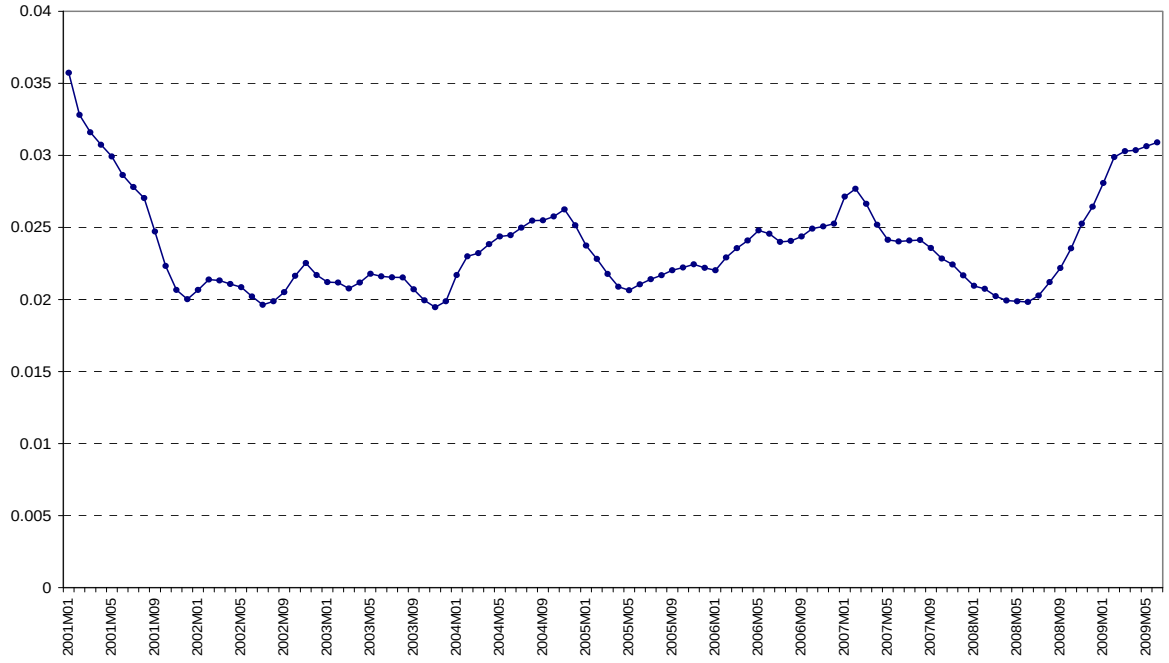
[12] The definition of the index is the same given above for manufacturing. In the present case P (production) is replaced by L (employment).

[13] The index is based on data that cover market industries, namely, mining, manufacturing, electricity, construction and market services, although financial intermediation and real estate are excluded for lack of data. The total economy used as reference is thus the aggregate of the sectors mentioned and excludes agriculture, fishing and non-market services. It is important to take into consideration this sectoral coverage, as changes in the shares of, for example, agriculture and public administration are part of the structural changes taking place either naturally (as in the case of agriculture), or due to political decisions (as could be the case with public administration). In a nutshell, the results presented below refer to sectoral churn within the market economy.

Second, real estate and financial intermediation are not included in the calculation. Consequently, the results may not fully reflect the changes that are taking place during the current crisis. This would explain the lower value in 2009 relative to 2001, which is surprising given the intensity of the current crisis. The nature of the 2001 crisis and the turbulence in technology sectors, which are included in the calculations, may also explain the higher value of the index during that period.

The third consideration is the level of sectoral aggregation used in the analysis. The calculations are carried out at the 2-digit level of NACE Rev.2 and 49 sectors are taken into consideration.

Figure 2-5: Lilien Index January 2001 – June 2009 (EU-27)



Sources: Commission services using Eurostat data

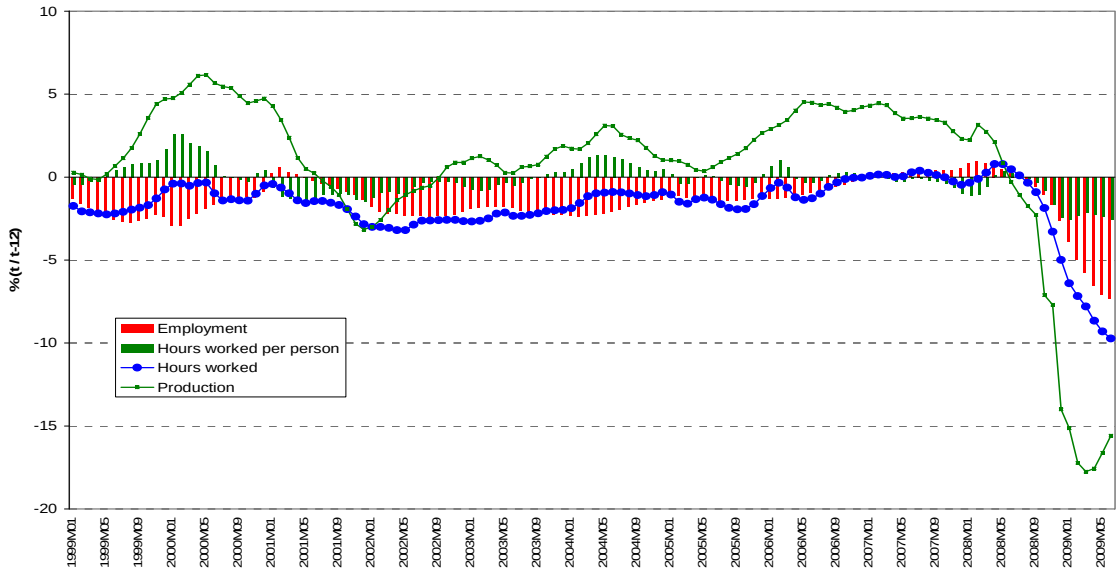
Finally, when using employment data to measure sectoral churn, it is important to take into account the different behaviour of labour inputs during the cycle, depending upon the way in which they are measured. The first adjustment businesses make in response to cyclical ups and downs will be in the number of hours worked per person and the latter series tends to be more volatile (see Figure 2-6).[14] The number of persons employed will be affected only when business expectations regarding the recovery or the recession are confirmed. We also see this in the cross-correlations between production growth and the number of persons employed (see table A.2.1.1 in Annex 2-1). In twenty out of thirty industries under consideration, employment growth lags behind production growth.[15] However, in a number of industries the reverse is true. These industries are tobacco products, textiles, wearing apparel, leather and

[14] Figure 2.6 shows the growth rates in production, total hours worked, employment and hours worked per person for the aggregate 'mining and manufacturing'.

[15] This lag is sector-specific and ranges between 1 and 6 months, with a majority of sectors displaying a lag of six months.

related products, wood and products of wood and cork, articles of straw and plaiting materials, coke and refined petroleum products, other non-metallic mineral products, motor vehicles, trailers and semi-trailers and furniture.

Figure 2-6: Growth in production, total hours worked, persons employed and hours worked per person in EU-27 (mining and manufacturing)



Source: Commission services

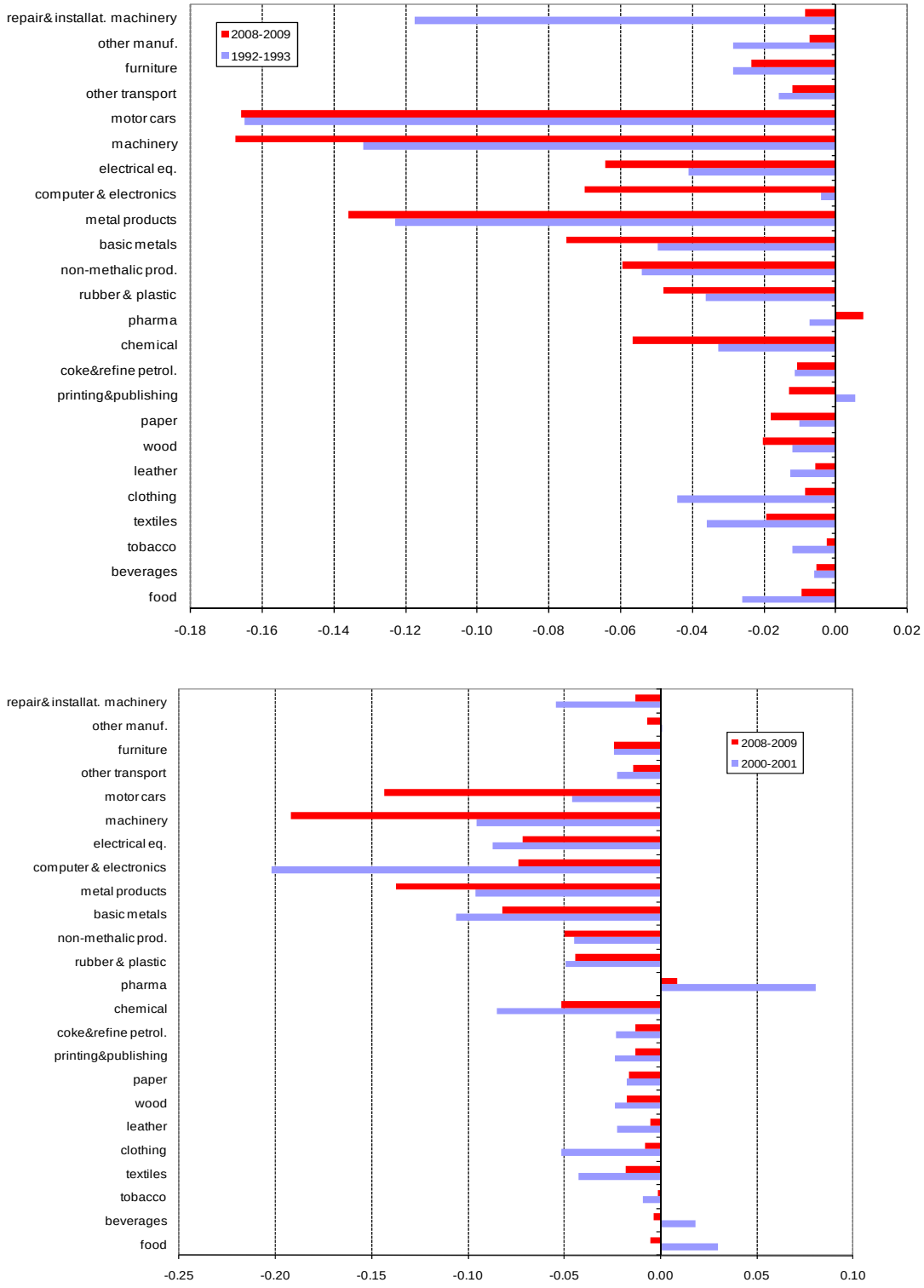
Another way to compare the current recession with those of 1992-1993 and 2001 is to consider the composition of overall growth from a sectoral perspective. Figure 2-7 shows the contribution of each sector to the overall growth in manufacturing and compares this contribution between 2008-2009 and 1992-1993, and between 2008-2009 and 2000-2001. The contributions are re-scaled to show the share of each sector in 1 percentage point of overall (negative) growth.[16]

The sectoral composition of the downturns in 2008-2009 and 1992-1993 are highly correlated and indicate a similar profile in the corresponding periods. The most significant difference refers to the sector 'repair and installation of machinery', (a new sector in NACE Rev.2, which was not included in NACE Rev.1[17]). When comparing the 2000-2001 and 2008-2009 downturns, the correlation between the sectoral contributions is lower but still positive and significant. It is worth noting that computers and office machinery made the largest impact in 2000-2001, more than twice as large as in 2008-2009. By contrast, motor cars and machinery played a much more moderate role in 2000-2001.

[16] The contributions are calculated for growth over the following periods: February 1992-July 1993, December 2000-November 2001 and February 2008-September 2009. These correspond to the shadow areas in Figure 2.1.

[17] The fact that this is a newly defined industry, consisting of services activities, may affect the quality of the data. To examine the robustness of the results the correlation was also calculated excluding this industry. Instead of 0.79 and 0.58, as reported in Figure 2.7, the correlation coefficients are 0.91 and 0.60 when this sector is excluded.

Figure 2-7: Sectoral composition of manufacturing growth in downturns - sectors' contribution to one percentage point of industrial production growth



Note: correlation coefficients between the series presented above are: 0.79 (top panel) and 0.58 (bottom panel). Both are significant at 5%.

Source: Commission services using Eurostat data

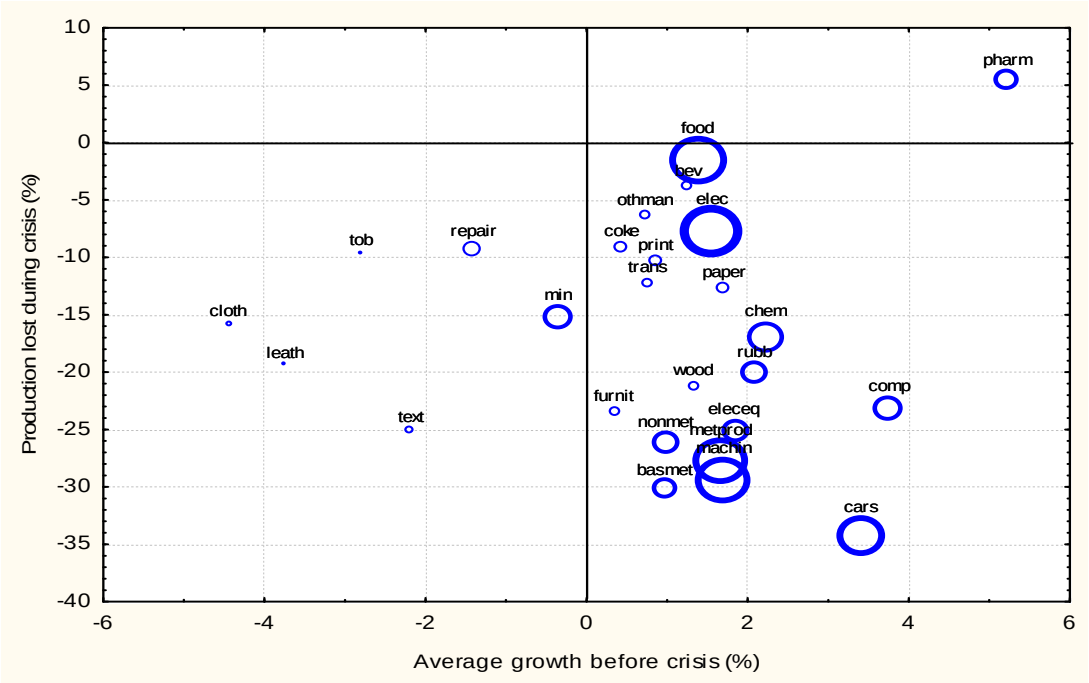
A more detailed examination of the performance of industries during the crisis reveals that the hardest hit sectors were, in general, those producing durable consumer goods and equipment goods such as basic metals, motor vehicles, and machinery (see Table A.2.1.2 in Annex 2-1). These industries have experienced the greatest production losses during the crisis. Substantial losses in production were also registered in the non-metallic mineral products, metal products, textiles industries and electrical equipment. Overall, two-digit production losses were registered in individual sectors whose shares in manufacturing add up to more than 54%. In contrast, the industries least affected are those producing non-durable and basic necessity consumer goods such as food products, beverages, other manufacturing and pharmaceuticals. Indeed, the pharmaceuticals industry has suffered no production losses at all during the crisis.

The deepness of the current downturn is also illustrated by the fact that, in general, sectors representing a high share of manufacturing value added have had medium to severe production losses during the crisis (Figure 2-8[18]). Furthermore, there also seems to be a positive correlation between the growth of industries prior to the crisis and the amount of production lost during the crisis: the higher the pre-crisis growth rates, the greater the loss in production. The fact that the most dynamic sectors of the economy have also been the hardest hit by the economic downturn will have a strong negative impact on the economy in the short run, however, the longer-term consequences have to be seen in the light of the cyclical behaviour of these sectors. Investigation of the cyclical patterns reveals a positive correlation between production losses during the crisis and a measure of cyclical intensity.[19] In the longer-term, therefore, these industries' large losses are likely to be partially compensated by their future cyclical upturn.

[18] Figure 2-8 provides a bubble graph of average growth (X-axis), the production lost during the crisis (Y-axis) and the relative size of each sector (bubbles) measured as its share in total value added of industry (from mining to water).

[19] Cyclical intensity is measured as the ratio between the standard deviation of the cyclical component in each sector and the standard deviation in the cyclical component of the industry as a whole.

Figure 2-8: Average growth before the crisis and production lost during the crisis



Source: Commission services

Even if these effects are only temporary, they can still lead to restructuring in important sectors of the economy if they produce unsustainable overcapacity over a longer period of time. While industries can operate with some degree of overcapacity during normal economic times without necessarily triggering a restructuring process, the degree of overcapacity may become unsustainable in periods of economic slowdown. The sustainability of this overcapacity is questionable in sectors where the current degree of capacity utilisation is substantially below average (Table A.2.1.3 in Annex 2-1). For example, the basic metals industry is currently using only 59% of its production capacity compared to an average level of nearly 84%, while the motor vehicles industry currently has 62% capacity utilisation compared to an average of 85%. Similarly, the current capacity utilisation in the rubber and plastics sector is slightly over 68% compared to an average level of nearly 81%, and capacity utilisation in the non-metallic minerals sector is 69% compared to an average of 80%.

All of these sectors are potential candidates for restructuring in the near future. Whether this will materialise depends on whether production levels return quickly to their pre-crisis levels once the recovery is firmly underway. There are also sectors such as textiles which had been suffering from overcapacity problems prior to the current downturn and where the restructuring process may be accelerated as a result of the crisis. In contrast, there are also a number of manufacturing industries where the capacity utilisation rate has not fallen substantially below its average level and where industrial restructuring in the near future is unlikely. These sectors include the manufacture of food products, printing and publishing, the manufacture of coke and refined petroleum products, as well as radio, television and communication.

2.2. Market monitoring: a tool to analyse sectors and markets pre-crisis

The first section analysed the crisis from a short-term perspective by comparing it to previous crises and identifying possible structural features that make this crisis different from previous ones. This section takes a more long-term perspective by suggesting that a number of sectors showed signs of potential structural problems prior to the crisis, which may have been exacerbated as a result of it and might slow down the recovery. This preliminary screening is part of a broader market monitoring exercise, which allows for the prioritisation of sectors, in both manufacturing and services, where in-depth analyses can investigate further the indications of poor market performance. These deep-dive studies will be of particular importance in the context of the current economic situation, as they may indicate possible sectoral and microeconomic problems, which policy initiatives can target in order to avoid pre-existing long run weaknesses hampering the exit from the current recession and prolonging the economic downturn.

2.2.1. The methodology

In the context of the Single Market Review (SMR) 2007, a tool was developed to improve the governance of the Single Market through a systematic and integrated monitoring of key goods and services markets. This tool, market monitoring[20], is an evidence-based tool which allows for the better identification and prioritisation of inefficient markets where adjustments can deliver gains in terms of growth and jobs. Actions can thus be targeted precisely at areas where the biggest impact is likely to occur and where markets do not currently deliver.

Specifically, market monitoring is a two-stage approach whereby a horizontal screening[21] is carried out in the first stage, which aims to identify a relatively limited number of sectors offering the greatest potential gains from intervention. This is subsequently followed by a second stage in-depth investigation, from both an economic and a policy standpoint, of some of the selected sectors in order to identify the appropriate instruments to address the structural nature of these problems. Examples of these "deep dive" studies are the ongoing studies on retail distribution, electrical engineering and the pharmaceutical sector, and the completed analysis on the food supply chain.[22] In this exercise, by analysing the whole supply chain from producers to consumers, market monitoring offers a comprehensive approach to sectoral analysis.

The initial screening stage of market monitoring consists of a first selection of sectors based on economic importance and market performance through a limited list of indicators.[23] Economic performance is proxied by three indicators representing value added (VA) share, consumption share and share of investment goods provision. The aim is to identify the sectors

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[20] It should be noted that the first step of the analysis looks at sectoral data before a sector is selected for in-depth market monitoring.

[21] The methodology has been revised since its original design in 2007 where the first stage was carried out in two steps: a screening step based on economic importance, importance for adjustment capacity and signs of potential market malfunctioning and a second step investigating the causes of the malfunctioning based on regulation, integration, competition and innovation. These two steps have been combined in the new approach.

[22] European Commission (2009), 'A better functioning food supply chain in Europe' COM(2009) 591.

[23] The details of the indicators used and the screening procedure are described in Annex 2-2.

which have the greatest economic weight in terms of production, consumption and investment. Market performance is captured by indicators of competition, integration and innovation.

Competition is an essential element for markets to perform well. It can have an overall positive impact on economic performance and lead to higher social welfare as firms strive to increase their efficiency and to offer products at lower prices and better quality than their rivals. The indicator aims to capture different dimensions of competition, namely aspects of structure (market concentration), conduct (turbulence indicators) and performance (mark-ups). These three aspects of competition are represented, respectively, by concentration ratios, the TNF index[24] and mark-ups. Both the concentration ratio and mark-ups are static measures but the TNF index allows for some dynamics as it measures turbulence among the top four firms over a five year period. Poor performance in this category is an indication of potential competition problems. It is of course not definitive proof that the sector is uncompetitive but identifies those sectors where there are signs of insufficient competitive pressure for the period covered.

Integration aims to measure the extent to which national economies in the European Union are inter-connected, and also how open the EU is to international trade and foreign investment flows. It is a crucial element to take into account when analysing the performance of markets, as removing tariff and non-tariff barriers increases the size of the market, giving firms an opportunity to capture the benefits of increasing returns to scale. The three indicators of integration are the share of intra-EU cross-border M&A in total M&A deals, price dispersion, and openness to trade. The first indicator captures the entry of firms into foreign markets via the acquisition of foreign firms. The second reflects the fact that liberalised and integrated markets should provide fewer opportunities for arbitrage and price discrimination, and ultimately increase cross-border price convergence. The final indicator measures the openness of a sector to foreign trade, in terms of exports and imports. As before, the combined performance of these three indicators does not prove the existence of low integration but points to the possibility that integration may be a problem in the identified sectors.

Innovation is key for future long-term growth hence its importance in market performance. The indicator aims to take account of investment in both new technologies and human capital, as both help stimulate further innovations and increase their chances of success. However, this measurement is particularly difficult because of the complexity which characterises the innovation system itself and the heterogeneity of the different dimensions concerned. In the analysis, innovation is proxied by three indicators, namely ICT[25], labour quality and labour productivity growth. Again, this limited number of indicators can only give a tentative indication of possible innovation problems within a sector.

It is an inherently difficult task to measure market performance because competition, integration and innovation are very broad, multidimensional concepts which cannot be fully assessed by any set of indicators. Measurement is further complicated by the lack of data and the constraint of having the same indicators for both manufacturing and services sectors and

[24] TNF, as defined in this exercise, is the ratio of the number of firms that have belonged to the group of the four largest firms in the five year period between 2003 and 2007 divided by the maximum number of different firms that could have potentially been included in this group during the defined period.

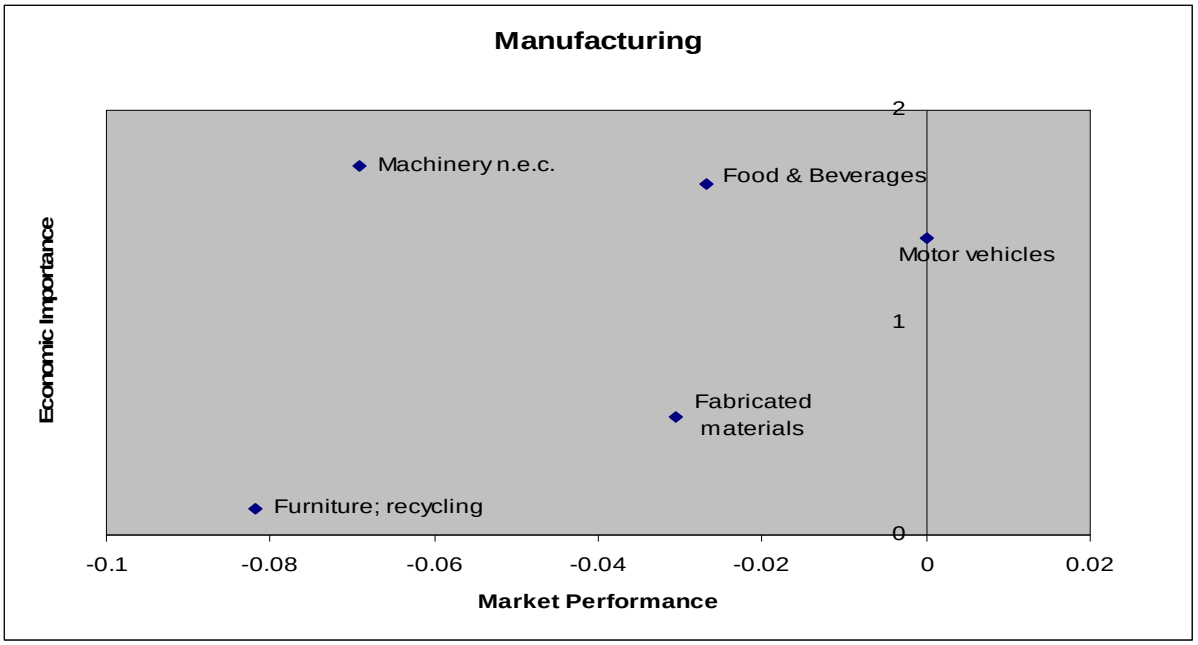
[25] This is the contribution of ICT to value added growth.

covering the EU as a whole. The aim of this screening exercise is therefore to find indications of problems using the set of indicators suggested and to provide potential insights into the different dimensions rather than to cover all aspects of market performance.

2.2.2. Results

The screening stage of the market monitoring methodology was carried out at the EU level for both manufacturing and services sectors separately.[26] Based on relative economic importance and relatively poor market functioning, the manufacturing sectors identified as requiring priority attention are machinery n.e.c., food products and beverages, motor vehicles, fabricated metal products and furniture & recycling.[27] In the services sectors the focus is on retail trade, hotels and restaurants and other business activities (which includes legal, accounting, taxation, consultancy, architectural and advertising activities), as well as construction. A snapshot of the selected sectors is shown in Figure 2-9 and Figure 2-10 below.[28]

Figure 2-9: Selected manufacturing sectors



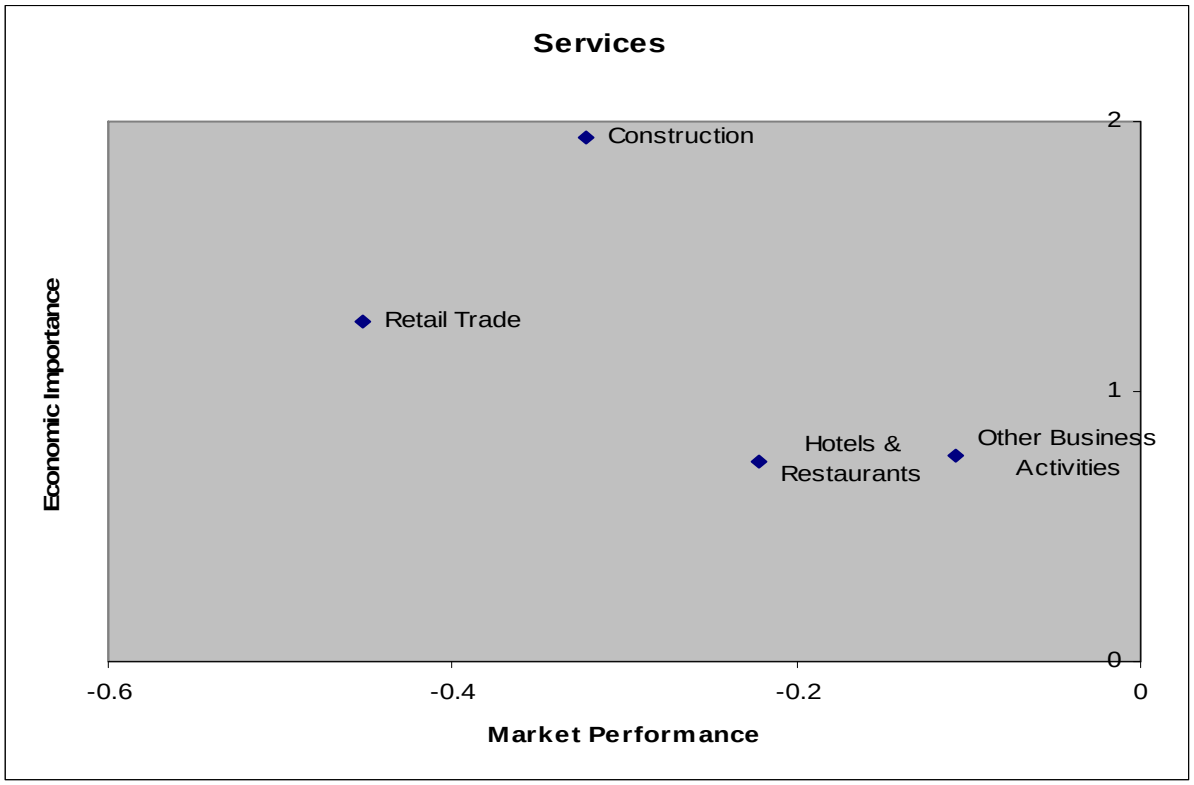
Source: Commission services

[26] Construction is included with services sectors as it is closer in characteristics to them. This is confirmed by repeating the screening exercise and including construction with the manufacturing sectors where it is shown to be a clear outlier.

[27] The data for these two sectors are combined in the analysis.

[28] The complete graphs are shown in Annex 2-2.

Figure 2-10: Selected services sectors



Source: Commission services

Regarding manufacturing sectors, the machinery sector is economically important in terms of its investment share and value added share and it performs poorly in terms of the innovation indicators mainly due to below-average labour productivity growth and labour quality. As regards food and beverages, the market is underperforming because of poor integration and innovation scores. Motor vehicles have an above-average concentration ratio and low TNF indicator, hence competition may be an issue, as innovation could potentially be, based on labour productivity growth. This sector is deemed economically important because of both high household consumption and investment shares. The fabricated metal products sector underperforms due to its low integration value for exports and imports. Competition does not appear to be a problem but labour productivity growth is an issue from the perspective of the innovation indicator. Finally, the combined sector of furniture & recycling is performing poorly due to both below average intra-EU M&A deals and openness of the sector. Labour productivity growth is also quite low.[29]

With respect to services sectors, retail trade is below average as regards the innovation indicators but its main problems lie in the integration indicators, especially in terms of openness. Hotels and restaurants have large household consumption shares and the performance problems are mainly due to poor innovation indicators, specifically labour productivity growth. Other business activities are knowledge-intensive and economically important mainly due to high value added shares, but labour productivity growth is very low in this sector. Finally, construction is economically important because of its high value added

[29] The innovation indicator is solely based on labour productivity growth as data on the other two variables is unavailable for this sector.

and investment shares. Its poor performance is due to low innovation indicators, especially as regards labour productivity growth and an obviously low openness indicator.

In general, the innovation indicator is deemed to be problematic in all the initially selected manufacturing and services sectors, though it is more severe in some than in others. The innovation indicator performs most poorly in services, namely in other business activities, construction and hotels and restaurants, but food and beverages and machinery also fare poorly. The competition and integration indicators are identified as being less problematic in the selected sectors, however more severe problems exist in the services sectors than in manufacturing. Specifically, the integration indicator is low in retail trade, other business activities and hotels and restaurants. More minor issues arise for food and beverages, fabricated metal products and furniture & recycling as regards the integration indicator, and also for machinery and motor vehicles in relation to the competition indicator.

Overall, the screening stage of the market monitoring tool allows for the prioritisation of sectors, in both manufacturing and services, where in-depth analyses can pinpoint the root causes of poor market performance, thus targeting the areas where policy improvements can have the greatest impact. This approach is of particular importance in the context of the current economic situation, as it identifies sectoral and microeconomic problems which policy initiatives can target. When the problems are rectified, improved sectoral performance will lead to enhanced EU growth and job opportunities, thereby helping Europe recover from the crisis.

