

Still standing: how European firms weathered the crisis

The third EFIGE policy report

BY GÁBOR BÉKÉS, LÁSZLÓ HALPERN, MIKLÓS KOREN
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Foreword

With this publication, which follows on from the preceding report *The global operations of European firms* by Giorgio Barba Navaretti and his colleagues (Bruegel Blueprint No 12, July 2011), the EFIGE project continues to bear fruits. Numerous research papers arising from the project (*European Firms in a Global Economy*) are in the process of being published in economic journals, and another policy report is already being prepared. All this output is based on the evidence gathered through the EFIGE survey of about 15,000 European firms in seven countries conducted in 2009.

The research output confirms the strength of the approach underpinning the project, which is based on the recognition that firms are heterogeneous in the extent and the pattern of their internationalisation, as they are in many other respects. EFIGE provides more, and more precise, evidence of what makes firms successful and therefore also what makes countries successful in the context of globalisation.

Internationalisation, however, also makes firms vulnerable to shocks affecting international trade and may transform them into agents of propagation of global downturns. At the time of the Great Recession of 2009, there was intense speculation about the reasons why trade collapsed much more than output. It was sometimes claimed that global supply chains were not only propagators, but also multipliers of international fluctuations.

This report by László Halpern and his colleagues makes use of the fact that the EFIGE survey was – by accident – conducted in 2009 and – by design – included questions about the firms' response to the global crisis. It provides a fascinating account of what happened to them in an especially turbulent environment, showing for example that a minority of firms managed to fare very well in spite of headwinds, and that their individual characteristics and their position in global supply chains both played major roles in determining their performance and their employment behaviour. This finding is reminiscent of a familiar insight from the analysis of labour markets: even in the worst possible macroeconomic conditions, some firms increase their payrolls and some individuals succeed in getting access to better jobs.

The stylised facts presented in this report are important to bear in mind at a time when Europe is heading for another severe downturn and when many firms, especially the smaller ones, are facing increasing difficulties getting access to credit.

The challenge now for the EFIGE team is to spell out the policy implications of its factual findings. Throughout Europe and beyond, governments are putting increased emphasis on competitiveness and growth. But effective policies require a proper understanding of what determines international performance. This especially applies to southern European countries, where the traded-goods sectors has shrunk in relative terms as a consequence of domestic credit booms and must now attract resources and expand.

For sure, policies that increase the stock of knowledge, foster human capital formation, improve labour-market institutions and make capital markets more efficient are called for. But the analysis of heterogeneous firms suggests that measures that would help firms just below the threshold of internationalisation to pass it, and firms already active in international markets to expand their reach, would do more for competitiveness than across-the-board, indiscriminate measures. This should not be an argument for 'picking the winners', rather to find ways to help 'fatten the tail' of globally competitive firms. How to achieve this goal in a non-discretionary, non-distortive way is what economic research should now help shed light on.

Research reported in this volume was supported by the European Commission's Seventh Framework Programme, and the data collection was also funded by UniCredit, which had pioneered similar work in Italy. We are very grateful to these institutions for their support and confidence.

*Jean Pisani-Ferry, Director of Bruegel,
December 2011*

Executive summary

The Great Recession of 2008 and 2009 brought about a 6.5 percent decline in world industrial production and a 12.8 percent decline in world merchandise trade in 2009, with even sharper declines during late 2008 and early 2009. Europe was particularly affected. Industrial production and merchandise trade in the European Union declined by 13.7 and 15 percent, respectively. The unemployment rate peaked at just below 10 percent at the end of 2009. Businesses, policymakers and academics alike would like to understand the causes and the consequences of the crisis, with the hope of avoiding or mitigating future ones.

This report asks how the Great Recession impacted European firms. In addressing this question, we rely on the EFIGE survey, which asked a total of 14,444 firms in seven countries about their performance, their modes of internationalisation, their employment decisions, their financing structure and their competitive environment, among other topics¹. The countries covered were Austria, France, Germany, Hungary, Italy, Spain and the United Kingdom. The countries differ markedly not only in their economic environments, but also in the policy responses applied during 2008 and 2009. This provides an ideal test bed for analysing the effect of the crisis.

A panel of questions in the survey dealt specifically with the crisis and firms' responses to it. The key outcome variables that firms reported are the percentage reduction (if any) in sales between 2008 and 2009, the percentage reduction of exports and the percentage change in employment. The survey proves that the crisis hit firms hard: on average, they reported a 12 percent decline in sales and laid off six percent of their employees.

The survey shows that these averages disguise significant heterogeneity across countries and firms in terms of how they were affected by, or responded to, the crisis. Despite a synchronised, substantial macro-economic shock, the response of firms was rather diverse and some firms did well in 2009 even in the hardest hit industries and regions.

1. For further details see <http://www.efige.org/>.

Identifying which firms suffered the most from the crisis is important for at least two reasons. First, we can identify which firms are most vulnerable in another crisis with a similar nature. Second, we can evaluate the policy responses that were implemented in the midst of the crisis with limited information about the scope and nature of the events. Identifying firms that fared better may help design more effective and better-targeted policies.

While a temporary reduction in output may be weathered by firms, the loss of jobs has more long-lasting effects. Firms with a greater drop in sales also laid off more workers, but the relationship was less than proportional. While we do not have information about which workers were laid off, there were more lay-offs at firms with many part-time employees and many unskilled workers. This suggests that during crises firms try to protect the human capital embodied in skilled blue-collar and white-collar workers, while some types of workers are seen as more easily replaceable should the recovery arrive.

Exporters contracted more than non-exporters. The average exporter suffered a 3.2 percentage points greater decline in sales than the average non-exporter within the same country. However, some of this difference boils down to structural differences between countries. When controlling for industry and size class, this difference is reduced to 2.5 percentage points. The difference in the sales decline between exporters and non-exporters was greatest in Austria, Germany and France.

One firm's exports are another firm's imports. Do trade linkages exacerbate the crisis or do they just transmit shocks from one country to another? Our next result is that importers and firms that outsourced some of their production were somewhat insulated from the shock of the crisis. The revenues of importers declined by 0.8 percentage points less than those of non-importers in the same country, industry and size category.

Taken together, it becomes clear that international trade is important in the transmission of the crisis, but some trade linkages may enable the firm to respond more flexibly to demand shocks. This finding raises the possibility of additional gains from trade and globalisation in core European countries. Well-established and deep linkages with other countries may help spread the risk associated with a sudden drop in demand such as the one seen in 2008-09.

Firms that outsource, and firms that control other companies, fared better during the crisis. Outsourcers saw a 1.8 percentage points smaller reduction in sales. Firms in a

controlling position within their company network laid off 1.3 percent fewer workers. By contrast, employment in firms that are controlled by other companies declined by up to an extra 4.2 percent. This suggests that the place of the firm in the production chain is an important determinant of the effect of the crisis. We also confirm this finding with technological indices: industries that sell mostly to other industries have contracted more.

Given the financial nature of the crisis, it is natural to look at how firms in different financial positions fared. Based on the survey, firms with self-reported financial constraints contracted more during the crisis. Because the survey questions were retrospective (firms were asked in late 2009/early 2010 about perceived financial constraints in 2008), it is difficult to establish a causal relationship between these financial indicators and performance. Nonetheless, we find that firms in industries with a greater reliance on collateralised property contracted more.

A key policy response in many of the countries was aggressive fiscal stimulus. This should have had a greater effect on firms that were already serving the public sector. Indeed, firms with public clients suffered a six percent less sales decline. This effect was much weaker in Hungary, which had little wiggle room in fiscal policy, and the UK, where the fiscal stimulus was largely tax-based.

An important theme, suggested by the findings of this report, is that dominant firms, centrally placed in the technology, trade and ownership network, fared better. Firms producing final goods, non-client specific goods and relying on a stable pool of skilled workers maintained higher sales. Similarly, relying on a network of suppliers (be it through importing or outsourcing) also mitigated the effect of the crisis. Finally, firms controlling other companies at home or abroad were able to preserve more jobs.

KEY FINDINGS

1. Despite a synchronised, substantial macro-economic shock, firms' responses were rather diverse and 10-20 percent of firms did well in 2009, even in the hardest hit sectors and countries. However, firm size itself made no difference.
2. Firms reduced employment by a lesser degree than their sales decline, and firms with relatively more skilled workers preserved more jobs.
3. Exporters contracted more than non-exporters, while importers suffered less of a decline.
4. Outsourcers and firms that control other companies fared somewhat better, while firms relying on specific demand from others suffered more.
5. Firms relying on external finance and experiencing financial constraints to growth (before the crisis) experienced greater sales declines. Firms with greater pre-crisis tangible assets or relying on local bank finance were particularly constrained.
6. Expansionary fiscal policy both mitigated the effects of the crisis by supporting general domestic demand and ensuring continued orders for firms supplying the public sector.

1 Scope of this report

The Great Recession of 2008 and 2009 brought about a 6.5 percent decline in world industrial production and a 12.8 percent decline in world merchandise trade in 2009, with an even sharper decline during late 2008 and early 2009. Europe was particularly affected. Industrial production and merchandise trade in the European Union declined by 13.7 and 15 percent, respectively. Businesses, policymakers and academics alike would like to understand the causes and the consequences of the crisis, with the hope of avoiding or mitigating future ones.

Most policy reports to date have analysed the macro-economic context of the crisis, assessing the effectiveness of countries' fiscal or trade policies in restarting economic growth. This report is different because it asks how the Great Recession impacted European firms. Using new data from seven European countries, the results shows that there is significant heterogeneity across countries and firms in terms of how they were affected by, or responded to, the crisis. Identifying which firms suffered the most from the crisis is important for at least two reasons. First, we can identify which firms are most vulnerable in another crisis with a similar nature. Second, we can evaluate the policy responses that were implemented in the midst of the crisis with limited information about the scope and nature of the events. Identifying firms that fared better may help design more effective and better-targeted policies.

In addressing these questions, we rely on the EFIGE survey, which asked a total of 14,444 firms in seven countries about their performance, their modes of internationalisation, their employment decisions, their financing structure and their competitive environment, among other topics. The countries covered were Austria, France, Germany, Hungary, Italy, Spain and the United Kingdom. Data was collected in 2010 and is representative of manufacturing sectors in each country. The countries differ markedly not only in their economic environments, but also in the policy responses applied in 2008 and 2009. This provides an ideal test bed for analysing the effect of the crisis.

We investigate six issues pertaining to the effect of crisis. We start by demonstrating

the heterogeneity of responses in spite of a synchronized shock. We then look at the employment aspect of firms' reactions, and at features of firms that are active in international trade. Ownership, networks and external financing are also shown to have played a role in response to the crisis. Finally, we look at how fiscal policies might have influenced firm performance.

After presenting a summary of key results, the report discusses these issues in detail. For each issue, we first note the key results to date, set out some hypotheses and present results using this unique dataset. The conclusion relates our results to opportunities in policy².

2. In the appendices we provide the definition of the variables used in the report, present some descriptive statistics and describe the estimation methods. For further details see <http://www.efige.org/>.

2 The crisis and heterogeneous firms

After more than six years of positive trade growth in OECD countries, the value of trade nose-dived in October 2008, reaching a record decline of 37 percent in April 2009. Trade series suggest that the current collapse appears to be the sharpest in the historical record. In the early months aggregate-level patterns reflected the very strong synchronisation of the trade collapse across countries. Using monthly trade data for OECD countries, Oliviera Martins and Araujo (2009) find that the average rate of decline between October 2008 and June 2009 was 25 percent with countries experiencing very strong concurrent drops in trade. With very few exceptions, OECD countries simultaneously exhibited a decline in exports and imports exceeding 10 percent at the end of 2008. There were no exceptions at the end of the 2009Q1.

