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Firm Exports, Foreign Ownership, and the Global Financial Crisis

Abstract

This paper shows theoretically and empirically how access to finance explains the exceptional export performance of foreign-owned firms. We build a model of heterogeneous exporters in which foreign-owned firms can access foreign capital markets via their multinational parents. The model predicts that foreign ownership makes exports more resilient to deteriorating credit conditions. To empirically identify this effect, we estimate a triple differences model using rich micro data from Spain and exploiting the global financial crisis as an exogenous shock to credit supply. We find that foreign ownership significantly stabilized firm exports in the crisis, in particular among financially vulnerable firms.

JEL-Codes: F100, F140, F230, G010, G320.

Keywords: firm exports, foreign ownership, multinational firms, financial frictions, financial crisis.

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1 Introduction

Foreign-owned firms are exceptional exporters. They are more likely to export; they export larger volumes as well as larger shares of their output; they serve more export markets; and they export more products than their domestically owned peers.[1] The superior export performance of foreign-owned firms is interesting not only from an academic perspective. It is also of central importance to policy makers, as it speaks to widespread arguments that inflows of foreign direct investment (FDI) are an effective vehicle to promote exports and economic development.

One key challenge for economic research is to sort out correlation from causation. In principle, the export success of foreign-owned firms could be purely driven by a selection effect: multinational enterprises (MNEs) may seek to acquire the most competitive and internationally active firms. While selection does play a role in the data, it does not tell the whole story. Carefully designed empirical studies suggest that foreign-acquired firms improve their export performance following acquisition compared to the counterfactual of non-acquisition (Guadalupe et al., 2012; Wang and Wang, 2015; Fons-Rosen et al., 2021).[2] This poses another, even greater challenge for research: to identify the precise mechanism by which foreign ownership promotes exports. Foreign-owned firms may benefit from technology transfers, lower input costs, or the global distribution networks of their multinational parents, giving them a competitive edge on export markets. Sorting out these and other possibilities has turned out difficult to date, yet it is crucial for designing effective policies regulating trade and FDI.

In this paper, we exploit rich micro data for Spain to overcome this challenge and identify precisely one channel through which foreign ownership promotes exports: access to finance. To achieve this, we build on the seminal contribution by Manova (2013), who demonstrates that financial market imperfections severely restrict firm exports. We introduce sharp ownership differences in access to finance into the Manova (2013) model. Specifically, we assume that foreign-owned firms can tap into additional funds via internal capital markets within multinationals, as in Desai et al. (2004), Egger et al. (2014), Biermann and Huber (2020), and Bena et al. (2021). This implies a financial advantage of foreign ownership that may rationalize their superior export performance compared to domestically owned firms. In the model, a credit supply shock causes a drop in firm-level exports, but this drop is mitigated among foreign-owned firms due to their financial advantage. Moreover, our model predicts that this differential effect on exports is larger among financially vulnerable firms that require financing for a larger share of their trade costs.

[1] These facts have been established in micro data from many different countries, including Indonesia (Arnold and Javorcik, 2009), Germany (Raff and Wagner, 2014), China (Manova et al., 2015), as well as 30 lower and middle income countries (Boddin et al., 2017).

[2] In a similar vein, foreign-divested firms (i.e., firms switching from foreign to domestic ownership) display a poorer export performance compared to the counterfactual of non-divestment (Javorcik and Poelhekke, 2017).

To clearly identify the credit channel of foreign ownership, our empirical analysis leverages the global financial crisis of 2008/09 as a major exogenous shock to financial market conditions. This crisis was not reasonably foreseeable and beyond the control of individual firms in Spain. In a first step, we estimate the differential impact of the crisis on exports across foreign and domestically owned firms—the *ownership differential*—using a difference-in-differences (DiD) model. To identify the crisis impact on exports beyond its effect on production, we focus on the export share (defined as exports over total sales) as our main outcome variable. In a second step, we pin down the credit channel by allowing the ownership differential to vary by the pre-crisis financial vulnerability of firms. More precisely, we propose a triple differences (DiDiD) identification strategy, motivated by our theoretical model, which exploits variation along three margins: the ownership structure of firms (foreign vs. domestic), the timing of the credit supply shock in the financial crisis, and the degree of financial vulnerability across firms prior to the crisis. Intuitively, firms entering the crisis with higher degrees of financial vulnerability are hit more severely by deteriorating financial market conditions, so that we expect the exports of these firms to benefit relatively more from the financial advantage of foreign ownership. To mitigate the influence of confounding factors, we control for firm fixed effects as well as industry shocks, and we combine our estimates with a propensity score reweighting approach to control for selection into foreign ownership based on past firm characteristics (as in Guadalupe et al., 2012, and Garicano and Steinwender, 2016).

