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Firms in the great global recession: The role of foreign ownership and financial dependence

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Abstract

This paper investigates the channels through which the global crisis of 2008-2009 spread to economic activity of an emerging, fast growing economy with sound macroeconomic fundamentals. On the basis of Polish firm-level data we find that a number of individual firm characteristics account for a heterogeneous response. In particular, foreign ownership appears to have provided a higher degree of resilience to the crisis. Our results indicate that this effect might be due to intra-group lending mechanisms supporting affiliates facing external credit constraints.

Keywords: global crisis, firm-level data, foreign ownership, financial constraints, internal capital market

JEL classification: C23, E44, F23, G32

Non-technical summary

While the 2007 subprime crisis originated in few developed countries, the ensuing global recession of 2008 quickly spread to most countries around the globe, revealing an extraordinary degree of interdependence and synchronisation in the world economy. Activity and trade fell abruptly and world-wide following the intensification of the financial turmoil in September 2008. Importantly, this sharp slowdown could be observed in nearly every country, even in those with relatively solid economic fundamentals and whose financial markets had remained relatively unaffected by the financial crisis.

This paper contributes to the strand of research which investigates how the financial troubles in few industrialized countries led to an economic and trade crisis that affected firms worldwide and, especially, in countries whose financial markets were not directly affected by the subprime crisis. It does so by exploring the channels and extent of contagion to Polish firms. The interest in this dataset stems from the features of the Polish economy. It is an emerging, small open economy, highly dependent on global and regional production chains, whose growth was robust and based on strong economic fundamentals before the crisis. Hence, there are reasons to treat the recent global financial crisis as a large but exogenous shock to the country and so its experience represents a model case for an empirical investigation of a global contagion.

Our analysis first assesses how key balance sheet indicators, including sales, profits, indebtedness, investment, foreign trade, evolved during the time of the global crisis. Secondly, it examines if foreign ownership, and the associated involvement in global value chains, was a factor influencing firms' performance and, if so, through which channels. Finally, the identified channels are shown to be also important to explain differences across firms in the trade response to the crisis. To the best of our knowledge, this is the first article addressing systematically the implications of the recent crisis for firms' balance sheets and drawing from it insights about their resilience to global shocks.

We find that ownership status (foreign vs. domestic), size and sector of activity are important to understand the firm-level impact of the global crisis: while firms producing all manner of postponable goods and services have been disproportionately hit by the crisis, foreign-owned and larger firms were better able to cope with the contraction of foreign demand and increased credit constraints. Our central result is that firms belonging to multinational groups were much more resilient to the crisis than their domestically owned counterparts. In this respect, access to external and intra-group financing emerges as a key factor supporting their sales, investment and trade activity. All in all, our results suggest that while multinationals may have acted as factors of synchronisation of the crisis, they also proved to be an important source of resilience for their local affiliates in the face of the global exogenous shock.

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Introduction

While the 2007 subprime crisis originated in few developed countries, the ensuing global recession of 2008 quickly spread to most countries around the globe, revealing an extraordinary degree of interdependence and synchronisation in the world economy. Activity and trade fell abruptly and world-wide following the intensification of the financial turmoil in autumn 2008. World industrial production collapsed by 13% between its zenith recorded in April 2008 and its nadir of March 2009. The world trade contraction from peak-to-trough was even faster-paced and deeper: it lasted eight months and amounted to 25% (see Baldwin and Taglioni, 2009). These patterns were observed in nearly every country, even in countries with relatively solid economic fundamentals and whose financial markets had remained relatively unaffected by the financial crisis. In short, the recent downturn has been unparalleled since at least the Great Depression in terms of its suddenness, severity and cross-country synchronisation (Eichengreen and O'Rourke, 2009).

Considerable research efforts are being devoted by economists worldwide to fully understand the causes and mechanics of the crisis. Over a thousand new working papers have been posted on the SSRN website since 2008 containing the terms "2008 crisis" or "global crisis" in their title, abstract or keywords. This rich literature in the making is slowly reaching a consensus on the key features and stylised facts characterising the harsh response of economic activity and trade to the recent crisis. First, the deterioration in global demand appears to have been sharper and more profound than during any other recession recorded after the Second World War. Second, the downturn has been accompanied by a general climate of extremely high uncertainty and exceptionally low business confidence. Third, the pace of financial markets tightening and asset prices collapse was faster than ever in post-war times. Finally, the rapid growth of internationally fragmented vertical production chains observed in recent decades is unanimously considered to be the main culprit for the synchronisation of the crisis' impact across countries.

Our paper contributes to the strand of this research which investigates how the financial troubles in few industrialized countries led to an economic and trade crisis that affected firms worldwide and, especially, in countries whose financial markets were not directly affected by the subprime crisis. It does so by exploring the channels and extent of contagion to Polish firms. The interest in this dataset stems from the features of the Polish economy. It is an emerging, small open economy, highly dependent on global and regional production chains, whose growth was robust and based on strong economic fundamentals before the crisis. While Poland experienced a significant slowdown in economic activity as of the second half of 2008, it was the only country in the EU that managed to record positive GDP in 2009. Also, Polish banks did not overinvest in toxic assets and the domestic housing market did not collapse. Hence, there are reasons to treat the recent global financial crisis as a large but exogenous shock to the Polish economy and so its experience represents a model case for an empirical investigation of a global contagion.

Our analysis first assesses how key balance sheet indicators, including sales, profits, indebtedness, investment, foreign trade, evolved during the time of the global crisis. Secondly, it examines if foreign ownership, and the associated involvement in global value chains, was a factor influencing firms' performance and, if so, through which channels. Finally, the identified channels are shown to be also important to explain differences across firms in the trade response to the crisis. To the best of our knowledge, this is the first article

addressing systematically the implications of the recent crisis for firms' balance sheets and drawing from it insights about their resilience to global shocks.

We find that ownership status (foreign vs. domestic), size and sector of activity are important to understand the firm-level impact of the global crisis: while firms producing all manner of postponable goods and services have been disproportionately hit by the crisis, foreign-owned and larger firms were better able to cope with the contraction of foreign demand and increased credit constraints. Our central result is that firms belonging to multinational groups were much more resilient to the crisis than their domestically owned counterparts. In this respect, access to external and intra-group financing emerges as a key factor supporting their sales, investment and trade activity.