Certain sectors suffered more during the crisis, meaning that countries in which these sectors are prominent suffered more. In the OECD, the greatest decline was observed in the following sectors: machinery and transport equipment, mineral fuels and related products and chemicals and related products.

The crisis motivated different lines of policy-oriented research aimed at understanding firms' reactions to this large shock. One question was whether the trade decline was caused by the exit of exporting firms (extensive margin) or by the decline in exports per firm (intensive margin). This is relevant for policy as these two margins can be influenced by different policy instruments and they may behave differently during recession and boom. Another important question was if trade decline differed across industries or export markets.

Behrens *et al* (2010) found that for Belgium, the fall in trade overwhelmingly occurred at the intensive margin (first half of 2008 versus first half of 2009). The intensive margin fall was evenly spread across products. Almost all trading firms remained active, with hardly any change in the average number of countries they traded with. It was the fall in demand that was the main cause of the trade collapse, not the trade

crisis *per se*. Behrens *et al* (2010) claim that there was no difference across consumer durables and capital goods in the intensive-margin decline. The same applies to destination and origin markets: though the fall was slightly less pronounced for EU partners and/or higher-growth countries, domestic sales and purchases fell equally fast with no systematic variation across firms.

The same result is found for France by Bricongne *et al* (2011). The key findings are: simultaneous drop in world trade; trade drop caused by exporters not serving as many markets as before the crisis, and the intensive margin; there were no additional exits of exporters compared to ‘good economic conditions’. The drop in the value shipped by exporters may be quite evenly distributed. Firm-level adjustment took place at the intensive margin.

In the French data, one part of this composition effect comes from intermediate goods. About one third of intensive-margin deterioration in exports is attributable to trade in intermediate goods. Equipment goods (excluding aircraft) and the automobile industry are the next two broad contributors. These figures are in line with earlier estimates suggesting that exports are about two to three times more volatile than GDP, owing to a relatively larger share of durables (Engel and Wang, 2011).

Looking at 450 items at NAICS 6-digit industry level quarterly data for the US³, Levchenko *et al* (2010) suggest that a trade collapse happened in durable and intermediate goods, and trade recovery can be seen by mean reversion by sector and partner country.

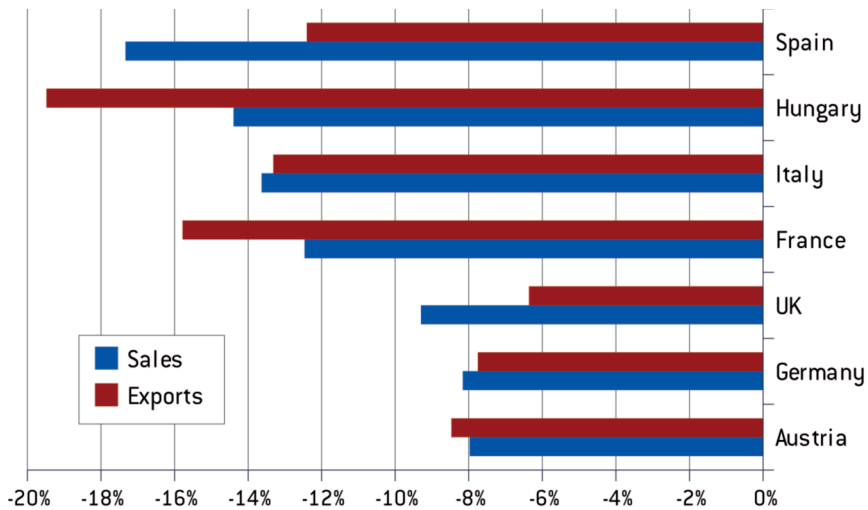
European firms faced a large and simultaneous macro-economic shock as the global financial crisis hit European banks and markets in late 2008. On average, sales dropped by over 12 percent⁴. Exports declined marginally less in the sample – 11.6 percent – and the recession was accompanied by a 6.2 percent fall in employment. Motivated by the previous findings, the EFIGE survey provides an opportunity to look in more detail into the heterogeneity of firm’s reactions to this simultaneous crisis. As will be detailed in this section, there was a great deal of divergence from country to country, industry to industry, and most importantly, firm to firm.

3. NAICS: North American Industry Classification System.

4. Numbers of macro aggregates are calculated by using the survey data. They differ from the official macro statistics as the weighting to ensure representativeness at country level for size and industry does not necessarily lead to similar numbers for the variables like growth rate of exports or sales. This is the inevitable consequence if the micro observations of the survey are to be aggregated to macro level. For example the export decline was smaller in our sample than the official data for Austria, Germany and the UK; larger for France, and very close for Hungary, Italy and Spain.

First, there were substantial differences in country performances (see Figure 1). The greatest decline was experienced by Spanish firms, followed by Hungarian companies, while companies in Austria and Germany suffered a relatively smaller decline. Indeed, for firms in Austria, Germany and in the UK, the collapse of both sales and exports remained below nine percent, while for the other countries it was more than 12 percent. The gap between the sales and export declines is rather different across countries, with the gap close to zero in Austria, Germany and Italy, while for Spain and the UK the sales decline exceeded significantly the export decline. In France and Hungary the opposite was the case.

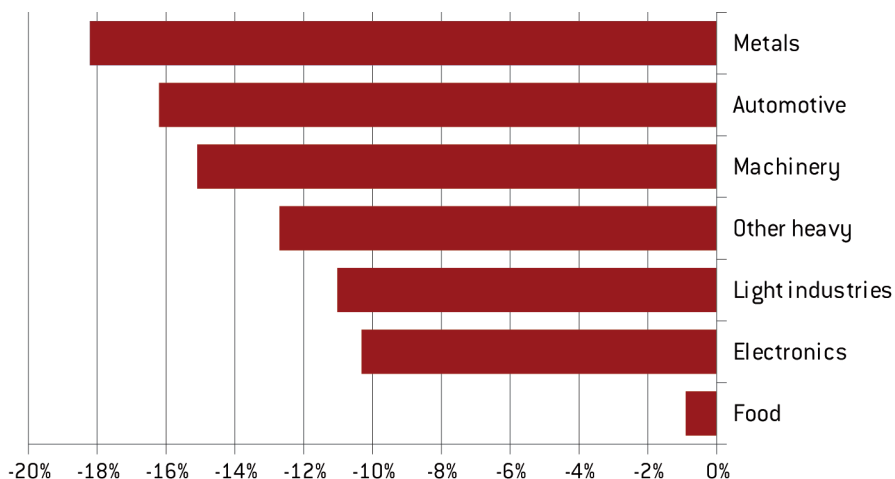
Figure 1: Sales and export declines across countries



Source: EFIGE.

Second, sales decline was different for firms in different industries; all but the food industry suffered a greater than 10 percent drop in sales (Figure 2). Cars, metals and machinery were hit the most, while electronics, light industry and other heavy industry suffered marginally less.

Figure 2: Average sales decline across industries



Source: EFIGE.

Finally, the statistics suggest that firm size did not matter on average; sales of different firm size categories fell by 10.8 to 12.6 percent.

Fact 1a – Sales and exports declined at uneven rates across countries (greatest declines in Hungary and Spain, lowest in Austria and Germany) and industries (food sector stayed stable, while metal production declined the most). Firm size did not matter; small and large firms performed similarly.

A great strength of the EFIGE survey is that it allows us to look beyond averages, and consider the diversity of responses regarding sales. This diversity is present both within countries and industries. The average sales decline of 12.2 percent masks a great degree of heterogeneity between firms: while sales of 18 percent of firms did not decline, or even increased, nearly one fifth of firms suffered substantial reductions exceeding 30 percent.

Table 1: Change in sales – all firms

Change	% of firms
Large decline (over 30%)	18.1
Medium decline (between 10-30%)	34.4
Small decline (less than 10%)	19.1
No change or sales growth	28.4

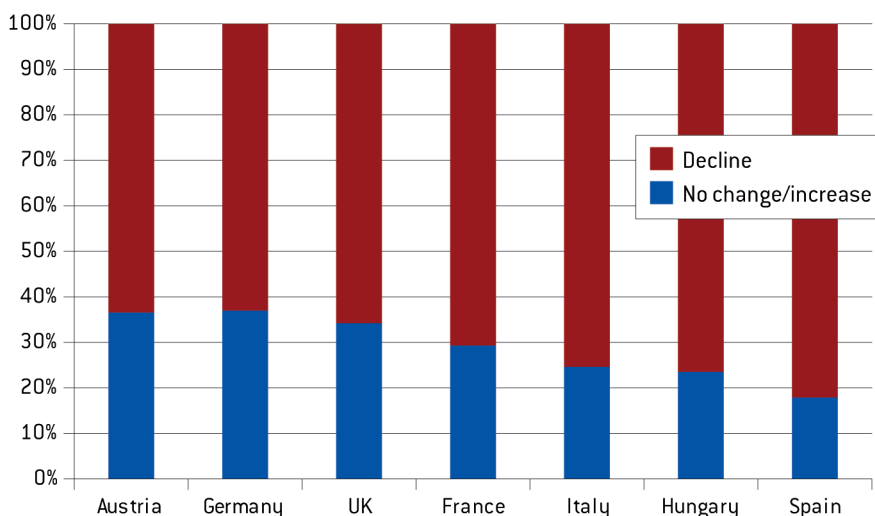
Source: EFIGE.

We have seen the diversity of reaction across countries and industries. However, firm-level performance is only partly determined by country and industry. A simple exercise suggests⁵ that industry and country differences are less important than within-industry/within-country heterogeneity in explaining firm-level performance. In terms of variance in change in sales, industry affiliation explains 9.6 percent, and the country of origin accounts for just 3.4 percent, together explaining only 13 percent of the total variation. The remainder is a consequence of firm heterogeneity. For percentage change in exports, these features explain 4.5 percent of variation only.

Many firms were able to prevent their sales from falling even in countries suffering a great contraction, and, conversely, there were several firms facing a decline even in economies faring relatively well (see Figure 3). Large declines were most frequently experienced in Spain, while over a third of firms in Austria, Germany and the UK experienced stable or rising sales. In terms of industries, the share of firms avoiding a drop in sales ranged between 13 percent and 44 percent, while the share of firms suffering a decline ranged between 63 percent and 82 percent.

5. Details of the analysis of variance (ANOVA) are available from authors on request.

Figure 3: Diversity of sales change across countries



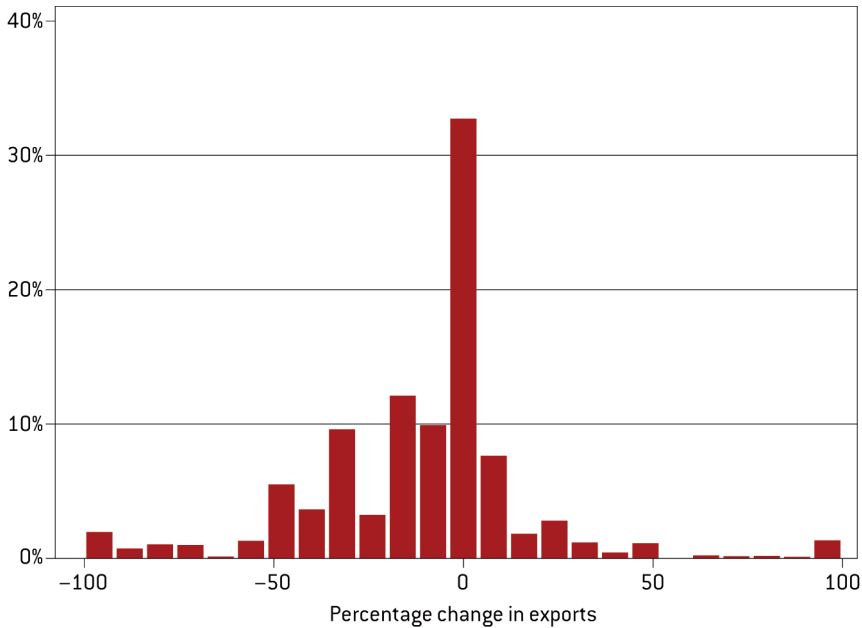
Source: EFIGE.