Our analysis exploits panel data from the Encuesta Sobre Estrategias Empresariales (ESEE), which covers a representative sample of manufacturing firms in Spain over the years 2005–2012. The ESEE data set is ideally suited for our analysis because it features a unique combination of the following five types of information at the firm level. First, it includes annual information on the volume of exports and domestic sales as well as the ownership structure of firms, which are essential in our context. Second, it provides a rich picture of firms' financial conditions, including debt levels (by maturity) and interest rates (on different debt components). This allows us to construct a precise measure of firms' financial vulnerability, viz. the ratio of short-term debt to sales, which we use to pinpoint the financial advantage of foreign ownership. Third, our data set identifies firms that belong to a corporate group (i.e., a group of multiple firms), which enables us to draw a sharp line between the financial advantage of foreign ownership and the benefit of belonging to any corporate group (regardless of location). Fourth, a rare feature of the ESEE data set is that it contains information on whether firms use the distribution networks of their foreign parents to access export markets. And fifth, it also includes annual information on firm-specific input price changes. The latter two pieces of information are not available in other comparable data sets, but they are crucial for identifying the credit channel from other benefits of foreign ownership in the crisis, namely lower export costs or lower costs of inputs other than capital.

Descriptive analyses of the ESEE data demonstrate that foreign-owned firms are, indeed, ex-

ceptional exporters also in Spain. We find that the share of exports in total sales is on average more than three times as large for foreign-owned firms (37%) compared to domestically owned firms (11%). A significant difference of 6 percentage points prevails even after controlling for industry composition, firm size, and whether the firm mainly produces intermediates or final goods. Similar differences exist both on the extensive and on the intensive margin of firm exports. Most notably, these differences widened substantially in the financial crisis. Taking a close look at firms' financial conditions, we find sharp ownership differences in the data: While the average short-term debt-to-sales ratios were almost identical across firms in domestic and foreign ownership before the crisis, financial vulnerability increased dramatically among domestically owned firms after 2008. By contrast, foreign-owned firms were able to issue relatively more new debt at lower interest rates, and the composition of this new debt suggests that internal borrowing from the firms' foreign parents played an important role in this divergence. In a nutshell, both the export performance and the financial situation of foreign-owned firms improved relative to their domestically owned peers over the crisis years.

We begin our econometric analysis by estimating the *ownership differential* in the DiD model. We find that, as the credit crunch hit Spain in 2009, foreign-owned firms significantly increased their export shares compared to domestically owned firms. This finding of a positive ownership differential is consistent with the presumption that exports depend more heavily on finance than domestic sales, as found e.g. by Minetti and Zhu (2011). Importantly, the ownership differential persisted over the subsequent crisis years, while we cannot reject a common trend in the export shares of both ownership groups over the pre-crisis years. We further show that the differential effect is concentrated in small firms, which are more likely to be credit constrained (see Gertler and Gilchrist, 1994; Guiso et al., 2004; Beck et al., 2008), and absent in large firms.

We then investigate the credit channel of foreign ownership directly using DiDiD estimations. We find that the ownership differential is increasing in firms' financial vulnerability (measured just before the crisis). Among financially vulnerable firms, the crisis substantially magnified the positive effect of foreign ownership on exports. What is more, these effects are again much more pronounced among small firms, for which other sources of finance are likely harder to access. The economic magnitude of the estimates is remarkable: The effect of foreign ownership on export shares in 2009 was larger by 5.3 percentage points for firms at the 75th percentile of financial vulnerability compared to those at the 25th percentile in the sample of small firms. This differential effect is half the size of the mean export share of 10.6% in this sample. Our findings thus provide strong support for the hypothesis that MNEs grant their affiliates a substantial financial advantage, which served to stabilize firm exports in the crisis.

Building on our main finding, we distinguish between the DiDiD effects on export market entry and exit (i.e., the extensive margin of exports) and on changes in the volume of export sales (i.e., the

intensive margin). We find no significant difference in the crisis impact on the extensive margin of exports across firms with a different ownership status or degree of financial vulnerability. Instead, our results are mainly driven by the intensive margin. This is in line with evidence from several countries showing that the financial crisis reduced firm exports predominantly at the intensive margin (Behrens et al., 2013; Bricongne et al., 2012; Eppinger et al., 2018; Paravisini et al., 2014).

Is the ownership differential in export performance due to specific features of *foreign* ownership, or due to the general benefit of belonging to a large group of firms? Out data allow us to answer this question by comparing the role of foreign ownership to the role of belonging to a corporate group (whether domestic or foreign). The evidence points to a differential effect of a corporate group that is around half the size of the foreign ownership effect, and it does not interact significantly with financial vulnerability. What seemed to be crucial for crisis exports was therefore the *foreignness* of the parent firm, which is a distinguishing feature of FDI.

What about other benefits of foreign ownership that might have promoted exports in the crisis? Our rich micro data allow us to go beyond the existing literature in investigating the two most important potential benefits in this context: improved export market access through the foreign parent's distribution network (the 'market access channel') and lower prices for inputs other than capital (the 'input price channel').

To scrutinize the market access channel, we first test whether the ownership differential depends on firms' use of their foreign parents' distribution networks before the crisis. On average, we do not find that this is the case. However, we do find interesting interdependencies with the credit channel: Among financially vulnerable firms, the ownership differential was smaller for those firms that *were already using* their parents' distribution networks. This is consistent with the presumption that access to MNEs' distribution networks lowers trade costs and hence the financial burden on firms, which consequently reduces the importance of internal capital markets. In line with this interpretation, a second set of regressions shows that firms *starting to use* their foreign parent's distribution networks over the crisis years showed a superior export performance, and this difference was greater among financially vulnerable firms. These findings point to two distinct benefits of foreign ownership—financing via internal capital markets and facilitating market access—but the use of the latter diminishes the value of the former.