This finding is consistent with papers looking at earlier crisis episodes. For instance, Bernard et al. (2009) analyze US exports during the Asian crisis and find that the decline in US arm's length trade towards Asia was more than eight times greater than the drop of US-Asia trade undertaken within supply chains. By contrast, no difference between the two categories of exports was found vis-à-vis the rest of the world.[1] Further evidence that foreign-owned companies might respond better than other firms to a financial crisis comes from Desai et al. (2004), who investigate the response of US multinational affiliates and local firms to currency crises in emerging economies. During these episodes, sharp exchange rate depreciations tend to be followed by a credit crunch, hitting particularly those firms that borrow in foreign currency. The key finding of the paper is that, unlike local firms, foreign-owned companies can rely on internal capital markets when faced with external financial constraints and so are better able to use investment opportunities related to a weaker domestic currency. Similar conclusions are offered by Blalock et al. (2008). They find that, in response to devaluation following the 1997 Asian financial crisis in Indonesia, only foreign-owned exporters managed to increase significantly their capital stock. By contrast, Alvarez and Görg (2007) fail to identify any significant effect of the ownership status on firm-level employment growth in Chile during the (relatively benign, compared to other emerging market crises) recession in the late 1990s.

The paper is structured as follows. Section 2 provides a discussion of the causes of the crisis, summarising the findings to date from the literature and, based on this literature, it provides a rationale for our research strategy. Sections 3 and 4 describe the dataset and present descriptive statistics on the performance of firms during the crisis. Sections 5 and 6 report empirical results, showing that foreign ownership greatly mitigated the impact of the crisis on firms balance sheets, and investigate the sources of the different response of foreign vs. domestically owned firms. Section 7 focuses on the trade performance of foreign-owned companies. Finally, section 8 offers concluding remarks. The econometric methodology is presented in the Appendix to this paper, which also reports all other technical details.

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[1] See Altomonte and Ottaviano (2009) for preliminary evidence confirming the results of Bernard et al. (2009) on the basis of data on exports from Western to Central and Eastern Europe during the recent crisis.

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The "great global recession" and implications for firms

The subprime crisis broke out in August 2007 and for over one year it was broadly viewed as a financial crisis restricted mainly to those few industrialised countries with financial markets developed enough to absorb large quantities of the sophisticated financial derivatives, which were at the origin of the crisis. The metastasis into the "Great Global Recession" took place in September 2008, when a rapid sequence of extreme events[2] plunged the world into "Knightian uncertainty", or fear of the unknown (see Caballero, 2010 and Blanchard, 2009). Consumers, firms, and investors around the world applied a strategy "wait and see" by delaying purchases and investments of all what could be postponed until they could determine how bad things would get. The crash in demand for postponable goods[3] was amplified by the fact that inventories in many countries and industries were at record high levels. At the same time, firms did increasingly focus on redressing their balance sheets by massively switching their wealth to the safest assets and causing what Caballero has called a "sudden financial arrest". Deleveraging and a retrenchment of investment, often towards domestic assets, were another aspect of this collective action (Kamil and Rai, 2009). In this framework, countries' ability to attract foreign capital is likely to have been less effective, in particular if their financial markets were not well developed and liquid.

In all likelihood, the freezing up of global credit markets has harmed activity and trade, in line with the findings of the earlier literature. Thorough research on the 1997 Asian crisis by Amiti and Weinstein (2009) and an analysis of twenty-three past banking crises from the period spanning 1980 to 2007 by Iacovone and Zavacka (2009) provide compelling evidence that credit conditions can affect trade flows. Moreover, according to Kannan and Koehler-Geib (2009), crises with a pronounced surprise element tend to result in a widespread contagion through the financial channel. Yet, model-based simulations (Eaton et al., 2009) and empirical evidence at the firm-level (Bricongne et al., 2009) suggest that the contagion to countries world-wide came mainly through the contraction of demand and a drop in consumer confidence rather than through direct financial channels. This is indirectly confirmed also by Mora and Powers (2009) who find that declines in global trade finance have not had a major impact on trade flows. In the remainder of this section we discuss the mechanisms that may have been at play.

Apart from direct trade and financial linkages, the worldwide propagation of the crisis may have also worked through indirect channels. First, the international crisis of confidence may also have easily spread to domestic money markets, as banks' willingness and capacity to lend was greatly reduced. Second, the decline in external demand may have further constrained the access to financial markets through the so-called financial accelerator (see Bernanke et al., 1999). Finally, in those countries where the crisis has been associated with exchange rate depreciation, the tightening of the credit terms is likely to have been more severe. Firms with liabilities denominated in foreign currency may have experienced a severe deterioration of their balance sheets, with further limits to their access to external financing (Aghion et al., 2001 and Desai et al., 2004).

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[2] See the timeline of the crisis by the New York Fed at
http://www.newyorkfed.org/research/global_economy/policyresponses.html
[3] We define here "postponables" as goods and services consumption of which can be easily postponed in time. It includes investment and equipment goods, durable consumer goods and all their parts and components as well as services that are related to the production and handling of this kind of goods or that are by definition postponable, such as tourism. In the appendix to this paper, we report our classification of postponable vs. non-postponable goods and services, based on the NACE rev. 2 classification.

2

By consequence, the negative impact on firms relying on sources of financing external to the firm is likely to have been disproportionately high. Indeed, the reliance on external finance influences the performance of firms or sectors in times of financial crises. For example, Dell'Ariccia et al. (2008), on the basis of a panel spanning 41 countries from 1980 to 2000, find that more financially dependent industries experienced significantly slower growth in banking crisis periods. Braun and Larrain (2005), by investigating on data from 111 countries in the years 1963-1999, add to the above results showing that, in times of tight financial markets, industries dependent on external funds are more strongly affected, in particular in countries with poor financial contractibility and in sectors with low tangibility of assets.[4] The above results indicate that banking sector problems may severely affect an individual firm's performance, in particular if indebtedness is high and the firm access to other sources of financing limited.

Moving to non-financial characteristics, involvement in value chain production may also matter. Value chain production may act as a factor of propagation and synchronisation of a demand crisis. However, other aspects of vertically integrated production suggest that the overall impact may turn out to be more muted. More in detail, if production is organized in value chains across several producers, the whole production network might suffer. Firms within production chains are in continuous communication to align the flow of parts and components with final demand. A decline in the latter combined with higher uncertainty over future demand developments can prompt a fast adjustment along the entire supply chain, with sizeable repercussions for all countries involved. Moreover, the just in time nature of many production chains may further complicate matters due to the so-called "disorganisation hypothesis" (Kremer, 1993, and Blanchard and Kremer, 1997). It says that exogenous shocks which hit intermediate goods can give rise to much larger contractions in output, if the affected inputs are important components of wider production processes. Indeed, Blanchard and Kremer (1997) find that the collapse of the Soviet Union had an impact on individual sectors proportionate to the complexity of the underlying production process and range of intermediate inputs used. Finally, many producers of intermediate inputs customise their output to the downstream buyer. The more the production relationship has monopsonist characteristics the more likely is that shocks to the downstream buyer propagate to suppliers (see Burstein et al., 2008). Coming to the reasons that would support a greater resilience of value chain production, Antras (2003) claims that vertical integration partly eliminates problems with enforcing contracts, making trade within a multinational corporation, or in well integrated production networks, less subject to payment delays or defaults.