Availability of more detailed data makes it possible to illustrate the diversity of changes in export sales. There was a wide variation in export performance, even among firms that experienced some change (66 percent of exporting firms – see Figure 4). Firms may react to the crisis along two margins: exiting from the export market altogether or reducing their export volume, but continuing to export⁶.

In line with earlier findings, the data suggests strongly that the reaction on the extensive margin was relatively small: 179 firms (2 percent of exporters in 2009) reported that they exported previously, but not in 2009. The reaction on the intensive margin, however, was much larger: exporting firms reduced their turnover by 11.6 percent, which is similar in magnitude to the decline in sales. This adjustment on the intensive margin was also heterogeneous across firms: about 50 percent of firms reduced their export volumes, and 19 percent increased them.

6. Using Argentine data from crises periods, Gopinath and Neiman (2010) also find that the extensive margin defined as the entry and exit of firms or the entry and exit of products (at the country level) plays a small role in understanding trade adjustment during the crisis. For imports, the number of firms that exit the import market is large, but when weighted by value these exits explain a small share of the decline in imports.

Figure 4: Distribution of change in exports – all firms



Source: EFIGE. Note: The spike at zero comes from the survey question: *did your exports stayed unchanged, rise or decline – and if changed, by how much?*

Fact 1b – Firm-level heterogeneity is overwhelmingly present in all industries and all countries, in terms of both overall sales and exports. More than 13 percent and 18 percent of firms were able to sustain or even increase their sales even in the worst-hit industries (metal products) and countries (Spain), respectively.

3 Employment adjustments

Firms adjusted their employment to the decline in demand differently. In this section we aim to understand how big this difference is and what explains it. Unfortunately we see only the first phase of the crisis and our data does not allow us to provide an answer to what happens to laid-off workers when the recovery comes.

Firms have reduced their employment to a significantly smaller extent than the average fall in their sales. We explore this relationship by tabulating the decrease in employment and the decrease in sales (see Table 2). The disproportionate presence of firms below the diagonal demonstrates that in proportional terms the majority of firms reduced employment less than the fall in demand. For example, about half of firms facing a very large (more than 30 percent) decline in sales laid off less than 10 percent of their employees. This also reflects a highly heterogeneous reaction to the fall in demand: even firms facing similar demand shocks adjusted their employment levels – and presumably, their technological and organisational structures – in various ways.

These significant and systematic differences between firms suggest that policies and firm-level characteristics may strongly affect how much of the demand shock is absorbed by adjusting employment versus restructuring production or declining productivity. The relative importance of these two margins is fundamental for policy, as it determines the labour market effects of a crisis, and may also affect the medium-term competitiveness of firms.

Table 2: Tabulation of sales and employment change

		Change in employment				Total
		No change	0-10% reduction	10-30% reduction	More than 30% reduction	
Change in sales	No change	24.2%	2.9%	1.2%	0.2%	28.4%
	0-10% reduction	11.9%	4.7%	2.1%	0.3%	19.1%
	10-30% reduction	14.3%	10.0%	8.6%	1.4%	34.4%
	More than 30% reduction	5.1%	3.8%	5.9%	3.3%	18.2%
	Total	55.6%	21.5%	17.8%	5.2%	100.0%

Source: EFIGE.

To study the heterogeneity of adjustment, we compare firms in the same industry facing a similar fall in demand (proxied by the decline in sales – see Table 3 for results). In particular, we look at change in employment when *sales decline is held constant* (ie we control for the decline in sales with a set of dummies in addition to the industry, size and country dummies) with a number of firm-level variables. A positive relationship suggests that an increase in the explanatory variables is associated with greater employment growth (smaller employment decline).

We also address the question of the composition of employment, which may affect firm responses to the crisis: more qualified workers may have more firm-specific human capital and may be costlier to replace.

The share of part-time workers is another dimension of the employment composition. On the one hand, it can be easier to layoff part-time workers; however, it may also be relatively easy to reduce the time they work.

The role of short-time work (STW) has been extensively analysed by several authors. Boeri and Bruecker (2011) present the case for short-time work in Europe arguing that in the right institutional settings such measures may indeed dampen the effects of crises. Indeed OECD data suggests that such measures may have helped create a greater adjustment at the intensive margin both compared to peers and to previous crises⁷.

7. For OECD countries, Boeri and Bruecker (2011) find that STW contributes to reducing job losses especially when output falls markedly (at least 2.6 percent) – which is the case for most countries in 2009. Micro-evidence for Germany also confirms the potential benefits of STW. While the large deadweight costs detected may modify policy conclusions, the evidence for firms already relying on temporary work solutions is clear – such measures may help adjustment at the hours-worked level rather than the head-count level.

Andersen (2011) argues that flexible labour markets in terms of hiring and firing will result in a crisis having greater short-term impact. In Denmark, employment adjustment is not particularly large by international comparison, but it is focused on the extensive (number of employees), rather than on the intensive (hours) margin.

BOX 1: SHORT-TERM WORK SCHEMES IN EUROPE

Before the crisis, access to short-term work (STW) schemes was largely limited to workers with open-ended contracts or did not exist at all in some countries. As a response to the crisis there was the introduction of (new) publicly-sponsored STW, increased generosity, extended conditions of participation, extended duration, and introduction of training incentives. As detailed by Arpaia et al (2010), many EU countries temporarily introduced new publicly-sponsored STW or increased their generosity (level, coverage and duration). For a limited period of time this may have helped stabilise employment levels and cushion social hardship. Both Germany and Italy spent about €5 billion on schemes related to such measures, with the aims of preventing otherwise profitable enterprises from going bankrupt and of preventing unnecessary labour shedding.

Fact 2a – On average, firms reduced their employment to a smaller extent than the decline in their sales.

The results suggest the following conclusions. First, the decline in employment was smaller than the decline in sales in each country. On average, a large (more than 30 percent) decline in sales is associated with 17.4 percent decline in employment relative to firms with stagnant or increasing sales. The numbers are 4.7 and 9.2 percent for firms facing sales declines of 0-10 and 10-30 percent, respectively. This relationship is remarkably similar across countries: European firms were willing to adjust both by sacrificing labour productivity and by laying off workers.

Second, labour reduction was the greatest in Spanish firms, followed by British ones, compared to firms facing similar demand shocks in Italy and Germany. These results suggest that labour market institutions and policies affected notably the adjustment strategy of firms.

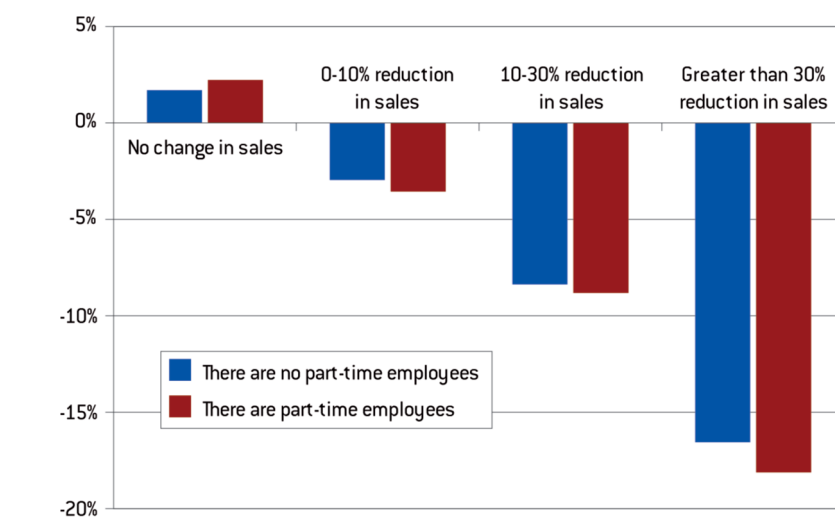
Third, firms are less willing to lay off skilled and especially white-collar workers. In our sample 10 percentage point increase in the share of white collar employees increased

the overall employment by 0.19 percent on average. There are, however, some differences across countries: skilled blue-collar workers were spared from layoffs in Germany and Hungary, while firms with more white-collar workers reduced the employment level to a lesser extent in Hungary and Italy.

Fourth, the share of part-time workers is negatively associated with employment growth, suggesting that firms employing more part-time workers can lay them off easier. When this relationship is examined on the country level, the share of part-time workers is significant for Spain only. This may indicate that the presence of part-time workers affected only the employment decisions of Spanish firms. Note, however, that the share of part-time workers is the greatest in Spain (10 percent), and it may be hard to identify this effect in other countries.

The relationship between the presence of part-time workers and layoffs requires somewhat deeper analysis. The difference between firms employing part-time workers and firms not employing part-time workers by sales-decline categories is presented in Figure 5. While the employment change for the two kinds of firms is similar for firms with stagnating or increasing sales, there is a significant difference for firms with declining sales. This difference seems to increase with the degree of sales decline. This pattern is even stronger when the interaction of the sales-decline and the part-time is included.

Figure 5: Part-time workers and labour decline



Source: EFIGE.

Table 3: Labour change and the composition of employment

Variables	Labour change (%)							
	All firms	Austria	France	Germany	Hungary	Italy	Spain	UK
Part-time employees (%)	-0.047*** (0.011)	-0.002 (0.068)	0.028 (0.04)	-0.026 (0.022)	-0.013 (0.058)	-0.054 (0.044)	-0.082*** (0.018)	-0.003 (0.034)
Share of skilled blue collars (%)	0.006 (0.005)	-0.013 (0.041)	0.005 (0.014)	0.024* (0.013)	0.082** (0.034)	-0.001 (0.012)	-0.002 (0.01)	0.009 (0.013)
Share of white collars & executives (%)	0.019*** (0.007)	0.037 (0.039)	-0.006 (0.016)	0.021 (0.013)	0.082* (0.044)	0.065*** (0.02)	0.035 (0.025)	0.003 (0.02)
Reduction in sales more than 30%	-17.4*** (0.396)	-24.353*** (2.81)	-18.333*** (0.933)	-16.892*** (0.821)	-15.708*** (2.302)	-14.051*** (0.879)	-20.024*** (0.975)	-19.888*** (1.121)
Reduction in sales up to 10-30%	-9.199*** (0.326)	-10.929*** (2.08)	-10.123*** (0.716)	-8.211*** (0.654)	-10.801*** (1.923)	-6.651*** (0.749)	-10.932*** (0.881)	-12.88*** (0.841)
Reduction in sales up to 10%	-4.75*** (0.361)	-10.955*** (2.295)	-5.364*** (0.865)	-4.688*** (0.643)	-3.642 (2.33)	-3.888*** (0.851)	-5.59*** (1.011)	-5.211*** (0.947)
Observations	11375	238	1979	2365	360	2274	2289	1870
R ²	0.216	0.387	0.258	0.214	0.316	0.153	0.260	0.233
Dummies	<i>Sector, country, size</i>	<i>Sector, size</i>	<i>Sector, size</i>	<i>Sector, size</i>	<i>Sector, size</i>	<i>Sector, size</i>	<i>Sector, size</i>	<i>Sector, size</i>
Model	<i>OLS</i>	<i>OLS</i>	<i>OLS</i>	<i>OLS</i>	<i>OLS</i>	<i>OLS</i>	<i>OLS</i>	<i>OLS</i>

Source: EFIGE. Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Observations are weighted by the sampling weights of firms.