Using our firm-specific price data, we can shed light on the input price channel: Foreign ownership can help firms to reduce the costs of inputs other than capital, a benefit which may have become more important in the crisis. While we find no indication for this channel in energy and labor costs, the data reveal that foreign-owned firms were indeed able to reduce the prices they paid for materials and services inputs relative to other firms in the crisis. Further regression analyses reveal, however, that input price changes in the crisis are orthogonal to pre-crisis financial vulnerability. This demonstrates the value of our triple differences identification strategy: it enables us to clearly

sort out the credit channel from these other benefits of foreign ownership.

Three important sets of robustness checks substantiate our main findings. First, one may suspect that foreign ownership or financial vulnerability might pick up the differential effect of the crisis across other confounding factors. We rule this out by explicitly controlling for time-varying effects of several key firm variables, including total factor productivity, measures of innovation and management quality, as well as firm-specific prices. Second, we explore whether the exposure to more favorable demand shocks in foreign markets may have benefited foreign-owned firms. It turns out that indeed foreign-owned firms were more likely to export to more distant world regions, which were less affected by the crisis, but controlling for these effects does not alter our inference regarding the credit channel. Third, we specifically address the fact that our main dependent variable, the export share, is a fractional response variable. The estimation of a fractional probit model, combined with a Mundlak–Chamberlain approach, lends strong support to our key hypothesis.

Our paper contributes to two strands of the literature at the intersection of corporate finance and international economics (see Foley and Manova, 2015, for an overview). The first is the literature on the nexus between international trade and financial frictions. This literature argues that export sales are inherently more dependent on external finance than domestic sales due to additional costs of exporting, longer shipping times, and greater risk involved in international transactions. Therefore, financial development can be a source of comparative advantage (Kletzer and Bardhan, 1987; Beck, 2002; Egger and Keuschnigg, 2017). To study the impact of financial frictions across heterogeneous firms, theoretical work by Manova (2013), Feenstra et al. (2014), and Chaney (2016) has extended the Melitz (2003) model with financial market imperfections.[3] These models predict that financial frictions may reduce aggregate exports through adverse effects on three different margins: selection of firms into production, selection of firms into exporting, and the quantity of exports. Several empirical studies have confirmed these key predictions (most prominently Manova, 2013).[4] Focusing on the 2008/09 financial crisis, several contributions show that financial frictions played an important role in the great trade collapse (Auboin, 2009; Ahn et al., 2011; Chor and Manova, 2012).[5] We contribute to this literature by providing evidence that financial frictions constrain firms more strongly in exports than in domestic sales, and that foreign ownership can be crucial to alleviate the detrimental effect of a financial crisis on firm exports.

[3]While the bulk of the literature focuses on the case in which the exporting firm needs to raise finance, Antràs and Foley (2015), Demir and Javorcik (2018), and Schmidt-Eisenlohr (2013) study different trade finance regimes.

[4]The empirical literature shows that improved financial market conditions due to financial development (Beck, 2002; Berman and Héricourt, 2010) or equity market liberalizations (Manova, 2008) boost exports. Muûls (2015) provides evidence on the nexus between credit constraints and the margins of trade from linked Belgian micro data. See Greenaway et al. (2007) for evidence on the converse result that exporting can improve financial health. Recently, Minetti et al. (2018) have shown that credit-rationed firms in Italy are *more* likely to participate in global value chains.

[5]Amiti and Weinstein (2011, for Japan) and Paravisini et al. (2014, for Peru) have made further progress towards identifying a causal effect of financial crises on trade by linking micro-level trade data with bank data, and they confirm that financial frictions impede trade.

The second strand of the literature closely related to our work focuses on MNEs and corporate finance. Desai et al. (2004) demonstrate how foreign affiliates of U.S. multinationals access internal capital markets to circumvent financial frictions in external capital markets. Consistent with this finding, Desai et al. (2008) show that foreign-owned firms intensify their activities in currency crises and outperform domestically owned firms in terms of sales growth. Alfaro and Chen (2012) investigate the benefits of foreign ownership in the global financial crisis using a worldwide panel of establishments. They find that foreign-owned plants fared significantly better at the time of the credit crunch. This effect is greater in sectors with stronger financial linkages or higher financial dependence and it is very weak in the pre-crisis years. Garicano and Steinwender (2016) investigate firms' investment behavior in the ESEE data set. They show that firms decreased their investments during the crisis, in particular long-term ones, if and only if they were in domestic ownership. All of these findings support the view that foreign ownership improves the crisis resilience of firms' real activities by alleviating financial constraints.[6] We complement this literature with a detailed analysis of MNEs' role in mitigating the impact of the global financial crisis on firm exports, a dimension of firm performance that is particularly sensitive to financial conditions.