As an addition to the core selection of sectors through economic importance and market performance, other policy perspectives can be subsequently taken on board in order to confirm the initial selection choice or to select a limited number of additional sectors which may be in need of an in-depth study. This supplementary information can be obtained from such sources as product market regulation indicators, environmental surveys and the Consumer Market Scoreboard.[30]

The screening, described in Annex 2-2, has selected the previously mentioned five manufacturing sectors and four services sectors on which "deep dive" studies should focus. These being food and beverages, machinery, fabricated metal products, motor vehicles and furniture & recycling for manufacturing and for services, retail trade, hotels and restaurants, other business activities and construction. It is noteworthy that in-depth investigations have been finalised in the food and beverages sector and are ongoing in retail trade, both of which were identified in the initial screening. Likely candidates for priority investigation would be motor vehicles, which is discussed in the next chapter, recycling (because of environmental challenges) and possibly construction, given the current economic crisis. Other sectors that have been proposed for further in-depth investigation, on the basis of different policy perspectives, are health care and health industry systems, electronic media and intelligent (transport) network systems. There is an obvious absence of a single market in the health sector, hence a consumer policy perspective could select this sector for further investigation. Electronic media is a major growth sector which could help integrate different product and service markets across intra-EU borders. Thus, from a regulation perspective, this sector may require a "deep dive" study. Finally, an in-depth analysis of intelligent (transport) network systems could bring greater economic and environmental efficiency if the sector reaches its

[30] http://ec.europa.eu/consumers/strategy/facts_en.htm#CMS

full potential of transport networks by better linking them through ITS (e.g. multimodality). More efficient transport networks and the use of tolls could also benefit public finances.

2.3. Market performance and growth

A comparison of sectoral capacity utilisation with the structural problems identified earlier in this chapter highlights a number of industries which, before the crisis, displayed signs of poor performance in terms of integration, competition and innovation, and whose capacity utilisation rates have fallen dramatically during the downturn. Should the capacity utilisation rate remain low for a prolonged period of time, restructuring may be accelerated in industries such as motor vehicles or basic metals. However, there are also a number of sectors such as food and beverages and printing and publishing, which already had signs of structural problems but which have not been significantly affected by the recession. In these cases, it is unlikely that the crisis produced an acceleration in the restructuring process. Initial figures comparing market performance (as defined in Section 2.2) and growth, before and during the crisis, are given in Table 2-1. This table shows data on capacity utilisation, growth in labour productivity and value added before the crisis, and production lost during the crisis.[31] The last column also indicates the sectors that are economically important but perform badly in terms of competition, integration and innovation (quadrant A in the market monitoring exercise). For capacity utilisation, the table shows the last observation (3rd quarter of 2009), the average over the period 1990-2009 and the relative difference between the two of them. The latter measures the decrease in capacity utilisation during the crisis relative to average capacity utilisation over the whole period.

One step further in this analysis is to look into the relationship between the market performance indicators and sectoral growth.. The approach taken is to calculate rank correlations in order to measure the degree of association between sectoral growth in labour productivity (both 'before' and 'during' the crisis) and market performance[32].

[31] For services sectors this column refers to growth in turnover at constant prices. As appropriate deflators for services are not available, turnover was deflated using various items of the HICP index as appropriate. This is necessarily a source of bias: first, because the correspondence between the nomenclatures (NACE Rev.2 and COICOP) is rough; second, because this approach does not take into account the fact that part of the demand for services is intermediate, particularly in the case of some sectors, such as business services.

[32] More precisely, to measure this association, growth "before the crisis" was measured over 1995-2005. As regards market performance, the three components (innovation, competition and integration) are taken separately to avoid the overlapping caused by the fact that labour productivity is one of the components of the composite indicator. Furthermore, to analyse the relationship between labour productivity and innovation, the "innovation" component was recalculated after dropping labour productivity growth.

Table 2-1: Market performance, capacity utilisation and production growth before and after the 2008-2009 downturn

Sector	Capacity utilisation "last"	Capacity utilisation "average"	Capacity utilization "relative"	Labour productivity growth (1995-2005) %	Value added growth (1995-2005) %	Growth during the crisis (%)	Market Monitoring quadrant "A"
food and beverages	74.4	79.3	-4.9	1.5	0.7	-2.3	x
tobacco products	-	-	-	2.7	-1.9	-9.1	
textiles	66.5	78.5	-12.0	2.4	-2.1	-24.8	
clothing	74.3	80.6	-6.3	1.8	-3.0	-14.7	
leather products	70.3	79.5	-9.2	0.9	-4.0	-18.7	
wood and products	70.9	80.7	-9.8	3.2	2.3	-20.6	
paper and paper products	77.6	84.8	-7.2	3.6	1.6	-13.2	
publishing and printing	75.1	81.1	-6.0	1.6	0.7	-9.9	
coke, refined petroleum	82.1	85.5	-3.4	-4.1	-6.8	-9.5	
chemicals	74.3	81.6	-7.3	3.9	2.8	-9.2	
rubber and plastic	68.2	80.8	-12.6	3.2	3.5	-20.0	
non-metallic mineral products	69	80.4	-11.4	3.9	2.2	-25.6	
basic metals	59	83.7	-24.7	2.0	-0.7	-31.2	
fabricated metal products	66	79.7	-13.7	1.7	2.2	-27.4	x
machinery and equipment n.e.c.	68	82.8	-14.8	2.6	1.4	-30.0	x
office machinery and computers	85.2	78.8	6.4	9.1	7.6	-50.1	
electrical machinery	69.6	81.5	-11.9	2.8	1.7	-29.9	
radio, TV and communication eq.	75.2	80.7	-5.5	11.8	10.3	-10.9	
medical, precision and optical instr.	76.3	83.8	-7.5	4.1	4.0	-14.9	
motor vehicles	62.2	85.3	-23.1	2.7	3.2	-35.0	x
other transport equipment	89	81.8	7.2	4.1	2.4	-11.8	
furniture; other manufacturing	69.7	79.4	-9.7	1.3	0.6	-14.4	x
electricity, gas and water	-	-	-	4.8	2.4	-7.5	
construction	-	-	-	0.4	1.2	-14.2	x
sale, maintenance of motor vehicles	-	-	-	0.9	2.3	-13.9	
wholesale trade	-	-	-	2.7	3.3	-5.9	
retail trade	-	-	-	1.8	2.1	-6.5	x
hotels and restaurants	-	-	-	-0.2	1.7	-11.7	x
land transport	-	-	-	2.5	2.1	-16.4	
water transport	-	-	-	9.2	7.4	-29.3	
air transport	-	-	-	1.1	1.5	-17.7	
auxiliary transport activities	-	-	-	-0.1	3.3	-17.1	
post and telecommunications	-	-	-	8.2	7.9	-10.2	
financial intermediation	-	-	-	4.7	4.6	-	
insurance and pension funding	-	-	-	-0.9	-1.5	-	
auxiliary to financial intermediation	-	-	-	2.2	4.3	-	
renting of machinery	-	-	-	-0.3	5.9	-	
computer and related activities	-	-	-	3.0	8.2	-	
research and development	-	-	-	1.7	0.8	-	
other business activities	-	-	-	-0.4	3.3	-11.3	x

Note 1: Growth 'before crisis' corresponds to the period 1995-2005, while growth 'during the crisis' is growth between February 2008 and August 2009. As the market monitoring indicator and the growth rates are calculated using NACE Rev.1 and NACE Rev.2 data respectively, the growth rates reflect a rough correspondence between the two nomenclatures. More precisely, for sectors 24, 30, 31, 32, 33 and 36, the growth rates are weighted averages of growth rates in NACE Rev.2 sub-sectors as appropriate. Overall, this means that matching the results of market monitoring and sectoral growth is based on a rough correspondence between the two nomenclatures. This is important when it comes to interpreting the results, particularly the rank correlations presented below.

Note 2: Capacity utilisation is expressed in % of full capacity.

Note 3: The column "Market monitoring quadrant 'A'" refers to those sectors identified in the market monitoring exercise as being more economically important but with relatively poor market performance.

Source: Commission services

Labour productivity growth is positively associated with innovation and, to a lesser extent, with integration.[33] Going into further detail, labour productivity growth is positively and significantly associated with labour quality (one of the components of the innovation index).[34] When growth in value added is considered, the results confirm the significance of innovation and, at more detailed level, the importance of ICT (a component of the innovation composite indicators).

As regards output growth during the crisis, when only manufacturing sectors are considered, the correlation is positive and significant with labour quality. If the analysis is extended to encompass also services sectors, the correlation is positive with ICT and negative with integration. However, when services are included, these results should be treated with caution, given the above-mentioned difficulties in measuring growth at constant prices.

Overall, these results underscore the relevance of innovation as a factor of long-term growth, but they also show the need for a more detailed analysis in order to disentangle the relationships among the various indicators used here. While more competition and better integration with other markets can be expected to deliver higher growth in the long term, this would require a more detailed analysis and a control for other factors. For example, competition triggers growth and beneficial effects for consumers, but these will be more apparent at market, rather than sector, level. Openness and market integration are also believed to have positive effects on output and productivity growth, but in order to establish more conclusive results one would need to consider the direction of causality and other variables would have to be included in the analysis.

In addition to the factors considered above and summarised in Table 2-1, given the nature of the current crisis it is interesting look at the possible influence of the financial structure of industries on their performance in the crisis. A preliminary picture is provided in Box 2.1.

Box 2.1: EU industries' financial structure and performance in the crisis

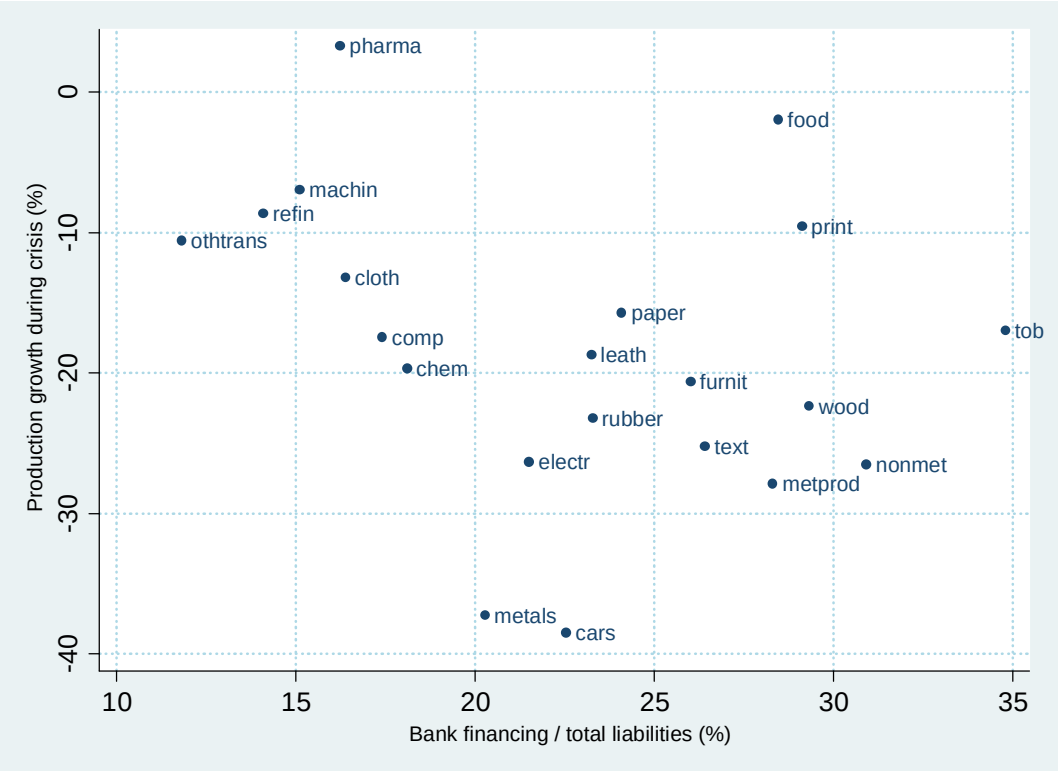
To capture the importance for industries of bank financing, the ratio "bank financing to total liabilities" was calculated for manufacturing sectors. The production lost during the crisis is plotted against this indicator of bank financing (Figure 2-11). There appears to be a positive relationship between the two in that the higher the weight of bank financing in the total liabilities of a sector, the higher the loss in production during the current downturn (Figure 2-11).[35] This confirms the negative effect that the disruption in financing activities had on sectoral activity. For an analysis and empirical evidence that supports the idea that "sectors more dependent on exte*rnal finance should perform relatively worse during banking crises*" see: Giovanni Dell'Ariccia, Enrica Detragiache, and Raghuram Rajan (2008).

[33] The rank correlation coefficients are, with innovation, 0.33 (significant at 5%) and, with integration, 0.30 (significant at 10%).

[34] Rank correlation coefficient is 0.7 (significant at 10%).

[35] Note that the manufacture of beverages (an outlier as regards the share of bank financing) is not included in the graph.

Figure 2-11: Production lost during the crisis versus share of bank financing in total liabilities



The indicator on bank financing is based on data for large firms, which may cause some bias for those: sectors where SMEs account for a larger share of the activity.

Source: Commission services with ORBIS data

Overall, the main conclusion emerging from this section is that the depth and severity of the current economic crisis is unlike any of the downturns that have taken place over the last twenty years. The industries hardest hit have been those producing durable consumer goods and capital goods, whereas the least affected sectors are those producing non-durable and basic necessity consumer goods. It also appears that expanding industries have generally been harder hit than declining industries. Nevertheless, figures suggest that adjustment will, probably, gather speed in traditional manufacturing industries such as textiles, and that adjustment may also take place in sectors such as basic metals, motor vehicles, machinery and electrical equipment. A lot depends on whether the current recession has led to permanent shifts in comparative advantages, consumer preferences or the reallocation of resources between sectors, which can prevent production in some sectors from returning to its pre-crisis levels.

It is still too early to make a firm assessment of the overall effects of the crisis. Nevertheless, some preliminary conclusions can be drawn by examining the behaviour of industries over the business cycle and by investigating whether there are any common elements as well as any features specific to the current crisis.

2.4. Structural changes

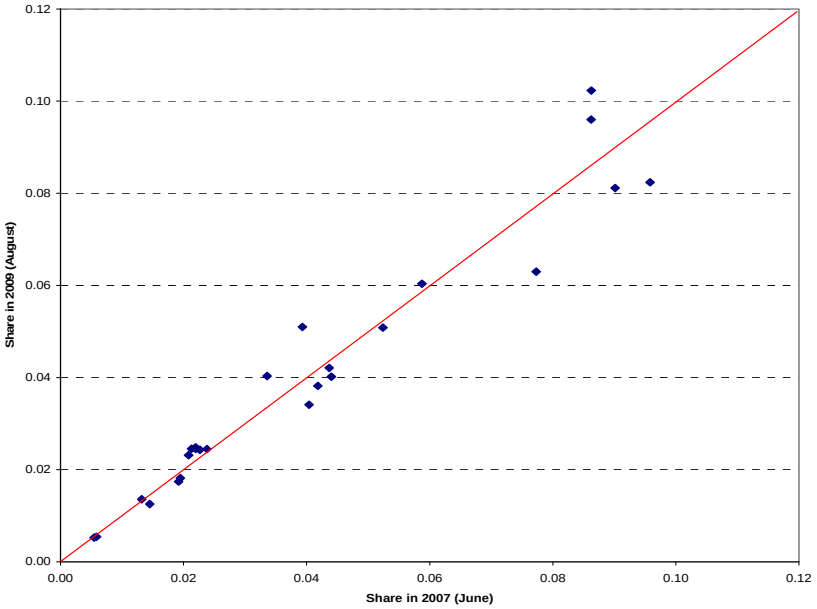
Section 2.1 of this chapter has shown some similarities and differences between the current downturn and those of 1992-1993 and 2001.[36] While it is clear from the previous section that production churn increases during downturns, this section looks at the changes in the sectoral structure that this turbulence may cause. To show the difference in the structure before and after the crisis, Figure 2-12 presents a scatter plot comparing the sectoral shares in manufacturing production between June-2007 and July-2009. These points correspond to minimum and maximum values of the Lilien index. The turbulence does not seem to be reflected in significant changes in the sectoral structure of the economy in the short run. The most significant changes in shares are in the food and pharmaceuticals sectors, which gain 1.6 and 1.2 percentage points respectively and in machinery and motor cars, which lose 1.3 and 1.4 points, respectively. The other sectors are clustered around the main diagonal of the graph. For reference, the bottom panel compares the share in July 2009 with those in January 1990 and shows the intensity of sectoral transformation in the long term.

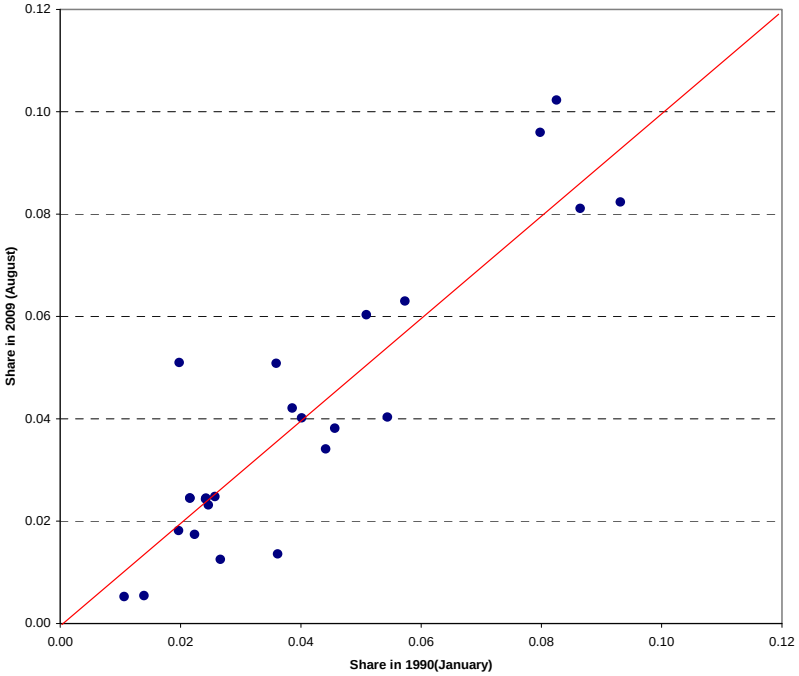
A comprehensive measurement of changes in the sectoral structure based on sectoral shares is provided by the Euclidean distance between the vector of sectoral shares in each month and the vector of shares at the beginning of the period.[37] Figure 2-13 shows the Euclidean distance calculated from raw data on production and its trend. This figure indicates that the sectoral structure has been gradually changing. There have been periods of acceleration in structural change, followed by decelerations, and corresponding decreases in the distance. In other words, it appears that the change caused by downturns is corrected, at least partially, once the recession is over. This is clearly the case in November 1993, when the process of accelerated change finishes. Currently, an acceleration in the process of change is taking place. Based on the past experience, this may well come to an end, with a corresponding correction, once the recovery phase starts. A comparison of the Euclidean distance with two other indicators of structural change is shown in Figure A.2.4.1.

[36] Due to data constraints and in order to provide the largest possible coverage, the analysis has used different sources and variables.

[37] For time "t" the distance is defined as $d_t = \sqrt{\sum_{i=1}^{n} (s_{i,t} - s_{i,1990m01})^2}$, where s_{it} refers to sector i at month t and $s_{i,1990m01}$ refers to the share of sector i at the beginning of the period (January 1990).

Figure 2-12: Sector shares in July-2009 compared to June-2007 and January 1990

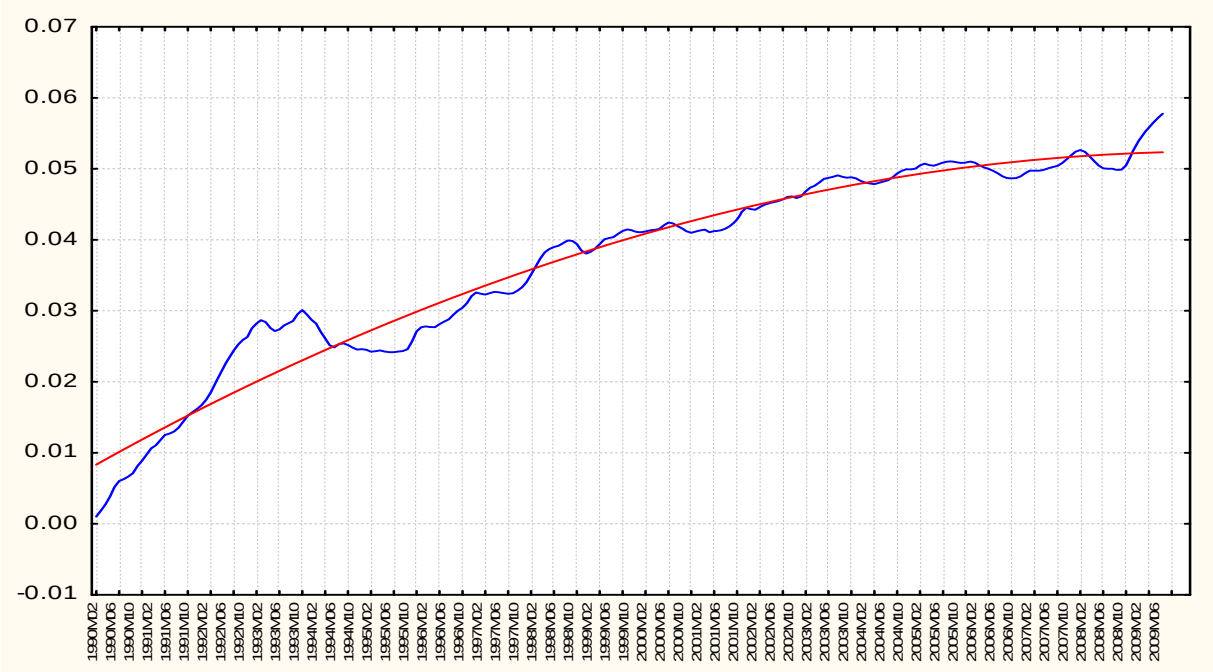




The sector shares are calculated on manufacturing production

Source: Commission services with Eurostat data

Figure 2-13: Euclidean distance from sectoral structure in January 1990 (manufacturing industries)



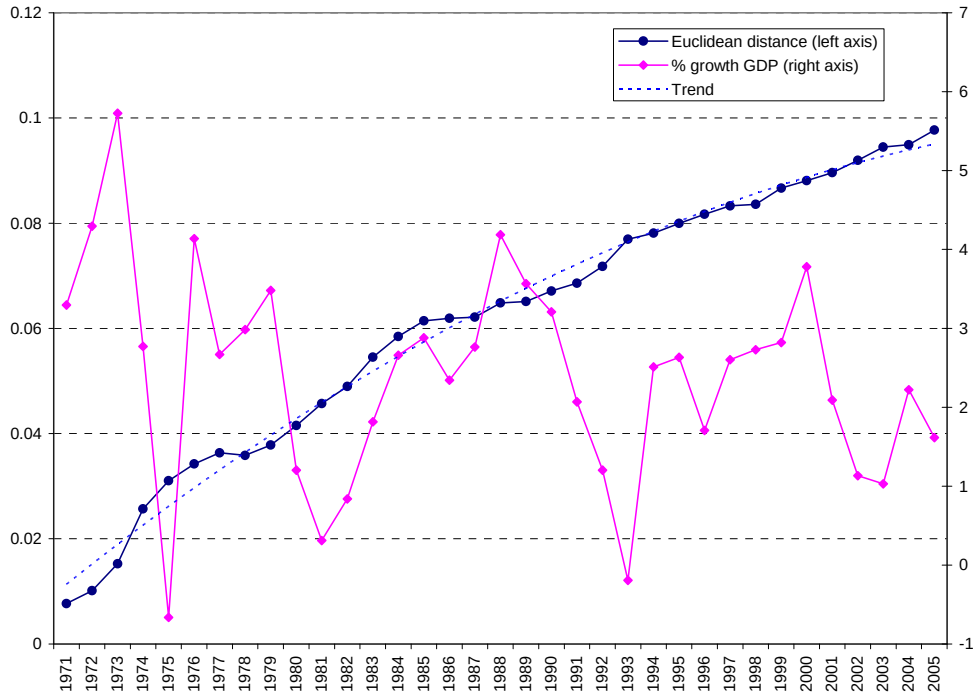
The sectoral structure is measured using shares in manufacturing production

Source: Commission services using Eurostat data

As the above results refer to manufacturing only, it is also interesting to look at changes in the whole economy. Figure 2-14 shows the Euclidean distance indicator of structural change, using value added data for EU-15. As for manufacturing, the periods of acceleration in structural change are followed by decelerations and decreases in the distance relative to the reference period, which is 1970. The change, as measured directly by the share of individual sectors in the whole economy (see Figure 2-14), is minor before and after the 1993 downturn. The first panel in Figure 2-15 compares the shares in 1989 and 1994 and does not show substantial changes in the sectoral structure.

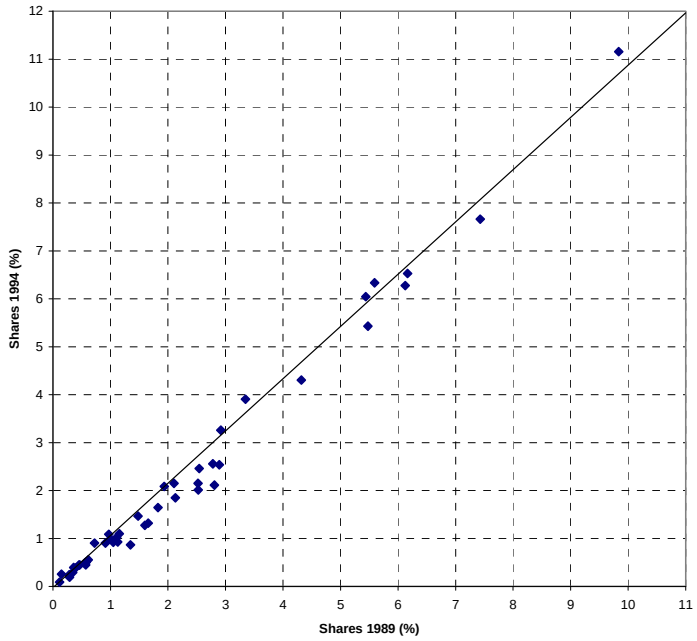
A more recent picture of structural change, covering more sectors than just manufacturing, can be seen from the employment data underlying Figure 2-16. This Figure shows the gain in the share of each main sector (mining, manufacturing, construction and market services), on a monthly basis, relative to the beginning of the period (January 2000). It is the familiar trend, with steady increases in services sectors (market services in this case) and a parallel decrease in the share of manufacturing. Between January 2008 and June 2009, the share of services increased by 1.3 percent points at the expense of manufacturing (-0.7) and construction (-0.6). Furthermore, 25% of the share gained by services (5.2 percent points) during 2000-2009 was achieved during the last 18 months. The loss of manufacturing share during this period is only slightly higher than the average loss over the whole period. However, these results need to be interpreted cautiously because of the volatility of the construction sector, which significantly affects the change in the share of the other sectors.

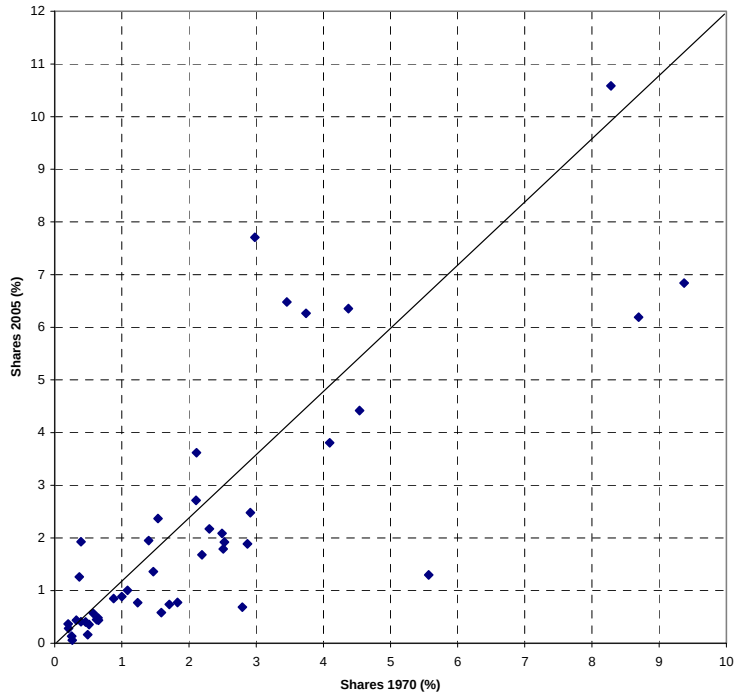
Figure 2-14: EU-15 change in sectoral structure and GDP growth (whole economy)



Source: Commission services using EU KLEMS data

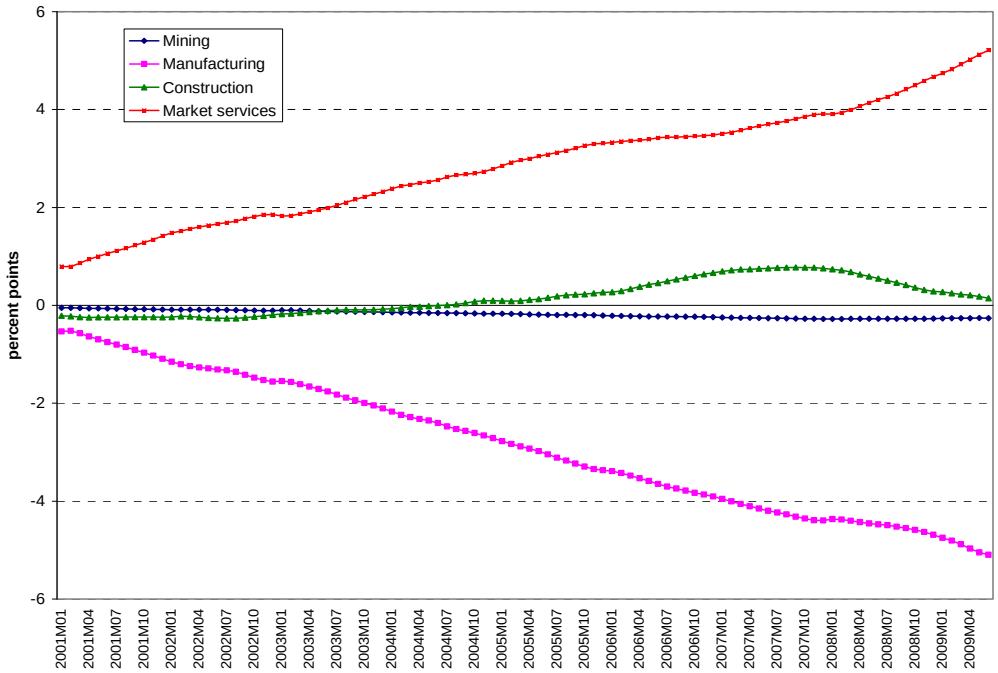
Figure 2-15: EU-15 sectoral shares in 1970, 1989, 1994 and 2005





Source: Commission services using EU KLEMS data

Figure 2-16: Gain (%) in share in total employment relative to January 2000



Source: Commission services using Eurostat data

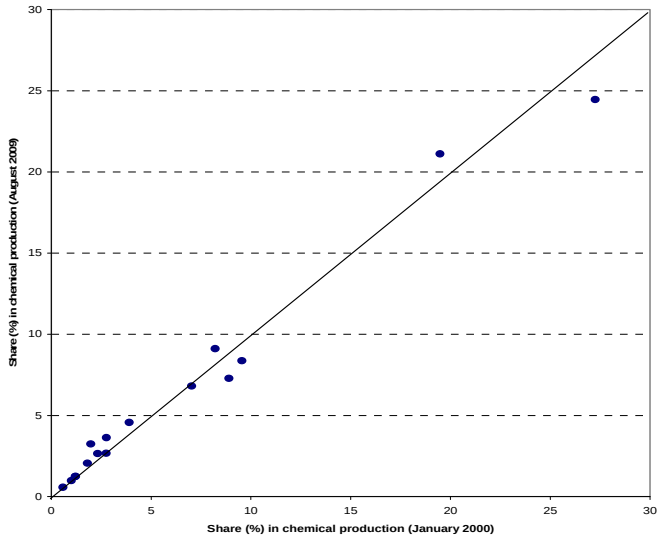
The results presented above show that changes in the sectoral structure concern only a limited number of sectors, and this affects the value of the indices used. Two qualifications are in order here. First, the analysis here concerns only changes in the sectoral structure, measured in terms of sectoral shares in employment, production or value added. Clearly, this is only one kind of change. This analysis does not capture profound changes in other areas (e.g. consumer and business attitudes), which are taking place as a response to the crisis but are not apparent at sectoral level. Second, it is important to bear in mind that the calculations have been carried out with a relatively high degree of sectoral aggregation (2-digits of NACE Rev.2). Most of the changes currently taking place in sectoral structures probably occur at a more disaggregated level, or (even more likely) at the level of particular product *niches* or within companies. Although lack of data constrains the ability to analyse sectors in great detail, it is worth looking at how production evolves within some sectors, which can be broken down into sub-sectors. One example – chemical industry – is presented in Box 2.2.