The insights from the existing literature and the key features emerging from the analysis of the great global recession suggest the following questions. First, which firms suffered the most in terms of sales, profits, investment and exports? Second, did reliance on external sources of financing constrain firms' performance? Third, how did foreign-owned companies respond compared to the rest of the sample? Finally, provided that we find a differential impact on foreign-owned firms, were access to intra-group capital markets and involvement into value chain production relevant explanatory factors?

The above discussion shows that there are still many blind spots in the existing literature and that the channels are much too complex to allow stylised predictions based solely on the current stock of knowledge. The recent crisis gives us material to empirically test some of the hypotheses raised above. Representing almost a "textbook experiment", it should help improving our understanding of the various factors at play.

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[4] Tangible assets serve as a collateral to loans that the firm may need to contract. Unlike intangible assets, such as software or intellectual property, tangible assets can be readily monetized by the creditor if the debtor defaults.

3

The dataset

We construct our dataset out of the firm-level data provided by the Polish Central Statistical Office (CSO). It combines two sources: the quarterly profit-and-loss survey (F-01) and the annual balance sheet survey (F-02). The two surveys are compulsory for all non-financial enterprises employing at least 50 and 10 persons, respectively. Besides financial data, the dataset also includes information on the number of employees, the type of ownership (foreign vs. domestic, private vs. state-owned) and major type of economic activity. All 3-digit NACE rev.2 sectors from headings 5 to 96 are included with the exception of financial intermediation (NACE headings 64 to 66). The resulting merged dataset, from which we exclude state-owned companies, covers almost 14,000 privately owned firms employing at least 50 people. At the end of 2006, these firms were responsible for 47% and 13% of total employment in manufacturing and nonmanufacturing sectors. The resulting coverage of total employment amounted to 20%.

Our dataset covers the period from 2006:3 to 2009:2. Given the focus on the recent global crisis and computational needs, most of our estimations are based on data grouped in three four-quarter periods, namely: 2006:3-2007:2, which we use as a base to calculate growth rates; 2007:3-2008:2, accounting for the pre-crisis period of economic growth; and 2008:3-2009:2, covering the time of the crisis. When this is not the case, an explicit mention is done.

Table 1.
Distribution of firms weighted by sales in 2006

	By sector		By postponability		Total
	non-manuf.	manuf.	non-postp.	postp.	
Sales orientation					
non-exporters	88.6	36.1	78.7	34.3	64.2
exporters	11.4	63.9	21.3	65.7	35.8
Ownership structure					
domestic	60.2	46.1	58.9	42.9	53.7
foreign	39.8	53.9	41.1	57.1	46.3
Size					
small	17.5	6.2	14.0	8.7	12.3
medium	45.5	34.4	42.4	36.0	40.3
large	37.0	59.4	43.6	55.2	47.4
Indebtedness					
low	17.2	24.5	17.6	24.2	19.8
intermediate	38.1	52.1	45.0	48.7	46.2
high	44.7	23.4	37.5	27.1	34.0

Notes: Exporters are defined as firms that realise more than 20% of their sales from exports; foreign-owned firms are firms declaring that foreign capital represents the majority share of capital in their firm; small firms are identified with reference to the period 2006/2007 by having employment below 100, medium firms by employment between 100 and 500 and large firms by employment larger than 500; low indebted firms are those whose liabilities represent less than 30% of total firm's assets, firms with intermediate debt levels detain liabilities between 30% and 60% of their assets and heavily indebted firms report a liabilities-to-assets ratio above 60%.
Source: Central Statistical Office (CSO) and own calculations.

3

Against the background of worldwide evidence that the impact of the crisis was primarily concentrated on manufacturing, it is worth inspecting the basic features of firms in manufacturing and comparing them with features of firms from the rest of the economy. As expected, firms in manufacturing tend to be very different from firms in the rest of the economy. More specifically, a majority of manufacturing firms are export oriented and owned by foreign entities; their distribution is concentrated towards large and medium-sized firms and they tend to be moderately indebted. By contrast, non-manufacturing firms are usually more oriented towards the domestic market, owned by domestic entities, moderately to highly indebted and more evenly distributed across size classes. As we explained in section 2, another important dimension in this crisis appears to have been the postponability of goods and services. In the next section we will show that this dimension partly explains a differential impact on firms. With respect to basic features, we note that firms producing postponable goods and services are more export-oriented or foreign-owned and more skewed towards large firms (Table 1).

4

Firms' performance during the crisis

The performance of Polish firms appears to have deteriorated noticeably since the hastening of the global crisis in mid-2008. Net profits decreased by over 37 percent over the four quarters covering the period 2008:3-2009:2. Meanwhile, operating profits, investment, exports, sales, and employment also decreased. Liabilities on the other hand increased, possibly owing to valuation effects related to domestic currency depreciation (Table 2). Taken together, the above-mentioned developments mark a clear inversion of trend relative to the performance of Polish firms during the period of sustained and continued growth that the country has enjoyed up to mid-2008. Indeed, in the year up to June 2008, total firms' sales, investment, and exports all increased by over 10%.

While the negative performance of Polish firms over the period from the third quarter of 2008 to the second quarter of 2009 reflects the global contraction, firms appear to have been heterogeneously affected. In particular, firms in the manufacturing sector registered high losses in terms of sales and employment. By contrast, sales and employment in the rest of the economy grew moderately. Operating profits contracted for all firms but in manufacturing the contraction was more that 7 percentage points higher than in services and other goods (Figure 1 panel a). Such developments are certainly not surprising as steel, automotive and electrical equipment industries, which constitute almost 40% of total sales in manufacturing, suffered exceptional losses during the crisis. The increasing dominance of manufacturing models relying on internationally fragmented supply chains, their importance in the Polish economy, and the fact that they may have contributed to a synchronised impact of the crisis on manufacturing may explain why the negative effects were strongest for manufacturing firms, and in particular for the above-mentioned sectors, which are dominated by value chain production.

As discussed in Section 2, the extreme events that took place in autumn 2008 plunged the world into "Knightian uncertainty", inducing consumers, firms, and investors around the world to delay purchases and investments of all what could be postponed until the situation would clear up a bit. Our descriptive statistics show, as expected, that firms producing postponable manufacturing goods were most severely hit. The contraction in sales, and even more so in exports, was substantially higher than in the rest of manufacturing. The difference in performance was even more evident for investment spending, which reflects expectations about future demand (Figure 1 panel b).