Most closely related to our work is the research by Manova et al. (2015), which connects the aforementioned two strands of the literature. The authors find that foreign-owned firms in China account for disproportionate shares of exports in finance-intensive industries. This specialization pattern is consistent with the idea that foreign-owned firms enjoy a comparative advantage in finance-intensive industries due to internal capital markets within MNEs.[7] Manova et al. (2015) identify the effect of credit constraints from variation in external financial dependence across industries within multi-product firms. We propose an altogether different approach by exploiting variation in credit supply over time along with variation in a pre-determined measure of financial vulnerability across firms. This identification strategy serves to establish a clear link between credit supply, financial vulnerability, and foreign ownership in determining firm-level exports.[8]

The remainder of this paper is organized as follows. Section 2 outlines a theoretical model of trade finance and foreign ownership, rationalizing the differential impact of the financial crisis on firm exports. Section 3 describes our firm data and offers descriptive evidence. In Section 4, we present our empirical strategy and estimation results. Section 5 offers some conclusions.

[6] As a notable exception, Álvarez and Görg (2012) find no stabilizing effect of foreign ownership for the Chilean crisis in the late 1990s.

[7] This is an endogenous outcome in Antràs et al. (2009), who show how financial frictions shape the pattern of FDI in theory and in firm-level data. Complementing this view, Raff et al. (2018) provide evidence on Japanese firms that adverse financial shocks reduce outward FDI.

[8] In related work, Wang and Wang (2015) use Chinese data to exploit variation in ownership over time within firms. They benchmark the effects of foreign acquisitions against domestic acquisitions and show that foreign ownership improves firm-level financial health and export performance, in line with our main finding.

2 A simple theory of trade finance and foreign ownership

To guide our econometric analysis, we outline a heterogeneous firms model of international trade with financial market imperfections. We focus here on the key assumptions and insights, while relegating all details to Online Appendix A.

The model setup follows Manova (2013): Consumer preferences are Cobb-Douglas across industries and CES across varieties within industries. Each industry is characterized by a continuum of heterogeneous firms in monopolistic competition. Upon paying a fixed entry cost, firms draw their productivity in a Melitz (2003)-type lottery. We focus on a two-country world, in which firms need to incur both fixed market-access costs and variable iceberg trade costs to service the export market. We assume that firms can finance domestic sales internally, but they require external finance for a certain share of all export-related costs. This share reflects the limited availability of internal funds and measures the firm's financial vulnerability. Due to frictions in financial markets, the lender will be repaid with an exogenous probability, representing capital market efficiency.

Firms maximize market-specific profits subject to a financial constraint, the participation constraint of the lender (i.e., the bank), and demand. The model predicts that firms sort into different activities based on their productivity levels. While the least productive firms exit the market, those with productivity levels in an intermediate range are active but serve only the domestic market. The more productive firms are exporters, serving both the domestic *and* the export market. However, within this group of exporters only the most productive firms export at first-best levels, while the less productive firms are constrained and export lower quantities at higher prices than in the first-best case. Intuitively, these firms cannot obtain sufficient credit for first-best exports even if they offer all revenues as a repayment to the bank.

Our model draws a sharp line between firms in *domestic* ownership and those in *foreign* ownership. While domestically owned firms are bound to finance their export activities in the domestic capital market, we assume that foreign-owned firms can access foreign capital markets through their parents if needed. This assumption is motivated by ample empirical evidence showing that MNEs use internal capital markets to finance the activities of their subsidiaries (see e.g. Desai et al., 2004; Egger et al., 2014; Biermann and Huber, 2020; Bena et al., 2021).[9] It implies that foreign-owned firms can decide between domestic and foreign banks to finance their export activities, while domestically owned firms are limited to domestic banks.

Since capital markets are perfectly competitive by assumption, banks are paid their outside options, which depend on the real interest rates in the two markets. In our setup, the real interest rate in the foreign capital market can be interpreted as the lowest interest rate at which the multi-

[9] An alternative interpretation consistent with our model and the empirical analysis is that foreign-owned firms benefit from easier access to foreign banks (Claessens and van Horen, 2021).

national parent can borrow abroad and lend to its affiliate in the domestic economy. If the foreign rate exceeds the domestic rate, all firms borrow domestically and there is no relevant ownership difference. We focus instead on the interesting case of lower borrowing cost abroad, which implies that foreign-owned firms prefer foreign to domestic borrowing and enjoy a financial advantage.

As a consequence, foreign-owned firms find it easier to export. This is reflected in the sorting of firms into different activities. Specifically, the cut-off productivity level separating exporters from non-exporters is lower for foreign-owned than for domestically owned firms. The same is true for the cut-off productivity level separating unconstrained exporters from constrained exporters. Hence, foreign-owned firms are not only more likely to export, but they are also more likely to export first-best quantities.

We use the model to study how the credit crunch in the financial crisis affected the export shares of foreign-owned relative to domestically owned firms. Our preferred approach is to cast the financial crisis as a drop in the repayment probability (or capital market efficiency). This approach is motivated by the fact that the financial crisis substantially increased the uncertainty of loan repayments, beyond the uncertainty associated with firms' fundamental characteristics. Around the peak of the financial crisis, marked by the bankruptcy of Lehman Brothers in September 2008, even loan repayments by major financial institutions were perceived as uncertain, which brought the interbank lending market to the verge of collapse. We view the deterioration of capital market efficiency as a temporary but global shock. In Online Appendix A.5, we alternatively model the financial crisis as an increase in borrowing costs and arrive at similar conclusions.