The results relating to part-time workers suggest that firms employing part-time workers laid off more workers than other firms facing a similar decline in demand. The size of this effect is not uniform across firms: the greater the fall in demand, the greater the effect of the presence of part-time workers.

To conclude, substantial heterogeneity exists between the reactions of different firms hit by similar demand shocks. The reactions differ across countries. The presence of part-time workers was associated with greater reductions in the number of employees. Second, firms employing more skilled workers reduced their workforces less.

Fact 2b – Firms employing skilled and permanent workers laid off fewer employees compared to other firms faced with a similar fall in demand.

4 Trade and crisis transmission

The trade linkages between EFIGE countries and the rest of the world contributed to a more rapid transmission of shocks. In country- and industry-level data, this transmission has been confirmed by Oliviera Martins and Araujo (2009) and Bems *et al* (2010), who found that global trade collapsed during the crisis in a simultaneous manner across countries. There are several studies (eg Behrens *et al*, 2010; Bricongne *et al*, 2011; and Gopinath and Neiman, 2010) analysing the trade response of firms within individual countries. The emerging conclusion is that the sales of already-trading firms have contracted by a significant amount, and that there are quantitatively small effects on the extensive margin (the set of firms that trade).

Alessandria *et al* (2010) looked at the motor vehicles trade in the US with aggregate and microdata for trade and inventories. In this sector, international trade declined more drastically than trade-weighted production or absorption (drop in trade was four times the drop in output and 50 percent greater than the drop in industrial production or trade-weighted demand) and inventory dynamics showed a sizable adjustment, especially for imported goods. Given the overshooting nature of inventory management, both output and trade are more responsive to shocks and are volatile when inventories are important – a key issue for motor manufacturers. Trade is affected relatively more than output because importers hold more inventory than non-importers.

Motivated by these previous studies, we look at the sales decline experienced by firms that are exporters, and contrast it to the dynamics of non-exporting firms. Exporter status is identified through a question asking whether the firm exported some of its output in 2008.

First we relate the change of total sales to the exporter status (see the first column of Table 4). We find that the sales of exporters declined by 2.3 percentage points more than those of non-exporters in the same country, sector and size class. The difference in sales decline is highly significant statistically. Then we investigate the link between sales change the importing status of a firm: indicating intermediate or service importer

status [see columns 2 and 3 of Table 4, respectively]. Both coefficients are positive, but are not significantly different from zero. Finally we look at the effect of these all trade status characteristics in the same time [column 4 of Table 4]. We find that exporters' sales declined significantly more than non-exporters (2.5 percent) and that intermediate importers fared somewhat better than non-importers. Those that import faced a 0.8 percentage point smaller drop in sales than those that do not. Service imports do not seem to matter.

Table 4: Trading status and sales change

Variables	Sales change			
	All firms	All firms	All firms	All firms
Exporter (dummy)	-2.252*** (0.424)			-2.49*** (0.439)
Intermediate importer (dummy)		0.258 (0.411)		0.813* (0.427)
Service importer (dummy)			0.139 (0.651)	0.405 (0.657)
Observations	14,413	14,412	14,412	14,412
Fixed effects	Sector, country, size	Sector, country, size	Sector, country, size	Sector, country, size
Model	Interval regression	Interval regression	Interval regression	Interval regression

Source: EFIGE. Notes: Standard errors in parantheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Observations are weighted by the sampling weights of firms.

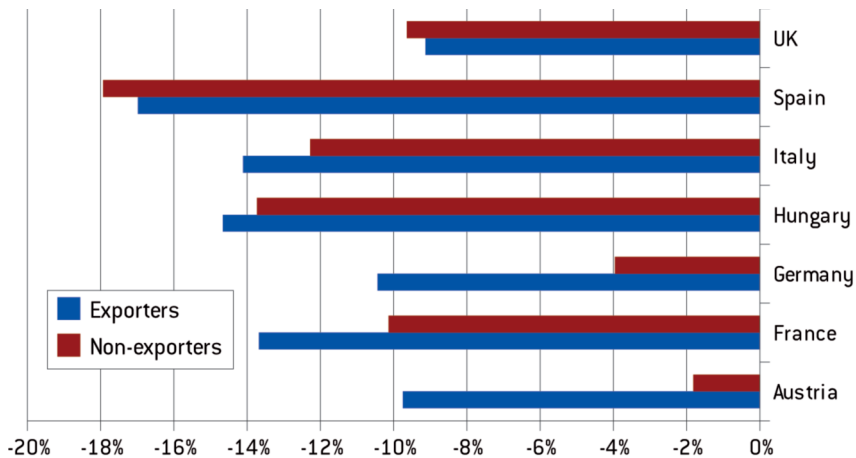
Fact 3 – Exporters contracted more than non-exporters, while importers suffered somewhat less of a decline.

Trade fell by more than GDP during the crisis. Manufacturing output and exports collapsed as the shock caused consumers and firms to retrench; private demand for all types of consumption beyond everyday use crashed. The huge gap between trade and production collapse calls for an explanation. Baldwin *et al* (2009) offer some tentative explanations, based on compositional effects: they show the products with the largest contractions in consumption to represent a large share in trade but a small share in GDP. The demand shocks to GDP and trade occurred simultaneously and this coincidence was enhanced by immediate online adjustments of orders and production

lines all over the world. It means that the negative impact on sales was larger for exporters than for non-exporters.

How did the exporter decline vary across countries? We report in Figure 6 the average sales decline of exporters and non-exporters, estimated separately by countries. We find that exporters' sales declined significantly more than non-exporters in Austria, France, Germany and Italy, but not in Hungary, Spain and the UK. One interpretation of this pattern is that in Hungary, Spain and the UK, there was significant domestic economic disturbance, and non-exporters suffered to a similar or even greater extent than exporters. Obviously, this pattern was affected by different macro shocks – as for example the domestic demand fell more in Spain and the UK – but as we have observations for one year only we are not able to separate their effect.

Figure 6: Average sales decline of exporters and non-exporters



In summary, international trade can be a way of importing demand shocks and, hence, greater fluctuations.

5 Supply chains and the crisis

While much of the trade collapse was a result of falling final demand, imported intermediate goods intensified the decline, suggesting that international linkages via the import of intermediate goods influenced each country's exposure to foreign shocks. The vertical specialisation transmission mechanism is subtle, value chains – both national and international – are complex and there are several ways in which these linkages could generate a significant and widespread collapse in trade. The story with value chains matters in particular because the crisis hit sectors such as motor vehicles, which has one of the largest supplier networks.

As we suggest, importers suffered less of a decline in sales than non-importers (see the results in Table 4). This may be because they can respond to demand shocks more flexibly than firms that do not have the ability to import⁸. Because more open countries source their output from more countries, their output may be more stable due to 'diversification through trade'.

The other hypothesis is that vertical linkages may magnify, not just transmit, shocks across countries. Using a global input-output framework that links demand to production via trade flows, Bems *et al* (2010) argue that as a result of vertical linkages, world trade declines by three percent when GDP falls by one percent. This argument suggests that the demand alone (via linkages) can account for 70 percent of the trade collapse.

In order to understand the details of this mechanism, and to quantify the consequences of intermediate-goods import linkages for the transmission of shocks and collapse in trade, one option is to measure bilateral imported intermediate-goods linkages using trade data combined with national input-output tables. Levchenko *et al* (2010) used a set of upstream and downstream linkage variables developed in di

8. A similar mechanism is emphasised by Bergin *et al* (2009), who show that when US companies outsource the volatile components of production to Mexico, the effect of a demand shock is dampened in the US and magnified in Mexico. At a macro level, Caselli *et al* (2010) study how productivity shocks are transmitted in a multi-country, multi-sector trade model.

Giovanni and Levchenko (2010), and found that reliance on downstream linkages partly explains the magnitude of decline in certain industries⁹.

While these authors used different databases, concentrating mainly on aggregates or firm-level data from one country, the EFIGE database provides an opportunity to use firm-level data from different countries.

In order to measure how shocks are transmitted along supply chains, we use two distinct but related concepts of supply linkages. The first is based on the technological features of the firm's activity. In particular, if the firm is producing intermediates used by other firms, it is likely to be towards the end of the supply chain, and subject to a larger set of demand shocks. On the other hand, if the firm is using a large amount of intermediates in its production or if it outsources some of its production, it may be better equipped to 'unload' the demand shocks it faces. We anticipate that these firms declined less¹⁰.

The second concept of firm linkages we exploit is based on governance. Firms that control other firms may respond more flexibly to a fall in demand than firms that are subsidiaries in a larger network. These linkages are often correlated with technological linkages, as downstream firms are more likely to control upstream firms.

To measure input-output linkages of the firm, we follow di Giovanni and Levchenko (2010). We first calculate the fraction of sectoral output that is used as an intermediate input in other sectors (computed based on national input-output tables). The complementary share is going to final consumers. We also measure the share of industry revenue spent on intermediate inputs.

We measure the link between the sales change and the firm's share of turnover produced to order, the outsourcing of some of its production, the industry-level measure of the share of output used as intermediate of other domestic sectors and

9. In terms of the effect of arm's length trade and offshoring, the evidence is scarce so far. Bernard *et al* (2009) look at the Asian crisis and US exports and finds that the 1998 decline in arm's length exports (26 percent) was substantially greater than the drop in trade undertaken within supply chains (4 percent). Altomonte and Ottaviano (2009) argue that within-firm effects are more moderate given the lack of liquidity problems. Bergin *et al* (2010) take a different stand and look at outsourcing in a hierarchical fashion. First, the headquarters provide different functions that are less volatile, such as design and marketing. Second, headquarters may use affiliates to protect jobs at headquarters.

10. This mechanism focuses on the transmission of demand shocks. When productivity shocks are the primary source of fluctuations, downstream firms may be more vulnerable. See Costinot *et al* (2011) for a productivity-shock driven theory of global supply chains.

intermediate usage as a share of output (see Table 5). The first two indicators capture various ways of organising production, the last two control for the technological place of the firm in the supply chain. First we assess these four links separately each and finally put them together. The estimated results take into account country, industry and size-class effects.

Table 5: Technological linkages and sales change

Variables	Sales change				
	<i>All firms</i>	<i>All firms</i>	<i>All firms</i>	<i>All firms</i>	<i>All firms</i>
Produced-to-order goods share	-0.022*** (0.005)				-0.021*** (0.005)
Outsources some production (dummy)		1.8* (0.989)			1.565 (0.987)
Share of output used as intermediate of other domestic sectors			-0.122*** (0.041)		-0.097** (0.042)
Intermediate use as a share of output				-0.15*** (0.035)	-0.138*** (0.035)
Observations	14,409	14,413	14,409	14,409	14,405
Fixed effects	<i>Sector, , country, size</i>	<i>Sector, , country, size</i>	<i>Sector, , country, size</i>	<i>Sector, , country, size</i>	<i>Sector, , country, size</i>
Model	<i>Interval regression</i>	<i>Interval regression</i>	<i>Interval regression</i>	<i>Interval regression</i>	<i>Interval regression</i>

Source: EFIGE. Notes: Standard errors in parantheses. *** p<0.01, ** p<0.05, * p<0.1. Observations are weighted by the sampling weights of firms.