Another interesting stylised fact emerging from the data under analysis is that export-oriented firms appear more prominently hit than non-exporters or small exporters. Their contraction in sales, employment, operating profits and investments was substantially higher that for the rest of the dataset (Figure 1 panel c). The worldwide deterioration of demand and economic activity, which has been particularly severe in rich OECD countries (Araujo and Oliveira Martins, 2009), may have indeed represented a primary reason for the subdued performance of Polish firms. Given the relatively high degree of openness of the Polish economy and its ongoing process of integration in the world economy and, in particular, with other EU countries, it is unsurprising that the trade channel emerges as important in transmitting the shock in demand and consumer confidence from industrialised countries to Polish firms.
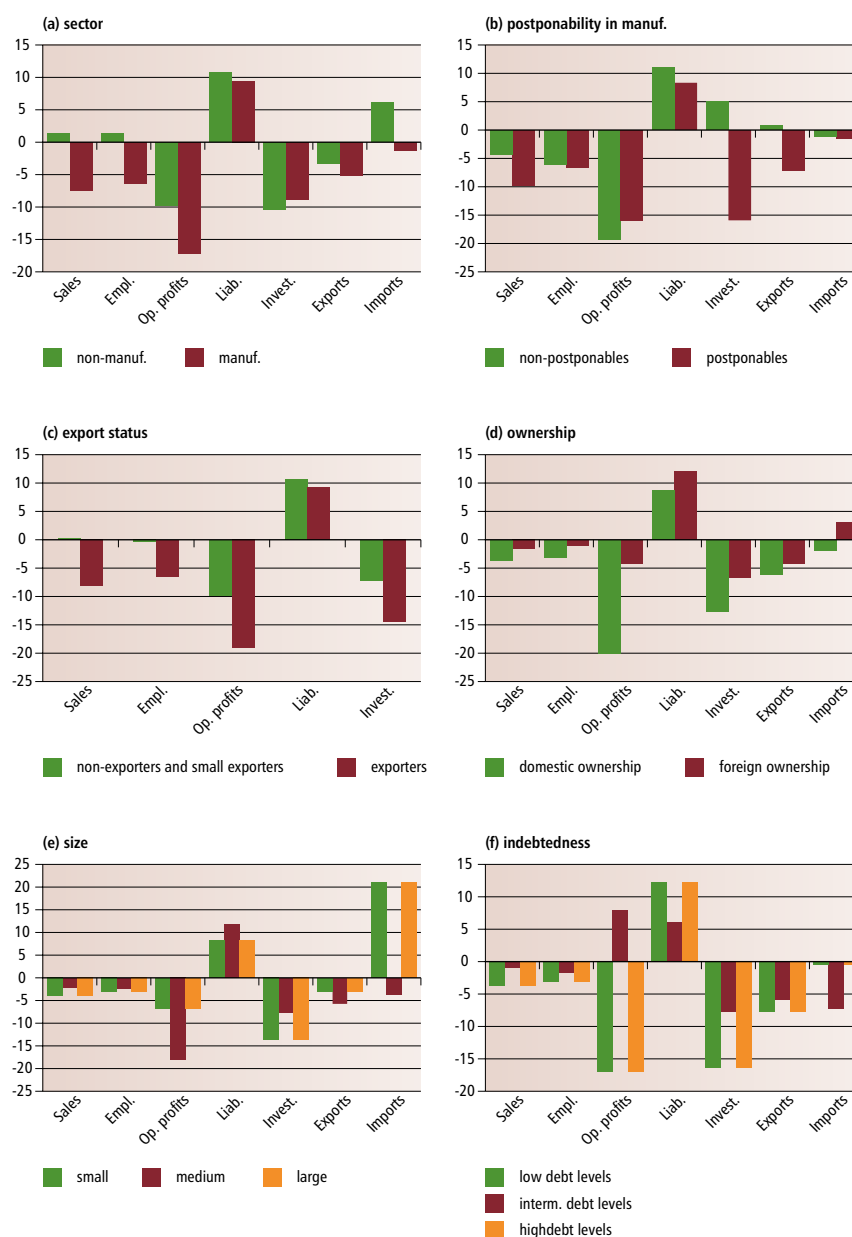
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Table 2.
Real and financial activity of Polish firms during the crisis (annual growth rates)

	Sales		Empl.		Exports		Imports		Op. profits		Net profits		Liab.		Invest.	
	07/08	08/09	07/08	08/09	07/08	08/09	07/08	08/09	07/08	08/09	07/08	08/09	07/08	08/09	07/08	08/09
Sales orientation																
low export share	12.3	0.2	4.9	-0.4					17.1	-9.9	17.4	-24.6	12.4	10.7	11.6	-7.2
high export share	10.8	-8.1	4.6	-6.5					-9.1	-19.1	-6.4	-59.0	10.2	9.3	14.1	-14.6
Ownership structure																
domestic	12.5	-3.6	3.2	-3.2	14.1	-6.2	23.7	-1.9	14.1	-20.1	13.1	-42.7	13.4	8.8	16.6	-12.7
foreign	10.9	-1.7	8.0	-1.0	7.9	-4.2	-2.1	3.0	-3.5	-4.2	0.6	-30.3	10.1	11.6	8.5	-6.7
Size																
small	10.7	-0.7	5.1	-0.7	7.5	-3.4	10.2	-5.8	20.3	-13.6	24.7	-43.8	15.1	10.7	16.7	-5.5
medium	10.9	-4.0	5.2	-3.1	10.0	-3.1	3.6	21.1	4.8	-6.8	2.9	-39.3	13.2	8.2	18.3	-13.8
large	12.8	-2.2	4.3	-2.3	10.2	-5.8	8.2	-3.7	3.3	-18.1	6.6	-34.2	9.9	11.7	7.9	-7.7
Indebtedness																
low	10.0	-3.6	3.7	-2.0	4.2	4.1	-24.2	32.5	-3.2	-19.0	-2.9	-20.3	14.1	16.9	12.1	0.0
intermediate	12.1	-3.7	4.4	-3.2	12.8	-7.8	11.7	-0.6	7.7	-17.1	10.0	-38.5	11.9	12.3	20.7	-16.4
high	12.4	-1.0	6.3	-1.7	9.2	-6.0	13.0	-7.4	22.7	7.9	31.2	-76.2	11.0	6.1	1.4	-7.8
Sector																
non-manufacturing	12.3	1.3	5.8	1.4	9.7	-3.4	8.1	6.2	14.2	-9.8	14.4	-21.3	10.9	10.8	14.4	-10.4
manufacturing	11.1	-7.5	3.9	-6.5	10.0	-5.2	4.8	-1.3	-2.4	-17.3	0.3	-55.5	12.4	9.5	10.2	-8.0
of which:																
non-postponable	*15.0*	*-4.4*	*1.1*	*-6.1*	*21.7*	*0.9*	*30.0*	*-1.2*	*7.0*	*-19.4*	*8.1*	*-56.3*	*15.4*	*11.1*	*11.0*	*5.0*
postponable	*8.4*	*-9.9*	*5.3*	*-6.7*	*6.7*	*-7.1*	*-7.5*	*-1.5*	*-7.1*	*-16.1*	*-3.8*	*-55.1*	*11.0*	*8.3*	*9.8*	*-15.9*
TOTAL	**11.8**	**-2.7**	**4.8**	**-2.4**	**10.0**	**-4.9**	**5.9**	**1.2**	**5.8**	**-13.3**	**7.3**	**-37.4**	**11.6**	**10.2**	**12.4**	**-9.7**

Notes: Classification of firms is the same as in Table 1.
Source: Central Statistical Office (CSO) and own calculations.