A central prediction of the model is that a deterioration in capital market efficiency in the crisis reduces the export revenues of all constrained exporters.[10] Since domestic sales are financed internally and thus remain unaffected by the credit shock, firms' export shares decline accordingly. Crucially, this negative effect is smaller for foreign-owned firms because they face a lower interest rate. Intuitively, as frictions in the capital market worsen, the financial advantage of foreign ownership gains more weight. By a similar logic, the difference between foreign and domestically owned firms will be more pronounced among firms that have less internal funds available and are hence more financially vulnerable. We summarize these predictions in:

Proposition 1 *Among constrained exporters, (i) a deterioration in capital market efficiency raises the export shares of foreign-owned firms relative to domestically owned firms, and (ii) this differential effect is larger among more financially vulnerable firms.*

Proof. *See Online Appendix A.4.*

[10] We focus on those firms that are constrained exporters before and after the credit shock. While the model also predicts that the deterioration in credit conditions will force some firms to stop exporting, this effect on the extensive margin turns out to be small and insignificant in Spain (see Section 4.3 and Eppinger et al., 2018). We therefore focus on the more interesting intensive margin of exports.

3 Data and descriptive statistics

In this section we introduce the data set used in our empirical analysis and provide descriptive analyses of firms' export behavior and their financial situation.

3.1 Data source and key variables

Our data come from the Encuesta Sobre Estrategias Empresariales (ESEE), an annual survey of about 2,000 manufacturing firms in Spain.[11] The sample we use for our analysis is a panel data set covering the period 2005–2012, which allows us to track firms through the years before, during, and after the financial crisis. The initial sampling of the data in 1990 followed a two-tier structure designed to guarantee representativeness of the data for the manufacturing sector at large. Survey questionnaires were sent out to all 'large' firms (those with more than 200 employees), and to a subset of 'small' firms (those with 10 to 200 employees). Small firms were selected through stratified, proportional, and systematic sampling with a random seed. Industry affiliation and size class (defined by the number of employees) serve as stratification variables. Industries are defined by product categories at the 2-digit level of the NACE Rev. 2 industry classification.[12] To mitigate sample attrition, SEPI incorporates refreshment samples, i.e., new firms are added to the survey as other firms exit. This is done in a way that preserves the representativeness of the data set over time.

It is crucial for our analysis that the data set includes information about (i) the ownership structure of firms (foreign vs. domestic), (ii) their export *and* domestic sales volumes, and (iii) their financial situation and debt structure. We define a firm as foreign owned if more than 50% of its equity is held by foreigners, and as domestically owned otherwise.[13] In the Spanish manufacturing sector at large, around 4% of firms are foreign owned over the period 2005–2012. This number is considerably higher for large firms (around 37%), and lower for small firms (around 3%), similar to other countries. In terms of employment, sales, and exports, foreign-owned firms are quite important in Spain. Of the total number of effective working hours reported in 2012, 29% can be attributed to foreign-owned firms. For sales and exports the numbers are even higher, standing at

[11] The ESEE is managed by the Spanish foundation Sociedad Estatal de Participaciones Industriales (SEPI). See http://www.fundacionsepi.es/esee/en/epresentacion.asp for more information.

[12] Until 2009, the survey defined industries according to the NACE Rev. 1 classification. We accommodate the two classifications based on concordance information provided by SEPI.

[13] A small number of firms is foreign owned by more than zero, but not more than 50%, and thus labeled as domestically owned. We have checked that these firms are not driving our results by excluding them from the sample or by relabeling them as foreign owned. Our data set also includes information about unusual events such as mergers, acquisitions, and splitting up of firms. Such events can contaminate the analysis, as they often imply a drastic change not only in the ownership structure of the firm, but also in the type and scale of its output and exports (e.g. because the acquired entity is a large exporter). Hence, whenever a firm experiences one of the above-mentioned events, we treat it as a different firm afterwards. This applies to 30 firms in our sample.

46% and 60%, respectively.[14] Table B.1 in Online Appendix B.1 provides summary statistics of all key variables used in the analysis.

3.2 Export behavior

Table 1 reveals a pronounced difference in the export performance between foreign and domestically owned firms. We pool all observations across the years 2005–2012 and then sort them into groups of firms depending on their ownership structure. Virtually all foreign-owned firms (95%) are exporters, as opposed to less than half of the domestically owned firms (46%). Among exporting firms, those in foreign ownership also export more, on average, than those in domestic ownership. These differences in both export status and export volumes translate into a considerably higher export share (*exports*/*sales*) for foreign-owned compared to domestically owned firms (37% vs. 11%). In Online Appendix B.2, we show that a significant foreign ownership premium in the export share of at least 6 percentage points prevails after controlling for industry composition, firm size, and whether the firm mainly produces intermediates or final goods. Hence, these differences are not trivially explained by firm size or intra-firm exports in vertical FDI relationships. The firm-level export share as a measure of export performance will be the focus of our empirical analysis in Section 4. However, while Table 1 compares average export shares across firms with different ownership structures in the pooled sample, our econometric analysis below exploits differential changes in the export share over time.