Firms that produce a greater share of their output to order witness a greater drop in their sales (see column 1 of Table 5). A firm that produces 100 percent of its output to order suffered a 2.2 percent larger decline in sales. We also find that firms outsourcing part of their production saw smaller declines in their sales during the crisis (Table 5, column 2). The difference is 1.8 percentage points.

The effect of input-output linkages is measured at the country/industry level and we control for both country and industry fixed effects. The estimates rely on variation across countries *within the same sector*. If the sector sells a 10 percentage points higher fraction of its output to downstream sectors, the average sales decline is 1.2 percentage points larger (Table 5, column 3).

Industries (and countries) using more intermediates relative to their output also contracted more (Table 5, column 4). This is in contrast to the assumption that they can unload the demand shock more effectively. One reason could be that these industries may face different demand shocks. This highlights the need to control for demand shocks, which we do when assess all these effects jointly (Table 5, column 5). The measured effects are similar to when they were estimated separately, but the effect of outsourcing loses its statistical significance.

Fact 4a – Firms producing a large fraction of their output to order, or selling a large fraction to other firms suffered a greater decline. Outsourcing firms fared somewhat better.

There are differences in sales changes between firms in different parts of corporate groups (see Table 6 for the results). We denote as ‘controlling firms’ those firms that have affiliates or are the head of a network. Similarly, we call firms that are subordinate members of a network, or have been acquired by another firm ‘controlled by others’. As anticipated, controlling firms decline less and controlled firms decline more, but the differences are not statistically significant. Again, the demand shocks facing these firms may be different.

To control for demand shock, we estimate how the number of employees of the firm changes when the magnitude of the drop in sales is taken into account. As Fact 2a has shown, employment changes are a significant way of responding to demand shocks. We capture demand shocks by the categorical variable measuring the change in sales between 2008 and 2009. The reference category is *no decline or increase* in sales.

We first look at the technological place of the firm in the input-output table. We have seen previously that firms selling more intermediates suffered a bigger decline in sales, potentially because they faced a larger demand shock. We next look at how the control of the firm affects its response to demand shocks.

Table 6: Firm control and sales change

Variables	Sales change		
	<i>All firms</i>	<i>All firms</i>	<i>All firms</i>
Controlling firm (dummy)	0.339 (0.458)		0.324 (0.458)
Controlled by others (dummy)		-0.837 (0.564)	-0.827 (0.564)
Observations	14,413	14,413	14,413
Fixed effects	<i>Sector, country, size</i>	<i>Sector, country, size</i>	<i>Sector, country, size</i>
Model	<i>Interval regression</i>	<i>Interval regression</i>	<i>Interval regression</i>

Source: EFIGE. Notes: Standard errors in parantheses. *** p<0.01, ** p<0.05, * p<0.1.

Observations are weighted by the sampling weights of firms.

The conditional effect of input-output linkages on employment changes, holding the sales decline fixed, is very small and is not different from zero statistically (see columns 1 through 3 of Table 7). Similarly to what is reported in Table 2, firms that suffered a 0 to 10 percent sales drop reduced their employment by about four to five percent. Firms with a 10 to 30 percent sales drop reduced employment by about nine percent. Firms with greater than 30 percent sales drop laid off 17 percent of their workers.

Firms that are the head of a network or otherwise have control over other companies, do not reduce their employment by as much (a positive coefficient means a greater increase or a lesser reduction – see column 4 of Table 7). For a given level of sales decline, controlling firms layoff 1.5 percentage points fewer workers. This may be because they can better shield their workers by reducing orders to affiliates instead. This interpretation is consistent with the estimate which shows that firms that are controlled by others suffer a larger employment decline, although the effect is not statistically significant (Table 7, column 5). Finally these results are confirmed when the effects are estimated jointly (Table 7, column 6).

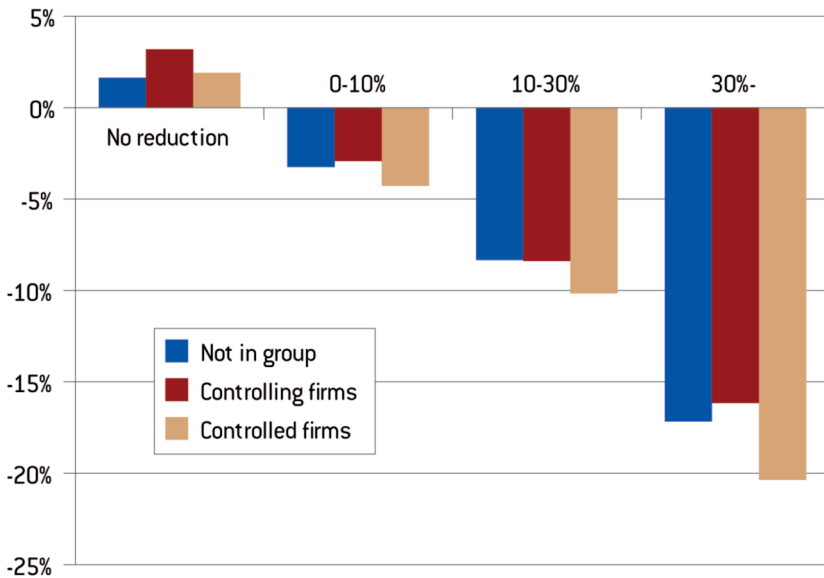
Table 7: Linkages and labour change

Variables	Labour change [%]					
	<i>All firms</i>	<i>All firms</i>	<i>All firms</i>	<i>All firms</i>	<i>All firms</i>	<i>All firms</i>
Share of output used as intermediate of other domestic sectors	0.008 (0.027)		0.009 (0.027)			
Intermediate usage as a share of output		-0.008 (0.023)	-0.010 (0.023)			
Controlling firm (dummy)				1.509*** (0.315)		1.5*** (0.315)
Controlled by others (dummy)					-0.566 (0.408)	-0.524 (0.40)
Reduction in sales up to 10%	-4.656*** (0.296)	-4.654*** (0.296)	-4.653*** (0.296)	-4.652*** (0.296)	-4.65*** (0.296)	-4.647*** (0.296)
Reduction in sales up to 10-30%	-8.955*** (0.289)	-8.948*** (0.289)	-8.951*** (0.289)	-8.969*** (0.289)	-8.947*** (0.289)	-8.964*** (0.289)
Reduction in sales more than 30%	-17.081*** (0.475)	-17.074*** (0.475)	-17.076*** (0.475)	-17.055*** (0.474)	-17.072*** (0.475)	-17.049*** (0.474)
Observations	13,901	13,901	13,901	13,901	13,901	13,901
R ²	0.206	0.206	0.206	0.208	0.207	0.208
Fixed effects	<i>Sector, country, size</i>	<i>Sector, country, size</i>	<i>Sector, country, size</i>	<i>Sector, country, size</i>	<i>Sector, country, size</i>	<i>Sector, country, size</i>
Model	<i>OLS</i>	<i>OLS</i>	<i>OLS</i>	<i>OLS</i>	<i>OLS</i>	<i>OLS</i>

Source: EFIGE. Notes: Standard errors in parantheses. *** p<0.01, ** p<0.05, * p<0.1. Observations are weighted by the sampling weights of firms.

If firms respond to demand shocks differently based on their position within the company network, then we expect the employment difference between controlled and controlling firms to be greatest when the demand shock is large. Figure 7 plots the average employment decline as a function of the sales decline separately for firms that are not members of a group, for controlling firms, and for controlled firms.

Figure 7: Firm control and labour change



Source: EFIGE.

Controlled firms always reduce their employment more than controlling firms, but this difference is most pronounced for large demand shocks. For firms that have seen their sales decline by more than 30 percent, the employment gap between the two types of firms is 4.2 percentage points.

Fact 4b – Firms that control other companies have reduced their employment relatively less in response to a demand shock of the same size. The employment difference is greatest for large demand shocks.

6 Financial constraints during the crisis

The evidence regarding financing and credit has been limited and mixed.

Mora and Powers (2009) argue that the decline in trade financing contributed directly to the decline in global trade in the second half of 2008 and early 2009. Banks and suppliers report that trade financing is the second most important cause of the global trade slowdown, after falling international demand. Early in the crisis, rising uncertainty increased demand for some trade financing. Demand for export credit insurance rose, and the insured value rose for capital goods during the crisis.

French data suggests that the crisis had a more severe impact on firms in industries relying on external finance. For some firms, mainly the small ones, financial constraints were found to be a significant aggravating factor, as documented by Bricongne *et al* (2011)¹¹.

The FIGE survey enables us to estimate the relationship between some firm-level and industry-level financial variables – which all proxy financial constraints in a crisis – on firm performance during the crisis. It is widely thought that finance could have played an important role during the crisis. Drying liquidity in major financial markets was imminent, but its effect on the corporate sector requires in-depth examination. We look at the effect of external finance on sales and exports during the crisis, and investigate the role of the maturity composition of external finance. Tangible assets that can be used as collateral have a positive impact on access to external finance in normal times.

11. In France, credit-constrained firms – those that faced a payment problem during the previous 12 months – experienced a greater drop in exports than those that did not have a payment problem. This existing feature was reinforced by the crisis. However, the magnitude of these constraints is small and hence cannot explain the severity of the downturn. In less-developed markets, the effects may have been different despite having banking sectors not suffering from a home-grown crisis. Trade credit is found to matter in Africa. Berman and Martin (2011) found that sub-Saharan countries are more sensitive to partner-country crisis than most developed countries, and external finance, especially trade credit, does matter.

Does this remain the case during a crisis? Finally we ask if different types of banks could have played any role in the effects of the crisis.

External finance

First let us consider the key indicators of reliance on external finance. One question in the EFIGE survey directly asks if the firm experienced financial constraints in 2008. On average, 34 percent of firms answered 'yes'. The share of constrained firms was greatest in Spain (54 percent) and France (49 percent). This variable has a significant, but economically modest, effect on sales decline; sales of firms experiencing such constraints were 1.3-1.9 percent smaller (see Table 8).

Another aspect of the financial crisis is that it may have created differences between firms that rely more on external financing and firms using internal financing to a greater extent. Our estimates provide evidence for a negative relationship between external financing and sales growth. Firms relying on external finance lost about 1.2 percent more of sales.

About 12 percent of firms in the sample used export credit as means to finance trade. When we used this variable in the regression only, we found some significant results. However, when more controls of financial position were added, we found no correlation between the use of trade credits and decline in export sales.

Fact 5a – Firms relying on external finance and experiencing financial constraints to growth (before the crisis) experienced a greater sales decline. The use of trade credits by itself did not prove to be a significant factor.

Results on the effect of the composition of external debt suggest that it was only the reliance on medium and long-term bank debt that became problematic during the crisis (see Table 9). However, its economic impact was rather small; 40 percent medium/long term debt reduces sales by a mere one percent.

Table 8: Effects of financial constraints

Variables	Sales		Exports	
	<i>All firms</i>	<i>All firms</i>	<i>All firms</i>	<i>All firms</i>
Firm perceived financial constraints	-1.261*** (0.408)	-1.47*** (0.41)		-1.921** (0.784)
Firm recurring to external financing	-1.19*** (0.404)	-1.199*** (0.406)		0.015 (0.766)
Exporter (dummy)	-2.484*** (0.415)	-2.395*** (0.427)		
Export credit (dummy)			1.946* (1.088)	1.251 (1.188)
Constant	9.9*** (1.527)	11.949*** (1.414)	1.525 (2.747)	3.556 (2.85)
Observations	11,604	11,604	7,523	6,199
R ²			0.043	0.047
McKelvey-Zavoina R ²	0.079	0.076		
Dummies	<i>Sector, country, size</i>	<i>Sector, country, size</i>	<i>Sector, c country, size</i>	<i>Sector, country, size</i>
Model	<i>Interval regression</i>	<i>Interval regression</i>	<i>OLS</i>	<i>OLS</i>

Source: EFIGE. Notes: Standard errors in parantheses. *** p<0.01, ** p<0.05, * p<0.1.