Figure 1.
Firms' performance during the crisis by:

(a) sector

non-manuf.   manuf.

(b) postponability in manuf.

non-postponables   postponables

(c) export status

non-exporters and small exporters   exporters

(d) ownership

domestic ownership   foreign ownership

(e) size

small   medium   large

(f) indebtedness

low debt levels
interm. debt levels
highdebt levels

Notes: We define firms' size as in Table 1 and the crisis as period 2008q3-2009q2.
Source: Central Statistical Office (CSO) and own calculations.

Notwithstanding the fact that those Polish firms which are more exposed on international markets through the exports channel appear to have suffered more than the rest of the sample, foreign ownership may also matter. One could expect that more globalised firms do overcome more easily increased credit constraints, for instance by relying on intra-group financing or securities issuing. Indirect support for this thesis and as far as it concerns exporters is provided by Muuls (2008), who focuses on exports. Our descriptive statistics show indeed that, compared to domestic firms, the sales and profitability of foreign-owned firms contracted less, while exports and investment adjustments were also smaller (Figure 1 panel d).

One further question with important policy relevance is whether smaller firms are more adversely hit by the economic crisis than larger (and presumably more productive firms). In our sample, it appears that smaller firms have recorded the highest profit losses, but differentials in terms of sales, employment, investment and exports appear relatively contained (Figure 1 panel e). This is in line with evidence by Bricongne et al. (2009), according to which the impact of the crisis on French exporters was independent from the size and degree of export diversification of firms.

Given the financial origin of the crisis, we further attempt to investigate if firms with higher degrees of indebtedness have been forced to downscale employment and production more than others. While we do not have direct evidence on production, we do observe variables correlated to it, including profits, sales, export, imports and investment (Figure 1 panel f).

The picture that emerges is not very clear-cut. The contraction in sales, investment and employment does not seem to be correlated to the level of indebtedness of the firm. Highly indebted firms do however record higher losses in net profits and higher contractions of both imports and exports. The intensification of the financial crisis may have led to liquidity shortages and to higher risk aversion and negative confidence effects, both on the side of financial institutions as well as of producers. As a result, the more limited availability of trade credit and financing, well documented by Auboin (2009), may have represented an important constraint for indebted firms. It may have greatly increased the costs of financing a firm's activities and obliged it to scale back its import and export activities.

In conclusion, the inspection of the data suggests that firm characteristics matter. Hence, in our next step, we perform econometric estimates aiming at explaining the growth rates of various determinants of firms' performance. Our conjecture is that, in the context of the global crisis, firms producing postponable goods and services where most hardly hit. Nevertheless, when controlling for the sector of activity, we expect to see that firms with higher financial resources fared better. Finally we do expect that financial constraints were less relevant for firms belonging to an international corporation, as these latter could rely on intra-group financing to overcome the contraction of foreign demand and increased credit constraints. With regards to import and export activity, we also expect these firms to post a greater degree of resilience than the rest of the economy.

5

Firm level evidence on the impact of the crisis

As indicated before, a different response of foreign and domestic firms to the financial crisis might be related to their different distribution across sectors, size or exposition to external markets. In this and the next two sections we offer a more formal analysis based on firm-level data, which allows us to control for this kind of effects.

We start our investigation by running a set of robust regressions for annual midpoint growth rates of sales, employment and investment, as well as for changes in profitability.[5] Our interest lies primarily on the foreign ownership dummy, but we also include a set of controls. These are: the export status (using the 20% export share thresholds used in Table 1), log employment and a full set of 3-digit industry dummies. The export status controls for the exposure of a firm to foreign demand changes and exchange rate movements. Employment proxies for the firm size, included in the regressions for reasons discussed in more detail by Forbes (2002). Industry-level fixed effects are used to control for differences among sectors in response to the crisis, among other accruing to the effect of postponability of produced goods. In all the regressions described in this section, the values for independent variables related to firms' characteristics refer to the base period of 2006:3-2007:2. Since our focus is not the overall difference in performance across foreign and domestic firms but rather the difference in their response to the crisis, we also include interactions of all our regressors with the crisis dummy. To ensure comparability with some earlier related studies, we also perform the estimations for the subset of manufacturing firms.

The estimation results are reported in Table 3. Several observations are in order. Focusing first on the results for all sectors, we find that foreign firms performed significantly better in terms of sales growth than their domestic counterparts both before and during the recent crisis. This superior performance can be due to a range of factors, like product quality, brand name reputation, managerial experience etc. Importantly, however, the difference is significantly larger in the second part of our sample, which means that foreign ownership, similarly to the firm size, helped to mitigate the contraction in sales related to the financial crisis. This result suggests that financial factors can be important in accounting for different performance of foreign vs. domestic firms.

While affiliates of foreign companies performed relatively well in terms of employment growth, this advantage somewhat declined during the crisis, which may suggest that their response to the turmoil was more flexible. According to our estimates, foreign firms also experienced a more moderate contraction of their profitability. This effect was somewhat dwarfed by the impact of firms' exposure to foreign markets, which is not surprising given the depreciation of the local currency during the crisis. Finally, foreign-owned firms cut their investment plans much less than domestic firms. The main findings are broadly similar for the subsample of firms in manufacturing.[6] In conclusion, our results clearly indicate that foreign ownership matters for the way a company deals with the financial turmoil.

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[5] See the Appendix for details of the econometric methodology.
[6] In not-reported regressions of similar specification with sectoral-fixed effects substituted by the dummy variable for sectors producing postponable goods, we found that postponable sectors performed significantly worse during the crisis. The negative effect of postponability on the growth rate of sales, employment and investment amounted to around 8%, 4% and 15%, respectively.

Table 3.
Firms' performance during the crisis

Sector	All sectors				Manufacturing			
Dep. variable	mpg_sales	mpg_emp	d_profrat	mpg_inv	mpg_sales	mpg_emp	d_profrat	mpg_inv
foreign	0.021***	0.028***	-0.001	-0.027	0.018**	0.033***	-0.005*	0.002
	[0.006]	[0.003]	[0.002]	[0.030]	[0.008]	[0.004]	[0.002]	[0.041]
foreign×crisis	0.014*	-0.007*	0.007***	0.084**	0.027**	-0.014**	0.015***	0.031
	[0.008]	[0.004]	[0.002]	[0.042]	[0.012]	[0.006]	[0.003]	[0.058]
exporter	-0.033***	-0.009***	-0.013***	-0.066**	-0.037***	-0.012***	-0.015***	-0.106***
	[0.006]	[0.003]	[0.002]	[0.030]	[0.007]	[0.003]	[0.002]	[0.036]
exporter×crisis	0.012	-0.016***	0.032***	0.003	0.023**	-0.010**	0.038***	0.079
	[0.008]	[0.004]	[0.002]	[0.042]	[0.010]	[0.005]	[0.003]	[0.051]
ln(emp)	-0.012***	0.002	0.001	-0.034**	-0.019***	-0.002	0.001	-0.036*
	[0.003]	[0.001]	[0.001]	[0.0144]	[0.004]	[0.002]	[0.001]	[0.021]
ln(emp)×crisis	0.024***	-0.004**	0.000	0.063***	0.029***	-0.006**	-0.000	0.037
	[0.004]	[0.002]	[0.001]	[0.020]	[0.006]	[0.003]	[0.002]	[0.030]
Observations	27458	27457	27245	26245	12692	12692	12583	12116
R-squared	0.170	0.147	0.093	0.049	0.173	0.154	0.075	0.048