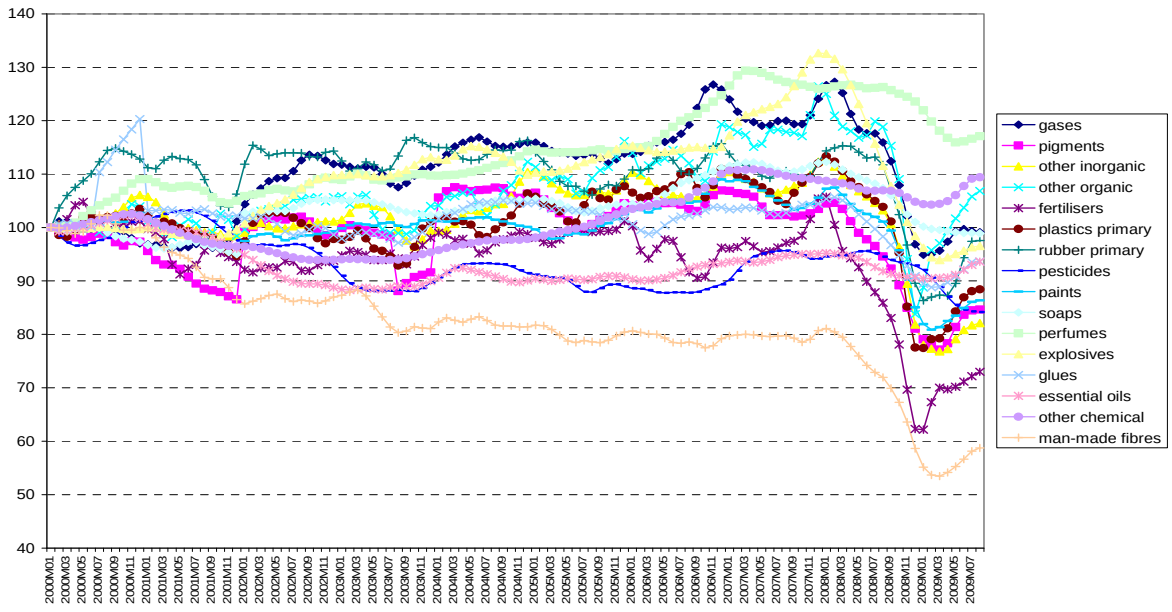
The analysis of structural change so far refers to changes in sectoral structure throughout the EU over time. While turbulence due to economic downturns does not lead to significant changes in the sectoral structure, it is worth investigating how the sectoral structure affects overall growth in labour productivity. Box 2-3 presents results comparing EU and US performance in labour productivity from a sectoral perspective.

Box 2.2: Sectoral developments and shares at 3-digit level – The chemical industry

The chemical industry (NACE Rev.1 code 24) is sub-divided into sixteen sub-sectors at 3-digit level. The share of these sub-sectors in total chemical production, in 2000 and 2009, is shown in Figure 2-17 (top panel). The most significant changes affect a few sub-sectors. It is worth mentioning 'other organic basic chemicals' (from 24.4% to 27.5%), 'plastics in primary forms' (from 21.1% to 19.5%) and 'man-made fibres' (from 3.2% to 2%). These sectors exhibit steady trends in their shares. The change in the sectoral structure is thus reflected in changes which affect, at least significantly, a limited number of sub-sectors. Nevertheless, the long term trends show changes, driven by competitiveness and technological factors, which are apparent in the contrasting evolution of industrial production as shown in Figure 2-17 (bottom panel). Although the intensity of the 2008-2009 recession varies from sector to sector, all sectors are affected in the same way, namely a decrease in production followed by some recovery in recent months. This explains why the crisis has not significantly affected the sector shares. On the other hand the graph shows significantly different long-term trends (2000-2009) in the production of the sub-sectors. The two extreme cases are 'plastics in primary form' and 'man-made fibres', which have steady upward and downward trends, respectively.

Figure 2-17: EU-27 chemical industry: shares of sub-sectors (2000-2009) in chemical production and production developments (1990-2009)





Source: Commission services with Eurostat data

Box 2.3: EU-US gap in labour productivity growth – Sectoral composition

The question examined in this Box is to what extent is the gap in labour productivity growth between the EU and the US due to the differences in sectoral composition between the two regions? This can be measured quite easily by breaking down the labour productivity growth gap into two effects, namely sectoral composition and labour productivity performance:

Labour productivity gap: $\sum_{1}^{n} \Delta Lp^{US}{}_{i,t} \cdot S^{US}{}_{i,0} - \sum_{1}^{n} \Delta Lp^{EU}{}_{i,t} \cdot S^{EU}{}_{i,0}$

Sectoral composition effect: $\sum_{1}^{n} \Delta Lp^{EU}{}_{i,t} \cdot S^{US}{}_{i,0} - \sum_{1}^{n} \Delta Lp^{EU}{}_{i,t} \cdot S^{EU}{}_{i,0}$

Labour productivity performance effect: $\sum_{1}^{n} \Delta Lp^{US}{}_{i,t} \cdot S^{US}{}_{i,0} - \sum_{1}^{n} \Delta Lp^{EU}{}_{i,t} \cdot S^{US}{}_{i,0}$

where:

$\Delta L_{Pi,t}$: labour productivity growth in sector "i" between time "0" and "t".

$S_{i,0}$: share of sector "i" in total value added in time "0".

n: number of sectors

The results obtained for the period 1995-2005, based on the average annual growth rate show that the EU has a productivity gap of 0.83 percentage points relative to the US, and that 40% of this gap (0.33 percentage points) corresponds to the composition effect. This effect measures the growth in EU labour productivity if the EU had the same sectoral structure as the US. In other words, the EU's sectoral structure accounts for 40% of its underperformance relative to the US in labour productivity growth.[38]

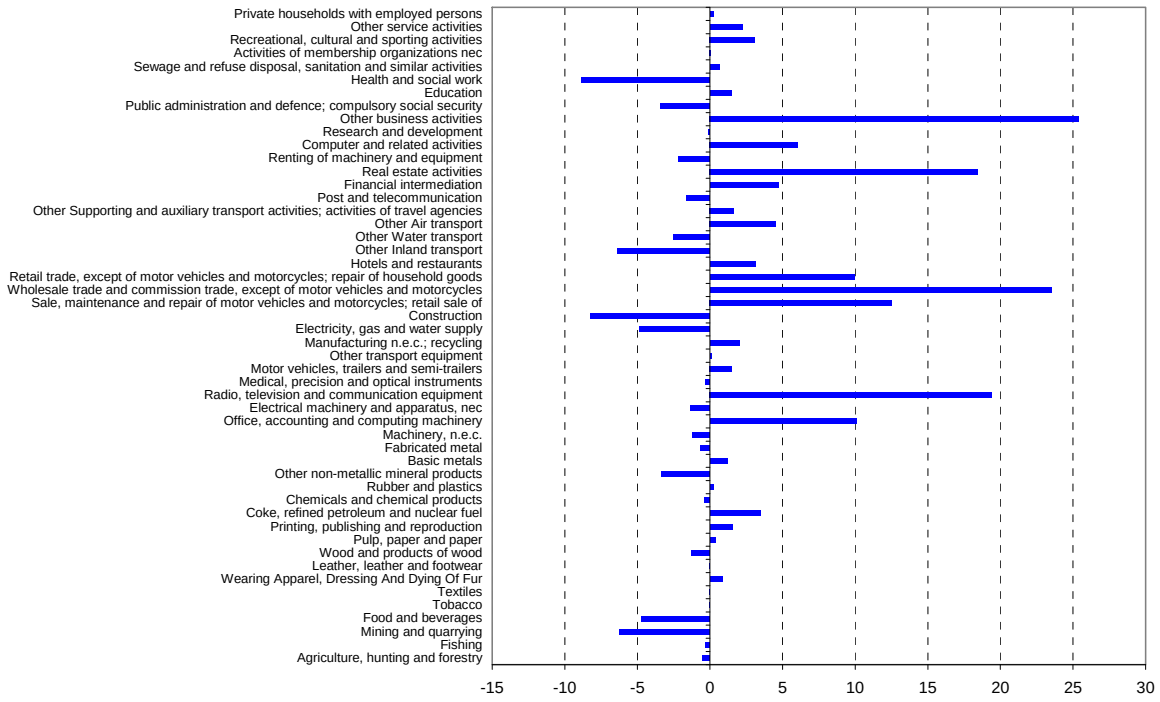
How much does each sector contribute to this gap? Figure 2-18 shows that the EU's underperformance is largely due to seven sectors, five of which are market services industries: other business services, real estate, wholesale trade, retail trade and the sale and maintenance of motor vehicles. The two manufacturing sectors concerned are both ICT industries: (i) computers and office equipment and (ii) radio, TV and communication equipment.

The gap between the EU and the US is also obvious when the comparison is made in terms of Total Factor Productivity (TFP). Table A.2.4.2 in the Annex shows annual growth in TFP in the EU over the period 2000-2005 and compares it with the situation in the US. On average,

[38] The source of data is EU KLEMS. The EU refers to EU-25 and the period covered is 1995-2005. For the calculation of the gap overall labour productivity is calculated as the weighted average of labour productivity in each sector: the weights are the share of each sector in total value added at the beginning of the period (1995). To carry out the calculations EU labour productivity growth in computers and office equipment and radio, TV and communication equipment was calculated using the US deflator for value added in these sectors.

the EU's annual TFP growth is 0.1%, well behind the US figure of 1.1%, and this lag applies to nearly all sectors. Only in six sectors does the EU outperform the US, and in two of them the difference is very small. These figures show that the EU's efforts to reach the technology frontier should concern nearly all sectors of the economy. At the same time, however, the large variation in TFP growth across sectors in the EU (from -5.3% in coke and refined petroleum to 3.6% in post and telecommunications) shows that overall TFP development is greatly affected by sectoral composition.

Figure 2-18: Sectoral contribution to the EU-US gap in labour productivity growth (1995-2005)



Note: The individual contributions add up to the total difference in labour productivity growth (US minus EU)

Source: Commission services using EU KLEMS data

These results underscore the relevance of two factors to improve the EU's overall labour productivity growth. First, structural changes towards a sectoral composition more conducive to improvements in labour productivity. Second, policies to improve the performance of specific sectors, especially the services industries mentioned above. Given the EU's specialisation bias towards high-intermediate and low-intermediate technology and labour skill industries, there is clearly room for structural change that will boost labour productivity in the EU economy[39].

[39] See Peneder (2009) and European Commission (forthcoming).

2.5. Structural breaks in EU sectors

Previous sections have shown that the severity and depth of the current crisis are unprecedented for the EU. Furthermore, the present crisis has a series of specific features which may have a variety of profound effects on the EU's economic future, for example, creating feedback loops between the financial sector and the real economy. Some evidence of structural change in the European economy has indeed emerged from the analysis in Section 2.4. The remainder of Section 2 provides further evidence, focused on the sector-specific effect of the downturn. By means of a structural break test, this section investigates whether the downturn, identified by an exogenous break point, has led to a significant change in the long-term trend of each manufacturing and service production series. The investigations are conducted following the methodology proposed by Perron (1994, 1997) and Ben-David and Papell (1998). The exogenous break point is chosen as September 2008, which is when the bankruptcy of Lehman Brothers was announced thereby triggering the current financial crisis.

To compare the behaviour of manufacturing and services sectors today with their behaviour in previous economic downturns, a similar test has been conducted on production series by choosing two different exogenous break points. Since there was not an unequivocal event leading to the previous two economic downturns, the turning points of July 1993 and December 2000 were chosen according to the Bry and Boschan (1971) methodology (see Figure 2-1) which enables analysts to identify turning points over the business cycle.[40]

Empirical evidence provided in Tables A.2.5.1 and A.2.5.2 suggests that the recent crisis is having a more profound and widespread effect on most sectors than the two previous slowdowns. These induced a significant break only on few of the industries under consideration. Specifically, recent monthly data on production indices suggest that the present downturn has caused a structural break in a majority of manufacturing (19 out of 25) and services sectors (15 out of 24). Some of the evidence is worth highlighting. First, the pharmaceutical industry is the only high-tech sector which has not suffered a structural break due to the current crisis. This has several implications in terms of innovation performance and structural change in European economies, as indicated in Chapter 4. Second, the data confirms that the causes of the current crisis are different from those of the 2000 downturn (financial versus IT-based sectors). The recent downturn has hit sales and trade activities while telecommunications do not appear to have experienced any structural break so far.

It is not yet possible to say whether the structural breaks detected since September 2008 will become permanent or whether they will disappear in years to come, as a sustained recovery leads to another shift in the long-term trends. There are several factors which could make these changes permanent. For example, a permanent change in consumer preferences/patterns (i.e. a higher share of cheaper goods or a lower replacement rate of durable goods), or a prolonged change in business conditions which, in turn, may have a lasting affect on company profitability and cause turbulence across sectors. Indeed, a permanent break in the behaviour of the series can lead to a change in the allocation of resources between sectors and therefore in the sectoral composition of value added. However, the sector-specific characteristics of these tests do not allow the issue of structural change to be investigated since this refers to the sectoral structure of the economy and occurs with significant time lags.

[40] See Annex 2-5 on the methodologies used in this chapter for more details on the structure of the tests.

2.6. Concluding remarks

By contrast with the growth slowdowns of 1993 and 2001, it is very striking that the majority of both EU manufacturing and services sectors have endured significant growth slowdowns since the crisis really took hold in autumn 2008. In earlier slowdowns, the majority of sectors were nowhere near as affected as they have been this time. In general, manufacturing sectors producing durable consumer goods and equipment goods such as basic metals, cars, electrical equipment, chemicals and metal products have been hit hardest, whilst amongst non-financial services, trade sectors (especially the car trade sector) and construction have suffered the worst impact of the crisis, demonstrating the importance of spillovers across sectors in creating feedback loops. In addition, it must be a real concern that the manufacturing sectors which have been suffering most from the crisis are also often the sectors that were the most dynamic prior to the crisis.

Interestingly, the sharp slowdown in sectors' growth rates has been accompanied by an acceleration of sectoral churn with volatile sectoral production from month to month. While it would be natural to think that this reflects evidence of a significant change in the underlying sectoral structure of the EU economy, other evidence suggests that this is not the case so far (at least, not at a reasonably aggregated level). Furthermore, even if significant sectoral structural change eventually occurs, previous experience of growth slowdowns show that, once growth resumes, Europe's sectoral structure will tend to return to close to its pre-downturn equilibrium. Of course, past experience may not be a good guide this time because this crisis is exceptional. Nonetheless, it offers some encouragement that the crisis may not lead to the wrenching structural adjustment so widely expected *ex ante*. At the same time however significant restructuring within sectors and firms is to be expected on account of the very low capacity utilisation rate observed to date.

If there is little structural change, the pre-crisis market performance problems in certain sectors identified by the market monitoring exercise would therefore remain and would still need to be addressed by policy-makers as a matter of urgency. Even if there is more structural change, market monitoring has demonstrated some broad problems common to all sectors with suboptimal market performance, notably disappointing innovation and, in service sectors, potential evidence of continuing market fragmentation. Hence, the development of systematic evidence-based tools such as market monitoring to analyse structural microeconomic problems with macroeconomic impacts remains as important as ever.

Annex 2-1: Sectoral performance in the current crisis

Table A.2.1.1: Cross-correlation between growth in production and the number of persons employed

Sector		production leads	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
b_c	mining and quarrying; manufacturing	x	-0.291	-0.22	-0.13	-0.011	0.149	0.332	0.513	0.539	0.541	0.526	0.506	0.489	0.476
c10	food products	x	-0.253	-0.205	-0.150	-0.078	0.017	0.125	0.231	0.300	0.350	0.385	0.414	0.439	0.457
c11	beverages	x	-0.176	-0.147	-0.109	-0.045	0.054	0.173	0.285	0.288	0.281	0.277	0.284	0.298	0.322
c12	tobacco products		0.496	0.471	0.444	0.415	0.379	0.335	0.285	0.234	0.165	0.096	0.039	-0.007	-0.048
c13	textiles		0.038	0.115	0.205	0.311	0.433	0.564	0.686	0.685	0.674	0.654	0.628	0.595	0.556
c14	wearing apparel		-0.368	-0.333	-0.292	-0.242	-0.177	-0.101	-0.025	-0.006	0.012	0.032	0.052	0.063	0.059
c15	leather and related products		0.205	0.252	0.304	0.362	0.426	0.485	0.530	0.500	0.472	0.453	0.440	0.426	0.405
c16	wood and of products of wood		0.075	0.136	0.196	0.272	0.380	0.509	0.643	0.622	0.580	0.525	0.472	0.426	0.390
c17	paper and paper products	x	-0.370	-0.372	-0.349	-0.292	-0.205	-0.103	0.000	0.060	0.108	0.138	0.155	0.167	0.179
c18	printing and reproduction of recorded media	x	0.074	0.112	0.148	0.184	0.224	0.271	0.326	0.359	0.388	0.405	0.408	0.399	0.381
c19	coke and refined petroleum products		0.368	0.352	0.324	0.276	0.210	0.133	0.056	-0.006	-0.059	-0.107	-0.153	-0.199	-0.242
c20	chemicals and chemical products	x	-0.289	-0.241	-0.185	-0.120	-0.042	0.047	0.146	0.179	0.200	0.206	0.203	0.202	0.210
c21	pharmaceutical products	x	0.230	0.293	0.355	0.411	0.463	0.512	0.557	0.576	0.595	0.614	0.630	0.638	0.635
c22	rubber and plastic products	x	-0.049	0.023	0.105	0.212	0.354	0.508	0.654	0.673	0.665	0.632	0.582	0.530	0.481
c23	other non-metallic mineral products		-0.046	0.042	0.138	0.244	0.369	0.508	0.652	0.651	0.613	0.555	0.504	0.478	0.468
c24	basic metals	x	-0.401	-0.387	-0.358	-0.308	-0.228	-0.126	-0.018	0.043	0.095	0.137	0.172	0.208	0.248
c25	metal products	x	-0.247	-0.179	-0.092	0.027	0.182	0.365	0.550	0.573	0.569	0.550	0.528	0.510	0.491
c26	computer, electronic and optical products	x	-0.021	0.074	0.171	0.270	0.376	0.482	0.584	0.640	0.681	0.709	0.726	0.735	0.734
c27	electrical equipment	x	-0.054	0.023	0.110	0.207	0.322	0.444	0.562	0.606	0.637	0.656	0.666	0.665	0.655
c28	machinery and equipment n.e.c.	x	-0.157	-0.092	-0.018	0.068	0.166	0.272	0.375	0.441	0.495	0.537	0.571	0.595	0.609
c29	motor vehicles, trailers and semi-trailers		-0.047	0.003	0.080	0.192	0.345	0.521	0.693	0.692	0.656	0.595	0.525	0.458	0.398
c30	other transport equipment	x	-0.129	-0.100	-0.060	-0.002	0.073	0.152	0.222	0.256	0.279	0.301	0.328	0.359	0.390
c31	furniture		0.076	0.152	0.234	0.327	0.433	0.541	0.637	0.579	0.512	0.446	0.384	0.322	0.259
c32	other manufacturing	x	-0.552	-0.540	-0.518	-0.482	-0.428	-0.357	-0.280	-0.203	-0.127	-0.049	0.029	0.095	0.145
c33	repair and installation of machinery	x	0.024	0.044	0.069	0.104	0.148	0.193	0.234	0.274	0.304	0.324	0.335	0.341	0.343
cag	capital goods	x	-0.105	-0.027	0.070	0.189	0.322	0.468	0.617	0.643	0.644	0.629	0.612	0.593	0.571
cog	consumer goods	x	-0.461	-0.425	-0.379	-0.305	-0.177	-0.021	0.135	0.194	0.242	0.281	0.313	0.336	0.353
dcog	durable consumer goods		0.233	0.297	0.373	0.464	0.568	0.682	0.791	0.766	0.729	0.685	0.639	0.593	0.546
ndcog	non-durable consumer goods	x	-0.590	-0.592	-0.589	-0.553	-0.455	-0.321	-0.183	-0.119	-0.060	-0.005	0.045	0.088	0.128
ing	intermediate goods	x	-0.223	-0.150	-0.059	0.060	0.222	0.411	0.603	0.623	0.615	0.584	0.546	0.516	0.495

Source: Commission services

Table A.2.1.2: Parameters of the distribution of growth rates over 1990-2009

code	sector	Share (%)	Cumulative growth (%)	Mean total (%)	Mean before crisis (%)	Mean crisis (%)	Std. Dev. before crisis	Mean - 2 StDev	Production lost crisis (%)	Min. (%)	Max. (%)
B	mining and quarrying	4.6	-1.1	-1.0	-0.4	-7.2	3.9	-8.2	-15.2	-12.6	12.3
C10	food	8.6	1.2	1.2	1.4	-0.8	1.1	-0.7	-1.6	-2.1	4.9
C11	beverages	2.1	0.8	0.9	1.3	-2.7	2.7	-4.1	-3.8	-5.4	7.9
C12	tobacco	0.6	-3.4	-3.4	-2.8	-9.5	3.1	-9.0	-9.6	-16.5	5.2
C13	textiles	1.5	-3.5	-3.3	-2.2	-14.8	3.5	-9.2	-25.1	-22.2	4.8
C14	clothing	1.3	-4.8	-4.7	-4.5	-7.4	4.0	-12.5	-15.8	-12.5	5.6
C15	leather	0.6	-4.6	-4.4	-3.7	-11.2	4.2	-12.2	-19.4	-17.6	6.0
C16	wood	1.9	-0.2	0.1	1.3	-12.6	4.1	-6.8	-21.2	-20.7	11.1
C17	paper	2.3	0.8	0.9	1.7	-7.3	3.2	-4.7	-12.7	-14.4	9.0
C18	printing&publishing	2.3	0.3	0.4	0.9	-4.9	2.5	-4.2	-10.4	-7.6	10.9
C19	coke&refine petrol.	2.2	0.0	0.2	0.4	-2.5	3.0	-5.6	-9.1	-9.4	9.5
C20	chemical	5.7	1.0	1.2	2.2	-9.2	3.5	-4.7	-16.9	-19.9	10.0
C21	pharma	3.7	5.0	5.0	5.2	2.7	3.3	-1.3	5.5	-3.6	11.0
C22	rubber & plastic	4.1	0.7	0.9	2.1	-10.8	3.5	-4.9	-20.1	-20.9	11.7
C23	non-methalic prod.	4.1	-0.6	-0.3	1.0	-13.5	3.3	-5.6	-26.2	-26.3	9.3
C24	basic metals	3.9	-1.2	-0.6	1.0	-16.2	5.2	-9.3	-30.2	-36.7	11.7
C25	metal products	8.3	0.0	0.4	1.7	-12.4	4.3	-6.9	-27.8	-26.7	10.8
C26	computer & electronics	4.5	2.2	2.7	3.8	-8.1	6.7	-9.7	-23.2	-19.9	19.7
C27	electrical eq.	4.0	0.4	0.7	1.8	-10.5	4.3	-6.7	-25.1	-24.4	10.2
C28	machinery	8.4	0.0	0.6	1.7	-11.2	5.5	-9.4	-29.4	-29.1	11.7
C29	motor cars	7.4	0.8	1.5	3.4	-17.9	6.6	-9.7	-34.3	-38.0	19.1
C30	other transport	2.0	0.2	0.4	0.8	-2.9	4.2	-7.6	-12.1	-12.2	10.5
C31	furniture	1.9	-0.9	-0.7	0.3	-11.4	3.3	-6.3	-23.4	-19.8	8.1
C32	other manuf.	2.0	0.2	0.4	0.7	-3.0	4.9	-9.0	-6.3	-17.3	7.8
C33	repair& installat. machinery	3.0	-1.6	-1.3	-1.4	0.2	8.5	-18.3	-9.3	-26.3	10.8
D	electricity & gas	8.9	1.0	1.1	1.6	-3.4	2.2	-2.9	-7.9	-8.8	6.5

This table shows: share in industrial value added and cumulative growth rate (1990-2009). Based on the monthly growth rates (t/t-12) the table also shows: mean (over whole period), mean (until crisis), mean (over crisis months), standard deviation (until crisis), maximum, minimum, "mean–2*standard deviation" and the percentage of production lost during the crisis (February 2008-September 2009). The "mean-2*standard deviation" is calculated for the period before the crisis. The total loss refers to the decrease in production between the last peak of the cycle and the last month available.

Source: Commission services

Table A.2.1.3: Capacity utilisation (% of full capacity)

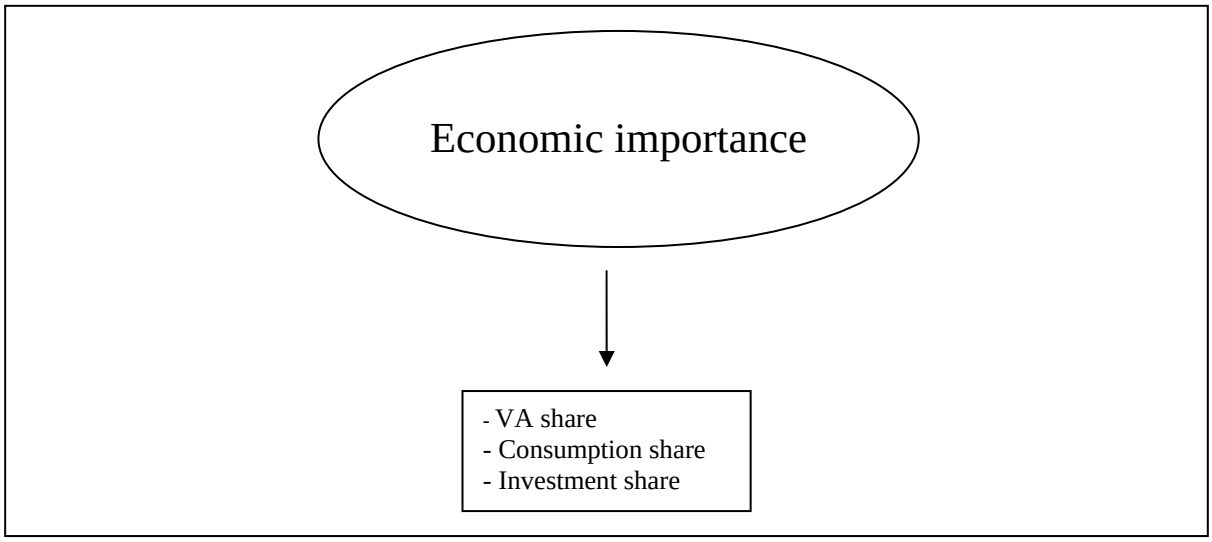
		1992-1993		Lowest level		Last observation			Highest level	
Code	Sector	Time	Capacity utilisation	Time	Capacity utilisation	Time	Capacity utilisation	Average level	Time	Capacity utilisation
TOTA	TOTAL Manufacturing (CONS + INVE + INTM)	1993-Q3	77.1	2009-Q3	70.2	2009-Q3	70.2	81.3	1990-Q1	85.3
CONS	Consumer Goods (CDUR + CNDU)	1993-Q2	78.6	2009-Q3	74.7	2009-Q3	74.7	80.2	1990-Q2	86.1
INVE	Investment Goods	1993-Q3	77.0	2009-Q3	67.7	2009-Q3	67.7	81.5	1990-Q1	86.1
INTM	Intermediate Goods	1993-Q4	75.8	2009-Q3	68.5	2009-Q3	68.5	83.2	2008-Q1	88.6
CDUR	Durable Consumer Goods	1993-Q3	79.5	2009-Q2	71.1	2009-Q3	72.7	81.2	1990-Q3	89.9
CNDU	Non Durable Consumer Goods	1993-Q3	79.1	2009-Q3	74.8	2009-Q3	74.8	80.2	1990-Q1	88.8
15	Manufacture of food products, beverages and tobac	1992-Q4	78.9	2009-Q3	74.4	2009-Q3	74.4	79.3	1991-Q2	83.5
17	Manufacture of textiles	1993-Q3	76.4	2009-Q2	66.3	2009-Q3	66.5	78.5	1990-Q1	84.5
18	Manufacture of wearing apparel; dressing and dyein	1993-Q3	79.3	2009-Q2	72.9	2009-Q3	74.3	80.6	1992-Q3	84.5
19	Manufacture, dressing and tanning of leather and le	1991-Q2	78.4	2009-Q3	70.3	2009-Q3	70.3	79.5	1995-Q4	82.9
20	Manufacture of wood and wood products	1992-Q2	77.9	2009-Q1	70.3	2009-Q3	70.9	80.7	2007-Q1	85.7
21	Manufacture of pulp, paper and paper products	1992-Q2	80.5	2009-Q2	76.7	2009-Q3	77.6	84.8	1998-Q1	88.1
22	Publishing, printing and reproduction of recorded me	1992-Q2	78.8	2009-Q3	75.1	2009-Q3	75.1	81.1	1990-Q3	85.8
23	Manufacture of coke, refined petroleum products an	NA	NA	1997-Q3	78.2	2008-Q4	82.1	85.5	2008-Q3	92.3
24	Chemical industry	1993-Q3	77.3	2009-Q2	73.8	2009-Q3	74.3	81.6	1995-Q2	85.8
25	Manufacture of rubber and plastic products	1993-Q3	78.0	2009-Q2	67.3	2009-Q3	68.2	80.8	1995-Q1	85.7
26	Manufacture of other non-metallic mineral products	1993-Q4	76.2	2009-Q3	69.0	2009-Q3	69.0	80.4	2007-Q1	85.9
27	Manufacture of basic metals	1993-Q4	75.5	2009-Q3	59.0	2009-Q3	59.0	83.7	1997-Q4	90.4
28	Manufacture of metal products except machinery an	1993-Q4	74.1	2009-Q3	66.0	2009-Q3	66.0	79.7	1990-Q1	85.7
29	Manufacture of machinery and equipment n.e.c.	1993-Q4	76.1	2009-Q3	68.0	2009-Q3	68.0	82.8	1990-Q2	89.0
30	Manufacture of office machinery and computers	1992-Q2	72.5	2007-Q1	66.6	2008-Q4	85.2	78.8	1995-Q4	88.8
31	Manufacture of electrical machinery and apparatus	1993-Q3	79.4	2009-Q3	69.6	2009-Q3	69.6	81.5	2006-Q4	86.0
32	Manufacture of radio, television and communication	1993-Q3	77.3	2009-Q2	74.6	2009-Q3	75.2	80.7	2000-Q4	87.8
33	Manufacture of medical, precision and optical instru	1992-Q2	79.3	2009-Q3	76.3	2009-Q3	76.3	83.8	2001-Q1	88.1
34	Manufacture of motor vehicles, trailers and semi-tra	1993-Q3	73.8	2009-Q2	60.3	2009-Q3	62.2	85.3	2008-Q1	91.8
35	Manufacture of other transport equipment	1994-Q1	70.1	1994-Q1	70.1	2008-Q4	89.0	81.8	2007-Q1	89.3
36	Manufacturing industries n.e.c.	1993-Q2	78.2	2009-Q3	69.7	2009-Q3	69.7	79.4	2000-Q1	83.5

Source: Commission services

Annex 2-2: Market monitoring

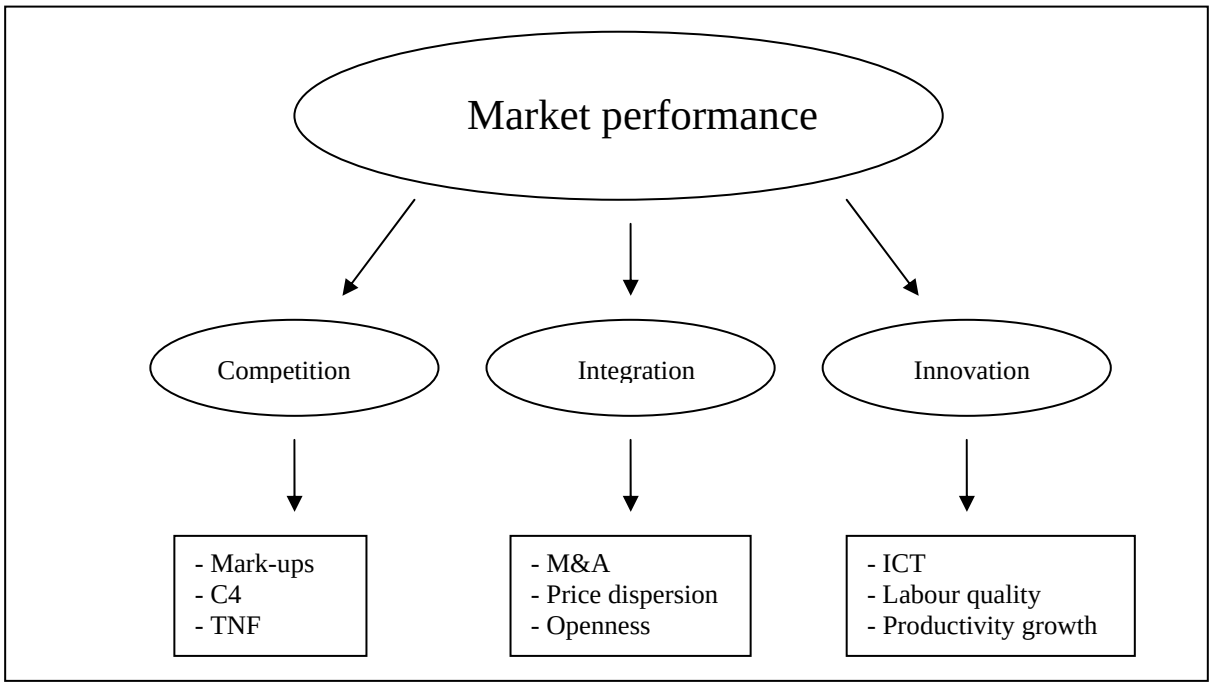
The screening stage of the market monitoring methodology consists of an analysis of economic importance and market performance. Economic importance is based on value added, consumption and investment shares (see Figure A.2.2.1) and market performance is represented by indicators of competition, integration and innovation (see Figure A.2.2.2). The aim of the screening stage is to have a limited number of priority sectors which will undergo a "deep-dive" study in the in-depth investigation stage.