Observations are weighted by the sampling weights of firms.

Estimation models and methods are explained in Appendix C and D, respectively.

Table 9: Financial liability structure of firms

Variables	Sales	
	<i>Firms with external financing</i>	<i>All firms</i>
Fin. structure: medium/long term	-0.024**	-0.030***
bank debt, %	(0.010)	(0.010)
Other financing, %	-0.003	-0.003
	(0.011)	(0.011)
Firm recurring to external financing	0.388	
	(0.919)	
Firm perceived financial constraints	-1.525	-1.258***
	(0.604)	(0.407)
Exporter (dummy)	-0.948	-2.515***
	(0.656)	(0.415)
Constant	8.755***	9.925***
	(3.069)	(1.526)
Observations	4763	11604
McKelvey-Zavoina R ²	0.0956	0.0792
Dummies	Sector, country, size	Sector, country, size
Model	<i>Interval regression</i>	<i>Interval regression</i>

Source: EFIGE. Notes: Standard errors in parantheses. *** p<0.01, ** p<0.05, * p<0.1. Observations are weighted by the sampling weights of firms.

Assets

Uncertainty in financial markets also leads to a difference between sectors with more tangible assets, which may be used as collateral, compared to sectors with fewer tangible assets.

Balance sheet data were used for those firms for which the EFIGE and AMADEUS data could be merged. Note that this was feasible for France, Hungary, Italy and Spain only.

We confirm the proposition of Chor and Manova (2009), which suggests that firms with a greater pre-crisis tangible assets (ie property) to total assets ratio suffered from declining valuations of these assets, and the lack of financing led to lower sales and exports (see Table 10). The argument that having large loans backed up by property turned out to be a curse in the crisis is also supported by the European data. This is true

after controlling for other size and financial-health variables, such as total assets and cash flow.

Table 10: Effects of financial constraints based on balance-sheet data

Variables	Sales	
	<i>All firms</i>	<i>Exporters</i>
Tangible fixed assets per total assets	-5.931*** (1.307)	-7.129*** (1.613)
Total assets per sales	1.204*** (0.245)	1.11*** (0.272)
EBIT per sales	2.365 (2.871)	-0.324 (3.328)
Cash-flow per sales	4.250 (3.214)	5.817 (3.725)
Sales per employees	-0.002** (0.001)	-0.001 (0.001)
Export dummy (broad)	-1.143** (0.547)	
Constant	9.906* (5.773)	6.171 (6.177)
Ln Sigma	2.876*** (0.013)	2.872*** (0.016)
Observations	6,671	4,611
McKelvey-Zavoina R ²	0.091	0.086
Dummies	<i>Country, size</i>	<i>Country, size</i>
Model	<i>Interval regression</i>	<i>Interval regression</i>

Source: EFIGE. Notes: Standard errors in parantheses. *** p<0.01, ** p<0.05, * p<0.1.

Observations are weighted by the sampling weights of firms.

Estimation models and methods are explained in Appendix C and D, respectively.

Similarly to other variables, exports fell disproportionately for firms having such financial constraints.

Fact 5b – Firms with a larger pre-crisis tangible asset (eg property) to total asset ratios suffered from declining valuations of these assets, and the consequent lack of financing led to lower sales and exports.

Banks and transmission of the crisis

The survey includes a number of other firm-specific questions about financing in general, such as firms' use of short-term finance and choice of bank. In the questionnaire, firms were asked what sort of banks they used for their domestic and foreign operations, selecting one or more out of three types: local, domestic national and foreign. They could also select how many different banks they use overall. Thus, we added these variables to the usual sales regression.

Results suggest that only having local banks affected sales negatively (see Table 11). This is true when all variables are used (columns 1 and 3) and also true when comparing firms that use only local banks with others (column 2). It is not only true at the domestic level, but also true for foreign operations of exporters; exports fell by over 2 percent for firms with local-bank finance. This suggests that crisis transmission to manufacturing firms did not really come through major international banks, but rather through smaller domestic banks. These banks play an important role in most countries, with the exception of Hungary and the UK. Looking at the country level, this negative impact is large and negative in Italy, smaller and negative in France and Spain, and zero elsewhere.

Fact 5c – Having local banks as their main financiers affected firms' sales negatively, in particularly in Italy but also in France and Spain.

Table 11: Use of banks

Variables	Sales		
	<i>All firms</i>	<i>All firms</i>	<i>Exporters</i>
Domestic local banks	-1.828*** (0.432)		-2.084*** (0.52)
Domestic national banks	0.082 (0.456)		0.143 (0.565)
Foreign banks	0.776 (0.606)		0.539 (0.862)
Domestic local banks only		-1.162*** (0.421)	
Number of banks	0.18** (0.086)	0.125 (0.083)	0.249*** (0.096)
Exporter (dummy)	-2.202*** (0.377)	-2.122*** (0.374)	
Constant	10.602*** (1.457)	10.074*** (1.438)	7.364*** (1.681)
Observations	14285	14314	9,545
McKelvey-Zavoina R ²	0.0807	0.0801	0.0710
Dummies	<i>Sector, country, size</i>	<i>Sector, country, size</i>	<i>Sector, country, size</i>
Model	<i>Interval regression</i>	<i>Interval regression</i>	<i>Interval regression</i>

Source: EFIGE. Notes: Standard errors in parantheses. *** p<0.01, ** p<0.05, * p<0.1.

Observations are weighted by the sampling weights of firms.

Estimation models and methods are explained in Appendix C and D, respectively.

In summary, our results indicate that financing opportunities mattered for firms attempting to cope with the crisis. A number of firms reported the presence of financial constraints, especially in France and Spain. Sales of firms that were less reliant on external financing declined less. Finally, the extent to which the firms' tangible assets could be used for collateral seems to have had a negative impact on firm growth.

7 Fiscal policy and the crisis

Governments reacted swiftly to the 2008 financial crisis and relaxed budgets substantially. As well as letting automatic stabilisers go to work, public procurement programmes were extended. According to OECD (2010), infrastructure spending in stimulus packages equalled €18 billion in Germany alone. Furthermore, as early as December 2008, the European Commission accelerated procurement procedures for all major public projects for 2009 and 2010 (European Commission, 2008). For more details for the auto industry, see Box 2.

BOX 2: LOANS, GRANTS AND CASH-FOR-CLUNKERS TO SUPPORT THE MOTOR VEHICLE INDUSTRY

In the car industry, several measures were introduced because it was directly hit by the crisis. EU initiatives included increasing the demand for cars: cash-for-clunkers programmes, public procurement and the setting aside of funds to finance reorganisation of the car industry. In 2009, the European Investment Bank increased the available credit to be used to €7 billion.

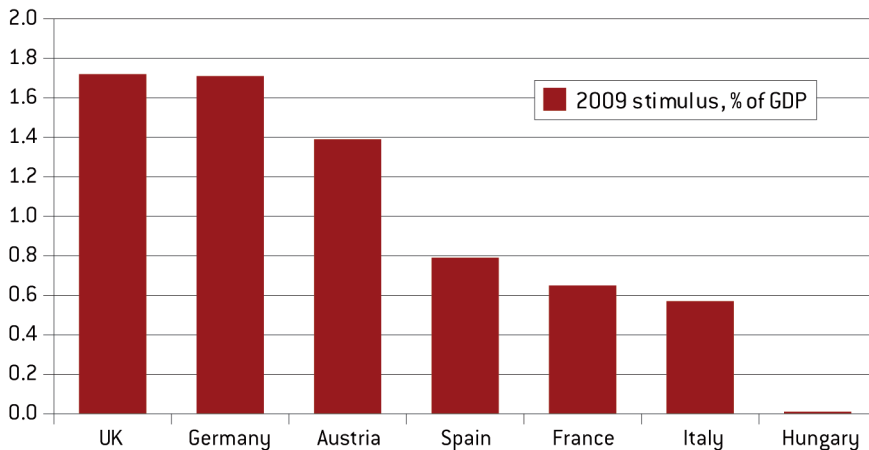
Germany spent €1.5 billion on cash-for-clunkers, and the bailout of Opel may have reached €4 billion. In France, at the beginning of 2009, the manufacturers were given a loan of €6 billion plus a set of subsidies; the cost of cash-for-clunkers totalled €0.6 billion. In Spain the package of different measures totalled €4.1 billion with cash-for-clunkers of €100 million. In the UK €2.3 billion in credit was granted to suppliers and car producers to support investments in environmentally friendly car production. More than half of this sum came from the European Investment Bank. The cash-for-clunkers programme was in the order of €120 million. In Italy the package of different measures totalled €2.5 billion including a cash-for-clunkers programme.

Evidence of the impact of various fiscal measures on firm performance is not widely available, as most research has either focused on the crisis from a macro-economic point of view (such as Aizenman and Jinjarak, 2011), or had no access to data on

public clients. Röger and in't Veld (2010) used model simulations to suggest a greater role for fiscal policy in credit crises.

During the Great Recession, state involvement in crisis management was rather widespread in OECD countries as governments reacted to the sharp GDP declines experienced in 2009. GDP fell by 2-7 percent in most EU countries, with some countries such as Greece, Ireland and Latvia experiencing a drop of 10-20 percent of GDP. Governments reacted with unprecedented fiscal relaxation to save their economies from collapse. As shown in Figure 8, the largest expansion was carried out in Germany and the UK followed by Austria. Significantly smaller relative amounts were committed in France, Italy and Spain, while Hungary enacted no fiscal stimulus and actually tightened its overall fiscal stance in 2009 as the country tried to weather a sudden halt to external financing and relied on an early bail-out by the IMF and the European Union.

Figure 8: Fiscal stimuli in 2009, % of GDP



Source: Röger and in't Veld (2010).

Relaxed fiscal policies and public programmes have helped to stabilise demand in two ways that we can detect in our data. First, countries that were in a good fiscal position before the crisis, such as Austria, France and Germany, could expand easily and without an increase in yields, and thus help stabilise the economy. In these countries, firms were hurt less while exporters experienced a relatively greater decline owing to worse performance of foreign markets.

In countries that could not expand because of a home-grown crisis, as in Hungary and Spain, sales of non-exporting firms declined along with those of exporters. Hungary was in the worst shape and firms on average realised the greatest losses among the seven countries. The UK is special as sterling could be allowed to depreciate against other currencies thus helping goods exporters.

Our results may capture the broad evidence of differences between countries only. They are obtained by relating firm-level sales with a set of country, industry and size dummies and the interactions of country dummies with the exporter dummy (see Table 12). Note that Austria is the base category. These results suggest the largest country effects in Italy, Hungary and Spain, while the largest deviation of exporting firms is found in Austria, France and Germany, and there are no effects in Hungary, Spain and the UK.

Table 12: Country effects in sales and exports

Country	Country effects on sales	Exporters' performance relative to non-exporters
Austria	0	-12.111***
Germany	-2.082	-8.615***
UK	-3.058**	-0.079
France	-5.574***	-6.857***
Italy	-7.375***	-3.986***
Hungary	-9.377***	-1.961
Spain	-13.307***	0.338

Source: EFIGE. Notes: Standard errors in parantheses. *** p<0.01, ** p<0.05, * p<0.1

In column one, we report values of country dummies in a summary regression of sales change on selected variables. In column two, we report coefficients from seven OLS regression of sales change on an exporter dummy. (Industry, size controls included.)