Notes: Standard errors in brackets; ***, ** and * indicate significance at 1%, 5% and 10% level, respectively; mpg_sales, mpg_emp and mpg_inv denote the mid-point growth rates of sales, employment and investment, d_profrat stands for change in the ratio of operating profits to operating costs, ln(emp) is log employment, while foreign, exporter and crisis are dummy variables indicating foreign affiliates, exporters and the crisis period, respectively; the explanatory variables refer to the base period (2006q3-2007q2); all regressions are run with a full set of 3-digit industry dummies and their interactions with the crisis dummy.

6

Why are foreign-owned companies different?

The literature surveyed in section 2 identifies two main channels through which firms owned by large multinational corporations may have been better equipped to cope with the crisis. To start with, many multinational corporations are the expression of the increasing dominance of vertically specialised international supply chains. Affiliates of the same corporation in different countries produce output in sequentially integrated value chains. Hence, the better performance of foreign-owned firms may be driven by a stronger resilience of value chain production models to global adverse shocks.

A better contractibility within supply chains (Antras, 2003) and possibly intercompany linkages that are more difficult to discontinue may constitute plausible reasons why foreign--owned firms were less affected by the crisis. Moreover, setting up organised supply chains entails large sunk costs. In the face of an adverse shock that is perceived as temporary, firms would prefer to adjust the entire chain along the intensive margin, i.e. by reducing volumes of sales, rather than along the extensive margin, i.e. disrupting part of the supply chain (Altomonte and Ottaviano, 2009). This is exactly what Bricongne et al. (2009) find by analysing the behaviour of French exporters during the crisis. Relying on monthly data for individual French exporters observed until April 2009, they show that the drop in French exports is mainly due to the intensive margin of large exporters, with small and large firms evenly affected once sectoral and geographical specialisation are controlled for.

The foregoing considerations are consistent with evidence from our data. We find an exceptionally low rate of exits during the crisis among foreign-owned firms (Table 4). Overall, exit rates in 2008 increased compared to the pre-crisis years. However, the increase was relatively modest for foreign-owned firms. As expected, given the large contraction in foreign demand, exporters were more adversely affected. The differences between foreign- and domestic-owned firms are even more pronounced in manufacturing.

To test for the significance of the differences reported in Table 4, we run a probit regression, where the dependent variable is the dummy identifying firms' exits from the sample over the calendar years 2006-2008. An exit is defined as not reporting to the Central Statistical Office in the last two quarters of the following year.[7] Explanatory variables include a dummy for the crisis period. In this regression, unlike in most of the other estimations, this is identified with the year 2008. Additional variables of interest include dummies for foreign ownership and export status and their interaction with the crisis dummy. A measure for size, approximated by the number of employees, and sectoral dummies are the standard controls that we include in the regression.

The results, in form of incremental (for dummies) or marginal (for log employment) effects calculated as suggested by Norton et al. (2004) for non-linear models including interactions, are reported in Table 5. They indicate that 2008 corresponded to a moderate but statistically significant increase in the probability to observe a firm exiting the market. This was particularly the case in manufacturing. Overall, foreign-owned and larger firms appear to be structurally less prone to exiting the market. This tendency seems to have enhanced in the crisis year 2008, confirming the intuition provided by the aggregate statistics in Tables 2, but not in a statistically significant way. By contrast, exporters do

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[7] This may imply that some exits are actually firms still in operation but that reduced their number of employees to a number below the threshold of 50 units.

seem to be subject to higher exit probabilities. This can be seen as surprising, as one would expect that, if sunk costs are a factor of hysteresis in exit decisions, exporters should post a behaviour qualitatively similar to foreign-owned firms. On the other hand, the overproportional increase in the rate of exits among exporters during the crisis reflects the observed collapse of foreign demand.

Table 4.

Exit rates in pre-crisis and crisis period (percent)

	All sectors		Manufacturing	
	2006-07	2008	2006-07	2008
Foreign ownership status	5.36	6.34	4.52	5.56
Domestic ownership status	7.57	9.26	6.53	8.80
Exporter	8.70	11.02	6.54	8.70
Non-exporter	6.33	7.50	5.57	7.34
Total	**7.12**	**8.64**	**6.05**	**8.00**

Notes: Exits are identified as the percentage of firms not reporting to the Central Statistical Office in the first two quarters of the following year; this may imply that some exits are actually firms still in operation but that reduced their number of employees to a number below the threshold of 50 units.
Source: Central Statistical Office (CSO) and own calculations.

Table 5.

Probit regression for exit rates

Sector	All Sectors	Manufacturing
Dep. variable	Exit dummy	Exit dummy
ln(emp)	-0.068***	-0.056***
	[0.001]	[0.001]
foreign	-0.005***	-0.002
	[0.002]	[0.002]
exporter	0.023***	0.010***
	[0.002]	[0.002]
crisis	0.007***	0.010***
	[0.002]	[0.002]
foreign×crisis	-0.002	-0.003
	[0.004]	[0.005]
exporter×crisis	0.011***	0.010*
	[0.004]	[0.005]
Observations	74769	37529

Notes: Standard errors in brackets; ***, ** and * indicate significance at 1%, 5% and 10% level, respectively; the dependent variable is the exit dummy, defined as not reporting to the Central Statistical Office in the first two quarters of the following year; ln(emp) is log employment, while foreign, exporter and crisis are dummy variables indicating foreign affiliates, exporters and the crisis period, respectively; all regressions are run with a full set of 3-digit industry dummies; the coefficients reported are incremental (marginal) effects of a given variable on the exit probability.

In conclusion, the above results provide some indication that firms involved in global value chains may have been more resilient to the crisis. Yet, the data availability, limited to 2008, does not allow reaching firm and strong conclusions on this point. The difference between foreign-owned firms and exporters, however, suggests that other factors, besides sunk costs, are important in determining the differential behaviour of foreign-owned firms.