Figure A.2.2.1: Economic importance



Specifically, economic importance is specified by value added shares, final household consumption expenditure shares and investment shares, represented by gross fixed capital formation (GFCF). These three figures are normalised and then the average is taken so as to have a composite indicator for economic importance.

Figure A.2.2.2: Market performance



Market performance corresponds to three areas, namely competition, integration and innovation, each of which have three indicators each and are given equal weights. This is to ensure each category is equally represented. Competition is proxied by mark-ups, concentration rates (C4) and a "total number of different firms" (TNF) index. Integration is represented by the number of merger and acquisitions (M&A), price dispersion rates and an openness indicator, specifically intra- and extra-EU exports plus imports as a percentage of total production. Finally, innovation is proxied by ICT, labour quality and labour productivity growth. Each of the indicators are normalised and then an average is taken for each category. The averages are then combined into a composite indicator by an overall average and this gives the figure for the market performance.

The ***economic importance*** indicators are:

- Value added share
- Consumption share
- Investment share

Value added share is the share (%) of a sector in total gross value added at current basic prices. The overall share in EU value added was calculated by adding the normalised sectoral contributions to total EU value added for EU-25. The data are taken from the EU KLEMS database, March 2008 release and correspond to data for the year 2005.

Consumption share is the share (%) of each sector in total final consumption expenditure by households. The structure of consumption is from input-output tables and is based on an aggregate of sixteen EU countries with the years listed: Austria (2005), Czech Republic (2005), Denmark (2005), Estonia (2005), Finland (2005), France (2006), Germany (2006),

Greece (2005), Hungary (2005), Italy (2005), Poland (2000), Portugal (2005), Romania (2006), Slovenia (2005), Spain (2005), Sweden (2005).

Investment share is the share (%) of each sector in total Gross Fixed Capital Formation (GFCF). The structure corresponds to an aggregate of sixteen EU countries. These are Austria (2005), Czech Republic (2005), Denmark (2005), Estonia (2005), Finland (2005), France (2006), Germany (2006), Greece (2005), Hungary (2005), Italy (2005), Poland (2000), Portugal (2005), Romania (2006), Slovenia (2005), Spain (2005), Sweden (2005).

The source for both consumption and investment shares is Eurostat's Input-Output tables. The final demand consumption by households and Gross Fixed Capital Investment vectors were aggregated using PPS for GDP. As regards GFCF, it is important to mention that this data do not refer to investment by each sector, but to the breakdown of total GFCF into the different types of investment goods and services. Again, only sixteen Member States are covered by both consumption and investment shares as these are the countries that have the most recent required information in the input-output tables. Older data from Poland is used in order to have a representative from the new Member States.

The three indicators are selected so as to take account of the production, investment and consumption perspectives of the economy however it should be noted that there is a somewhat high correlation between value added share and investment share of 50% approximately.

Figure A.2.2.3(i): Pairwise correlation among indicators of economic importance

	Value added	Household consumption	GFCF
Value added	1		
Household consumption	0.3497**	1	
GFCF	0.5022***	-0.097	1

***, **, * are significance at 1%, 5% and 10%, respectively

Figure A.2.2.3(ii): Spearman rank correlation among indicators of economic importance

	Value added	Household consumption	GFCF
Value added	1		
Household consumption	0.4856***	1	
GFCF	0.382**	-0.069	1

***, **, * are significance at 1%, 5% and 10%, respectively

The ***competition*** indicators are:

- Mark-ups
- Concentration ratios
- Total number of different firms index

Mark-ups are the ratio of the difference between price and marginal cost over price and are taken from an ECB paper by Christopoulou and Vermeulen (2007). The data estimate mark-ups for fifty sectors in eight euro area countries and the US over the period 1981-2004. The

estimates are obtained by applying the methodology developed by Roeger (1995)[41] to the EU KLEMS dataset. The assumptions on which this estimation is based are profit maximisation, cost minimisation and constant returns to scale. A negative normalised value is taken for mark-ups since the lower the mark-up, the greater the competition. Whilst eight euro area Member States is less than sufficient coverage of the EU, to our knowledge, no other data are available covering more Member States.

Concentration ratios are the four-firm concentration ratio (*C4*), i.e. the cumulative market share of the four largest firms in a sector. The market share of company *j* in sector *i* is defined as the ratio of the company's turnover (reported at market prices) in sector *i* to total sector turnover (i.e. the sum of the turnover of all the companies in the sector).[42] The indicator is computed with data from the Orbis database for the year 2007.[43] Negative normalised values are also used for this indicator since the lower the concentration ratio, the higher the degree of competition.

The "total number of different firms index" (*TNF*) is defined here as the ratio of the number of firms that have belonged to the group of the four largest firms in the five years between 2003 and 2007 divided by the maximum number of different firms (i.e. 20) that could have potentially been included in this group during this period. It follows the methodology used in London Economics (2007) and the data are extracted from the Orbis database.

The first two indicators were chosen because they are the most commonly used measures of competition and TNF is a relatively new and innovative method of measuring churning among the top four firms in an industry. There is a low correlation among these three indicators hence the composite competition indicator is picking up different aspects of competition.

Figure A.2.2.4(i): Pairwise correlation among indicators of competition

	Mark-ups	C4	TNF
Mark-ups	1		
C4	-0.0407	1	
TNF	0.1954	-0.255*	1

***, **, * are significance at 1%, 5% and 10%, respectively

Figure A.2.2.4(ii): Spearman rank correlation among indicators of competition

	Mark-ups	C4	TNF
Mark-ups	1		
C4	-0.1224	1	
TNF	0.2188	-0.2636*	1

[41] The Roeger methodology on mark-ups assumes constant returns to scale. This assumption is less problematic in the context of the exercise since manufacturing and services sectors are compared to their respective averages and not the overall average.

[42] Each company in the database is assigned to a particular NACE sector. There are drawbacks with this procedure as the turnover of a company will be allocated to a single industry while it can be active in several industries.

[43] It should be noted that since the version of Orbis used to calculate the concentration ratios does not cover small companies thus the four firm concentration ratios are upwardly biased.

***, **, * are significance at 1%, 5% and 10%, respectively

The ***integration*** indicators are:

- Openness
- Mergers and acquisitions
- Price dispersion

Openness is defined as percentage (%) of total production by sector that is exported and imported. The data correspond to an aggregate of sixteen EU countries, namely Austria (2005), Czech Republic (2005), Denmark (2005), Estonia (2005), Finland (2005), France (2006), Germany (2006), Greece (2005), Hungary (2005), Italy (2005), Poland (2000), Portugal (2005), Romania (2006), Slovenia (2005), Spain (2005), Sweden (2005). The indicator measures exports and imports to the rest of the world and within the EU. Exports to non-EU countries were calculated from the input-output data on total exports using data from Eurostat's COMEXT and the Trade in services databases. The source is the Eurostat input-output tables and the aggregation was produced using PPS for GDP.[44]

Mergers are acquisitions are the number of intra-EU cross-border M&A deals divided by the total (domestic and cross-border) number of M&A deals. The data are taken from the Thomson Financial Services database on mergers and acquisitions activity and cover only intra-EU M&A activity.[45] The indicator was calculated as an average over the period 2003 to 2008 for EU-25.[46]

Price dispersion is calculated as the coefficient of variation of prices for a given sector, i.e. the ratio of the standard deviation and average price across EU countries. Consumer price data according to the COICOP classification developed by Eurostat are used.[47] Ideally producer price data should be used but such data are unavailable. The fact that these price data refer to final goods sold to consumers (therefore including the mark-up added by the

[44] Input-output tables are not available for all Member States hence this figure can only be calculated for those reporting sufficient information in input-output tables.

[45] There are some drawbacks associated with this database which are important to consider. First, the M&A data used refer to a count of the number of deals and do not provide information on the value of these deals. Using value data is not advisable given that only around 40% of the values of the total M&A deals covered in the database are reported. Second, the number of deals may be inflated by the methodology used in the construction of the database; if a firm acquires the entire target company at once, this is counted as one deal, whereas if a firm acquires a target company in successive steps over several years, the buy-out of this company will be counted in the database as several deals.

[46] It should be noted that a bias may exist due to the timing of sector restructuring; sectors that underwent consolidation prior to 2003 will be identified as being less integrated than those that restructured between 2003 and 2008, the identified period in this case.

[47] Given that the market screening phase of the exercise relied on the NACE classification of sectors, it was necessary to establish a link between the COICOP price categories and the NACE classification. The availability of price data according to the COICOP classification does not allow us to obtain prices at the disaggregated product level. As a consequence, several COICOP categories correspond to one NACE sector only. This is why the average of the COICOP price categories for a given NACE sector was taken to represent the price for that sector.

retail outlets as well as taxes such as VAT) is one important drawback of this dataset. Another is that since the data refer to retail consumer prices, they are not appropriate for assessing the price dispersion of intermediate goods. In fact, some of the NACE sectors do not have an equivalent in the COICOP price category, for example "Basic metals" (27) and "Recycling" (37). The data are calculated for the 1999-2008 period for EU-27.

The three integration indicators measure how well the internal market of the EU is integrated and how open it is to the rest of the world. The first indicator is a broad measure of openness and was chosen because of this over more restricted indicators that focus solely on either exports or imports. The M&A indicator measures intra-EU activity and an average is taken so as to smooth business cycle fluctuations. Finally, price dispersion measures the convergence of prices to the EU average. A period average is also taken here so as to avoid variations stemming from business cycle movements and a negative normalised value is taken of this indicator as the lower the price dispersion, the more integrated the market. A low correlation between the three integration variables is confirmed.

Figure A.2.2.5(i): Pairwise correlation among indicators of integration

	Openness	M&A	Price dispersion
Openness	1		
M&A	0.3238*	1	
Price dispersion	-0.0995	0.339*	1

***, **, * are significance at 1%, 5% and 10%, respectively

Figure A.2.2.5(ii): Spearman rank correlation among indicators of integration

	Openness	M&A	Price dispersion
Openness	1		
M&A	0.5740***	1	
Price dispersion	-0.1872	-0.1649	1

***, **, * are significance at 1%, 5% and 10%, respectively

The ***innovation*** indicators are:

- Quality of labour index
- ICT
- Labour productivity growth

The quality of labour index is the contribution of the changes in the composition of the labour force in terms of skill categories of workers (high, medium, low) to value added growth. This is computed as an average for the EU from 2001 to 2005 inclusive to minimise business cycle influences. The data are extracted from the EU KLEMS database and data for the EU refer to Austria, Belgium, Denmark, Finland, France, Germany, Italy, Spain, the Netherlands and the UK.

ICT is the contribution to value added growth of ICT investment in office and computing equipment, communication equipment and software. It is computed as an average for the EU for the years 2001 to 2005 to reduce the business cycle influence. The data are taken from the

EU KLEMS database and data for the EU refer to Austria, Belgium, Denmark, Finland, France, Germany, Italy, Spain, the Netherlands and the UK.

Labour productivity growth is defined as gross value added per hour worked by sector. Data is taken from the EU KLEMS database for the EU-25 and an average over the period 1995 to 2005 is calculated to diminish business cycle movements.

The first two indicators only represent ten EU countries but no alternative indicators, to our knowledge, are available on skill levels and ICT that would allow for data on both manufacturing and services sectors to be calculated. Labour productivity is preferred to total factor productivity (TFP) as the TFP data only cover ten EU countries and are not available for sectors 3637 and E; labour productivity growth covers the EU-25. Averages are also taken of the indicators to take account of business cycle fluctuations and there is a relatively low correlation between the variables.

Figure A.2.2.6(i): Pairwise correlation among indicators of innovation

	Labour quality	ICT	Labour productivity growth
Labour quality	1		
ICT	0.2444	1	
Labour productivity growth	0.0197	0.1566	1

***, **, * are significance at 1%, 5% and 10%, respectively

Figure A.2.2.6(ii): Spearman rank correlation among indicators of innovation

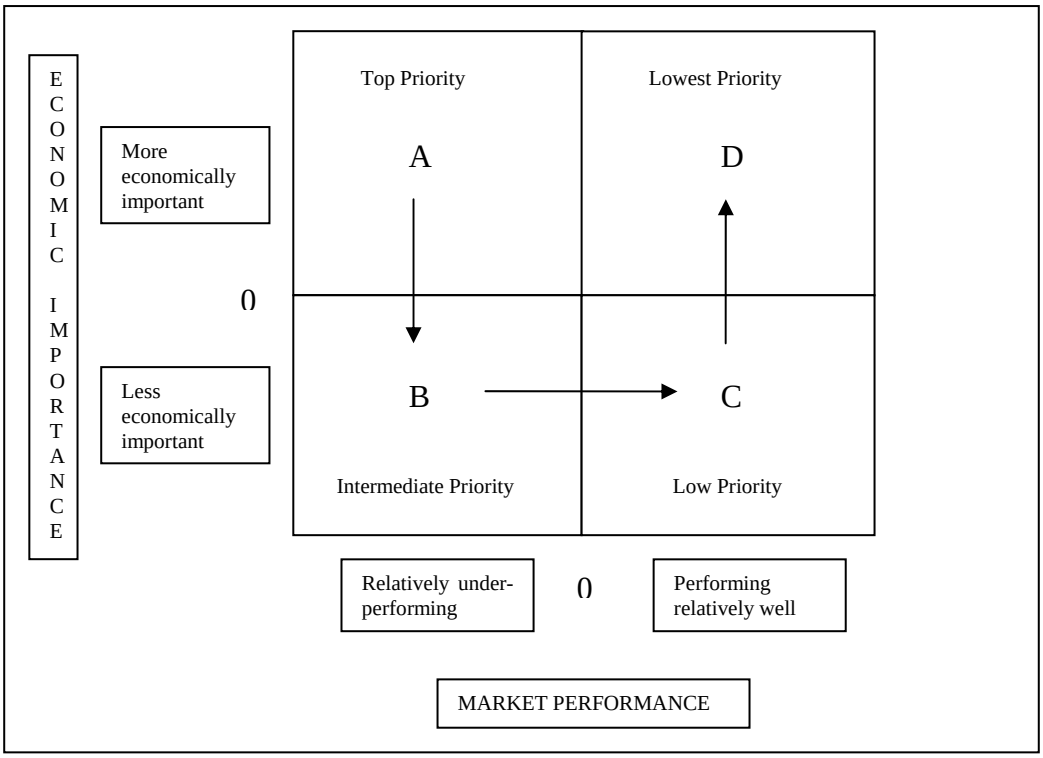
	Labour quality	ICT	Labour productivity growth
Labour quality	1		
ICT	0.2138	1	
Labour productivity growth	0.3418**	0.2348	1

***, **, * are significance at 1%, 5% and 10%, respectively

The exercise presents all two-digit sectors on two separate scatter plot graphs, split between manufacturing and services.[48] The y-axis represents the composite indicator of economic importance and the x-axis denotes the composite indicator of market performance. The benchmark is the average of EU manufacturing and services separately. The core selection diagram is shown in Figure A.2.2.7.

[48] Construction is included with services sectors as it is closer in characteristics to them. This is confirmed by repeating the screening exercise and including construction with the manufacturing sectors where it is shown to be a clear outlier.

Figure A.2.2.7: Core selection diagram



A scatter plot is drawn where sectors are split into manufacturing and services sectors separately and compared to each other. A vertical line and a horizontal line are drawn at zero so as to highlight those sectors which are performing relatively well or poorly and are either relatively economically important or not, depending on the respective EU averages. Thus, sectors falling into quadrant A are those sectors in most need of attention since they are both economically important and are performing relatively poorly. Sectors in quadrants C and D are the best performing sectors but those in quadrant D have relatively higher economic importance. Sectors in quadrant B are also performing quite badly but are of less economic importance than those in quadrant A.

However, for other reasons than those specified in the composite indicators, such as environmental issues, consumer welfare or regulatory problems, a small number of sectors in quadrant B can also be selected for further in-depth investigations. The reason for this is that it would be unwise to select sectors for "deep dive" studies in such a mechanical way as to solely focus on quadrant A. Therefore, as an addition to the core selection of sectors through economic importance and market performance, the aforementioned policy perspectives are subsequently taken on board. Information can be obtained through product market regulation indicators and environmental surveys for the first two, and the consumer perspective can be acquired through DG SANCO's Consumer Market Scoreboard.[49]

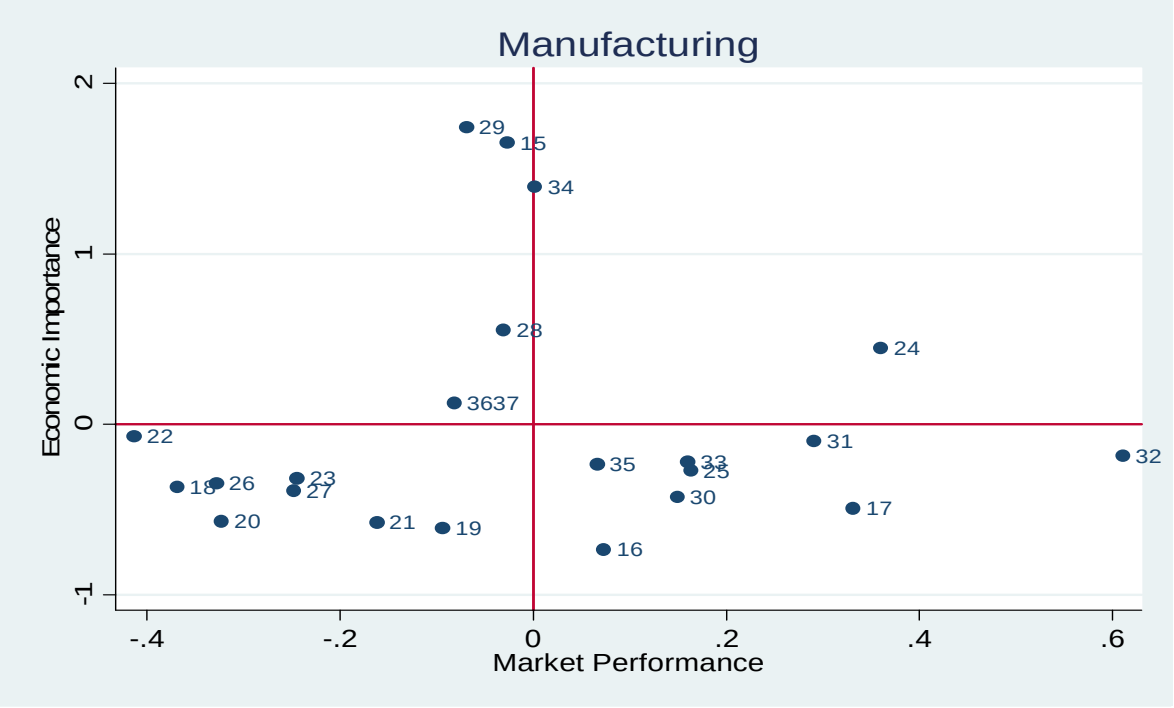
[49] http://ec.europa.eu/consumers/strategy/facts_en.htm#CMS

The advantage of this methodology is that it also allows for more flexibility when choosing sectors which are to undergo a detailed analysis and policy viewpoints supplement the economic information represented in the two-dimensional graph. Focussing on sectors in quadrant A only has the advantage of leading to a high degree of prioritisation. However, it could be interesting to refer some sectors in quadrant B for in-depth investigation, especially if there are important regulatory, environmental or consumer challenges. Thus, this flexible methodology allows for both a quantitative analysis and qualitative judgements to be considered in advance of selecting sectors for "deep dive" studies, whilst at the same time pointing to priority areas.

The results of the screening stage, carried out at the EU level, are shown in Figures A.2.2.8 and A.2.2.9 as the analysis is undertaken separately for manufacturing and services. Sectors in quadrant A are deemed to be a priority but a few sectors in quadrant B could also be selected.

As can be seen from Figure A.2.2.8[50], the manufacturing sectors which are most economically important but perform the most poorly according to the specified indicators are machinery n.e.c., food products and beverages, motor vehicles, fabricated metal products and furniture; recycling. These details are summarised in Figure A.2.2.9 with more stars indicating more problems in the particular area concerned.[51]

Figure A.2.2.8: Results for manufacturing sectors[52]



Source: Commission services

[50] All NACE sector codes are shown in Figure A.2.3.1.

[51] Each star implies that the indicator is significantly below its EU manufacturing average.

[52] The x-axis represents the average normalised values of the market performance indicators; the y-axis represents the average normalised values of the economic importance indicator.

Figure A.2.2.9: Overview of manufacturing sectors in quadrant A

Indicator	Food & beverages	Fabricated metal products	Machinery	Motor vehicles	Furniture; recycling
Integration	*	*			*
Competition			*	*	
Innovation	***	*	**	*	*

The innovation indicator is deemed to be problematic in all the initially selected sectors, though it is more severe in some than in others. The competition and innovation indicators are much less problematic for these five manufacturing sectors. In addition, none of these selected sectors are classified as high technology, these sectors, which are office and computing machinery, radio, television and communication equipment and medical and optical instruments, are found in the quadrant that is relatively well functioning but less economically important than the average. Hence, on the positive side, the most high technology industries in the EU are functioning relatively well however on the negative side, they are of less economic importance than average.[53] The results are not entirely driven by innovation indicators as office and computing machinery performs well in terms of openness, M&A and mark-ups. Radio, television and communication equipment is a well integrated sector as regards openness and price dispersion. Medical and optical instruments also performs well in terms of integration with openness being among the highest for manufacturing sectors and M&A and TNF also functioning relatively well.

The list of manufacturing sectors falling into each of the four quadrants is shown in Figure A.2.2.10. Sectors in quadrant A are the priority sectors in terms of the core screening diagram. The sector in quadrant D is the best performing sector of the EU manufacturing industries.

Figure A.2.2.10: Manufacturing sectors by quadrant

Manufacturing sectors			
A	**B**	**C**	**D**
15: Food products and beverages	18: Wearing apparel; dressing and dyeing of fur	16: Tobacco products	24: Chemicals and chemical products
28: Fabricated metal products	19: Leather, leather products and footwear	17: Textiles	
29: Machinery n.e.c.	20: Wood and products of wood and cork	25: Rubber and plastic products	

[53] Given that high technology sectors will by definition be more innovative than average, these sectors are compared to the US averages: Sector 30: ICT: -0.4 (EU) 0.08 (US); labour quality: -0.25 (EU) 0.76 (US); productivity: 140% (EU) 15051% (US); Sector 32: ICT: 0.76 (EU) 0.04 (US); labour quality: 0.5 (EU) 0.26 (US); productivity: 206% (EU) 471% (US); Sector 33: ICT: -0.04 (EU) 0.16 (US); labour quality: 0.57 (EU) 1.04 (US); productivity: 50.2% (EU) 38.6%. Thus, despite performing well in comparison to other EU sectors, high technology sectors in the EU underperform those in the US.

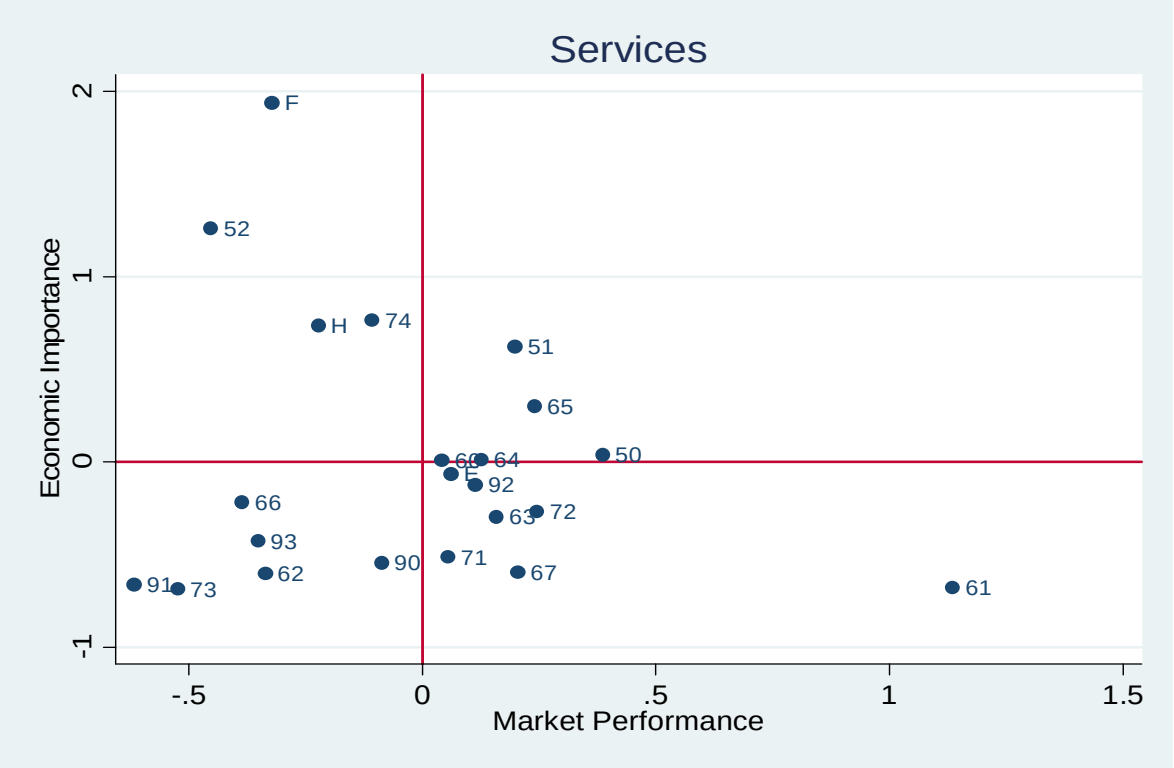
34: Motor vehicles, trailers and semi-trailers 36t37: Furniture; Recycling	21: Pulp, paper and paper products 22: Printing, publishing and reproduction 23: Coke, refined petroleum products and nuclear fuel 26: Other non-metallic mineral products 27: Basic metals	30: Office, accounting and computing machinery 31: Electrical machinery and apparatus n.e.c. 32: Radio, television and communication equipment 33: Medical, precision and optical instruments 35: Other transport equipment	

Chemicals and chemical products perform well overall, especially in terms of ICT and labour quality. Radio, television and communication equipment also performs well but has a lower economically important score than the chemicals sector. Low price dispersion rates account for the good performance in electrical machinery, along with a low concentration ratio and high TNF. Sectors which could be selected for further in-depth screening based on other external factors include printing and publishing, pulp and paper, coke and refined petroleum products, basic metals and wearing apparel i.e. sectors in quadrant B. Taking account of various policy perspectives may also reinforce sectors highlighted in quadrant A such as environmental policies for motor vehicles and recycling.

Sectors performing relatively poorly in terms of the chosen indicators for services in the EU, shown in Figure A.2.2.11, are retail trade, hotels and restaurants, other business activities, which includes legal, accounting, taxation, consultancy, architectural and advertising activities and construction. Retail trade has below average innovation rates, ICT, labour quality and labour productivity growth, but its poorest indicator is integration, especially in terms of openness. It is economically important due to the high household consumption shares. Hotels and restaurants also have large household consumption shares and the performance problems are mainly due to inferior innovation indicators, specifically labour productivity growth. Other business activities are knowledge-intensive and identified as being economically important mainly due to high value added shares but labour productivity growth is very low in this sector. Finally, construction is economically important based on high value added and investment shares. Its poor performance is a factor of low innovation scores, especially as regards labour productivity growth and an obvious low openness indicator. The details of the sectors falling into quadrant A, as regards market performance, are summarised in Figure A.2.2.12 where more stars indicate problems in that particular area.[54]

[54] Each star implies that the indicator is significantly below its EU services average.

Figure A.2.2.11: Results for services sectors[55]



Source: Commission services

Figure A.2.2.12: Overview of services sectors in quadrant A

Indicator	Retail trade	Other business activities	Construction	Hotels & restaurants
Integration	**	**	*	**
Competition	*		*	*
Innovation	**	***	***	***

The priority services sectors show innovation to be the most problematic market performance indicator with at least two, and in most cases three, out of three indicators being below the EU services average. The integration indicator is also an issue for each of the four sectors and but the competition indicator is less problematic, though prevalent, in all but one of the sectors, which is other business activities.

The list of services sectors falling into the four quadrants is shown in Figure A.2.2.13. The best performing sectors according to the specified screening are listed in quadrant D but most services sectors fall into quadrant C with nine of the total twenty-two positioned in this quadrant.

[55] The x-axis represents the average normalised values of the market performance indicators; the y-axis represents the average normalised values of the economic importance indicator.

Water transport (NACE 61) performs very well due to high levels of intra- and extra-EU imports and high labour productivity growth. Sectors that may merit in-depth investigations are those in quadrant B such as insurance, air transport, research and development and sewage and refuse disposal. The insurance sectors problems stem from both low innovation and integration indicators, specifically low labour productivity growth and a low openness indicator. Air transport is a concentrated sector and therefore has a low scoring competition indicator. Research and development suffers from both low innovation scores, in terms of labour productivity growth, and low competition scores, in terms of mark-ups and concentration ratios. Sewage and refuse disposal has low labour productivity growth. Taking account of consumer and climate change policies may reinforce the selection of sectors in quadrant A such as construction.