Observations are weighted by the sampling weights of firms.

Fact 6a – Fiscal policy may help to mitigate the effects of crises on firms, while home-brewed crises (such as in Hungary and Spain) will substantially reduce sales.

The second body of evidence comes directly from the EFIGE survey data. In the survey, firms were asked if they had private and/or public-sector clients. Public-sector clients may include national or local government and other state-owned institutions. Firms with clients from the public sector managed on average with a six percent smaller decline in sales (see Table 13).

Interestingly for five of the seven countries, the estimated coefficient does not vary greatly, ranging between 5.8 percent and 7.5 percent. However, for the UK and Hungary, being a public client helped marginally (1-2 percent) only. There may be several explanations for this difference. In the case of Hungary, fiscal tightening meant that the public sector could not afford to play a cushioning role. In the UK, the fiscal stimulus itself was half the size of Germany's and its composition was more focused on loans and tax cuts (CRS, 2009, pp 141-142). Also, the public sector in the UK is smaller than in continental Europe¹².

Fact 6b – Firms with public-sector clients suffered less of a sales decline, but this effect was weak in Hungary and in the UK.

Another possible effect of government orders on firms is that they may come with strings attached, probably forcing firms to lay off fewer workers. To check this possibility, we ran regressions with employment change as a dependent variable, including the public-sector clients dummy, and controlling for sales decline. The public-sector clients dummy, however, is not significant in these regressions. This supports a hypothesis that governments were somewhat effective in boosting demand for firms with public-sector customers, but this did not have any extra effects on employment beyond the indirect effect of greater sales.

12. Coefficients are calculated from individual country regressions including industry and size dummies as well as several other controls relating to competition and clients. Results are available on request.

Table 13: Clients and competitors

Variables	Sales							
	Full sample	Austria	France	Germany	Hungary	Italy	Spain	UK
Intra-group clients dummy	0.478 (0.601)	1.976 (2.750)	-0.023 (1.119)	-0.608 (1.184)	-1.685 (2.938)	1.682 (1.643)	3.257* (1.696)	1.735 (1.480)
Public administration clients dummy	5.625*** (0.519)	7.222** (2.892)	5.795*** (0.826)	6.272*** (1.186)	1.578 (3.177)	7.508*** (1.427)	6.66*** (1.349)	2.062* (1.151)
Outsource production dummy	1.945** (0.961)	-6.570 (5.025)	0.912 (1.691)	1.550 (2.199)	1.039 (7.958)	2.183 (1.918)	4.473 (3.314)	4.402* (2.598)
Share of production to order	-0.025*** (0.006)	-0.082** (0.034)	-0.026* (0.016)	-0.035*** (0.010)	0.034 (0.041)	-0.018 (0.015)	-0.002 (0.013)	-0.037** (0.015)
Share if imported intermediates	0.017* (0.010)	0.034 (0.050)	0.018 (0.016)	0.002 (0.024)	0.067* (0.037)	0.004 (0.020)	0.049** (0.025)	0.025 (0.032)
Competitors from EU dummy	-1.381*** (0.422)	-6.831** (2.718)	0.210 (0.875)	-2.928*** (0.915)	0.459 (2.290)	-1.243 (0.902)	-0.346 (1.041)	-1.989* (1.188)
Exporter (dummy)	-1.569*** (0.413)	-8.986*** (3.454)	-2.811*** (0.868)	-4.563*** (0.862)	-0.888 (2.329)	-0.604 (0.912)	1.087 (0.995)	0.834 (1.173)
Constant	10.167*** (1.686)	22.792*** (5.826)	4.736*** (1.550)	9.918*** (1.257)	-6.412 (4.752)	6.875*** (2.064)	-3.539 (1.727)	9.253*** (2.621)
Ln Sigma	2.903*** (0.010)	2.654*** (0.069)	2.837*** (0.022)	2.895*** (0.022)	2.904*** (0.052)	2.899*** (0.021)	2.903*** (0.024)	2.923*** (0.028)
Observations	12.804	248	2.537	2.894	449	2.819	2.204	1.653
McKelvey-Zavoina R2	0.086	0.191	0.097	0.098	0.059	0.077	0.093	0.055
Dummies	<i>Sector, size, country</i>	<i>Sector, size</i>	<i>Sector, size</i>	<i>Sector, size</i>	<i>Sector, size</i>	<i>Sector, size</i>	<i>Sector, size</i>	<i>Sector, size</i>
Model	<i>Interval reg. Interval reg. Interval reg. Interval reg. Interval reg. Interval reg. Interval reg. Interval reg.</i>							

Source: EFIGE. Notes: Standard errors in parantheses. *** p<0.01, ** p<0.05, * p<0.1.

Observations are weighted by the sampling weights of firms.

Estimation models and methods are explained in Appendix C and D, respectively.

8 Conclusions for policymakers

Our report has found significant heterogeneity among firms, industries and countries in terms of how they responded to the crisis. While the typical firm experienced declining sales and had to shed workers, this was by no means ubiquitous. Policymakers can learn from studying the experience of firms that were relatively successful in weathering the crisis.

This heterogeneity also suggests that one-size-fits-all policies might be ineffective. Understanding the patterns emerging from this heterogeneity may enable governments to better target spending and regulations.

Short-time work in Europe may be the right instrument to dampen the effect of crises on employment. This report finds no support for this. Moreover, our data suggests that temporary workers were fired first, with firms with larger pools of temporary workers actually shedding more employees. Skill-composition seems to matter more, as firms with less-skilled workers shed more jobs than those with more white-collar and skilled blue-collar labour. Firms prioritised the retention of human capital embodied in skilled labour during the crisis. As companies tend to retain their core employees, policy should help reallocate and retrain the others.

Regarding the role of exports, our evidence is in line with earlier findings; exports fell more than sales in most countries. Reducing imports and relying on outsourcing offered flexibility that helped mitigate the crisis and helped maintain sales and employment. National policies should not fear a sudden disappearance of trade contacts; the key adjustment is taking place within the firm. Also, larger firms will be able to adjust through imports and outsourcing, hence, trade protection is not a helpful solution.

Dominant firms centrally placed in the technology, trade and ownership network fared better. Firms producing final goods and relying on a stable pool of skilled workers had more success maintaining their sales. Making specific products ordered by large customers may result in greater sales reductions. Similarly, relying on a network of

suppliers could also mitigate the effect of the crisis. Finally, firms controlling other companies at home or abroad could preserve more jobs. This suggests that in such crises, policy should focus on helping stabilise firms that are in weaker positions, owned by foreign firms and producing less skill-intensive and/or specific products for large customers.

This raises an important policy trade-off. On the one hand, while export-oriented strategies may improve competitiveness, they also bring about greater exposure to foreign crises. Accessing foreign markets may help firms attain bigger scale, achieve greater productivity or upgrade their products in stable times, but such firms, sectors and countries will also be more vulnerable to crises.

The flip side of the same trade-off is that outsourcing to other countries has distinct stabilisation benefits. While many see competition by lower-wage countries as a threat, it should also be clear that these supply chain linkages give greater flexibility when responding to a demand shock. These additional gains from trade for rich countries imply that protectionist instincts during the crisis may be misguided.

Anecdotal evidence suggested that as banks collapsed, trade credit dried up and hence exports fell more sharply than output. Yet, earlier studies found mixed evidence regarding the effect of trade finance. This report falls in line with other papers, finding no convincing result. As trade credit was not itself a major reason for export decline, policy should consider a broader set of financing options. However, we can confirm the importance of pre-crisis external constraints, and add that a greater reliance on external finance had a negative impact on sales during the crisis. It was detected that the financial crisis affected firms not through major international banks but through smaller and financially weaker local banks. Of course, this may have been a result of government intervention shoring up the capital positions of some large and important banks. Whichever is the case, strengthening local banks may help firms to cope with the consequences of the crisis.

While fiscal policy was the main policy tool used by governments, with sizeable new government purchases from the private sector, evidence on the role of the state is limited. The general fiscal policy stance and the role of public-sector orders from companies are found to help mitigate declining sales.

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Appendix A: the EFIGE survey and its variables

The firm level data used in this report are drawn from the EFIGE survey, collected within the project *EFIGE – European Firms in a Global Economy: internal policies for external competitiveness*. For this report, the EFIGE data was complemented by balance sheet data drawn from the Amadeus database managed by Bureau van Dyck. The questionnaire is mainly focused on 2008, with some questions on firms' activity in 2009 and in previous years. It contains a rich section on internationalisation as well as organisation of the firm, labour and finance. Crisis indicator variables were asked directly, such as how did sales or export change in 2009 compared with 2008.

The number of firms that answered the EFIGE questionnaire is reported in Table A1. The sample includes around 3,000 firms for France, Italy and Spain, more than 2,200 for UK and Germany, and 500 each for Austria and Hungary. In the Appendix we provide the distribution of the sample by sector and size class for each country.

Country	Number of firms
Austria	344
France	2759
Germany	2935
Hungary	486
Italy	3021
Spain	2832
UK	2067
Total	14444

Source: EFIGE Survey dataset. NB these are firms for which the manufacturing sector codes are broadly available. 316 firms have been dropped.

Variables and modifications

Variables used in this policy report have been chosen to allow the maximum possible comparability across countries and industries. Hence, some modifications were made:

- in several cases, dummy variables on a given activity were modified by imputing zero instead of NA/DK. This was used for simple variables such as FDI dummy or exporting;
- the method of imputing zeros was *not* used for ‘opinion’ questions such as asking if the firm has financial constraints. Hence, the number of observations may be well below 14K for some regressions;
- when for some firms percentage, while for others actual values were available (ie skill levels of labour), percent values were uniformly created to allow comparison;
- for exporters, we have detailed data for 7738 firms. The export dummy is 1 for 9460 firms given the broad definition is used.

Since the sample is not fully representative as it overweights certain sectors and firm size categories, sampling weights were constructed in terms of size-sector cells to make the sample representative of the underlying population – for each of the countries. All the analysis of the report is based on the weighted sample.

Appendix Table A.2: Variables from EFIGE Survey

Dependent variables

<i>Variable used</i>	<i>Definition</i>
Changes in sales (modes)	Change of sales (turnover) in 2009 compared to 2008. Multiple outcome variable. Equals 0 if sales rose or were unchanged, 1 for small (0-10%) decline, 2 for moderate (10-30%) decline and 3 for large decline (30%+)
Change in exports	Change of exports in 2009 compared to 2008, in percent. Measured for those reported exports in 2008.
Change in employment	Change of labour from 2009 to 2008, in %.
Change in employment (modes)	Change of labour in 2009 compared to 2008. Multiple outcome variable. Equals 0 if employment rose or was unchanged, 1 for small (0-10%) decline, 2 for moderate (10-30%) decline and 3 for large decline (30%+) in employment.