Indeed, a second important reason for the better performance of foreign-owned firms may stem from their less restricted access to financing opportunities external to the firm. As pointed out by the literature surveyed in the introduction, the ability to use intra-

firm financial markets may help firms to avoid the effects of a credit crunch by commercial banks, at least partly. An analysis of aggregate intra-group financing data shows that internal capital markets are much more important for multinational affiliates than for local companies (Table 6). The share of intra-group financing in total liabilities amounted to about 40% in the case of the former and to about 13% for the latter. Moreover, during the crisis period the growth rate of intra-group financing of multinational affiliates was three times higher than the growth rate of their external liabilities, which constitutes an informal evidence that access to internal capital markets helped foreign-owned companies to be more resilient to the recent adverse financial shocks.

Table 6.
Intra-group financing and foreign ownership status

Ownership:	domestic			foreign-owned		
Liabilities	total	intra-group	external	total	intra-group	external
Share in total						
2006/07	100	13.5	86.5	100	38.2	61.8
2007/08	100	12.8	87.2	100	37.6	62.4
2008/09	100	12.6	87.4	100	40.4	59.6
Growth rate						
2007/08	13.4	7.4	14.4	10.1	8.3	11.3
2008/09	8.8	6.5	9.2	11.6	19.9	6.6

Source: Central Statistical Office (CSO) and own calculations.

In order to further investigate the relevance of financial dependence in a more formal way we follow an approach, which builds on Braun (2003) and Rajan and Zingales (1998).[8] Our aim is to check if the sensitivity of firms' leverage with respect to assets tangibility depends on the ownership status. We interpret tangibility as able to proxy the easiness with which firms can shift control to the lender, and so substitute for financial contractibility.

More specifically, we regress the change in firm-level indebtedness, defined as total liabilities over total assets, over the share of tangible assets in total assets, the foreign status dummy and their interaction. We use a range of controls, which include log employment, the export status dummy, profitability and sectoral fixed effects. As a robustness check we also try a few other, more financially motivated controls. As before, we augment the estimated equations with interactions of all our regressors with the crisis dummy and report our results for all sectors and for the subsample of manufacturing firms.

The main results are presented in Table 7. When we run our regressions on the total sample, we find that foreign-owned firms managed to raise external funds better than their domestic counterparts. We do not find, however, that during the crisis foreign ownership had an effect on the sensitivity of leverage to the tangibility of assets. These results are robust to controlling the regressions for such indicators as initial leverage, capital intensity (indicating firms with relatively higher borrowing needs) or provision of liquid assets.

A different picture emerges when we restrict our attention to manufacturing. Similarly to the total sample results, we find that multinationals increased their indebtedness by more than domestic companies. For many firms, however, tangibility of assets turns out to be an important determinant of access to external financing during the crisis. Importantly, we find that this financial market imperfection was significantly less binding for borrowing

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[8] The most natural way to explore the relevance of internal capital markets would be to look at the flows of funds within multinational groups. Unfortunately, such flow data are not available. Therefore, we follow an indirect approach which does not distinguish between the sources of external financing.

possibilities of foreign-owned firms. As in the case of total sample, the regression results for manufacturing are robust to the inclusion of additional controls.

In conclusion, our results are consistent with the hypothesis that foreign ownership helps to mitigate the effects of a credit crunch. Particularly in manufacturing there may be intra-group lending mechanisms supporting affiliates that face external credit constraints. Alternatively, the findings might simply indicate a creditworthiness premium related to being a part of a multinational corporation. However, as Table 6 suggests, the former effect is more likely to be at work.

Table 7.
Access to external financing during the crisis

Sector	All sectors		Manufacturing	
Dep. variable	dindebt			
foreign	-0.009	-0.014**	-0.018	-0.021*
	[0.007]	[0.007]	[0.011]	[0.011]
foreign×crisis	0.026**	0.029***	0.063***	0.065***
	[0.010]	[0.010]	[0.016]	[0.016]
tang	0.018**	0.002	0.007	0.001
	[0.009]	[0.009]	[0.013]	[0.014]
tang×crisis	0.007	0.016	0.044**	0.050***
	[0.013]	[0.013]	[0.019]	[0.019]
tang×foreign	-0.017	0.000	0.006	0.017
	[0.018]	[0.018]	[0.026]	[0.026]
tang×foreign×crisis	0.005	-0.001	-0.089**	-0.094***
	[0.026]	[0.025]	[0.037]	[0.036]
indebt		-0.084***		-0.086***
		[0.005]		[0.0066]
indebt×crisis		-0.005		0.013
		[0.007]		[0.009]
capint		0.000		0.001
		[0.000]		[0.001]
capint×crisis		-0.000		-0.001
		[0.001]		[0.001]
liquid		-0.008		-0.000
		[0.014]		[0.023]
liquid×crisis		0.033*		0.023
		[0.019]		[0.033]
Observations	23067	23067	10809	10809
R-squared	0.08	0.11	0.07	0.09

Notes: Standard errors in brackets; ***, ** and * indicate significance at 1%, 5% and 10% level, respectively; dindebt and indebt are defined as change and the level of the share of total liabilities to total assets, tang is the ratio of tangible assets to total assets, capint is the capital-to-output ratio, liquid is the share of cash in total assets, while foreign and crisis are dummy variables indicating foreign affiliates and the crisis period, respectively; the explanatory variables refer to the base period (2006q3-2007q2); all regressions are run with a full set of 3-digit industry dummies and their interactions with the crisis dummy; additional and not reported explanatory variables are: export status, log employment and the ratio of operating profits to operating costs, as well as their interactions with the crisis dummy.

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Global companies and trade performance

In the last step we analyse whether the ownership status also mattered for firms' performance in terms of exports and imports. Our hypothesis is that access to intra-group financing, combined with involvement in value chain production, enhanced the resilience of foreign-owned firms.

Three key channels may account for how the global crisis affected trade by Polish firms. The first, and possibly the most important channel, may have been the worldwide collapse of demand for postponable goods and services. This shock should have affected domestic- and foreign-owned companies in a similar way, where the scale of the impact is likely to be mainly a function of the sector in which a given firm operates. The second possible channel is represented by higher risk, which may have led to tighter financial markets and the massive depreciation of the local currency, by over 30% in real effective terms within less than six months. The depreciation may have enhanced the international price competitiveness of Polish firms, but at the same time may have resulted in a higher leverage for companies with debt denominated in foreign currency. Higher leverage, in combination with tight financial markets, could have constrained domestic companies in their access to financial markets, both to finance new investment opportunities and in terms of trade credit availability.[9] On the contrary, foreign-owned companies with access to intra-firm capital markets might have exploited new investment opportunities and rolled over their debt (Desai et al., 2004). The third channel through which the crisis may have influenced foreign trade activity is the increased uncertainty related to the contractibility of payment for shipped goods. This uncertainty might be especially detrimental for liquidity constrained firms, decreasing their willingness to export. It could also influence Polish importers, which become less credible for their foreign suppliers.