Figure A.2.2.13: Services sectors by quadrant

Services sectors			
A	**B**	**C**	**D**
52: Retail trade, except of motor vehicles and motorcycles; repair of household goods	62: Air transport	60: Inland transport	50: Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel
74: Other business activities	66: Insurance and pension funding, except compulsory social security	61: Water transport	51: Wholesale trade and commission trade, except of motor vehicles and motorcycles
F: Construction	73: Research and development	63: Supporting and auxiliary transport activities; activities of travel agencies	65: Financial intermediation, except insurance and pension funding
H: Hotels and Restaurants	90: Sewage and refuse disposal, sanitation and similar activities	64: Post and Telecomms.	
	91: Activities of membership organisations n.e.c.	67: Activities related to financial intermediation	
	93: Other service activities	71: Renting of machinery and equipment	
		72: Computer and related activities	
		92: Recreational, cultural and sporting activities	
		E: Electricity, gas and water supply	

The best performing services sectors in terms of the selected indicators are sale and repair of motor vehicles, wholesale trade and financial intermediation. Sale and repair of motor vehicles is well placed as regards the competition indicator with below average mark-ups and concentration ratios. Integration and innovation scores are also shown to be well performing but the openness indicator is quite low, due to certain obvious integration issues, and labour productivity growth has improvement potential. Wholesale trade performs well for the integration and competition indicators but some problems are highlighted within the

innovation indicator, specifically in terms of labour quality. Both sale and repair of motor vehicles and wholesale trade are deemed to be economically important based on the household consumption share. Financial intermediation falls into quadrant D mainly due to its high innovation statistics in all three categories of ICT, labour quality and labour productivity growth. A high value added and final consumption share give it an above average economic importance score.

Most problems in both manufacturing and services sectors stem from the innovation indicators, specifically labour productivity growth but there are more issues identified within the selected services sectors than the selected manufacturing sectors. Thus, policies designed to remedy the difficulties in the manufacturing sectors may need to be less numerous than those in the services sectors. An overview of the main problems in the sectors highlighted in quadrant A is shown in Figure A.2.2.14.

Figure A.2.2.14: Overview of sectors in quadrant A

NACE code	Sector	Main problems			Annual growth during crisis (%)
		Innovation	***Competition***	***Integration***	
	Manufacturing				
29	Machinery	Labour quality; Labour productivity growth	TNF		-29.2
15	Food & beverages	ICT; Labour quality; Labour productivity growth		Openness	-0.4
34	Motor vehicles	Labour productivity	C4		-24.6
28	Fabricated metal products	Labour productivity		Openness	-22.2
3637	Furniture; recycling	Labour productivity		Openness	-11.1
	Services				
F	Construction	ICT; Labour quality; Labour productivity growth	TNF	Openness	
52	Retail trade	ICT; labour quality	TNF	Openness; M&A	
H	Hotels & restaurants	ICT; Labour quality; Labour productivity growth	C4	Openness	
74	Other business activities	ICT; Labour quality; Labour productivity growth	TNF	Openness; Price dispersion	

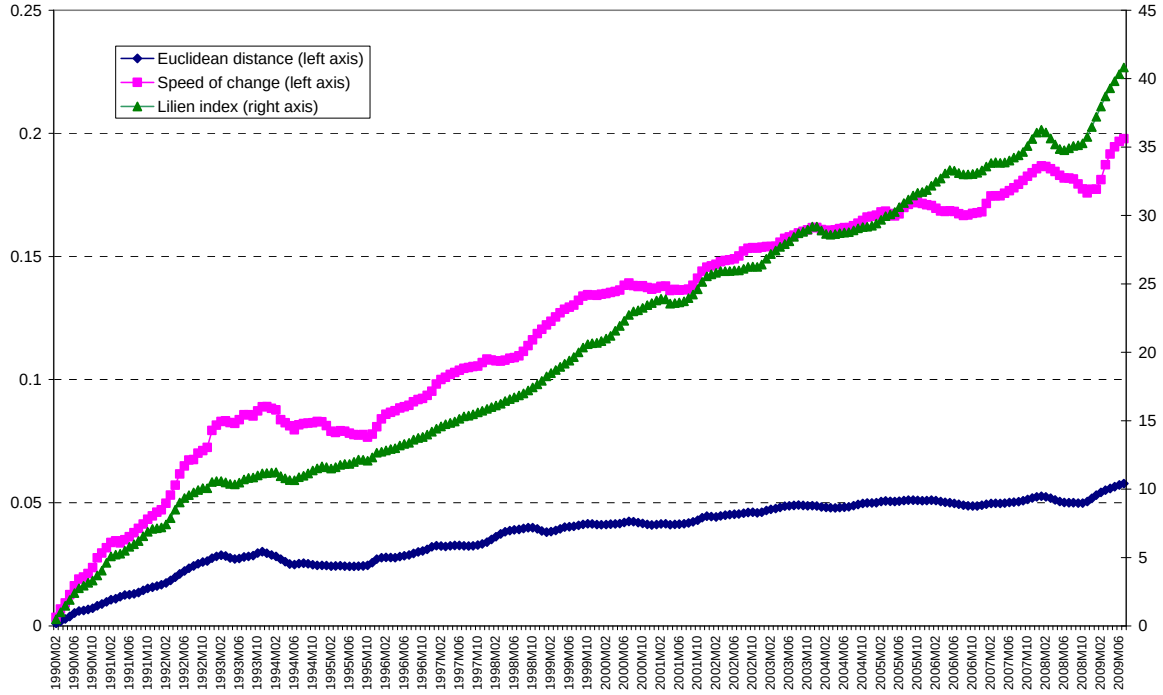
Annex 2-3: NACE Rev.1 codes

Figure A.2.3.1: 2-digit NACE Rev.1 industry classification

Code	
15	Food products and beverages
16	Tobacco products
17	Textiles
18	Wearing apparel; dressing and dyeing of fur
19	Leather, leather products and footwear
20	Wood and products of wood and cork
21	Pulp, paper and paper products
22	Printing, publishing and reproduction
23	Coke, refined petroleum products and nuclear fuel
24	Chemicals and chemical products
25	Rubber and plastic products
26	Other non-metallic mineral products
27	Basic metals
28	Fabricated metal products
29	Machinery n.e.c.
30	Office, accounting and computing machinery
31	Electrical machinery and apparatus n.e.c.
32	Radio, television and communication equipment
33	Medical, precision and optical instruments
34	Motor vehicles, trailers and semi-trailers
35	Other transport equipment
36t37	Furniture; Recycling
E	Electricity, gas and water supply
F	Construction
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles
52	Retail trade, except of motor vehicles and motorcycles; repair of household goods
H	Hotels and Restaurants
60	Inland transport
61	Water transport
62	Air transport
63	Supporting and auxiliary transport activities; activities of travel agencies
64	Post and Telecommunications
65	Financial intermediation, except insurance and pension funding
66	Insurance and pension funding, except compulsory social security
67	Activities related to financial intermediation
71	Renting of machinery and equipment
72	Computer and related activities
73	Research and development
74	Other business activities
90	Sewage and refuse disposal, sanitation and similar activities
91	Activities of membership organisations n.e.c.
92	Recreational, cultural and sporting activities
93	Other service activities

Annex 2-4: Structural changes

Figure A.2.4.1: Three indicators of structural change



Source: Commission services

Besides the Euclidean distance discussed in the text, the two other indicators shown in this figure are the "speed of change"[56] and the Lilien index calculated using the share at the beginning of the period analysed which is January 1990.

[56] Aiginger, K. (2000), The indicator is defined as: "Speed of Change" = $\sum| a_t - a_{t-n} |$, where a_t and a_{t-n} are shares in final year and starting year respectively.

Table A.2.4.2: Total Factor Productivity: growth in the EU[1] and distance to the US (2000-2005)

Sector	TFP annual growth (%)	US-EU[2]
TOTAL INDUSTRIES	0.1	1.1
Agriculture, hunting, forestry and fishing	0.5	1.5
Mining and quarrying	-2.8	-1.8
Food products, beverages and tobacco	-0.1	0.6
Textiles, textile products, leather and footwear	-0.5	4.3
Wood and products of wood and cork	1.4	0.9
Pulp, paper, paper products, printing and publishing	0.0	2.6
Coke, refined petroleum products and nuclear fuel	-5.3	6.2
Chemicals and chemical products	2.7	0.5
Rubber and plastics products	1.7	0.4
Other non-metallic mineral products	1.0	0.7
Basic metals and fabricated metal products	0.2	2.5
Machinery, nec	1.1	1.6
Electrical and optical equipment	2.5	8.8
Transport equipment	1.9	0.7
Manufacturing nec; recycling	-0.3	5.2
Electricity, gas and water supply	2.6	-1.7
Construction	-0.4	-0.8
Sale, maintenance and repair of motor vehicles	-0.1	3.4
Wholesale trade	1.0	0.9
Retail trade	0.4	1.7
Transport and storage	-0.4	2.1
Post and telecommunications	3.6	1.2
Financial intermediation	1.2	-0.5
Real estate activities	-0.3	0.6
Renting of machinery and other business activities	-1.3	3.0
Public admin and defence; compulsory social security	0.4	-0.1
Education	-1.4	0.7
Health and social work	0.3	-0.2
Other community, social and personal services	-1.1	2.2

1 The EU consists of Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Spain.

2 Difference in TFP annual growth rates: US *minus* EU

Source: EU KLEMS

Annex 2-5: Structural breaks in EU sectors

Structural Test for Industrial Production Series in Levels

The structural break tests have been carried out for manufacturing and services sectors by using series on levels of industrial production and turnover respectively. The test consists of estimating the following regression:

$$y_t = \mu + \theta DU_t + \beta t + \gamma DT_t + \sum_j c_j y_{t-j} + \varepsilon_t$$

where j=1,…,k. DU is a dummy variable which measures whether there has been a significant change in the intercept of the trend over time, with $DU_t = 1$ if t>T_B, 0 otherwise. DT is the dummy variable which measures whether there has been a significant shift in the slope of the trend over time with $DT_t = t - T_B$ if t>T_B, 0 otherwise, and t is a time trend. In terms of levels a structural break can therefore occur either due to a change in the intercept of the trend of the series, or to a change in the slope of the trend of the series or both. The test concerned here examines whether $H_0: \theta = \gamma = 0$ (no structural break in the series). Rejection of H_0 implies the existence of a structural break after September 2008.

Structural break test conducted for the current crisis (September 2008) and for December 2000 and July 2003 have been carried out using the same set of information, namely by replicating the tests for previous crises by using the same available amount of (monthly) data for the analysis on September 2008 and, thus, allowing comparability of the results.

Note that since the industrial production series contain a unit root, the use of the standard critical values for the F-test can lead to an over-rejection of the hypothesis of no structural break (Vogelsang, 1997).

Table A.2.5.1: Structural break tests for levels in manufacturing industries

Industry	F-stat 2008	F-stat 2000	F-stat 1992
Manufacture of food products	n.s.	n.s.	n.s.
Manufacture of beverages	***	n.s.	n.s.
Manufacture of tobacco	n.s.	n.s.	n.s.
Manufacture of textiles	***	*	*
Manufacture of wearing apparel	n.s.	n.s.	n.s.
Manufacture of leather and related products	n.s.	*	n.s.
Manufacture of wood and wood products	***	n.s.	**
Manufacture of paper products	***	n.s.	n.s.
Printing and publishing	***	n.s.	n.s.
Manufacture of coke	***	n.s.	n.s.
Manufacture of chemicals	***	***	n.s.
Manufacture of pharmaceuticals	n.s.	n.s.	**
Manufacture of rubber and plastics	***	*	**
Manufacture of non-metallic minerals	***	n.s.	***
Manufacture of basic metals	***	n.s.	n.s.
Manufacture of fabricated metal	***	n.s.	*
Manufacture of computer, electronic and optical instruments	***	***	*
Manufacture of electrical equipment	***	**	***
Manufacture of machinery and equipment nec	***	n.s.	n.s.
Manufacture of motor vehicles, trailers and semi-trailers	***	n.s.	n.s.
Manufacture of transport equipment	***	n.s.	**
Manufacture of furniture	***	n.s.	**
Other manufacturing	**	n.s.	n.s.
Repair and installation of machinery and equipment	n.s.	n.s.	n.s.
Electricity, gas steam and air conditioning supply	n.s.	n.s.	n.s.

***, **, * and n.s. represent 1%, 5%, 10% significance confidence levels and non significance respectively.

Source: Commission services

Table A.2.5.2: Structural break tests for levels in services sectors[57]

Services sector	F-stat 2008	F-stat 2000
Sale of motor vehicles; sale and repair of motorcycles	**	n.s.
Wholesale trade, except of motor vehicles and motorcycles	***	n.s.
Retail trade, except of motor vehicles and motorcycles	***	n.s.
Land transport and transport via pipelines	*	**
Water transport	***	**
Air transport	n.s.	n.s.
Warehousing and support activities for transportation	**	n.s.
Postal and courier activities	***	n.s.
Accommodation and food service activities	***	n.s.
Publishing activities	n.s.	n.s.
Motion picture, video and TV programme production	n.s.	*
Programming and broadcasting activities	***	n.s.
Telecommunications	n.s.	**
Computer programming, consultancy and related activities	n.s.	n.s.
Information service activities	n.s.	n.s.
Legal, accounting and management consultancy activities	***	n.s.
Architectural and engineering activities	**	*
Advertising and market research	***	*
Other professional, scientific and technical activities	***	n.s.
Employment activities	n.s.	n.s.
Travel agency, tour operator reservation service and related activities	n.s.	n.s.
Security and investigation activities	n.s.	n.s.
Cleaning activities	*	*
Office administrative, office support and other business support services	**	*

***, **, * and n.s. represent 1%, 5%, 10% significance confidence levels and non significance respectively.

Source: Commission services

[57] Due to lack of data the test could not be carried out on service sectors for the year 1992.

3. SECTORAL MEASURES TAKEN IN RESPONSE TO THE ECONOMIC CRISIS AS ILLUSTRATED BY THE CASE OF THE AUTOMOTIVE INDUSTRY

3.1. Sectoral evolutions in Member States

In autumn 2008, the financial crisis spread dramatically into the real economy through tighter credit conditions and collapsing confidence, leading to a sharp contraction in global demand and trade. Across the EU, the fall in GDP in the fourth quarter of 2008 and the first quarter of 2009 was particularly severe, furthermore Commission services estimate that real EU GDP in 2009 as a whole may fall by an average of around 4%. This reflects a severe drop in output and capacity utilisation as the sharp decrease in business and consumer confidence led to dramatic falls in demand in some consumer sectors – automotive, hotel and restaurants – and investment sectors – construction.

In EU Member States, manufacturing output has shrunk on the back of production decreases in intermediate, capital and investment sectors such as motor vehicles, basic metals, metals products, textile, wood and chemicals. In non-financial services, trade sectors are mostly affected (in particular trade in motor vehicles) while in construction, the construction of buildings has been more severely affected than civil engineering (construction of roads, railways and other utility projects). Overall, the contraction of GDP in the Member States is expected to be deepest in the EU countries most exposed to the financial crisis due to their large financial sector (e.g. the United Kingdom, Ireland and Luxembourg), exposed to the overvaluation of the housing markets (e.g. Ireland, Spain and the Baltic countries), or most exposed to the sharp contraction of world trade (e.g. Germany, the Netherlands, and Austria).

3.2. Sectoral measures as a response to the crisis

In response to the deteriorating economic situation, the European Commission first proposed a framework to deal with the financial crisis and promote a coordinated EU approach to rescue measures in the banking sector.[58] The spread of the crisis to the sectors in manufacturing and services then prompted public authorities to start introducing more measures, this time aimed at helping the real economy. Most of these measures were introduced under the European Economic Recovery Plan (EERP)[59] proposed by the Commission and adopted in December 2008 to ensure a coordinated EU response to the crisis.

The EERP set out to limit the accelerating deterioration of economies after September 2008, thereby avoiding massive wasteful labour shedding and destruction of technological know-how and human capital. The Plan called on Member States to devote 1.2% of GDP to the crisis and adopt short-term measures to support employment, infrastructural development, construction and business. At EU level, public funding in support of immediate actions (around 0.3 % of EU GDP) was proposed and public private partnerships (EIB, Member

[58] From October 2008, the European Commission adapted state aid rules to the measures applied in the financial institutions. Other documents relating to the financial institutions (recapitalisation, treatment of impaired assets) were issued in late 2008-early 2009 as well as the communication on the return to viability of 23 July 2009. See http://ec.europa.eu/competition/state_aid/legislation/temporary.html for all the state aid measures taken after the financial and economic crisis.

[59] European Commission, From financial crisis to recovery: A European framework for action. COM(2008)706, 25.10.2008.

States, businesses) for "green" products (cars, construction) were set up. In addition, a large number of Member States proposed and adopted measures to support the real economy; these covered labour markets (including measures to protect vulnerable groups), investment, and businesses (see Annex 3.1). At the same time, the Commission adopted a Temporary Framework authorising Member States to grant supplementary state aid to support access to finance.[60] Most EERP measures were introduced at the end of 2008 or beginning of 2009.

In this context, some Member States introduced schemes allowing policy support for the sectors most seriously hit by the crisis. It is the first time since the mid-1980s that significant sectoral packages have been designed in Europe on such a large scale. While the worst affected sectors are broadly the same in all Member States, there is considerable variation between Member States in terms of the support actually provided, both in terms of sectoral composition and regarding the mix between supply and demand measures. Sectoral measures account for one third of all measures to support business.[61] They have consisted of various instruments aiming to ease access to finance and to support demand in specific sectors hit particularly hard by the crisis (see Annex 3-2 for details), in particular tourism, construction and, above all, automotive industry, which has received significant demand and supply support at both national and EU level. Such a public intervention in favour of industrial sectors reverses a decades' orientation towards horizontal state aids.[62]

The bulk of measures supporting the automotive industry have generally been adopted by Member States where the industry plays an important role in the economy[63], notably France, Germany, Italy, Spain and the UK but also Luxemburg, the Netherlands, Portugal, Slovakia and Romania. Measures to support tourism were also introduced, mostly countries in southern Europe where the size of the sector is meaningful (Cyprus, Malta, Portugal, Greece).

3.2.1. Political economy considerations for sectoral measures: general

In a perfectly functioning market, sectoral supply measures are not justified as they distort competition and lead to resource misallocation. This is why, unlike the ESCS Treaty[64] which gave prominence to industrial policy, the Treaty on the Functioning of the EU (TFEU) does not provide for any specific circumstances entailing substantial sectoral intervention. Instead, Article 173 of the TFEU puts competitiveness at the heart of industrial policy and encourages the use and compatibility of horizontal instruments to achieve this goal.

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[60] Communication from the Commission. Temporary framework for State aid measures to support access to finance in the current financial and economic crisis - 17 December 2008. 2009/C 16/01.

[61] Two thirds of the measures adopted by Member States to support business have been horizontal and focused on the need to cope with credit tightening and to ease access to finance. The measures taken include the extension of volumes and conditions of credit guarantees, including export credit, particularly for SMEs and the increase in the capital of public development banks to bring this about; easing conditions of access to and repayment of loans; temporary tax reductions and exemptions; and changes in depreciation rules favouring SMEs.

[62] The European Council in Brussels (2003) encouraged the application of horizontal aids rather than sectoral aids.

[63] However, other countries with an important car industry (e.g. Belgium, the Czech Republic, Hungary, Poland) did not adopt such measures.

[64] Article 3 of the Treaty states that the Community shall ensure a steady development of the industry in order to supply the market at low prices. The objective of Article 3 – supply the market at low prices – contains the foundations of a pro-active industrial policy.

There is, however, room for government intervention such as state aids in the EU if the market does not lead to socially efficient outcomes, i.e. in the presence of market failures (Neven and Verouden, 2008, European Commission, 2005). The financial crisis and its dramatic consequences for the rest of the economy, not just in the EU but also globally, could be considered to be originating from a market failure in the financial markets, preventing these markets from playing their traditional role of providing credit and guarantees. As a result, the sharp crisis-related deterioration of business and consumer confidence is translating into a slump in demand in some sectors, well beyond normal business cycle corrections thus provoking an abnormal strong supply contraction. Many sectors have been identified in Member States as having been severely affected by this supply contraction e.g. automotive, basic metals and chemicals (see Table 3-1). Therefore, a key criterion for assessing the legitimacy of sectoral support measures is to investigate whether or not they actually respond to a market failure, that being one leading to a serious disturbance in the economy.[65] If support measures meet this criterion, then they are helping to prevent the bankruptcies of otherwise viable and competitive businesses, they are helping to maintain innovation development programmes and they are preventing unnecessary and wasteful labour shedding.

Table 3-1: **Sectors displaying the strongest growth contraction relative to historical pattern by Member State***

[65] State aid measures in the context of the financial crisis have been authorised by the Commission on the basis of Article 107/3(b) of the TFEU (serious disturbance in the economy).

	Manufacturing	Non financial services**	Construction
Belgium	Motor Vehicle	Wholesale trade	Buildings
Bulgaria	Motor Vehicle	Publishing activities	Buildings
Czech Republic	Basic Metals	Employment activities	Buildings
Denmark	Wood	Computer related activities	Buildings
Germany	Motor Vehicle (parts)	Trade of motor vehicle	Buildings
Estonia	Basic metals	Trade of motor vehicle	Buildings
Ireland	Wood	Trade of motor vehicle**	Buildings
Greece	Textiles	Legal and accounting activities	Civil engineering s
Spain	Motor Vehicle	Trade of motor vehicle	Building and civil engineering s
France	Motor Vehicle (construction of motor vehicles)	Trade of motor vehicle	Civil engineering
Italy	Motor Vehicle (construction of motor vehicles)	Air transport	n.a.
Cyprus	n.a.	Travel agencies	Buildings
Latvia	Coke	Employment activities	Buildings
Lithuania	Fabricated Metals	Publishing activities	Buildings
Luxembourg	n.a.	Computer related activities**	Civil engineering
Hungary	Computers	Programming and broadcasting	Buildings
Malta	n.a.	Retail trade	n.a.
Netherlands	Chemicals	Trade of motor vehicle**	Buildings
Austria	Motor Vehicle	Water transport	Buildings
Poland	Tobacco	Trade of motor vehicle	Buildings
Portugal	Rubber	n.a.	Buildings
Romania	Basic Metals	Other professional activities	Civil engineering
Finland	Basic Metals	Wholesale trader	Buildings
Sweden	Motor Vehicle	n.a.	Civil engineering
United-Kingdom	Motor Vehicle (construction of motor vehicles)	Employment activities	Buildings

Source: Eurostat short term indicators

* Sectors are overreacting vis-à-vis manufacturing, service, or construction. The sector overreacts when the short term growth spread with manufacturing, service or construction is higher than the long term growth spread with the same aggregate.

** The analysis is limited by the availability of data in sectors.

3.2.2. Political economy considerations: the car sector

However, as we have seen, not all sectors hard hit by the crisis have been treated equally. While the automotive sector was one of those most affected by the crisis, it is also true that the vast majority of sectoral measures across the EU have targeted it.[66] The rest of this chapter will explore the issues raised by the very significant aid given to the car industry, its rationale and the issues it raises.

[66] Measures in tourism are less problematic as they target SMEs put at risk by the credit squeeze and the amounts of support are lower. Similarly, the construction sector is mainly national and support measures are less prone to cause intra-EU distortions.

The extent of aid received by the automotive sector appears to be linked to the perceived importance of the industry in the economy at large. While the automotive industry's direct weight in GDP is less than 1% in the EU[67], it reaches almost 3.5% in some countries such as Germany and the Czech Republic. Some 5.3 million people in the EU are directly employed in the industry, 2.3 million by original equipment manufacturers (OEM) and another 3 million by their suppliers. In some countries the automotive sector is a very significant employer. The total share of workers employed by the automotive industry represent generally up to 2% of the total, and above 2% in Germany and the Czech Republic (see Figure A.3.3.1, Annex 3-3).

However, in France and Italy where massive support has been provided the industry's share of GDP and employment is below 1%. This support is related to the presence of some of Europe's main car players, large historical companies often identified as national industrial success stories. This is particularly the case of companies such as Renault, Peugeot and Fiat which were created at the beginning of the last century and emerged as 'national champions'. Those companies have considerably extended their activities abroad and are ranked among the top car producers in the world (see Figure A.3.3.2, Annex 3-3).

Also important are the indirect effects of the automotive sector. The sector has significant interactions with upstream industries, such as the rubber, steel and metal industries and also electric equipment industries. As the automotive industry also involves various service activities, such as car financing, insurance, dealers and maintenance, its indirect weight is even larger.

Together, the persons directly and indirectly dependent on the automotive sector[68] account for a significant share of all manufacturing jobs in the EU, which highlights the social dimension of the severe deterioration of the sector following the crisis and the political sensitivity of related policy measures. The automotive industry contributes greatly to international trade[69], its share of R&D in Europe is among the largest and it contributes to the technological capacity of the economy.[70] In addition, the sector is rather concentrated geographically. Large

[67] This is less than the tourism and construction sector. Hotel-Restaurants account for 2.2% of EU value added and 4.6% of EU jobs, but it accounts for a higher share in some countries (8-10% of employment in Cyprus, Malta, Spain, Portugal, Greece). The same can be said of construction which accounts for a high share in employment (more than 10% in Spain, Ireland and Cyprus) and has strong links with upstream and downstream activities.

[68] The automotive industry provides more than 2 million direct jobs in Europe and represents 7% of total manufacturing employment. Together with an additional 10 million indirect jobs, it accounts for up to one third of total manufacturing employment.

[69] The world export volume of automotive products reached $1.18 trillion in 2007 (WTO 2008), accounting for 8.7% of world merchandise exports in 2007. Exports from the EU-27 amounted to $635bn, representing 53.7% of the total export value, followed by Japan and the United States.

[70] Investment and innovation are another important aspect of the sector. With an annual budget of about €40bn for capital expenditure and another €28bn for R&D, the sector is one of the largest investors in Europe and the largest for R&D. R&D intensity drives the international competitiveness of the sector, but also the technological industrial capacity of the economy. According to the R&D industrial scoreboard, the top R&D investors in the motor vehicles and parts sectors are the large car manufacturers (Volkswagen, BMW, Fiat, Renault, Peugeot) which account for 70% of R&D investments (€19bn). The other 30% is shared among a large number of suppliers (of parts and components).

car manufacturers may form part of regional automotive clusters composed of component suppliers directly linked to them.[71]

The crisis hit the automotive industry hard in the last quarter of 2008 and the first quarter of 2009. There has been clear evidence of an "overreaction" in the EU automotive industry as a whole but particularly in some Member States**.**

Figure 3-1 shows how capacity utilisation in the EU car industry has declined sharply since the beginning of the crisis, more so than in the previous crisis in 1992-93, while the output gap became extremely negative. By contrast, production increased quite significantly over the past decade while the capacity utilisation rate remained stable.

Box 3.1: Assessment of overcapacity in the car sector

The assessment of overcapacity is crucial in order to identify the need to adapt to market demand. Idle capacity due to the economic crisis might require a "light adaptation" to the new economic environment. By contrast, overcapacities before the economic crisis might lead to huge restructuring needs leading to a consolidation of the sector.[72]

Assessing overcapacity in Europe is difficult as there is no a single way to measure it. According to the ACEA, overcapacity was estimated at about 2m units at OEM level in Europe before the crisis and approached 5m to 6m units at the beginning of 2009.

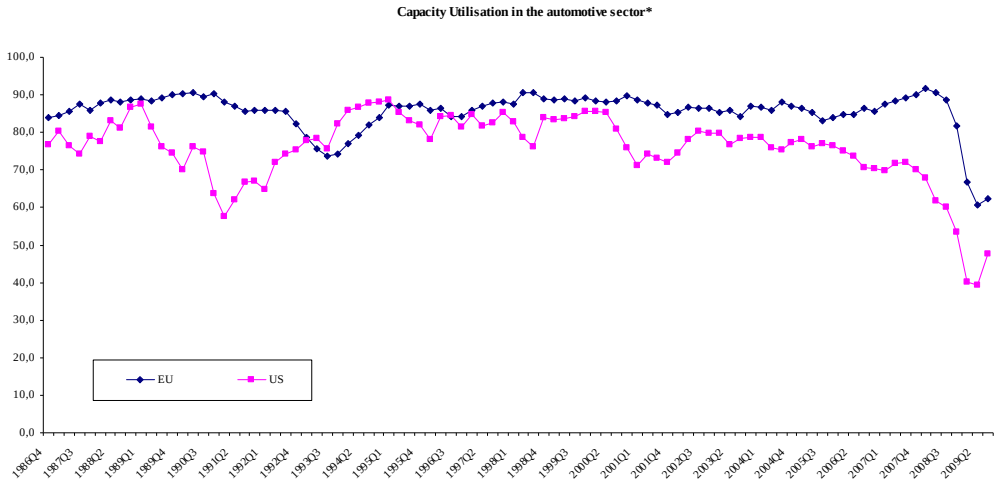
A direct way to measure idle capacity is to conduct a business survey at company level. According to ECFIN's business survey, capacity utilisation in EU car sector was higher on average than in manufacturing (85% versus 81% from 1992 to 2009) with its minimum value in the second quarter of 2009 at 60.6%. The third quarter of 2009 indicates a slight improvement (62.2%).

Another way to measure capacity utilisation is the use the output gap, which highlights the gap between actual and potential output. It provides a good indication of the level of utilisation of equipment as it is strongly correlated with capacity utilisation. The Federal Reserve Board estimates the rate of capacity utilisation as the seasonally adjusted output index expressed as a percentage of the related capacity index (estimate of potential output). US data show that capacity utilisation in the car sector started to shrink before the financial crisis - from the last quarter of 2007.

[71] In Sweden, the automotive sector accounts for 2%, but Volvo is part of an automotive cluster. The support introduced by the Swedish authorities targeted the viability of whole clusters composed of both large firms and SMEs.

[72] Overcapacity could also be strategically used by incumbent firms to prevent new entries. De Ghellinck and Huveneers analyse the case in the chemical fibre industry and the resulting conflict between industrial and competition policy. See chapter 4 in Buigues, Jacquemin and Sapir (1995).

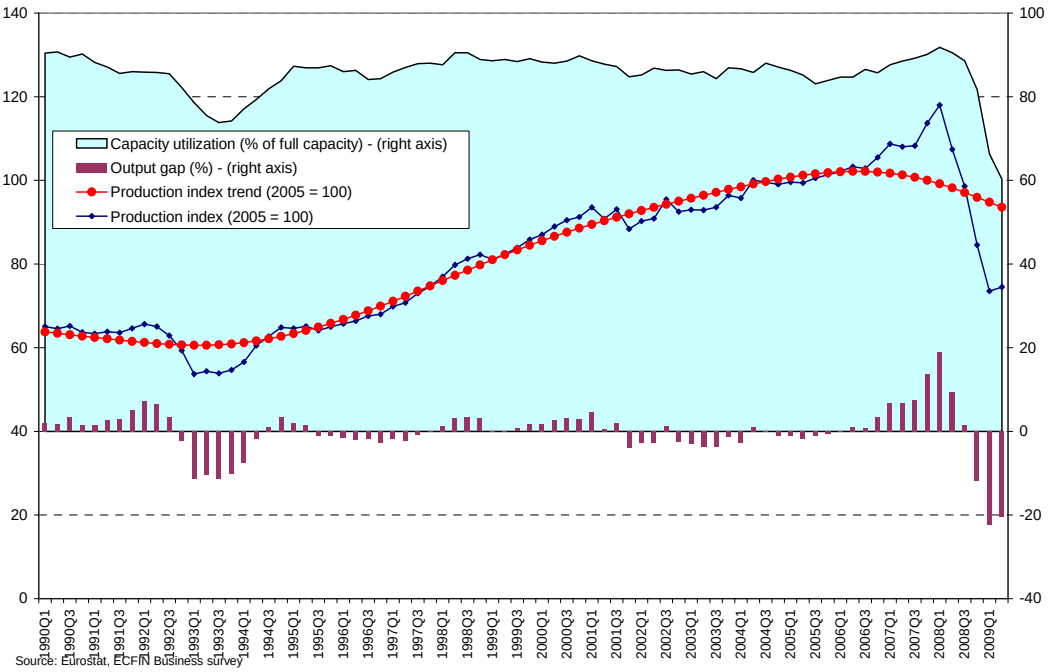
Figure 3-1: Evolution of capacity utilisation in the automotive sector – EU and US



* Comparison between both evolutions should be cautious. The methodology to assess capacity utilisation is not the same in the EU and US (see box above).
Moreover, EU figures cover car manufacturers and supplier. For EU, NACE 1rev1 2 digit (34); for US NAICS=33611, seasonnally adjusted

Source: ECFIN Business Survey, Federal Reserve Board

Figure 3-2: Capacity utilisation and output gap in the EU motor vehicle sector



Source: Eurostat, ECFIN Business survey

Under these circumstances, supporting such an important sector was justified on the grounds of the need for economic stability. Without government support, demand for cars would have further decreased and many motor manufacturers would have found it difficult to get access to loans and guarantees at market conditions. Without public support then, there was a real risk of massive bankruptcies and lay-offs affecting entire regions, which would have had devastating effects on business and consumer confidence.