Table 1: Descriptive statistics of export behavior

	Domestic			Foreign		
	Mean	Std. dev.	Observations	Mean	Std. dev.	Observations
Exporter dummy	0.462	0.499	13,440	0.951	0.215	2,187
Exports (in logs)	12.836	2.460	8,022	15.708	2.343	2,099
Export share (*exports*/*sales*)	0.113	0.220	13,440	0.369	0.307	2,187

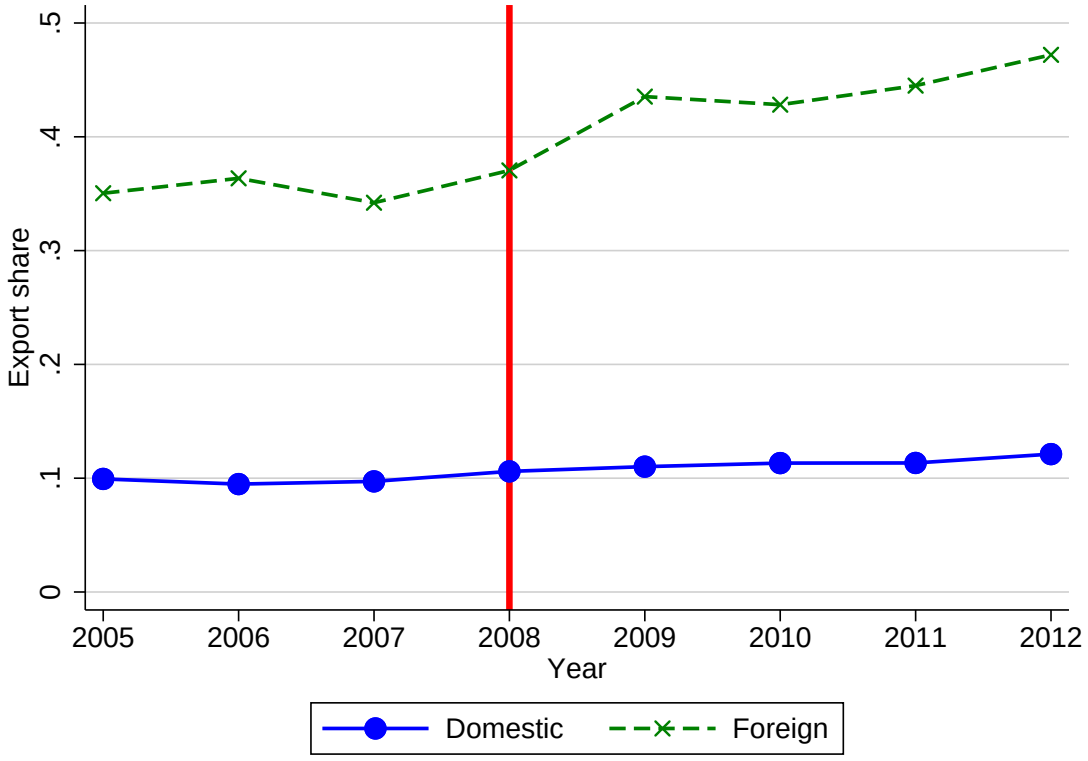
Notes: This table shows means, standard deviations, and numbers of firm-year observations for key variables by ownership (domestic vs. foreign). The sample covers the years 2005–2012. Exports and sales are expressed in constant 2005 prices. *Source:* Authors' computations based on ESEE data.

[14]These and other descriptive statistics provided below are computed by applying sampling weights to describe the Spanish manufacturing sector at large. The sampling weights reflect the inverse sampling probability of a firm relative to the population of firms by industry-size stratum in 2010, based on data from the Spanish Instituto Nacional de Estadística (INE). Throughout the paper, we express exports and sales in constant 2005 prices using firm-level output price indexes from the ESEE data. Where firm-level price information is missing, we complement it with industry-level price information from INE.

Figure 1 provides a first glance at the evolution of export shares depending on firm ownership (foreign vs. domestic). We balance the panel on firms with positive sales in each and every year over the period 2007–2010, which allows us to abstract from the effects of market entry and exit. Two key observations stand out. First, in line with the evidence in Table 1, foreign-owned firms have a consistently higher export share than domestically owned firms. Second, we see a considerable increase in the export share among foreign-owned firms in 2009 (from 37% to more than 42%). By contrast, the line for domestically owned firms is almost completely flat throughout the years before, during, and after the financial crisis, indicating a roughly constant export share of around 10–11%.[15] This different evolution of the export shares between ownership groups is consistent with Proposition 1. However, we also see that the export shares did not decline for either group in the crisis, as would be expected based on a pure credit supply shock. This observation can

[15] Balancing the panel on firms *exporting* over the period 2007–2010, rather than on *producing* firms, yields a very similar picture (available on request). This implies that the firm-level extensive margin of exports is not driving the differential change in export shares visible in 2009.