To test the hypothesis that foreign ownership had a positive impact on trade activity, we run a set of regressions for the annual mid-point growth rates of exports and imports values, using the insights from the previous sections. These regressions have two general specifications. In the first one we explain exports and imports dynamics by foreign ownership, the level of indebtedness and their interactions with the crisis dummy. However, this specification does not fully address the above discussion, which indicates that foreign ownership should have a positive effect on foreign trade performance mainly in firms with constrained access to external financial markets. We tackle this issue in the second specification, in which we add the interaction of firm indebtedness, which we interpret as a measure of credit constraints, with the foreign ownership dummy. Consistently with the rest of the paper, we augment the estimated equations with control variables: we account for a sector specific impact of the worldwide trade collapse and the local currency depreciation by using a full set of 3-digit industry dummies and their interactions with the crisis dummy, and we add log employment to control for firm size. The estimation is carried out over the whole population of firms, as well as for the subsample of firms operating in the manufacturing sector.

The estimation results for the first specification, reported in columns (1) of Table 8, show that during the crisis foreign-owned companies performed significantly better than local firms, especially in their importing activity. Moreover, firms' indebtedness appears

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[9] ICC Banking Commission (2009) report presents extended discussion of trade financing problems during the recent crisis.

to represent a significant drag on exports and imports in times of relatively tight financial markets, whereas it is statistically not significant in times of prosperity. These results confirm ICC Banking Commission (2009) report, according to which trade financing problems have concurred to determine the recent trade collapse. We are however unable to determine the relative importance of these supply-side problems relative to other factors, such us the fall in demand. The estimation results for the second specification (columns (2)) confirm that, even for exports, if the whole sample of firms is considered, being an affiliate of a foreign company relaxes the crisis-related indebtedness-trade link. Unfortunately, this result is not confirmed in the sub-sample of firms from the manufacturing sector. Nevertheless, the above results are consistent with the positive role that multinational companies had in attenuating the impact of the recent crisis on foreign trade.

Table 8.
Foreign trade performance

Sector	All sectors				Manufacturing			
Dep. variable	mpg_exp		mpg_imp		mpg_exp		mpg_imp	
Specification	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
foreign	0.003	-0.032	-0.067**	-0.078*	0.009	-0.015	-0.070**	-0.088*
	[0.022]	[0.031]	[0.032]	[0.045]	[0.019]	[0.026]	[0.035]	[0.048]
foreign×crisis	0.069**	0.022	0.164***	0.090	0.053*	0.033	0.133***	0.089
	[0.032]	[0.044]	[0.045]	[0.062]	[0.027]	[0.037]	[0.049]	[0.068]
indebt	0.011	-0.033	0.040	0.027	0.016	-0.017	0.041*	0.014
	[0.017]	[0.025]	[0.025]	[0.0385]	[0.013]	[0.021]	[0.025]	[0.043]
indebt×crisis	-0.053**	-0.110***	-0.110***	-0.190***	-0.035*	-0.077**	-0.079**	-0.140**
	[0.024]	[0.036]	[0.033]	[0.050]	[0.019]	[0.031]	[0.035]	[0.064]
indebt×foreign		0.058*		0.019		0.041		0.032
		[0.033]		[0.050]		[0.027]		[0.053]
indebt×foreign×crisis		0.080*		0.120*		0.040		0.076
		[0.047]		[0.0665]		[0.039]		[0.077]
ln(emp)	0.005	0.006	-0.003	-0.003	-0.008	-0.007	-0.024	-0.024
	[0.012]	[0.012]	[0.018]	[0.018]	[0.011]	[0.011]	[0.020]	[0.020]
ln(emp)×crisis	0.040**	0.041**	0.006	0.007	0.027*	0.029*	0.009	0.010
	[0.018]	[0.018]	[0.025]	[0.025]	[0.015]	[0.015]	[0.028]	[0.028]
Observations	13952	13952	13530	13530	9427	9427	8596	8596
R-squared	0.160	0.160	0.089	0.090	0.079	0.082	0.061	0.061

Notes: Standard errors in brackets; ***, ** and * indicate significance at 1%, 5% and 10% level, respectively; mpg_exp and mpg_imp denote the mid-point growth rates of exports and imports, indebt is the share of total liabilities in total assets, ln(emp) is log employment, while foreign and crisis are dummy variables indicating foreign affiliates and the crisis period, respectively; all regressions are run with a full set of 3-digit industry dummies and their interactions with the crisis dummy.

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Conclusions

This paper investigates the impact of the global crisis on Polish firms. Our key results are the following: the ownership (foreign vs. domestic), size and sector of activity are important to understand the impact of the global crisis on Polish firms. While producers of all manner of postponables have been disproportionately hit by the crisis, foreign-owned and larger firms were better able to cope with the downturn. Foreign-owned firms in particular were more easily able to overcome the contraction of foreign demand and increased credit constraints. Our results are consistent with the hypothesis that reliance on intra-group financing or securities issuing may have been a key factor in explaining the greater resilience of these firms. Our paper also addresses an issue highly debated, namely the role of value chain production during the crisis. Our data do not provide strong conclusions regarding this point, but the evidence gathered would suggest that this model of production might be better suited to respond to global exogenous shocks. Finally, we test directly foreign trade response of foreign-owned firms. Also in this case foreign-owned firms posted better results than the rest of the sample, in particular during the crisis.

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Appendix

A.1 Econometric strategy

As we are interested in changes over time, our variables of interest are computed in terms of growth rates. In particular we use the so called "mid-point growth rates" method proposed by Davis and Haltiwanger (1992). We apply this method to annual data, which in our database are represented by four-quarter periods 2006:3-2007:2,2007:3-2008:2 and 2008:3-2009:2. Namely, the mid-point growth rate for variable y_t is computed according to the formula:

$$g_t = \frac{y_t - y_{t-1}}{\frac{1}{2}(y_t + y_{t-1})} \ .$$

The main advantage of the mid-point growth rate over traditional methods is that it makes possible computing growth rates also for quantities that were equal to zero in the initial period. This measure is therefore more suitable to calculate dynamics for individual firms. In the next section, the mid-point growth rate is computed for the following variables: sales, employment, investment, exports and imports. In case of other variables, their dynamics is measured in standard manner.

As regards the estimation method, we had to address the problem of extremely deviant observations, i.e. outliers, which are present in every firm-level database. Since in the presence of outliers, and consequently heterogeneity, OLS estimates become inefficient, we applied the robust regression (see Huber, 1996, for extended exposition of the method). The main idea of the robust regression is to assign a weight to each observation, with higher weights given to better-behaved observations, whereas the extremely deviant cases are assigned weights close to zero. In our study we use the iteratively reweighed least squares method proposed by Holland and Welsch (1977).

A.2 Classification of postponable goods and services

We define as postponables goods produced in the following sectors (NACE rev. 2 classification):

Two-digit sectors: 16, from 22 to 32, 41, 43, 50, 51, 55, 68, 77 and 79

Three-digit sectors: 191, 205, 206, 491 and 492

Four-digit sectors: 1724, 2011, 2012, 2013, 2016 and 2017