3.3. Measures taken in the automotive sector

A few Member States took supply measures for car manufacturers in order to stabilise their financial conditions. In addition, about eleven Member States took measures to stimulate demand for cars.

3.3.1. A mix of demand and supply measures

In the automotive industry, the sharp drop in demand was related to the degradation of households' access to finance, which is a precondition of more car purchases in consumption, with uncertainty about future economic prospects. Public authorities' actions therefore focused on measures to ease access to credit in order to maintain companies' capacity to grow and compete (France, Spain, Sweden).[73] In addition, in France, the United-Kingdom, Spain and Germany, some of the measures in the large support packages were designed to encourage the car industry to adapt early to recent environmental legislation. Such supply-side measures took the forms of subsidised loans and guarantees.[74] This means they do not substantially affect the public budget, but might have an impact on the public debt level if they were called in (loans and guarantees amounting to approximately €10 billion).[75] Finally, France set up a number of funds to invest in suppliers in the automotive sector.

Among the sector-specific demand support, car scrapping schemes are the main support, accounting for more than €8 billion for 2009-2010 (0.08% of EU-27 GDP). Twelve Member States have so far implemented recycling and recovery schemes ('scrapping schemes') to support demand. These measures are temporary and, in some cases, make support conditional on the purchase of new or nearly new vehicles that should be less polluting (France, Portugal, Luxembourg, Spain, Italy). Germany, Austria and the UK have introduced favourable conditions for the purchase of cleaner cars, with higher incentives in the range of €1500 to €2500. Table 3-2 gives details of car support schemes in the Member States both for demand- and supply-side measures.

[73] In France, the competitiveness programme – "Pacte Automobile" – includes subsidised loans to Renault and Peugeot to finance clean vehicles (€6500m), loans to the internal banks of Renault and Peugeot (€2000m), guarantees for suppliers, funds to help modernise the suppliers and measures to support employment. In Spain, the competitiveness plan – Plan Integral de automocion – includes support to car manufacturers to develop hybrid cars, to become more international, to support employment and to support logistics. In Sweden, automotive clusters receive loan guarantees and rescue loans if needed. Volvo is one of the beneficiaries. In Germany, Opel received a state bridging loan (€1500m) after the US carmaker General Motors filed for insolvency. In UK, the Automotive Assistance Programme includes €2500m in loans and guarantees to the automotive sector.

[74] These schemes were designed and adopted in the context of the Temporary Framework.

[75] They have nevertheless an impact on the budget because companies do not pay the market price for these loans and guarantees. This impact is small from a fiscal point of view (for example, in the UK loans to the automotive, the part of subsidised interest rate amounts to 0.01% of GDP).

Table 3-2: Summary table on measures taken in the automotive sector

	Demand side measures (2009-2010)	**Supply side measures (2009-2010)**		
	Car scrapping schemes, tax exemptions Mn €	Subsidised loans and guarantees[c] Mn €	Green products (subsidised loans)[c] Mn €	Other Mn €[d]
AT	45[a]			
CZ	100[b]			
CY	n.a.			
DE	5770	1500[i]	500	500
ES	1600[h]	690[e]	100	320
FR	600	6500[j]	500	600
IT	1441			
LU	10			
NL	65			
PT	n.a.			200
RO	50	320[k]		
SK	22.1			
SE		400[l]	1861	744
UK	449	8500[e]		
European Investment Bank (EIB)				7560[g]

a) Initial budget: €45m. €23m are provided by government, the rest by industry.
b) Pending approval of Parliament.
c) Budgets include loans and guarantees which will be reimbursed. In those cases, preferential interest rates and guarantees requirements represent the public aid.
d) Other measures: R&D support, special funds for suppliers…
e) This budget is for subsidised loans and green products. The €8500m might also be allocated to other sectors as the scheme is not sector specific. 2500 m are part of the Automotive Assistance Programme.
f) Plan Integral de Automocion (PIA).
g) The EIB loans are for car manufacturers and suppliers. They are provided at market conditions. Approved operations since January 2009.
h) €1200m are off budget (VIVE Plan) and €400m corresponds to the scheme 2000E implemented from May 2009.
i) Bridge loan to Opel.
j) Loans to Renault and Peugeot.
k) Guarantee to Ford Romania
l) Pending. Guarantee to Volvo. A guarantee of €40m has been given at market conditions.
Source: Commission services, Member States, EIB.

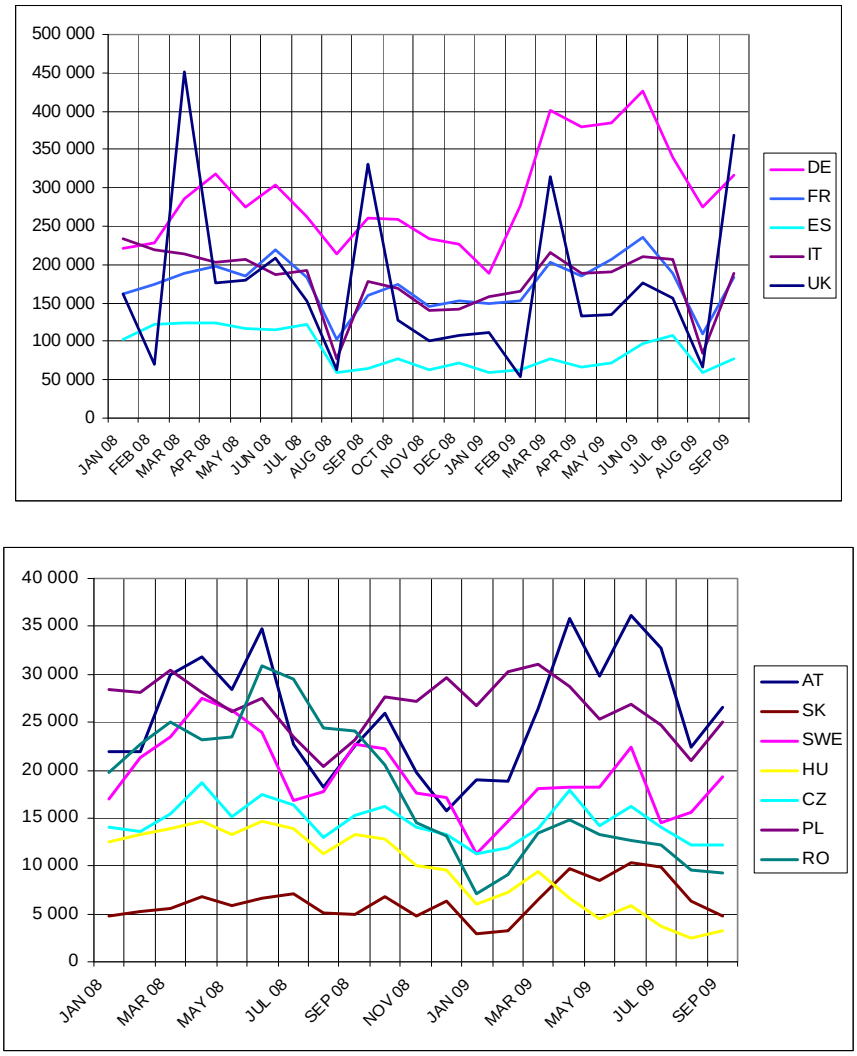
3.3.2. Impact of car scrapping schemes

Effect on sales and production

The scrapping schemes may have blunted the impact of the crisis on car sales in the beginning of 2009 (see Figure 3.3). New car registrations rose particularly strongly in Germany, Austria, Slovakia and the UK.[76] The high level of the premium (between €1500 and €2500), the favourable terms and the early public announcement of these schemes may have contributed to their success.

[76] On a year-on-year basis, only France, Germany, Slovakia, Czech Republic, Austria and Poland recorded an increase in car registrations. This result is likely to be influenced by the timing of the introduction of the car scrapping schemes.

Figure 3-3: Evolution of new car registration in Europe – January-September 2009



Source: ACEA

Because of its strong inter-linkages with other manufacturing sectors, any increase in the demand for cars translates into additional demand in other sectors of the economy.[77] It could therefore be significant that sectors related to the automotive sector have increased production over the first eight months of 2009 in the countries that introduced a car scrapping scheme. The effect is particularly strong in Germany where the fiscal stimulus and the level of the premium have been the highest (€5 billion and a premium between €2000 and €2500). Over

[77] The cumulative output multipliers take into account the effect along the full value chain (e.g. the purchase of other inputs by intermediate sectors). In Germany, the domestic output multiplier is 2.2 for the manufacturing sector, which means that a strong increase in car sales will also boost other sectors of the economy. The total output multiplier amounts to a high 2.9 meaning that the automotive sector also impacts other manufacturing sectors through trade.

the first eight months of 2009, sectors related to the automotive industry[78] have increased production by 0.9% in contrast to the decrease in total industrial production of 0.2%.[79] Note, however, that in Germany in the third quarter of 2009, car registrations were down by over 5% suggesting that the effects of the car scrapping schemes might have been fading there, even before the scheme was withdrawn in September 2009.

The scrapping schemes may also have had an impact on the type of cars being bought. The premium of about €1000 to €2500 for the purchase of a new car might have contributed to decreasing car prices temporarily by approximately 5-10% for a small car (i.e. a car costing less than €25000). Given the crisis, price sensitiveness is likely to increase. That would help explain why the share of small cars in total passenger cars reached 44.9% during the first five months of 2009 against an average share of 37% over the past three years (2005-2008).[80] This downshifting towards smaller cars driven by the 'green' conditions attached to the support measures also potentially reflects a pre-existing change in consumer preferences[81] which could increase the competitive pressure from manufacturers producing low-medium models and be reflected in the profit margins of carmakers, as smaller vehicles are less profitable. This trend, if confirmed, would also raise concerns about long-term perspectives for car manufacturers and whether margins will return to their previous levels over the next few years.

In addition, the scrapping schemes have had cross-border effects.[82] Since car scrapping schemes have been designed in a non-discriminatory way, national scrapping schemes may not only have positively influenced short-term demand in the Member States introducing them, but may have spilled over into other countries (e.g. in Czech Republic, Poland, Hungary, Sweden[83]). Analysis of trade flows seems to provide some evidence of spillovers from the incentive measures in Germany to other countries, as the number of cars imported by Germany significantly increased in the first half of 2009, particularly from Slovakia, Romania, France and Italy. In particular, the scrapping schemes seem to have favoured manufacturers producing cheaper and smaller cars wherever they are located. This

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[78] The evolution of sectors related to the automotive sector is weighted by their production for the car industry and their share of industry value added. See Brunner and Costa (2009). They include rubber and plastics, automotives, fabricated metals products, basic metals, textile, furniture and electricity for the most part.

[79] The same positive effect is seen in France where sectors related to the automotive industry increase by 0.82% versus 2.28% for total industry from January to August 2009. In Spain, the increase was 0.62% versus a contraction of 4.39% for total industry. By contrast, Belgium and Sweden which did not introduce car scrapping schemes, experienced contractions over the same period of -0.54% for the automotive sector versus 1.59% for total industry and 1.55% versus 11.9% for total industry, respectively. Automotive output grew in Hungary (+0.03% versus -2.4% for total industry) and the Czech Republic (+0.41% versus +3.94% for total industry) although these countries did not introduce car scrapping schemes.

[80] Figures from ACEA.

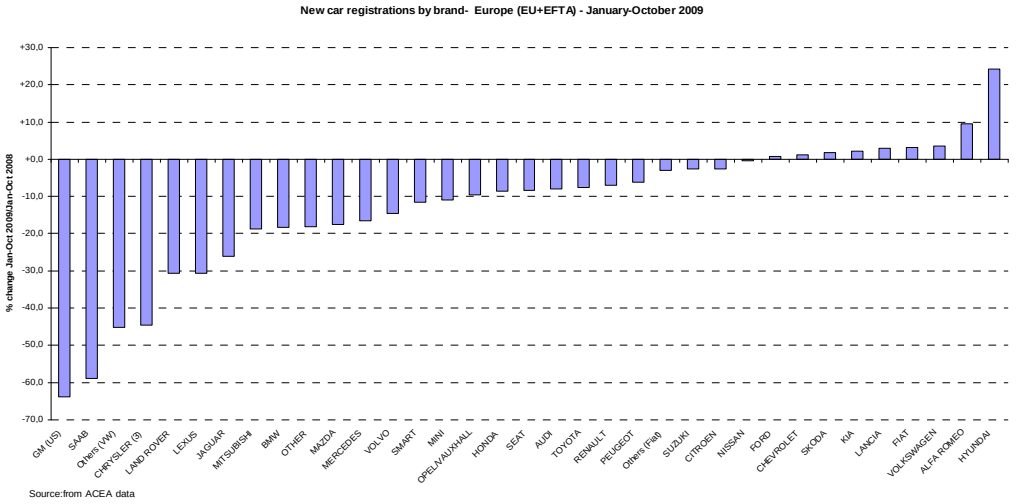
[81] Consumer preferences can be influenced by several factors (e.g. design, security, environmental awareness, etc.). Further analysis of the change in the structure of car sales will have to confirm whether it is temporary or permanent.

[82] Due to their possible spill over effects, scrapping schemes must be designed in a non discriminatory way in order to avoid difficulties regarding state aid rules.

[83] In the Czech Republic, there is no scrapping scheme, but VAT deductions for entrepreneurs purchasing new cars. In Poland and Hungary there is no scrapping scheme. In Sweden, there was a tax premium for private persons purchasing a new eco car until July 2009.

development contributed to the success of some European brands produced in the new Member States (Dacia, Skoda) but also of Asian brands produced in Europe (Hyundai, Kia) (see Figure 3-4).

Figure 3-4: Evolution of new car registration by brand – January-October 2009/08



Source: ACEA

Substitution effects within consumption of durable goods and inter-temporal effects

Even if car support measures are leading to increases in car sales, they may be doing so at the expense of purchases of other products. Transport accounts for about 13% of households' consumptions[84], and comes second after housing expenditures (20%) and just before housing equipment such as furnishing (6.3%). Accordingly, households may have to choose between durable goods, such as furniture, electrical equipment, and new or used cars. The premiums have price distortion effects which artificially boost demand for new cars. A potential crowding-out effect could wipe out the macroeconomic benefit of the incentive measures for cars. Although drawing final conclusions would be premature, one can observe the concomitant increase in new car registrations and in total final consumption by households and the decrease in retail sales of all products except cars. This is the case in Germany where households' final consumption increased in volume by 0.6% and 0.7% in the first two quarters of 2009. In the same period, the index of new car registrations increased by 23.4% and 12.8% while the turnover index of retail trade, for all products except cars, decreased by -0.93% and -0.24%. According to the ECB (2009), in the first half of 2009, the positive contribution from car sales was compensated for by a corresponding negative contribution from reduced purchases of other goods.[85]

[84] This includes transport services. Eurostat.

[85] ECB Monthly Bulletin (October 2009). Evidence of such a crowding-out effect is shown on the basis of the quarterly real private consumption growth and the contributions from retail sales (except sales of motor vehicles and motorcycles), car sales (as measured by new car registrations) and other expenditure. However, the authors stress that there is an important caveat: the structure of car sales might no longer be valid in the

It is also possible that car scrapping schemes are encouraging car sales today at the expense of car sales in the future. New car registrations in Germany peaked in the first quarter of 2009 and fell in the third quarter. More time would be needed to assess the inter-temporal effects.[86] Some car owners responding to the incentives may have brought forward a purchase they would have made without the scrapping scheme. In that case, after the scheme has expired, a sharp fall in purchases can be expected. In addition, the premium may also have subsidised purchases that would have taken place even without it, therefore generating windfall profits. Such an effect could lead to a fall in demand, which would further contribute to maintaining idle capacity utilisation and threaten the sustainability of the economic recovery. There are therefore concerns that the short-term positive effect might be reversed after the measures have come to an end. Previous experience of such measures shows that demand often shrinks once they end. In France, cash premiums introduced from October 1995 to September 1996 temporarily boosted the market. At the beginning of 1997, sales of new cars fell by 20%.[87] The measures have clear sunset clauses and have already been ended in most countries. At this stage, only France has opted for a gradual exit from the scheme.

Net effect

Despite all these indications, it may still be too early to draw conclusions about the overall macroeconomic impact of car scrapping schemes. As the OECD (2009) mentions, the short-term impact of such schemes is difficult to assess given the lack of information on what would have happened in their absence. In the short term, they have contributed to boosting car sales. However, in Germany, other sectors such as chemicals and textile display positive evolutions even though they received no specific support. For example, the weighed growth of sectors related to the chemicals industry[88] was +0.4% from January to August 2009 (whereas total industry declined 0.2% over the same period). Hence, other factors unrelated to car scrapping schemes may have helped to boost some sectors. More controversial are the long term economic effects of such schemes as windfall effects and substitution effects might have been present. If such effects were predominant, they would offset the macroeconomic impact of car scrapping schemes while the cost to public finances would be high.

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current crisis situation (the car scrapping schemes appear to have skewed car sales towards smaller and cheaper cars).

[86] Price elasticities for cars are estimated at -1.2 in the US market. Principles of Economics, Arthur O'Sullivan and Steven M. Sheffrin, 1st edition, Prentice Hall, (2002). Assuming that the premium in Germany led to a temporary price decrease of 5-10% for small cars and applying a price elasticity of -1.2, demand would be expected to increase by 6-12% (leaving aside the income effect). Obviously, the evolution observed in Germany was higher (+23% during the first quarter of 2009), which means that around 10% could be attributed to the inter-temporal effect of the temporary premium.

[87] See INSEE Premières, N° 585. May 1998, See also Adda J. Cooper R. 'Balladurette and Juppette: a discrete analysis of scrapping subsidies', NBER Working Papers Series, May 1997.

[88] The evolution of sectors related to the chemicals sector is weighted according to their production for the chemicals industry and their share of industry value added. The main sectors in this category are pulp and paper, coke and petroleum products, chemicals and electricity.

3.3.3. Design of supply side measures and supply chain considerations

The automotive industry comprises of many operators working closely through different contractual arrangements.[89] One outcome of the economic crisis and its related measures may be that the relative position of European car manufacturers will be strengthened in comparison with their upstream suppliers and their downstream distributors, which have received much less specific direct support.[90]

Component suppliers have not only faced severely reduced demand for cars, which has translated into a decline in revenues, but also a liquidity shortage due to the near breakdown of the credit insurance market, a key provider of liquidity to the sector. This is a source of concern as suppliers account for a major share (65% to 75%) of a vehicle's value added and contribute to a large extent to R&D in the automotive industry.[91] Suppliers' financial difficulties coupled with a lack of access to finance brought by the crisis may lead to bankruptcies, which could have consequences for innovation and for the restructuring process of the whole automotive industry.

Car manufacturers have already started to reinforce the linkages with a few key suppliers, providing them with significant financial support.[92] In France for example, the newly created FMEA (Fonds de Modernisation des Equipementiers Automobiles) is financed on an equal basis by public funding[93], Renault and Peugeot. There is a need to ensure a sufficient degree of competition at each of the levels of the automotive supply chain to avoid unwanted consequences of the crisis such as a potential control by car makers over key suppliers, which would create barriers to entry and result in a lower level of competition and less incentive to innovate. Improving suppliers' access to finance is a priority to avoid a high number of bankruptcies among them and damage to the industry's capacity to innovate.

Downstream, car manufacturers' relationships with distributors are covered by a sector specific regulation which was revised in 2002 to ensure competition in the downstream

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[89] The automotive industry includes companies that are involved in production of cars and commercial vehicles (OEM), and automotive suppliers involved in various segments of the automotive value chain. The automotive industry in Europe has 15 large OEMs for cars, trucks and buses, and about 5000 automotive suppliers, most of them SMEs (see Annex 3-5 for a brief description of the automotive value chain).

[90] Operators at all levels of the automotive supply chain have benefitted from demand measures (car scrapping schemes). However, for car distributors, a possible substitution effect between new and used cars can limit this impact.

[91] According to Oliver Wyman (2007) "A comprehensive study on innovation in the automotive industry", the breakdown of automotive R&D in 2005 was as follows: 60.5 percent of all R&D was done by suppliers, 31.4 percent by OEMs and 8.1 percent by engineering service providers.

[92] Over the past two decades, relationships between suppliers and car manufacturers have been strengthened. First, car manufacturers have continuously outsourced their component production. Second, suppliers have been more and more responsible for a percentage of the development and design of modern vehicles. At the same time, suppliers and vehicle manufacturers closely monitor each other's production schedules in order to ensure the Just In Time delivery of components. All these evolutions have lead to pre-existing strong interlinkages along the supply chain.

[93] Through the FSI – Fonds Stratégique d'Investissement – managed by the Caisse des Depôts et Consignations.

market (Regulation 1400/2002).[94] The main objective of this regulation is to ensure competition between car makers, but also between car distributors. After an evaluation report[95] in May 2008 and a Communication in July 2009, the Commission has proposed a revised legal framework in December 2009, which makes a distinction between the distribution of new cars (which fall under the standard block-exemption regulation) and the distribution of spare part or the repair of cars, which fall under the sector-specific regulation.

At the beginning of the 2000s, it was considered that car manufacturers had some market power, which could lead to anticompetitive strategic behaviour (foreclosure of the market).[96] The 2002 Regulation introduced some important provisions promoting competition: encouraging trade between territories within the common market, ending the exemption of combined exclusive and selective distribution agreements, promoting multi-branding, ending the exemption of location clauses and breaking the sales-services link. It was felt necessary to provide for certain minimum contractual standards in order to strengthen dealers' independence and encourage them to act pro-competitively.

Preliminary empirical studies show the positive effects of the 2002 regulation on competition and welfare.[97] The increase in price convergence and the decrease in the concentration index (C4) show that competition has intensified in the car market.[98] The Regulation has helped increase multi-branding, especially in some countries. The proportion of multi-brand dealers is: 29.7% in Sweden, 35.2% in Denmark and 38.9% in Estonia, although it is below 20% in the other countries. Nevertheless, the situation should be closely monitored as large car manufacturers seem to be rationalising their distribution network. Recent years have seen a large drop in dealer density across all countries and across all brands.[99] Average sales per main dealer and per total number of outlets increased for almost all countries over the period 1995-2008. While manufacturer ownership of retail outlets across the EU remains low at about 2% of retail outlets, in France, Germany, Italy and the UK, the rate increased by about 70% between 1995 and 2008.

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[94] Regulation 2790/99 is horizontal and exempts certain forms of vertical agreements as they can provide efficiency gains (reduction in transaction and distribution costs, risk sharing, double marginalisation) which can outweigh potential anticompetitive effects (foreclosing access to rival suppliers and/or to rival distributors). The sector-specific regulation (1475/95 and then 1400/2002) lays down stricter rules on the motor vehicle sector. In 2002, the revision of the regulation was driven by consumer welfare. The key question was how to improve intra- and inter-brand competition. By promoting inter-brand competition, intra-brand competition could also be enhanced. To achieve this, it was important to promote competition between different modes of distribution and between repairers (independent and authorised).

[95] The Commission's assessment is that competition has improved on the new vehicle markets while the brand-specific aftermarkets are less competitive.

[96] The block exemption of the automobile sector in the EU was used by car producers to avoid imports and inter-market arbitrage. See Discussion by D. Laussel and C. Montet in Buigues, Jacquemin and Sapir, *European Policies on competition, trade and industry* (1995).

[97] The Commission's evaluation report also shows that other factors such as over-capacity, technological change and globalisation could also explain this positive evolution.

[98] London Economics (2006)

[99] According to London Economics (2006), "the reduction in dealer numbers represents a deliberate strategic decision by manufacturers, who want larger and more efficient dealerships than a move necessitated by market conditions such as falling demand".

3.3.4. Long term risks of supply-side measures

Sectoral supply-side support measures (loans and guarantees) carry other risks in the long run. Measures to maintain companies' innovation capacity, for instance, might have adverse effects on potential innovative entrants. In particular, by favouring incumbents, public authorities do not encourage disruptive innovative new players to enter the market (OECD, 2009). The preferential loans provided to large car manufacturers is a specific example; it could provide those car manufacturers with a competitive advantage in leading the change to a green economy.

Supply-side measures might also hold back the restructuring and consolidation process in the car industry. The overcapacity triggered by the crisis might be aggravated by the support measures, as they do not provide incentive to adapt to the fall in demand. Restructuring will put pressure on employment, particularly in regions where the industry is clustered. Current market evidence indicates that some restructuring measures have been announced by companies and there are a number of others in the pipeline. However, it is still premature to assess the extent of the ongoing restructuring in the sector.

Another reason for concern is the proliferation of support measures at the international level. The automotive industry has been one of the main recipients of financial support throughout the world. The measures put in place by third countries often involve large direct support and could therefore, if not accompanied by significant restructuring measures, be rather distortive of competition. The bankruptcies of General Motors and Chrysler have involved massive public intervention. In spring 2009, the US government launched a programme to support critical automotive suppliers coupled with thorough restructuring plans. In China, demand side measures (tax exemptions) have been introduced. Russia has temporarily increased its import tariffs. Other countries have adopted tax reductions on cars (see table in Annex 3-4). Unfortunately, the heterogeneity of the situation across the world might lead to national second-best solutions leading to uncoordinated actions and beggar-my-neighbour policies. In the worst case, this might lead to a situation in which the industry removes itself from WTO discipline, as has happened in the past in the textile and shipbuilding sectors.[100]

3.4. Concluding remarks

This chapter has focused on the support measures provided both directly (supply-side measures) and indirectly (demand-side measures) to the automotive sector as this sector was among the sectors worst hit by the crisis and which benefitted most from sectoral support. Several messages can be read from the analysis concerning the rationale for the support and some useful insights can be proposed for policy recommendations related to the exit strategy.

Although car scrapping schemes have been introduced in a large number of countries with a substantial automobile industry, their net impact on the economy is uncertain. In the short term, car scrapping schemes have clearly stimulated car sales. Such effect is however directly linked to the temporary and timely nature of the measures. In the long term, the macroeconomic impact of the support measures may be mitigated by adverse effects on the demand for other products and by inter-temporal substitution effects. Since buyers may have

[100] Brunet C. and Hufbauer G., *Money for the auto industry: consistent with WTO rules?* Policy Brief n° 4. February 2009. Peterson Institute for International Economics.

advanced their purchases as a result of the economic incentives, a substantial decline in car sales is expected in 2010.

Countries have varied greatly in their response to the crisis in the automotive sector, in terms of both the size and type of their support measures (supply and/or demand). To a large extent, sectoral support was motivated by national economic policy considerations, particularly the presence of historical well-established world-class manufacturers. However, despite such national considerations, car scrapping schemes have had cross-border effects benefitting countries specialised in the production of cheaper and smaller cars. For these reasons, better coordination of support measures at European level is advisable in future. It would introduce some degree of harmonisation into the design of support measures and would allow for the internalisation of spillover effects.

In addition, coordination of measures at international level would reduce pressures for protectionism. Support for the automotive sector has been introduced both in developed and emerging countries. The heterogeneity of the situation across the world might favour national second-best solutions leading to uncoordinated actions and beggar-thy-neighbour policies. Given the export oriented nature of the sector, the need for some coordination of sectoral support by public authorities across the world should be raised in international discussions.

Finally, it is worth mentioning that the industrial policy measures, adopted in response to the crisis, are of a different nature than in the previous crises but are not without risks. The nature of recent industrial policy interventions has been different from previous, more prescriptive sectoral interventions. Given the accumulation of support measures targeting a single sector, attention should be paid to the phasing out of such measures. Experience shows that public intervention is not neutral in reshaping supported sectors. Moreover, another legitimate concern is the impact of the crisis and the ensuing support measures on the functioning of the supply chain that puts motor manufacturers at the centre of inter-linkages between upstream component suppliers and downstream distributors of cars.

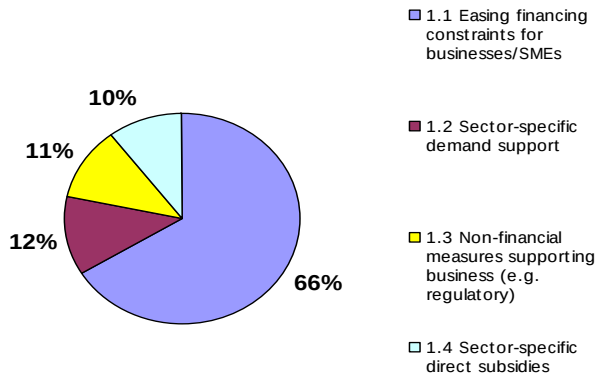
The phasing-out of these measures should therefore be carefully monitored. If this is not done properly, the potential impact of long-lasting support measures to specific sectors on the internal market may counteract their effectiveness and may well also hinder much-needed adjustment and in-depth restructuring. Re-establishing proper functioning of product markets is particularly important in order to prevent the emergence of a post-crisis economy with reduced opportunities for growth and jobs.

Annex 3-1: Overview of measures taken at Member States and EU level[101]

1. Details on EERP measures taken at Member States level

Measures to support businesses and companies make up the largest part of Member State's response to the crisis under the EERP in terms of the number of actions (29% of total measures). They also represent a considerable share (about 16%) of the overall discretionary stimulus provided for 2009-2010.

Figure A.3.1.1: Types of Business support measures as share of total



Source: Commission services

Two thirds of all measures supporting industrial sectors, business and companies aim to ease financing constraints for business and represent an estimated budget of €20 billion. These measures comprise of the extension both in terms of volumes and conditions of credit guarantees, including export credit, particularly for SMEs and the increase in the capital of public development banks to bring this about; easing the conditions of access to and repayment of loans; temporary tax reductions and exemptions; and changes in depreciation rules favouring SMEs. The bulk of these support measures have no direct fiscal impact as they represent a small amount of aid, loans and guarantees. These measures usually do not raise competition concerns as they generally do not target specific sectors and most of them fall under the Temporary Framework. However, their effectiveness is a relevant issue. According to the ECB (Euro Area Bank Lending Survey, September 2009), access to finance continued to deteriorate during the first half of 2009. Large and well-established companies tend to have less difficulty with access to credit while new firms or micro firms find it difficult to get a loan. More specifically, SMEs reported a worsening of the costs and conditions of loans and collateral requirements.

[101] This section draws on the assessment of the crisis measures made in Chapter 4 in European Economy, (2009), "The EU's response to support the real economy during the economic crisis: an overview of Member States' recovery measure", ECFIN Occasional Paper, No. 51.

Non-financial business support measures (e.g. regulatory reforms) were mainly geared to reducing administrative burdens for businesses, in particular SMEs, but also to providing advice services to business in export activities and trade fair participation.

Sectoral measures (both demand support measures and direct subsidies) account for almost a quarter of all measures supporting business and companies, but they are concentrated in a limited number of Member States with industries that are particularly hard-hit by the crisis. Sector-specific demand support is provided through temporary tax breaks, permanent changes and other financial incentives to purchase of sector-specific products in support of environmental and innovation policy objectives; easing regulatory requirements and financing conditions for homeowners and first-time buyers; sectoral liberalisation measures; and issuing coupons for the consumption of certain goods and services. Sector-specific supply measures (including direct subsidies) provide direct financial support, such as tax reductions, direct state aid payments and measures aimed at complementing the deterioration of financial conditions (guarantees and loans with subsidised interest rates).