Figure 1: Evolution of export shares by ownership status (2005–2012)



Notes: This figure depicts the average firm-level export share by ownership (domestic vs. foreign). The panel used to construct the figure is balanced on firms with positive sales over the period 2007–2010. Sampling weights apply. *Source:* Authors' computations based on ESEE data.

be rationalized by a contemporaneous drop in domestic demand, as emphasized by Almunia et al. (2021). In the next section, we will conduct a systematic econometric analysis of the differential crisis impact on export shares. Guided by our theoretical model, we focus on the hypothesis that foreign ownership was especially helpful in facilitating exports among those firms that were characterized by a high financial vulnerability as they entered the crisis.

3.3 Financial situation

Our data set includes detailed information on Spanish firms' assets, sales, and debt (i.e., total debt, debt volumes by maturity and types of creditors, and associated interest rates). This allows us to paint a rich picture of a firm's financial situation through the years of the financial crisis, and to directly identify the credit channel in our econometric analysis. Our focus is on a firm's financial vulnerability, which we measure by the ratio of short-term debt to sales, where short-term debt comes due within one year and includes both debt repayments and interest payments. Intuitively, this variable measures the share of a firm's revenue that is used for servicing its short-term debt. The higher the short-term debt-to-sales ratio, the more difficult it is for the firm to obtain a loan and roll over its debt, and hence, the more financially vulnerable is the firm (other things equal). This variable is closely related to the (inverse) debt service coverage ratio, which is a widely used benchmark to determine a firm's ability to service its debt.[16]

A first glance at the financial data strongly suggests that the crisis had a differential impact on firms' financial situation depending on their ownership structure. Figure 2 depicts the evolution of firms' short-term debt-to-sales ratios (i.e., financial vulnerability) and other important financial variables over the years 2005–2012, separately for firms in domestic and foreign ownership. In Figure 2(a), we see an average financial vulnerability of around 0.40 over the period 2005–2008, and an extremely close comovement of this measure for foreign and domestically owned firms. Interestingly, the two series start to diverge after 2008. On the one hand, domestically owned firms experienced a striking increase in their short-term debt-to-sales ratios from 0.44 in 2008 to more than 0.75 in 2012. On the other hand, foreign-owned firms had about the same degree of financial vulnerability in 2012 as in 2007; after a peak at 0.49 in 2009, their indebtedness returned to its pre-crisis level. In our econometric analysis in the next section, we exploit this variable as a predictor of firms' export performance in the financial crisis. However, rather than using a time-varying measure, which is influenced by the crisis itself, we look at a firm's financial vulnerability in 2008

[16] While our measure of financial vulnerability uses short-term debt (service), we have also considered alternatives that include debt service (debt repayments and interest payments) associated with both short-term and long-term debt. It turns out that doing so does very little to our estimation results; see footnote 24.

to exploit variation in firms' financial situation at the onset of the crisis.[17]

We dig deeper into firms' financial conditions by examining the volumes of total and newly issued debt over the crisis years. Figure 2(b) shows that domestically owned firms reduced their debt ratios (i.e., total debt over assets) more strongly over the crisis period than foreign-owned firms. This observation is in line with the idea of a credit supply shock that restricts access to credit more severely for domestically owned firms.[18] Figure 2(c), which illustrates the volume of newly issued debt relative to total assets, supports this view. While in each of the pre-crisis years 2005–2007 foreign and domestically owned firms issued similar volumes of debt relative to their assets, this ratio dropped significantly in the crisis relative to 2007, and much more so for domestically owned firms. Hence, in contrast to the years before the crisis, foreign-owned firms borrowed considerably more in the crisis than their domestically owned peers.