Explanatory variables

Competitors from EU dummy	Dummy for firm having competitors from the EU
Controlled by others (dummy)	Dummy for controlling other firms as head of a group or having affiliates
Controlling firm (dummy)	Dummy for controlled by other firms: affiliate or acquired or is controlled by other firms as part of a group
Domestic local banks	Dummy for firm has finance from local domestic bank(s), such as regional thrifts
Domestic local banks only	Dummy for firm has finance from local domestic bank(s) only
Domestic national banks	Dummy for firm has finance from national domestic bank(s)
Export credit (dummy)	Dummy for firms having a significant share of exports financed by export credit
Exporter (dummy)	Dummy for exporter - wide definition: firm is direct exporter in 2008 or has been actively exporting in years before 2008. For exporters, we have detail data for 7738 firms. The export_wide dummy is 1 for 9460 firms given the broad definition used.
Fin. structure: medium/long term bank debt, %	Financial structure: medium/long term bank debt, % in 2008
Fin. structure: medium/long term securities, %	Financial structure: medium/long term securities, % in 2008
Fin. structure: short term bank debt, %	Financial structure: short term bank debt, % in 2008
Fin. Structure: short-term securities, %	Financial Structure: short-term securities, % in 2008
Firm perceived financial constraints	Dummy for firm perceived financial constraints (pre-crisis)
Firm recurring to external financing	Dummy, Reply to: firm recurring to external financing in (pre-crisis)
Foreign banks	Dummy for firm has finance from foreign bank(s)
Intermediate importer (dummy)	Dummy for importer of raw materials and/or intermediate goods in 2008
Intermediate use share	Use of intermediate goods (domestic and import) as a share of output
Intra-group clients dummy	Dummy, the firms have clients who are affiliated (part of the same group)
Number of banks	The number of banks the firm has financing from
Outsource production dummy	Dummy for the firm that has outsourced production
Outsources some production (dummy)	Dummy, Outsources some production
Part-time employees (%)	Part time employees share in total labour (%)
Produced-to-order goods share Share of production to order	Produced-to-order (specifically made for selected clients) goods share to total output
Public administration clients dummy	Dummy for having public administration clients

Service importer (dummy)	Dummy for importer of services in 2008
Share of output used as intermediate of other domestic sectors	Share of output used as intermediate of other domestic sectors
Share of skilled blue collars (%)	Skilled blue collar employees share in total labour (%)
Share of white collars & executives (%)	White collar and executive employees share in total labour (%)

Appendix Table A.3: Variables from Amadeus database

<i>Variable used</i>	<i>Definition</i>
Tangible Assets share	Share of tangible assets in total assets
Assets_to_sales	Assets to sales ratio
EBIT_to_sales	Earnings before interest and tax to sales ratio
Sales_to_employees	Sales per employees ratio

Available for Spain, Italy, France, Hungary only

Appendix Table A.4: Sector/country specific variables

<i>Variable used</i>	<i>Definition</i>
Upstream_share	Intermediate use as a share of output is a (2-digit) industry-country level variable. Defined as in di Giovanni-Levchenko (2010) using national input-output (Supply) tables of 2007 from Eurostat (2005 for Hungary).
Downstream_share	Share of inputs used as intermediate of other domestic sectors is a (2-digit) industry-country level variable. Defined as in di Giovanni-Levchenko (2010) using national input-output (Supply) tables of 2007 from Eurostat, (2005 for Hungary).

Appendix B: descriptive tables

Appendix Table B.1: Reaction of firms to the crisis			
Sales in 2009 compared to 2008	<i>Observations</i>	<i>Share</i>	<i>Mean</i>
no reduction/increase	4,183	28.4%	
small reduction (0-10)	2,810	19.1%	
moderate reduction (10-30%)	5,061	34.4%	
large reduction (30%+)	2,675	18.2%	
<i>Total</i>	14,729	100%	-12.3%
Change of export volume in 2009 vs 2008	<i>Observations</i>	<i>Share</i>	<i>Conditional mean increase/decrease</i>
Increased	1,456	18.9%	23.6%
No change	2,240	29.0%	
Reduced	4,028	52.2%	-30.8%
<i>Total</i>	7,724	100.00%	-11.6%
Change of labour in 2009 vs 2008	<i>Observations</i>	<i>Share</i>	<i>Conditional mean increase/decrease</i>
increased	1,905	13.4%	11.9%
no change	5,778	40.6%	
reduced	6,561	46.1%	-16.9%
<i>Total</i>	14,244	100%	-6.2%
Mode of labour change	<i>Observations</i>	<i>Share</i>	
No Change	6,135	41.7%	
Temporal Change	1,705	11.6%	
Permanent Change	6,890	46.8%	
<i>Total</i>	14,730	100%	
Recurring to external financing in 2008-2009	<i>Observations</i>	<i>Share</i>	
Recur	6,344	44.7%	
No recur	7,856	55.3%	
<i>Total</i>	14,200	100%	

Appendix C: models used

When testing our hypotheses, we rely on the EFIGE survey database, collected within the project *EFIGE – European Firms in a Global Economy: internal policies for external competitiveness*. For this report, the EFIGE data has been complemented by balance sheet data drawn from the *Amadeus* database. The questionnaire is mainly focused on 2008, with some questions on firms' activity in 2009 and in previous years. It contains a rich section on internationalisation as well as organisation of the firm, labour and finance.

Several indicators directly related to the crisis had been asked directly. One such question, central to this study was 'How did sales change in 2009 compared with 2008?'. Similar questions were asked on exports and employment, too.

The sample includes around 3,000 firms from each of France, Italy and Spain, more than 2,200 from each of Germany and the UK, and 500 from each of Austria and Hungary. In Appendix A we provide a description of the variables, and document the distribution of the sample by sector and size class for each country.

When testing the hypotheses we rely on a number of descriptive statistics as well as on two types of regressions. The first type of regression investigates the variables related to the unconditional decline in sales (or exports) suffered by each firm. For example, a positive coefficient of a dummy representing exporters suggests that sales of exporting firms declined to a smaller extent than sales of non-exporting similar firms in the same industry.

The second regression model investigates how differently firms reacted in terms of their employment *assuming* a similar sized demand shock. For example, we considered if some firms were less likely to lay off workers, conditioning on sales decline. For example, the positive coefficient of white collar workers in a regression, when adjusting for differences in the demand shock suggests that firms employing more such workers will tend to lay off fewer workers.

In all our models, every variable is specified in percentage terms, ranging between -100 percent and 100 percent, where a 100 percent change indicates doubling of sales (or exports, employment) and -100 percent means exit. The models are described in Box 3.

BOX 3: MODELS USED

The first type of regression used in this report models sales decline unconditionally. These regressions take the following form:

$$\text{Change in sales}_i = X_i' \beta + D_i \gamma + \varepsilon_i$$

where i denotes firms, X_i' is a vector of different firm-level variables and D_i is a set of country, 2-digit industry and size dummies. The EFIGE survey did not include exact turnover data for 2008-2009. Instead it asked firms by what extent sales changed from 2008 to 2009. Change of sales (turnover) from 2008 to 2009 is thus a multiple outcome variable, equalling 0 if sales rose or were unchanged, 1 for small (0-10 percent) decline, 2 for moderate (10-30 percent) decline and 3 for large decline (>30 percent). To use as much information as possible when estimating the model, we rely on a maximum likelihood technique called interval regression. We provide a short description of this method in Appendix D. When implementing this procedure, we transform the dependent variable in such a way that it shows change in sales in percentage from -100 to 100. A positive value shows increase in sales.

The second type of regression investigates which firms are more likely to lay off workers, holding demand shock constant. In this case the dependent variable is employment change, while we control for sales decline (as a set of dummies):

$$\text{Change in employment}_i = X_i' \beta + D_i \gamma + S_i \delta + \varepsilon_i$$

where S_i denotes the set of sales change dummies. Fortunately firms reported employment change in percentages, thus these regressions can be estimated by OLS.

Appendix D: estimation methodology

In this report, two types of estimation methods are used, an interval regression for change in sales and labour and OLS for change in exports.

The EFIGE survey did not include exact turnover data for 2008-2009. Instead it asked firms by what extent sales changed from 2008 to 2009. Change of sales (turnover) from 2008 to 2009 is hence, multiple outcome variables. Equals 0 if sales rose or were unchanged, 1 for small (0-10 percent) decline, 2 for moderate (10-30 percent) decline and 3 for large decline (>30 percent).

Average decline in sales values was estimated using sales intervals (see previous section). For closed intervals we used simple mid-points [-0.05 for decline of 0-10 percent, and -0.2 for 10-30 percent drop]. Using the Amadeus dataset, we estimated values for open intervals (0.4 for decline of 30 percent and above and -0.1 for zero and below) and used these mid-points to calculate sample averages.

In order to measure the effect of various firm level variables on sales, we used interval regressions. This is different to using ordered probit in that here, we need not estimate cut-off points as they are given by the data collection scheme. Indeed, interval regression can be defined as an ordered probit with cut points fixed and with coefficients and variance estimated by maximum likelihood (Wooldridge, 2002, p. 509). The advantage is that estimates can now be interpreted as if they came from an OLS¹³.

A similar method was applied for change in the labour. Here we used a set of survey questions to construct a similar set of values and use interval regressions as well.

For change in export values, a simple OLS was used with a dependent variable given as percentage change of exports in 2009 compared to 2008, also constructed from several survey questions.

13. Another option would be to provide mid-points directly rather than using ML estimates. Our results are robust to using this methodology as well as ordered probit in lieu of interval regressions.

For regressions a set of dummy variables were used to denote 2-digit NACE1.1 industries, countries and firm size. The survey used four firm size categories that were kept in this report: “10-19 employees”, “20-49 employees”, “50-249 employees” and “250 employees and more”.

Interval regressions

In order to measure the effect of various firm level variables on sales, we used interval regressions. An interval regression can be defined as an ordered probit with cut points fixed and with coefficients and variance estimated by maximum likelihood (Wooldridge 2002, p. 509).

The estimation of interval models by maximum likelihood, introduced by Stewart (1983) is relatively straightforward and has been applied in a number of contexts estimating willingness to pay models. The data generating process for the effect on crisis is assumed to be

$$y_i^* = x_i' \beta + \varepsilon_i$$

where sales change is denoted by y_i^* but it is not directly observed. Instead what we observed are values that refer to intervals in value for i intervals (in our case $i=4$), denoted by

$$m_i \leq y_i^* \leq M_i$$

Note that intervals may be unbounded either at minimum or maximum (i.e. denoting cases like 30 percent and above). Once we assume normality, we can compute the log likelihood for an observation:

$$l_i(\beta, \sigma) = \ln P(m_i \leq y_i^* \leq M_i) = \ln \left[\Phi \left(\frac{M_i - x_i \beta}{\sigma} \right) - \Phi \left(\frac{m_i - x_i \beta}{\sigma} \right) \right]$$

The likelihood-ratio chi-squared tests the difference between the full model (with predictors) and the constant only model. The McKelvey-Zavoina pseudo R^2 is computed using the variances of the latent variable and the latent predicted variable. Further, we use a simple correlation between the predicted and observed values as a simple goodness of fit measure applied frequently. The ancillary statistic of σ is basically the same as the standard error of estimate in OLS regression.

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Still standing: how European firms weathered the crisis The third EFIGE policy report

What impact has the Great Recession had on European firms? In 2008 and 2009, the European Union experienced a 14 percent decline in industrial production, and a 15 percent decline in trade. Companies were hit hard, going through an average 10 percent sales decline, and reducing their workforces by 6 percent.

But the unique firm-level dataset compiled from the EFIGE survey shows that not all firms were affected in the same way. Exporters contracted more than non-exporters, while importers, and those that outsource some of their production or have an affiliate suffered less of a decline. These findings raise an important policy trade-off. While export-oriented strategies might improve competitiveness, they also bring about a greater exposure to foreign crises. However, outsourcing to other countries has distinct stabilisation benefits. Dominant firms centrally placed in the technology, trade and ownership network, fared better, but firms relying on external finance, and experiencing financial constraints to growth, experienced greater sales declines.

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EFIGE (*European Firms in a Global Economy*) is a project to examine the pattern of internationalisation of European firms. The research leading to this report has received funding from the European Union's Seventh Framework Programme, and from UniCredit Group.



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