2. Details of EERP measures taken at EU level

Actions at EU level have focused both on measures to soften the impact of the economic crisis and to prevent further bankruptcies and measures to reinforce the competitiveness of European enterprises in the long term. The adoption of the Temporary Framework for EU state aid rules simplified and enhanced the Member States' access to a range of options for providing financial support to companies and to stimulating demand while maintaining a level playing field and contributing to support EU objectives such as R&D, innovation, ICT, transport and energy efficiency. In order to improve the cash flow of European businesses, the Commission has proposed substantial changes to the late payment Directive of 2000, suggesting that public authorities should pay their bills within 30 days. Further efforts have also been made to substantially reduce administrative burdens for SMEs and micro-enterprises, for example through the removal of the requirement on micro-enterprises to prepare annual accounts.

The European Investment Bank (EIB) has mobilised its resources quickly to provide a timely response to the financial and economic crisis. The EIB has also announced additional resources, boosting its SME lending possibilities by €15 billion per year in 2009 and 2010 over its usual lending in this sector. It has boosted its lending to mid-sized corporations by €1 billion a year and provided an additional €1 billion to the EIF for a mezzanine finance facility. These activities take the form of loans, equity, guarantees and risk-sharing financing.

To support innovation in manufacturing, in particular in the construction industry and the automobile sector which have been hard hit by the crisis and which also face significant challenges in the transition to the low carbon economy, the Commission has proposed to launch 3 major partnerships between the public and private sectors.

In the automobile sector, the "European green cars initiative", involving research on a broad range of technologies and smart energy infrastructures aims to contribute to the development of the use of renewable and non-polluting energy sources. The partnership is funded by the Community, the EIB, industry and Member States' contributions for a combined envelope of €5 billion. In this context, through the European Clean Transport Facility (ECTF), the EIB provides cost-based loans to car producers and suppliers to finance innovation, in particular in technologies improving the energy efficiency and the environmental performance of cars, e.g.

through improvement in traditional internal combustion engines and development of hybrid and electric vehicles.

In the construction sector, the "European energy-efficient buildings initiative" aims to promote green technologies and the development of energy-efficient systems and materials in new and renovated buildings. The initiative includes an important regulatory and standardisation component. The estimated envelope for this partnership is €1 billion.

To increase the use of technology in manufacturing, the "factories of the future initiative" should help EU manufacturers across sectors, in particular SMEs, to adapt to global competitive pressures by increasing the technological base of EU manufacturing through the development and integration of engineering technologies for adaptable machines and industrial processes, ICT, and advanced materials. The estimated budget for this action is €1.2 billion.

Under the European Clean Transport Facility (ECTF) the EIB provided significant loans to Europe’s automotive industry through support investments targeting research, development and innovation in emissions reduction and energy efficiency. The EIB committed to contributing at least €4 billion in loans to the Green Cars Initiative in 2009 (€2 billion) and 2010 (€2 billion); these funds come from the ECTF initiative. This is in addition to the approximate €2 billion the EIB lends annually to the auto industry under other EIB operational objectives. Since the beginning of the economic downturn in autumn 2008, the EIB has increased its lending to the automotive sector. Since December 2008, almost €8.3 billion in new loans has been approved. Up to the end of 2009, total approvals of EIB loans are expected to total €8.5 billion, since December 2008 addressing all market segments, including OEMs and suppliers.

Annex 3-2: Sectoral stimulus package – Member States

Country	Instruments	Type of measures	Sector	Planned budget* (€m)	Premium (€)	Age of old cars	Number of cars	Sustain demand	Green products	Access to credit	R&D &I
CZ	Tax exemptions	Demand	Automotive					*			
DE	Scrapping scheme	Demand	Automotive	5000	2500	9	2m	*	*		
DE	Subsidised loans to green products	Supply	Automotive (+ other sectors)	500					*		
DE	Tax incentives (CO2 emissions)	Demand	Automotive	770				*	*		
DE	R&D innovation support	Supply	Automotive	500							*
ES	Scrapping scheme	Demand	Automotive	1600 (1200 off budget)	2000	10		*	*		
ES	Subsidised loans to green products	Supply	Automotive	100					*		
ES	Subsidised loans	Supply	Automotive	690					*	*	
ES	R&D support	Supply	Automotive	320							*
ES	R&D tax credit	Supply	Automotive	100							*
FR	Scrapping scheme	Demand	Automotive	600	1000	10	600000	*	*		
FR	Subsidised loans	Supply	Automotive	6500					*	*	
FR	Subsidised loans to green products	Supply	Automotive	500					*	*	
FR	Modernisation Fund	Supply	Automotive (suppliers)	600							
IT	Scrapping scheme	Demand	Automotive	1441	1500-3000	9		*	*		
LU	scrapping scheme	Demand	Automotive	10	1500-1750	10		*	*		
NL	Scrapping scheme	Demand	Automotive	65	750-1000	9/13		*			
AT	Scrapping scheme	Demand	Automotive	45 (23 public budget)	1500	13		*			

PT	Scrapping scheme	Demand	Automotive		1000-1250	8/13		*	*		
PT	Credit line	Supply	Automotive	200						*	
RO	Scrapping scheme	Demand	Automotive	50	1000	10	60000	*			
SK	Scrapping scheme	Demand	Automotive	22,1	2000	10		*			
SE	Loans to green cars	Supply	Automotive	1860,9					*	*	
SE	Rescue loans	Supply	Automotive	465,2					*	*	
SE	capital support	Supply	Automotive	279,1					*	*	*
UK	Scrapping scheme	Demand	Automotive	449				*			
UK	Subsidised loans to green products+loans guarantees	Supply	Partly automotive	8985,2	2250	10			*	*	
PT	Credit line to SMEs	Supply	Commerce	200						*	
BE	VAT reduction for new buildings	Demand	Construction	300				*			
IE	Support to the property market	Supply	Construction	180							
ES	Construction of penitentiaries	Supply	Construction	380							
FR	Social housing	Demand	Construction	340				*			
FR	Zero interest rate	Demand	Construction					*			
Fr	Programme de rénovation urbaine	Supply	Construction								
FR	Income reduction in new house	Demand	Construction					*			
FR	30 000 apartment	Supply	Construction								
CY	Public infrastructure investments	Supply	Construction	200							
NL	Property market	Demand	Construction					*			
FI	Interest subsidy for social housing production	Supply	Construction	10							
ES	Improve maritime logistics	Supply	Logistics	950							

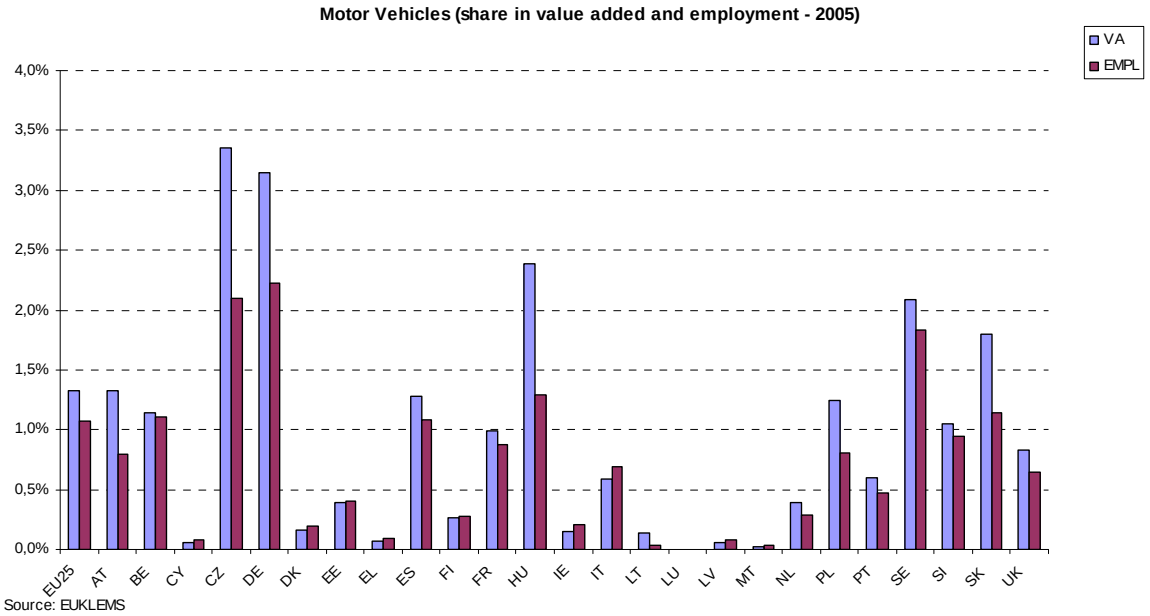
EL	Tax reduction for businesses	Supply	Tourism		*			
EL	Support to SMEs	Supply	Tourism	170			*	
EL	Free holidays coupon	Demand	Tourism	78	*			
ES	Social tourism	Supply	Tourism	30	*			
CY	Tax reduction	Demand	Tourism	55	*			
CY	Campaign Promotion	Supply	Tourism	55	*			
MT	Support	Supply	Tourism	36			*	
SK	Recreation coupon	Demand	Tourism		*			
MT	Moratorium capital repayment	Supply	Tourism (horeca)				*	
PT	Credit line	Supply	Tourism	500			*	
PT	Credit facilities	Supply	Agro-agriculture	175			*	

* These figures related to planned budgets for 2009-2010. They include measures off-budgets such as guarantees and loans.

Source: Compiled by the Commission services from various sources.

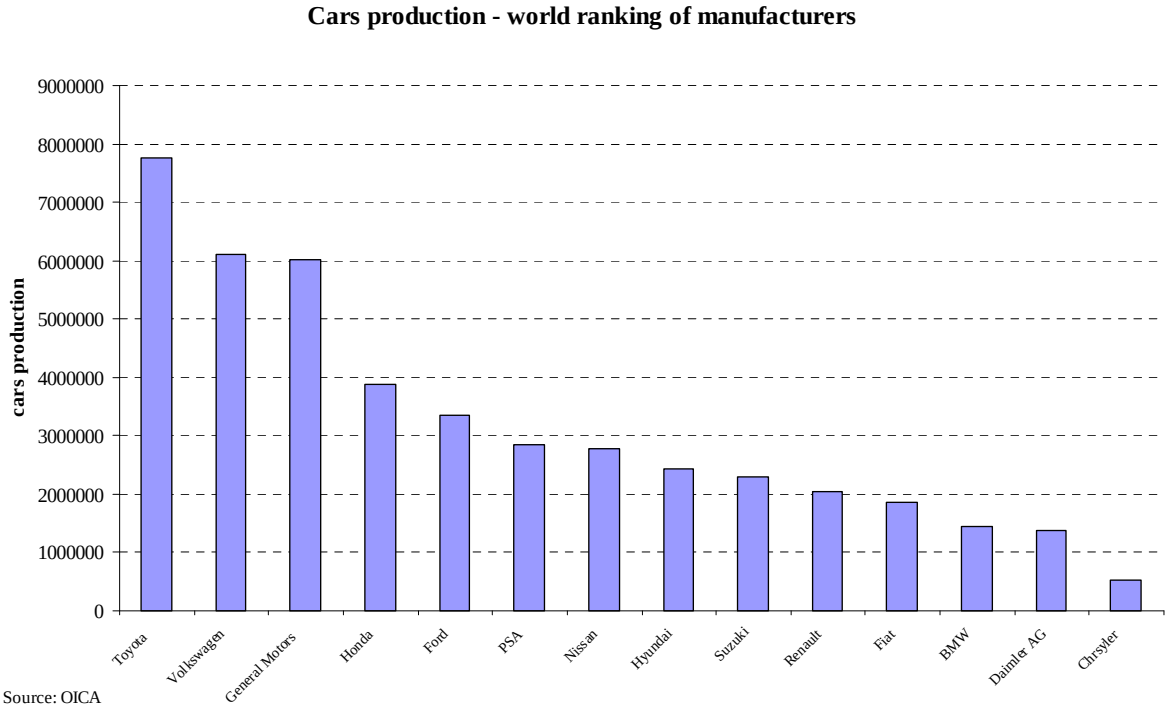
Annex 3-3: Rationale for sectoral measures: role of the automotive industry in the economy

Figure A.3.3.1: Share of motor vehicles in value added and employment



Source: EUKLEMS

Figure A.3.3.2: World motor vehicle production by manufacturers



Source: OICA

Annex 3-4: Sectoral stimulus package in the rest of the world

Country	Measures
Australia – December 2008	Special Purpose Vehicle as a financing trust to provide liquidity for car dealer financiers. 12 months.
Brazil – Feb 2009	Government credit for carmakers. Temporary reduction in the industrial product tax on car sales until April 2009.
Canada – March 2009	Disbursement of government loans to GM of Canada and Chrysler Canada. The Government has also taken an ownership position in these companies.
Canada – April 2009	Canadian Warranty commitment Programme to guarantee warranties from GM Canada and Chrysler Canada during the restructuring period. Expanded accounts receivable insurance for automotive parts suppliers.
China March 2009	Expansion of the scope of the support policy for disposal and renewal of used vehicles refund of no more than the purchase tax of vehicle).
Korea – Dec 2008	Reduction of the individual consumption tax on automobiles (local and imported) by 30%. December 2008 to June 2009. May 2009: 70% cut on individual consumption tax and acquisition tax for new automobiles purchased to replace old cars. Effective until December 2009.
Russia – November 2008	Financial support measures for the car industry (government procurement volume increased, loans to leasing companies, state guarantees, partial compensation of credit rates for vehicles purchased by private persons).
Chinese Taipei	Commodity tax on cars reduced.
Turkey	Reduction of tax on cars
United States	US Auto industry Financing Programme (loans to GM and Chrysler) Loans to GM: $13.4bn Loans to Chrysler: $4bn April-May 2009: new loan to GM ($2bn) to provide working capital for the company.
United States	Auto supplier support programme ($5bn). Available to all critical suppliers. The programme provides the same benefits to foreign and local suppliers

	through financial protection on receivables from any domestic auto companies.
Japan – June 2009	Government programme (U$3.87bn) to encourage the purchase of environmentally friendly vehicles (local and imported). June 2009-March 2010.

Source: WTO; Report on the Financial and Economic Crisis and Trade-Related Developments. September 2009.

Annex 3-5: Brief description of the automotive value chain

Large car manufacturers, also called Original Equipment Manufacturer (OEM), assemble the final product, i.e. the car. The OEMs work closely with suppliers which deliver car parts and components. There are three tiers of suppliers, depending on the type of products supplied to the OEM: Tier 1-suppliers, Tier 2-suppliers and Tier 3-suppliers102. There are 15 large OEMs for cars, trucks and buses in Europe and about 5000 automotive suppliers, most of them SMEs or Mid Caps.

There is a strong integration between the different tiers of the supplier industry. The so-called "Tier 1"-suppliers, having more than 50% of direct sales to OEMs, are particularly R&D- and knowledge-intensive and act as "system integrators", which includes the design and pre-assembly of sub-components from other suppliers further upstream. This also gives a key role to Tier 1 suppliers. Upstream suppliers are classified as "Tier 2"-suppliers with direct sales to "Tier 1"-suppliers, and "Tier 3"-suppliers with direct sales to "Tier 2"-suppliers.

Another distinction among suppliers is between specialised and diversified suppliers. While some suppliers are entirely depending on the automotive industry, others provide components to several other industries as well, e.g. aeronautics and energy/environment industries, which reduces their exposure to ups and downs in the automotive industry.

[102] See Competitiveness Report 2004, Chapter 4, The European automotive industry: competitiveness, challenges and future strategies.

4. INNOVATION IN TIMES OF ECONOMIC CRISIS

The role of technological change as a major driver of sustained long-term economic growth is unanimously recognised and a wealth of theoretical and empirical evidence underlines the link between innovation investment and overall economic performance as measured, for example, by economic growth, competitiveness and social welfare.[103] This has led economic policy to focus on the tools to promote public and private R&D investments, innovative activities and the diffusion of innovation within the single European market.

The EU's commitment to a long-run strategy of R&D support is commonly identified with the 2010 R&D target under the Lisbon Strategy for Growth and Jobs, i.e. an R&D expenditure ratio of 3% of GDP where two-thirds is funded by private sources. Although the appropriateness of a single target for a complex phenomenon such as innovation is sometimes questioned, the general objective of increasing innovation in Europe remains undisputed. The EU-27 is lagging behind the US, Japan and South Korea in terms of R&D intensity, mainly due to a lower level of R&D funded (and performed) by the business sector. The latest available data show that R&D expenditure came to 1.85% of GDP in the EU-27 in 2007, unchanged from 2006, broadly equivalent to the levels achieved at the beginning of the century and far from the 3% target. Moreover, business R&D accounted for only 55% of overall R&D spending, 10 percentage points below the target set, although there is some evidence that R&D expenditure by the business sector increased strongly before the crisis in 2008.[104]

Chapter 2 in this publication has provided an overview of the structure and short-term performance of the European economy in different product markets. The chapter has illustrated the unprecedented fall in output in many sectors of the EU economy, especially in those dependent on exports and credit financing. This affects policy design and the trade-off that policymakers face in terms of time consistency, sector specification and long-term goals, as documented in chapter 3. This chapter assesses the effects of the crisis on the R&D and innovation performance of the European economy. In particular, Section 4.1 identifies the possible effects of the crisis on innovation performance, specifically on business R&D and the financing of innovation activities. Section 4.2 gives an overview of the policy initiatives taken by Member States to support knowledge investment. Section 4.3 offers a sectoral perspective by highlighting the possible sectoral composition effect of the crisis on R&D and Section 4.4 details the main policy conclusions.

4.1. Economic crisis and innovation performance

The current economic crisis may have a long-lasting effect on the innovative potential of European economies if it permanently reduces the stock of R&D capital ('knowledge stock'). This would pose a formidable challenge in terms of policy initiatives, taken at both the national and Community levels.

Business cycles and innovation dynamics are interrelated. The Schumpeterian tradition tends to focus more on the effect of innovation creation and diffusion on the dynamics of business

[103] Romer (1994), Young (1998).

[104] EU Industrial R&D Investment Scoreboard 2009.

cycles.[105] In line with this stream of literature, the focus is on the interaction between micro-economic actors and its resulting macro-economic effect.[106] On the other hand, aggregate time series and investment theory reveal the high elasticity of business capital and R&D investments to the business cycle.[107]

Both these traditions of economic literature offer important insights for policymakers. A major current policy concern is to minimise the adverse effect of the business cycle on R&D spending. Indeed, a drop in R&D-related expenditure now may have long lasting effects on the European economy far beyond the time necessary for a full recovery. Both the cumulative and path-dependent nature of knowledge accumulation[108] suggest that a consistent, although time restricted, fall in the flow of R&D investment may affect the overall knowledge stock and, in turn, dampen potential economic growth far beyond the short-term effect of the business cycle. This is mainly due to the role of R&D externalities in raising productivity levels of labour and capital thus affecting the long-term (*steady state)* growth rate.[109]

This issue is relevant for both the public and private components of R&D investment. There is a risk that, over the medium term, public R&D investment may be reduced in some countries due to the additional constraints on public finances induced by the crisis and a potential reallocation of financial resources towards more short-term goals. However, as indicated in the survey of Member States' policies in Section 4.2, many Member States mitigated this risk using public R&D spending in 2009, in conjunction with the European Recovery Plan, as a counter-cyclical tool to support overall R&D spending.

The slowdown of private R&D investment represents a more difficult and important challenge from a policy perspective (see Section 4.1.1). It is *difficult* because it involves several economic actors operating in different sectors under very different economic conditions (i.e. the degree of competition and integration) and responding to different market incentives and financial constraints. It is *important* because companies investing in innovation are more likely to increase their productivity and experience higher growth which constitutes the main motive for the Barcelona agreement signed by European Member States in 2002[110], which aimed to define the necessary policies for creating a knowledge-based Europe in the context of the Lisbon strategy. Indeed, it is precisely in business R&D performance that Europe is relatively weak.

Unfortunately, the nature of the current economic crisis appears to affect many market channels that support innovative investment by firms. In particular, the credit constraint induced by the financial crisis, associated with a strong decline in demand, affects two of the major determinants of innovative investment. On the one hand, the decline in aggregate demand renders it more difficult to introduce innovation into the market since demand is also

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[105] Schumpeter (1928), Freeman *et al.* (1982).

[106] Nelson and Winter (1982).

[107] Cooper (1999).

[108] Arthur (1994), Rosenberg (1994).

[109] R&D externalities allow non-increasing returns at the micro-economic level to be reconciled with unbounded growth at the macro-economic level. This puts R&D at the core of both the endogenous growth models (Romer, 1986; Lucas, 1988) and of any policy attempt to raise a country's long-term economic growth.

[110] See Barcelona European Council, Presidency Conclusions, 15/16 March 2002.

a fundamental driver of technological change which is often embodied in new products.[111] On the other hand, tighter credit reduces a firm's capacity to obtain financial support for innovative investments (see Section 4.1.2).

4.1.1. Estimating business R&D expenditure

This section discusses estimates of business R&D trends based on available time series data for European Member States. *Eurostat's Science and Technology Indicators* represent the main information source of observed R&D spending since they provide comparative data for all European Member States from 1980 onwards. However, indicators in this area are only available with a two-three year lag.[112] This hampers an assessment of the actual effect of the crisis on R&D spending.

The results discussed in this section are based on estimated R&D expenditure based on a structural model (see Box 4.1).

Box 4.1: Forecast of real business expenditure EU-27 – Background model specification and empirical results

The procedure for estimating business R&D spending comprises the following steps. First, the following dynamic model specification of R&D funded by the business sector is estimated for a panel of EU Member States over the period 1996-2006:

$$R\&D_{ct} = \alpha + \beta_1 R\&D_{ct-1} + \beta_2 GDP_{ct} + \beta_3 Int.Rate_{ct} + \sum_{i=1}^{27} \gamma_i CD_i + \sum_{t=1996}^{2006} \delta_i YEAR_t + \varepsilon_{ct}$$

where R&D and GDP are expressed in logarithms and in real terms using Eurostat's GDP deflator. Real interest rates are obtained from AMECO. The specification is augmented by (1) a set of country dummies to capture time-invariant country-specific effects and (2) a set of time dummies to capture idiosyncratic shocks in the time series. Finally, estimations are based on an AR(1) correction of the error term to account for autocorrelation in the time trend.

Second, GDP forecasts are drawn from Eurostat up to 2010 and used to estimate the effect on R&D based on the coefficient obtained in the previous step for all Member States. The final point estimate of R&D is based on the joint effect of the statistically significant regressors, namely lagged R&D and GDP only.[113]

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[111] Schmookler (1966), Thirtle and Ruttan (2002).

[112] In particular, the latest available release covers the year 2007 for aggregate R&D spending and the year 2006 for R&D spending disaggregated by source of funding and sector of performance.

[113] Robustness checks (available on request) support the choice of the adopted estimation for the forecast exercise by revealing a highly statistically significant correlation between point forecasts and true R&D values over the period 2000-2006.

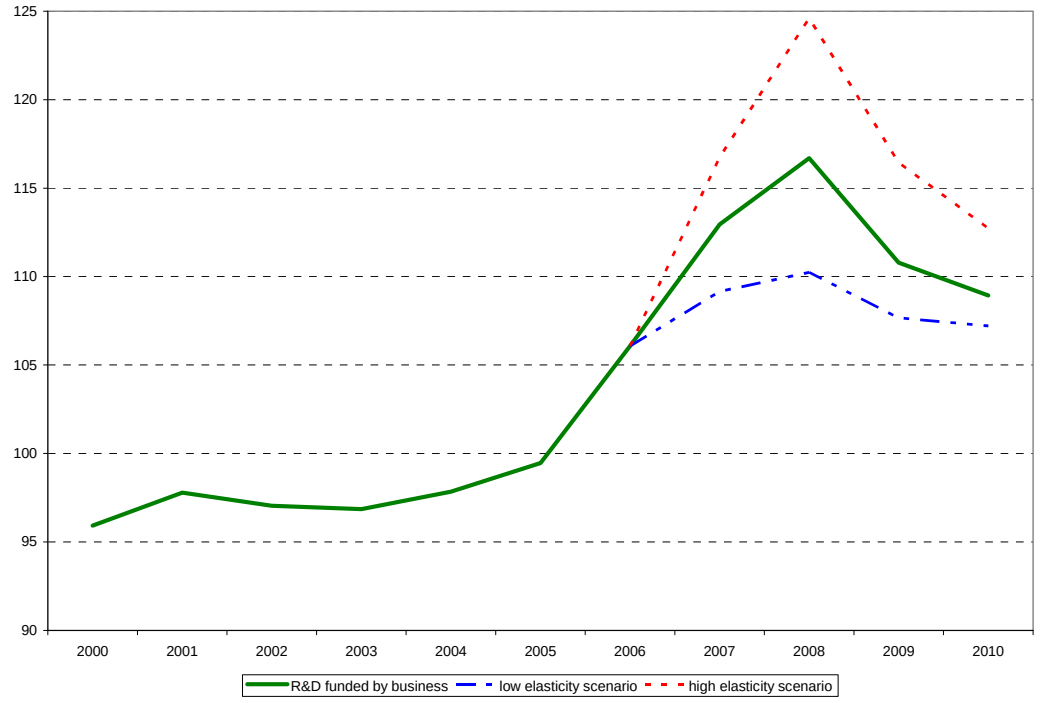
Finally, the confidence interval obtained in the previous regression allows for the identification of a high (low) elasticity scenario of business R&D, as reported in the following table:

Year	R&D funded by business (ML Euro - 2000 Prices)	%-change	R&D funded by business - Low Elasticity	R&D funded by business - High Elasticity
2000	95.92			
2001	97.79	1.95		
2002	97.05	-0.76		
2003	96.85	-0.20		
2004	97.85	1.03		
2005	99.45	1.64		
2006	106.07	6.65	106.07	106.07
*2007	112.94	6.48	109.15	116.73
*2008	116.70	3.32	110.24	124.60
*2009	110.79	-5.06	107.66	116.43
*2010	108.93	-1.68	107.21	112.72

** forecast values.*

Sources: Eurostat Database, forecast based on DG ECFIN calculation

Figure 4-1: Development of R&D expenditure funded by business in the EU-27 (€bn)



Source: Eurostat Database, forecast based on DG ECFIN calculation

As expected, our findings confirm the high cyclical nature of private R&D spending and GDP.[114] Indeed, these results suggest that the elasticity of business-funded R&D expenditure with respect to GDP is significantly above 1. This value is lower than the elasticity of overall investments to GDP and thus suggests that R&D spending is a more long-term oriented commitment. Moreover, this finding is reinforced by the evidence that business R&D expenditure does not significantly react to changes in the real interest rate, which indicates the prevalent use of internal financing for R&D activities. In turn, this means that the current crisis has an impact on business R&D expenditure mainly by shrinking internal cash flows.

Under the 'no policy change' assumption, the estimates show that the positive trend recorded in recent years comes to an end in 2009 when the downturn in GDP begins to drive business R&D down. A fall is also expected in 2010 (see Figure 4-1).

Two important messages emerge from this analysis. First, the economic crisis has stopped a virtuous trend of increasing business expenditure on R&D activities which represents one of the major policy targets at the EU-wide level. Second, the inertia in the process of knowledge accumulation, as suggested by economic literature (see Section 4.1), also emerges in the empirical analysis reported here. In particular, a value of elasticity close to 60% between current and lagged values of R&D spending suggests that R&D spending is determined, to a large extent, by its own dynamics. Therefore, a drop in the current level of R&D spending will depress future values of R&D. Indeed, these two combined sets of evidence indicate that the effect of the economic downturn on private R&D spending may last beyond the economic recovery and thus offset the progress recorded in the last years.

4.1.2. Financing of innovation

Possible credit constraints linked to the current crisis and the expected deterioration in the balance sheets of many companies are expected to play an important role in the current and future dynamics of business R&D investments. The current decline in business R&D expenditure is due to the fact that firstly, retained earnings shrink during economic downturns, resulting in firms generating fewer internal R&D funds, and secondly, external financing may also become more difficult. Empirical evidence shows a comparatively higher risk associated with R&D activities even under "normal" economic conditions.[115] As risks are expected to be even higher in a period of crisis (e.g. on account of difficulties with launching new products), financial institutions, which may become more risk-averse in the wake of the crisis, could well impose stricter conditions on access to finance. Even when funds are available, such higher risk may lead companies to postpone planned R&D investment in favour of safer investment choices.

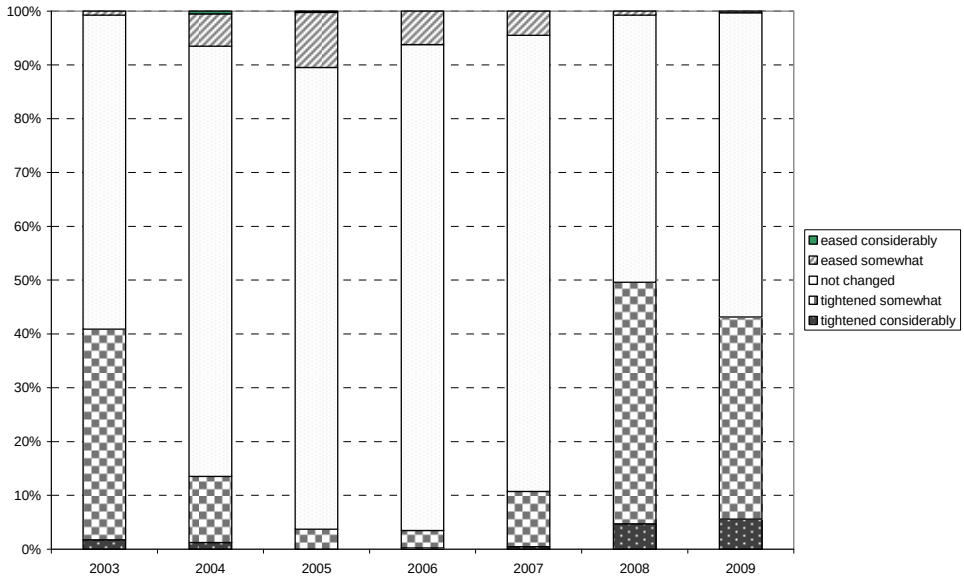
There is already emerging evidence that the crisis is driving banks to shift their portfolios towards less risky activities to the detriment of financing of business R&D. Even when funding is made available, the high cost (including a risk surcharge) may discourage companies from accepting it. Sharp reductions in the volume of bank loans and in venture capital spending have been witnessed in recent months as a result of an increase in risk

[114] A similar analysis has been conducted on overall capital investment. Results are available on request.

[115] Scherer and Harhoff (2000), Scherer *et al.* (2000).

aversion among financial institutions and private investors.[116] Indeed, the ECB underlines that a considerable share of banks have tightened their credit standards applicable to the approval of loans or credit lines to enterprises in recent months (see Figure 4-2).[117] In a recent survey conducted for the Commission, entrepreneurs reported a decrease in the willingness of banks to provide loans in the first half of 2009.[118]

Figure 4-2: Change of credit standards as applied to the approval of loans or credit lines to enterprises



Sources: ECB, Bank Lending Survey 2009 (Sample: 118 euro area banks)

The evidence presented above seems to suggest that the impact of the crisis will be substantial for those categories of companies which cannot rely on big internal financial reserves. This may substantially hamper the effectiveness of policies developed in recent years aimed at widening the innovative base of the European economy by including small and medium enterprises (SMEs) in the innovative process.

Empirical evidence suggests that SMEs and companies operating in mid-low technology sectors generally identify financing constraints as one of the major obstacles to innovation activities.[119] The current economic crisis is very likely to exacerbate this phenomenon. The proportion of SMEs reporting an increase in external financial needs is approximately twice

[116] See also OECD, 2009, First Interim Report on the OECD's Strategic Response to the Financial and Economic Crisis, C(2009)26 and European Private Equity & Venture Capital Association, 2009, Quarterly Activity Indicator – Trends in Q2 2009.

[117] ECB, Bank Lending Survey 2009 (Sample: 118 Euro Area banks).

[118] European Commission, 2009, Flash Eurobarometer 271, Access to Finance.

[119] ECB, 2009, Survey on the Access to Finance of Small and Medium-sized Enterprises in the Euro Area.

as large as that of large firms. Smaller companies experience a lower availability of external financing and an increase in related costs when financing is made available, compared to larger and incumbent firms.[120]

These financial constraints may also constitute a serious obstacle to start-ups and to the more dynamic and young innovative companies (YICs). Indeed, for these companies access to external finance is the most important issue for implementing innovation strategies. With short company histories and a lack of collateral, young companies are more likely to be constrained by capital market imperfections than other firms. Additionally, young innovative companies usually conduct more radical investment projects, which further exacerbates the difficulty to attaining credit.[121] It is, therefore, necessary to account for these factors when implementing policies supporting innovative activities by this category of companies and overall entrepreneurship opportunities in Europe.

4.2. Anti-crisis measures

Section 4.1 examined how the nature and magnitude of the current economic crisis might lead to a substantial decline in private R&D investment. This is the main reason why Member States and the European Commission paid growing attention to identifying a number of counter-cyclical measures – in terms of both increased public support for R&D and policy tools to sustain private R&D investment – aimed at preserving the current stock of knowledge and thus sustaining the major determinant of long-term economic growth.[122]

The objective has been to design policy measures which combine short-term gains in terms of economic recovery and long-term goals such as building a stronger economy for the future.[123] The European Economic Recovery Plan[124] recommends that Member States "increase planned investments in education and R&D (consistent with their national R&D targets) to stimulate growth and productivity. They should also consider ways to increase private sector R&D investments, for example, by providing fiscal incentives, grants and/or subsidies."

Following their common agreement and acknowledging the need to support private sector investment in times of crisis, many Member States have stepped up their public R&D spending to counteract the adverse effects of the economic downturn on R&D and innovation. These measures have been recorded and analysed by the Commission services.[125] The survey shows that approximately two thirds of the Member States appear to have increased their public R&D spending in response to the economic crisis. Overall, public sector support measures seem to have increased by about €4 billion in 2009, thereby compensating half of the estimated decline in business R&D spending in the EU-27 due to the crisis (see Section 4.1.1.).[126] While there is more uncertainty concerning expenditure in 2010, and public and

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[120] European Commission, 2009, Flash Eurobarometer 271, Access to Finance.

[121] See Gaspar *et al.* (2008), Schneider and Veugelers (2008).

[122] See OECD, 2009, Policy Responses to the Economic Crisis: Investing in Innovation for Long-Term Growth.

[123] See Conclusions of the Brussels European Council 19/20 March 2009.

[124] Communication from the Commission and the European Council COM(2008)800.

[125] A detailed list of the crisis related measures taken by EU Member States which entail an increase in spending in the area of R&D is provided in the Annex 4-1.

[126] See Annex 4-1 and European Commission, MICREF Database.

private sector funding are not perfect substitutes, this is nevertheless a significant result. It suggests that the damage to 'R&D capital' and thereby to potential growth could be lower than would otherwise have been the case.

Examining the measures taken, it can be seen that around two thirds constitute direct funding (subsidies, grants) whereas the remaining measures offer tax relief (credits, exemptions). Direct funding, in the majority of the cases, is predominantly aimed at business-related research, but also at universities and research institutions, though to a lesser extent. Tax incentives often appear in the form of increases in tax credits for R&D expenditure or reductions in taxes on the salaries of researchers. In general, Member States tend to resort to the same policy instruments that were used to stimulate R&D and innovation before the crisis. In a slight majority of cases, the additional measures are temporary. Conversely, measures without expiration dates tend to be tax incentives, which generally appear compatible with the common European endeavour to stimulate innovation in the long run.

Public support should not only aim to stabilise the economies in the short term via increased demand, but also to sustain (mid- to long-term) increases in R&D spending in the private sector by setting the right incentives to innovate by providing adequate knowledge infrastructures (e.g. on educated workforce, broadband communications).

A crucial aspect to be considered when designing policy measures is the possibility of crowding-out private R&D[127], for example due to a scarcity of researchers. Therefore, close collaboration between the public and private sector is necessary, not only to gain information about the correct timing and necessary volume of (additional) support, but also to identify special needs and opportunities in the business sector.

The coordination of policies at European level plays an important role here. Information about different national policy initiatives and their effect on economic performance is at the core of the European Commission's monitoring of microeconomic reforms undertaken by the Member States (see Box 4.2).

Box 4.2: Innovation Policies and Microeconomic Reforms

Innovation is a multifaceted phenomenon involving a range of actors (e.g. universities, businesses, institutions) and different policy and business strategies (from a government's design of tax incentives to a firm's investment choice in innovation, its location and its cooperation and competition strategies). As a crucial determinant of the competitiveness of a country, innovation is clearly intertwined with a wider range of public policies dealing with many of the most pressing economic challenges in our societies such as climate change, ageing, globalisation, long-term economic growth and welfare.

There is a growing consensus that structural reforms are crucial to addressing these policy issues. Many of the structural reforms adopted across Europe deal with economy-wide framework conditions, which, in turn, affect the scope and the effectiveness of innovative activities. For instance, improving the functioning of the European Single Market may result in a new wave of innovative activities related to better and deeper information flows and to increased competitive pressures on companies across Europe. Policy reforms aimed at

[127] Cox and Gagliardi (2009).

increasing the educated population may result in innovation in companies due to a better skilled workforce and to a higher rate of business start-ups. Reforms affecting the financial sectors may prove important to innovative activities, as discussed in Section 4.1.2.

Each of these dimensions can be better reinforced by specific policy initiatives taken at EU and national level. Mapping national policy initiatives at the EU-27 is the purpose of the Commission's MICREF database which helps to improve the surveillance of micro-economic reforms in the context of the Lisbon Strategy for Growth and Jobs. Available data indicate that R&D and innovation represent the policy field in which Member States adopted the highest percentage of reforms between 2004 and 2008 (around 30% of all reforms recorded by Member States in their National Reform Programmes). Descriptive evidence from the MICREF dataset indicates an increasing number of policy initiatives across most Member States, especially in the field of education, and in support of the business environment. Indeed, it appears that over time most Member States are increasingly relying on a complementary set of policies to stimulate economic growth.

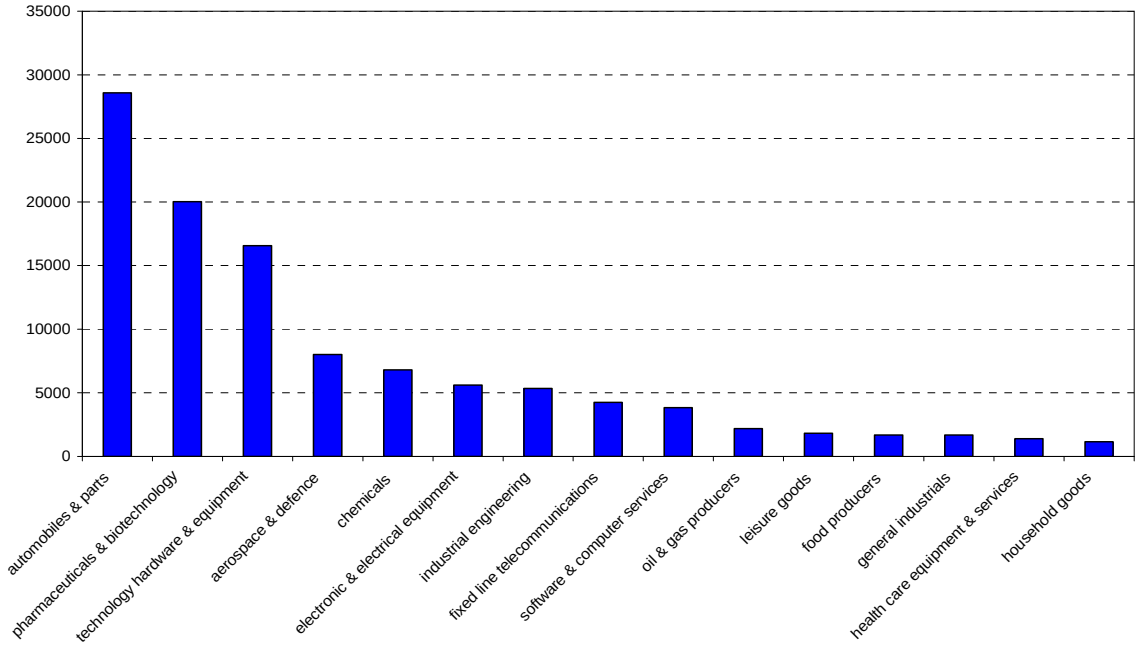
4.3. Sector specific R&D activity

To complement the sectoral analysis conducted in chapter 1, this section provides a sector-specific analysis of R&D investments. R&D spending is strongly dependent on the sector-specific technological environment. Indeed, the technological nature of products, their life cycle, the role that innovation plays among consumers (i.e. open innovations) and the competitive interaction of companies all affect the intensity and type of innovative investments pursued by businesses.[128] Figure 4-3 provides data on sector R&D spending by top European R&D-investors.[129] Data indicate that the top spending sectors are (1) automobiles & parts, (2) pharmaceuticals & biotechnology and (3) technology hardware & equipment, whose combined shares account for approximately 15% of EU value added.

[128] Malerba (2004).

[129] Sectors are defined according to the ICB's (Industry Classification Benchmark). Since the data refer to top investors only, differences in market structure may to some extent affect the comparison of sectors and countries.

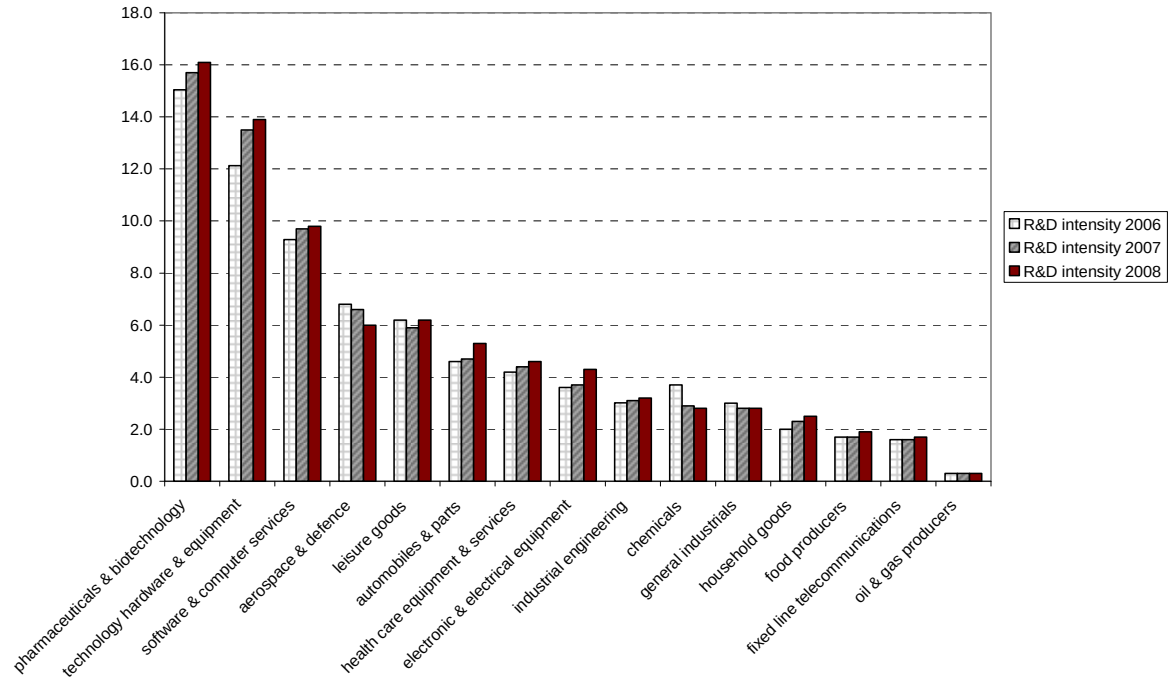
Figure 4-3: R&D investment by top R&D investors in EU-27 (€mil)



Source: EU Industrial R&D Investment Scoreboard 2008

Figure 4-4 provides the same sector disaggregation but it provides data on R&D intensity, namely the relationship between R&D spending and companies' net sales. Sector ranking is quite similar to Figure 4-3 with the exception of the automobiles & parts sector, due to its relatively high volume of sales and value added (see Chapter 2).

Figure 4-4: R&D intensity (R&D investment/ net sales) by sector (EU-27)



Source: Data from EU Industrial R&D Investment Scoreboard 2007, 2008, 2009

The comparison of sectoral R&D intensities over time indicates a similar ranking across sectors. It appears that the relative divide between sectors with higher and lower R&D intensity has increased as a result of increased spending in high-tech sectors and stable R&D investments in lower tech sectors.

As stated earlier in this chapter, EU-27 data on aggregate R&D spending indicate a gap with the Lisbon policy objective of 3% mostly due to lower-than-expected R&D investment by the business sector. Consequently, many policy initiatives in recent years have focused on creating incentives for private R&D investments. Whilst this is undoubtedly helpful, the figures above illustrate the importance of the sectoral composition of the economy. In fact, the analysis presented in Box 4.3 indicates that the relatively medium-technology orientation of the EU economy explains about 50% of the gap with the US, which stresses the role of the composition of economic activity in explaining this gap. This, in turn, indicates that a long run R&D and Innovation strategy should also aim to address the general framework conditions that facilitate structural change and sectoral adaptation. The structural reform agenda covered by the Lisbon strategy is, therefore, of eminent importance. A corollary of this is also that due caution is required when focusing on aggregate expenditure ratios and policies that aim at increasing public funding *per se*.

Box 4.3: Decomposing the source of the EU-US gap in R&D spending.

The aim of this analysis is to estimate the effect that sector composition has on R&D investment in Europe. Specifically this section breaks down the gap between EU and US R&D spending into two components: (1) a *between* component, namely the R&D gap due to the different economic importance of different sectors in the EU and US and (2) a *within* component, namely the R&D gap due only to R&D underinvestment in EU sectors compared with US sectors.

Eurostat's Science and Technology Indicators was used to identify sector R&D spending (according to NACE Rev. 1.1) in EU-25 countries (no sector data are available for Bulgaria and Romania). A direct comparison is hampered by the lack of sector R&D figures in the US. Moreover, the missing values at sector level generate a very unbalanced data structure within the EU. Eurostat's data are combined at sector level with the EU KLEMS database, from which information on sector value added is obtained for the last available year (2005) for each EU Member State compared with the US.

Assuming constant R&D intensity within sectors, and specifically that an increase/decrease in value added in a sector will result in a proportional increase/decrease in R&D spending, fictional R&D figures are computed at sector level based on the hypothetical sector composition taken to be that of the US. These figures are then compared with the original figures and aggregated at country level for each EU Member State. Finally, the data are weighted for the EU-25 according to each Member State's share of total EU-25 R&D.

The results indicate the relevance of the sector composition in explaining the gap with equivalent US figures. Indeed, applying US sector composition to the European economy results in a 20% increase in overall R&D spending. In turn, this would increase overall R&D intensity at the EU-27 from 1.85 to 2.19 compared with 2.67 in the US (latest figures available for 2007) and thus reduces the overall gap from 0.82 to 0.48.

These results indicate, therefore, that around 40% of the gap between EU and US R&D intensity is explained by sector composition.[130] This evidence has a relevant policy implication in the debate on the future of R&D policies in Europe. It calls for the recognition of the importance of sector composition *per se* and in cross-country comparisons of aggregate figures. Moreover, it appears to be important to two aspects of policy making – timing and scope. Indeed, it calls for a distinction between policy initiatives aimed at short-term R&D targets and the definition of long-term R&D strategies involving a more systemic approach to the so-called *knowledge triangle* (R&D, education, innovation), namely by making *education, competition and regulation policies* converge in their support of R&D, innovation and entrepreneurship.

[130] This analysis is conducted at the NACE Rev.1.1 two-digit sector aggregation. At the one-digit level, sector composition accounts for almost half the gap (48%) in R&D intensities between the EU-27 and the US.

4.3.1. Regulatory aspects beyond the crisis: The case of the European pharmaceutical sector

This section explores the impact of regulation on incentives to innovate by summarising a recent examination of the pharmaceutical sector carried out by Commission services.[131] The aim is to discuss the role played by regulatory aspects in this sector in supporting innovation on a long-term perspective, namely beyond the current economic downturn. Indeed, regulation is a major factor affecting the functioning of this complex industry. Although only marginally affected by the crisis, the pharmaceutical sector exemplifies the implications that regulation may have on the competitiveness of the European business community. According to the 2009 EU R&D Investment Scoreboard, the pharmaceutical sector, including biotechnology, is among the top R&D investors in the EU and the most R&D-intensive (see Figure 4-3 and Figure 4-4). Nevertheless, the EU cannot match the ability of the US to generate, organise and sustain innovation processes in pharmaceuticals and therefore cannot match US productivity growth.[132] Consequently, the last decade has seen Europe lose ground in pharmaceutical innovation and witnessed the core of pharmaceutical research move to the US and Asia, where new international competitors are emerging.[133] There is growing pressure from buyers and greater scrutiny of pricing, combined with drug patent expiries and uncertainty over replacements, which is hinting towards more innovative commercial and research models.[134]

The pharmaceutical industry focuses on fulfilling unmet medical needs by carrying out R&D on new pharmaceutical products and by discovering new compounds. This entails uncertain, long-term investments in new products and since most pharmaceutical R&D fails to bring a new product to market, total investment per successful drug marketed is very high. The investment per successful drug is an inverse indicator of the 'productivity' of pharmaceutical R&D spending.[135] R&D expenditure in the sector has grown substantially, but the number of innovative medicines reaching the market has declined.[136]

Governments are significantly involved in the pharmaceutical sector, not only as regulators, but also as the primary source of financing.[137] Regulation has overlapping and also sometimes competing objectives, ranging from supporting innovation to ensuring high standards of public health and containing public expenditure. Differences in regulation across Member States depend on numerous factors including available resources, the health needs of the

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[131] European Commission (2009).

[132] Pammolli and Riccaboni (2008).

[133] European Commission, COM(2008) 666.

[134] Financial Times, 30.09.2009, 'Healthcare and the Recovery', 'Same end, entirely different means'.

[135] OECD (2008).

[136] According to the industry, this is due to increased scientific complexity, which requires a more extensive knowledge base, high attrition rates due to regulatory risk aversion, and uncertainty about the financial rewards. The increase in the time taken to market new products due to regulation and approval procedures also makes drug development less attractive to investors. In a recent survey of the life sciences industry, carried out by Deloitte, over 80% of the respondents considered regulatory review and approval processes to be major impediments to innovation today, and likely to remain so over the next 10 years. Deloitte Development LLC (2007).

[137] OECD (2009).

population and political priorities. Moreover, there is often an important link with the structure of the Member State's pharmaceutical industry. Perhaps the most difficult trade-off in pharmaceutical policy is between static efficiency (maximising the impact of today's expenditure on current general health) and dynamic efficiency (creating incentives to carry out R&D on products that could help improve health and cure diseases in the future).[138] Healthcare regulation, including pharmaceutical financing and reimbursement policies, is largely the exclusive competence of EU Member States, contributing to market fragmentation. In turn, this contributes to disparities in national pricing and reimbursement schemes, unnecessary regulatory burdens caused by divergences in the implementation of Community legislation and a lack of commercial interest in economically unattractive national markets.[139]

A key challenge for the sector is the high cost and high risk of innovation. The pharmaceutical sector relies very heavily on patents to protect its inventions because products have a long life cycle. By providing patent holders with exclusive rights, patents offer a pharmaceutical company the opportunity of reaping financial rewards from investment in developing new medicines, which also acts as an incentive to further innovation. Thus, intellectual property rights promote dynamic competition by encouraging undertakings to invest in developing new or improved products and processes.[140] The fact that patents are only temporary also gives patent holders incentives to invest and innovate further to maintain a competitive advantage. It is very important that the criteria for patentability are set at the right level and that they are strictly implemented. Patents granted too restrictively may discourage innovation whilst patents granted too easily may restrict competition in the market place.

It is still not possible to obtain a patent that is valid and enforceable throughout the EU, although it seems that very recently some progress has been made towards this objective.[141] At present, patents in the EU can be obtained either by filing applications at national patent offices or by filing a single patent application at the European Patents Office (EPO). However, national validation and maintenance of the 'European patent' remains necessary in each Member State where the patent owner wishes the patent to exist and to be enforceable. The 'European patent' – as it exists today – is thus merely a bundle of national patents. This fragmented patent system is a major impediment to innovation in Europe and to the EU's global competitiveness.[142] This is why the Commission has long proposed a Community

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[138] OECD (2009).

[139] European Commission, COM(2008) 666.

[140] Although not the focus of this section, the role of competition by putting pressure on undertakings to innovate should be mentioned, since competition is necessary to promote innovation and to ensure a competitive exploitation thereof. As example the recent Pharmaceutical Sector Inquiry of the European Commission (European Commission (2009)) argues that defensive patenting strategies that mainly focus on excluding competitors without pursuing innovative efforts and/or the refusal to grant a license on unused patents should be subject to antitrust scrutiny, in particular in situations where innovation was effectively blocked.

[141] On 4 December 2009 the EU Member States reached a unanimous agreement on the general focus of European patent regulation and Council conclusions on a common European Patent Court.

[142] European Commission, COM(2007) 165: '*Recent studies have also shown that a European patent designating 13 countries is about 11 times more expensive than a US patent and 13 times more expensive than a Japanese patent if processing and translation costs are considered. For the total costs with up to 20*

patent. It would eliminate the cost of national validation and renewal of patents because, once granted, a Community patent would be a unitary legal title valid throughout the EU, providing consistent legal security and uniform protection across Member States and, hence, a level playing field for all stakeholders in the patent system. A Community patent would also be easier, less costly and less risky for start-ups and SMEs in particular.[143] A similar problem affects the current patent litigation system in the EU. At present, a company may have to litigate simultaneously in all Member States where it has a validated patent. This involves considerable cost, complexity and legal insecurity and can also lead to contradictory court decisions in different Member States.[144] This provides *prima facie* justification for a unified and specialised patent litigation system covering European and Community patents. In addition, by avoiding the cost of duplicating infringement and revocation cases, the European economy could also benefit significantly.[145]

To increase and protect public health and facilitate trade in pharmaceutical products within the EU, pharmaceutical products are only allowed to enter the market after market authorisation has been granted in accordance with Community pharmaceutical legislation. Before market authorisation is granted, all these products are tested extensively for their quality, safety and efficacy. This requires administrative work by pharmaceutical companies and any delays in authorising market entry lead to losses for the companies and delayed patient access to new medications. Based on an evaluation by the European Medicines Agency (EMEA), the way the network of EU medicines authorities currently works needs to be rethought in order to improve efficiency, minimise the regulatory burden and speed up market access for medicines.[146]

The fragmentation of the EU pharmaceutical market is primarily due to the diversity of national pricing and reimbursement schemes, which lead to disparities in pricing, time-to-market delays and access inequalities. Inevitably, price regulation also influences the 'ideal' R&D investment decision by lowering a firm's expected return from R&D and therefore reducing its incentive to invest. The trend towards more stringent regulatory requirements for market authorisation and for price and reimbursement authorities only adds to pharmaceutical companies' R&D costs. The different Member States' price and reimbursement schemes affect pharmaceutical R&D. In particular, differences in pricing and reimbursement systems across the EU sometimes lead to considerable delays in launching pharmaceutical products. This has additional negative effects on a company's R&D investment returns and consequently on its incentives to innovate. This is an EU-specific issue which justifies policy initiatives designed to reduce institutional fragmentation. To allow companies to spend more funds on research and less on bridging regulatory fragmentation, it is essential that Member States develop better information exchange, greater convergence in procedures and information requirements and identify best practices as benchmarks in pricing and reimbursement schemes. Finally, the Transparency Directive, which seeks to provide an overall view of national pricing arrangements and specifies a series of procedural

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years of protection, European patents are nearly nine times more expensive then Japanese and US patents. If the analysis focuses on patent claims, the cost differences increase further'.

143 Council of the European Union, 8588/09 PI 28.

144 European Commission, SEC(2009) 330.

145 European Commission, Final Report Tender No. MARKT/2008/06/D.

146 European Commission, COM(2008) 666.

requirements, could be scrutinised for possible amendments to ensure that pricing and reimbursement decisions are taken in a timely and transparent manner.

This example illustrates how a fragmented internal market, insufficiently harmonised framework conditions (i.e. the absence of a truly European patent), other regulatory requirements (e.g. the Transparency Directive) and certain anti-competitive practices of companies can work together to pose a formidable challenge to improving R&D performance.

4.4. Concluding remarks

R&D investment is crucial for the European Union to emerge stronger from the current economic crisis. Progress, which has occurred in the last years in terms of overall R&D investment and private R&D spending, is estimated to have come to a halt. Indeed, given the high pro-cyclicality of business R&D, the current economic crisis is set to lead to a contraction in business R&D activity of more than 5% in 2009. The impact of the crisis is likely to vary between firms. In particular, while large companies might have financial reserves available for R&D, small and medium-sized companies and start-ups may postpone or cut innovative investments due to the decreased availability of reserves and increased cost of external funds.

To compensate for the expected decline of business R&D spending in the EU-27, governments have introduced special measures to support R&D activities. Measures adopted by the Member States thus far account for approximately half of this amount, suggesting that the adverse effects on potential growth may be smaller than assumed. However, analysis also suggests that a sustainable long-term increase in R&D in Europe requires significant structural change in our economies. Indeed, almost half of the total gap in R&D intensity with the US appears to be related to the EU economy's less high-tech specialisation. This is a crucial issue to be considered when defining policy initiatives to enhance R&D investments in Europe. Indeed, further reforms are needed to create better framework conditions for innovation. A balanced policy mix needs to cover not only R&D and innovation but also education, financing, competition and regulation policies in supporting R&D, innovation and entrepreneurship.

Annex 4-1: Crisis-related changes in Member States' public R&D spending

Most measures described below have been reported by the Member States to the Commission as measures taken in response to the current crisis; additional information has been retrieved from the ERAWATCH Research Inventory, the OECD, Member States' Stability and Convergence Programmes and Member States' National Reform Programmes. The given list of measures is not necessarily exhaustive.

MS	Type of crisis-related measure	Description of measure
AT	direct funding	In Austria €404 million are made available additionally for R&D for the years 2009 and 2010 from the federal budget altogether. €100 million thereof has been foreseen explicitly to counteract the crisis (two thirds of this amount is earmarked for business-related research, one third for universities).
BE	tax relief	Belgium extended the partial exemption from payment of the withholding tax on salaries of researchers. After the harmonisation of the exemption rate at its maximum of 65% in July 2008, this maximum rate has been increased to 75% as of 2009.
BG	direct funding	Bulgaria announced in the 2009 State budget Law to increase the volume of the funding through the National Fund for Scientific Research by 50% in 2009 compared to 2008, up to a total of 100 million Lev. These funds are mainly targeted to applied research projects. However, the budgetary allocation has not been implemented yet.
CY	direct funding	In Cyprus the budgetary allocation for the "Research and Promotion Foundation´s Framework Programme for Research, Innovation and Technological Development" for the three years from 2008 to 2010 will be €120 million (co-financed by EU structural funds) compared with just €10 million in 2006.
CZ	direct funding	The Czech Republic increased the public expenses on research and development by 8% in the 2009 budget and intends to apply this rule in the coming years. 600 million Czech Crowns are allocated as investment incentives for projects of technology centres, which will be spent in the following years.
DE	direct funding and tax relief	Germany increases its general spending on R&D by nearly €1 billion in 2009 compared to 2008. Additional resources will come from the "Central Innovation Programme for SMEs", €0.45 billion in 2009 and 2010 respectively, to support individual R&D operations. Specifically for R&D activities on hybrid-propulsion, fuel cell and saving technologies additional €0.5 billion for 2009 and 2010 (total for two years) are made available in the form of loans to the automotive sector. Furthermore, a special depreciation facility for SMEs has been introduced. During 2009 and 2010, in addition to the degressive depreciation, the federal government will increase the business asset thresholds and profit thresholds relevant in this regard. The budgetary impact of the latter measure will amount to €605 million for 2009 and 2010.
DK		Denmark did not directly react to the crisis with increased public R&D expenditure. However, public R&D expenditure is planned to increase from 0.89% of GDP in 2008 to 0.94% in 2009 and 1% in 2010, as already announced ahead of the current crisis.
EE		Estonia did not increase public R&D expenditure in reaction to the crisis.
ES	tax relief / direct funding	The planned elimination of the R&D tax credit on the corporate income tax has been suspended. Moreover, the tax credit has been expanded as of 2008. The credit may now be applied also to companies with more than 25% of their research activity in another EU or European Economic Area country. Non military R&D budget amounts increase in 2009 by 10,2% with respect to 2008.
FI	direct funding	Finland introduced additional business subsidies focusing on R&D for 2009. €561 million have been foreseen within the budget, for a total of €5.6 billion off-budget guarantees have been arranged.
FR	tax relief	France substantially increased the R&D tax credit as of 2008. Additionally, as of 1 January 2009 any outstanding R&D tax credits not offset against corporate tax will be immediately refunded upon request.

GR		Greece did not increase public R&D expenditure in reaction to the crisis.
HU	direct funding	Hungary wants to maintain employment in the field of R&D, not only to prevent temporary unemployment but also to avoid brain drain. It is foreseen to achieve this by giving financial support to public research centres and SMEs which could amount to about €6 million.
IE	tax relief	Ireland introduced a 25% tax credit for equipment related to R&D as of 2009.
IT		Italy did not increase public R&D expenditure in reaction to the crisis. However, the extension of tax credit to research carried out in Italy commissioned by foreign entities as of 2009 has been proposed.
LT		Lithuania did not increase public R&D expenditure in reaction to the crisis. However, corporate income tax exemptions for investment into R&D have been introduced as of 2008. The measure has already been announced before the economic crisis.
LU		Luxemburg did not increase public R&D expenditure in reaction to the crisis.
LV		Latvia did not increase public R&D expenditure in reaction to the crisis. An increase in government R&D funding, envisaged in the budget of 2009, has been postponed.
MT	direct funding	Malta directs €20 million to business related R&D activities in the period 2009-2013.
NL	tax relief / direct funding	In the Netherlands the Research and Development Promotion Act (WBSO) principally is intensified in phases, increasing from €39 million in 2009 to €115 million in 2011. Recently, the WBSO has been stepped up, and €150 million are made available additionally in 2009 and 2010 respectively. Under this Act, a contribution is paid towards the wage costs of employees directly involved in R&D in the form of a reduction of payroll tax and social security contributions and an increase in the tax deductions available to self-employed persons. Two additional measures foreseen for 2009 and 2010 are expected to be adopted soon: €180 million will be made available to support the employment of researchers in the private sector, and €100 million will be allocated to support research projects in areas where the Netherlands have a strong position, such as nano-electronics and automotive.
PL		Poland did not increase public R&D expenditure in reaction to the crisis.
PT	tax relief	Portugal increased the R&D tax credit to a maximum rate of 82.5% of total expenses in R&D as from 2009.
RO		Romania did not increase public R&D expenditure in reaction to the crisis.
SE	direct funding	In Sweden a new research and innovation bill was presented in October 2008 which covers the period 2009-2012 and in terms of additional resources, includes the largest allocation ever. It amounts to 5 billion Swedish Kronas and is more than twice as large as the former bill.
SI	direct finding	For the period 2009-2011 Slovenia is providing additional subsidies to businesses for investment in R&D and new technologies. In the latest supplementary budget for 2009, in comparison to the implemented budget 2008, additional €75.4 million (representing additional 0.21% of GDP) were dedicated to R&D, and additional €163.3 million (representing 1.04% of GDP) to science and technology.
SK	direct funding / tax relief	Slovakia grants financial support for research and development activities carried out by the business sector in the form of state subsidies and corporate income tax allowances, amounting to an overall volume of about €100 million in 2009 and 2010.
UK	direct funding	The United Kingdom brings forward parts of the funds intended for the financial year 2010-11 to provide fiscal stimulus. In this way £442 million will be available earlier for projects to improve infrastructure for further education, improve facilities at higher education institutions, and to bringing forward development of scientific research facilities and improvements to university research infrastructure.

Source: Conte, Schweizer, Dierx & Ilzkovitz (2009)

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