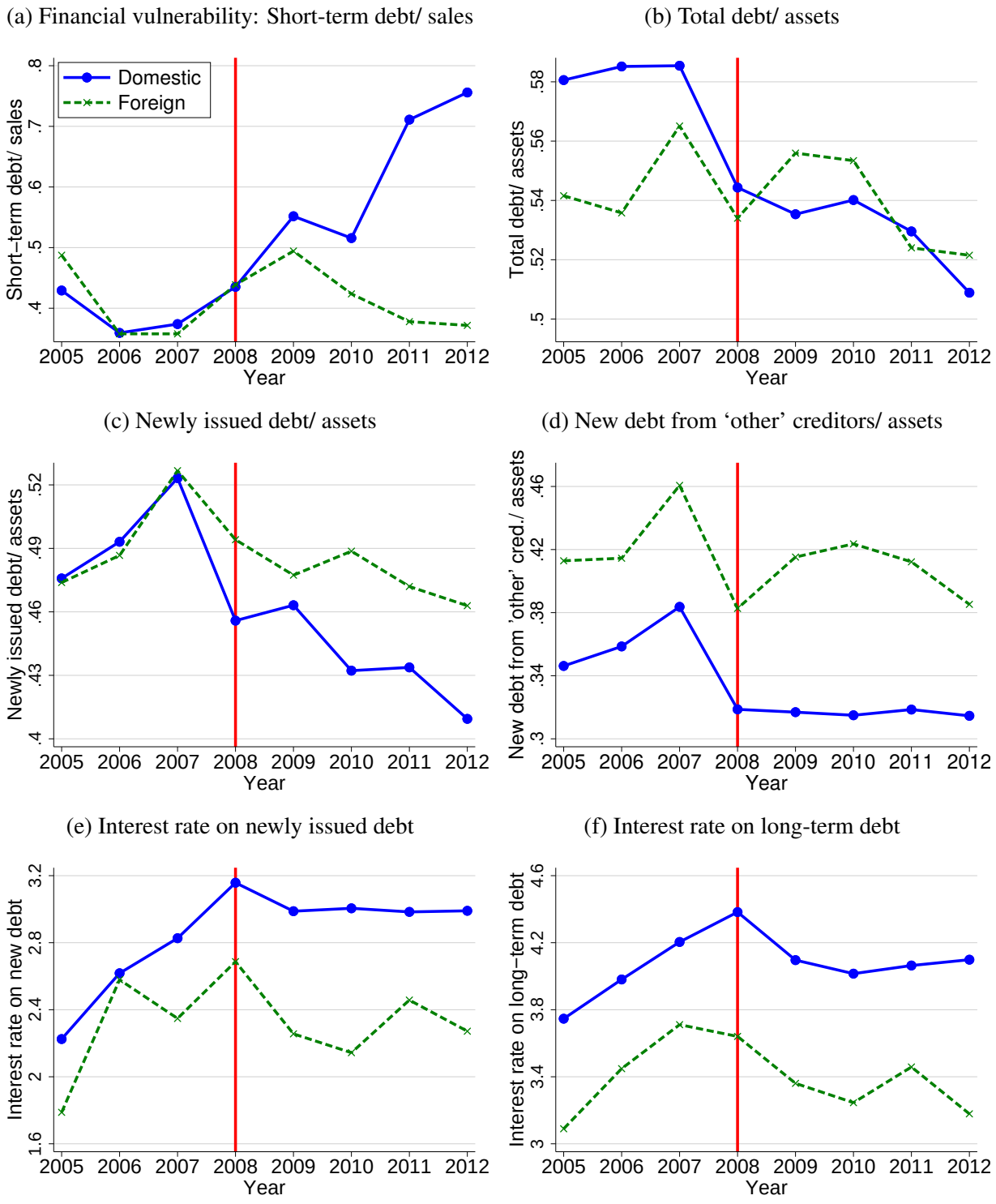
Figure 2(d) provides suggestive evidence that internal capital markets are responsible for this divergence. It shows the new debt-to-assets ratio for the subcategory of new debt with 'other' creditors. Importantly, this debt category includes intra-firm lending by the parent firm, and therefore it is plausibly greater for foreign-owned firms in all years. However, following a strikingly similar evolution across the two ownership groups up until 2008, this ratio clearly increased in 2009 and 2010 among foreign-owned firms, while it remained low and completely flat among domestically owned firms. This pattern is consistent with rising internal borrowing from the foreign parent over the crisis years 2009–2011.

Finally, we examine the interest rates paid by firms to see whether the observed changes in credit volumes are driven by factors related to credit demand or supply. Figure 2(e) shows the interest rate on newly issued debt, which is a weighted average of interest rates on short-term debt and newly issued long-term debt, while Figure 2(f) shows the interest rate on long-term debt. In both figures we see that average interest rates are generally lower for foreign-owned firms, which squares well with our assumption that they can access foreign capital at a lower cost (see Online Appendix A.3). Figure 2(e) shows that the interest rate on newly issued debt peaked in 2008 and remained high for domestically owned firms, in line with an adverse credit supply shock. Foreign-owned firms had a vastly different experience. They seemed to be able to sidestep the credit shortage, as the interest rate on their new debt rose by less between 2006 and 2008 and quickly fell in 2009–2010, even below the pre-crisis level of 2006–2007. When it comes to the interest

[17]The similarity between domestic and foreign-owned firms in terms of their financial vulnerability before the crisis extends beyond the simple *averages* of this variable depicted in Figure 2(a). Specifically, we show in Figure B.2 in Online Appendix B that the *distribution* of financial vulnerability across foreign-owned firms in 2008 largely overlaps with the corresponding distribution for domestically owned firms.

[18]We also see that, overall, debt ratios before the crisis were slightly higher for domestically owned compared to foreign-owned firms. However, foreign-owned firms generally exhibit higher ratios of short-term to long-term debt, which explains why the financial vulnerability is nevertheless similar across both groups before the crisis.

Figure 2: Financial situation by ownership status (2005–2012)



Notes: This figure depicts the evolution of different aspects of firms' financial situation over time, on average by ownership (domestic vs. foreign). Sampling weights apply. *Source:* Authors' computations based on ESEE data.

rates on long-term debt, illustrated in Figure 2(f), we see a similar picture, though the adjustments there are naturally more sluggish. We can conclude that the gap in credit costs between foreign and domestically owned firms widened sharply over the crisis years. The raw data thus support the view that foreign-owned firms benefited in the crisis from more and cheaper credit, accessed through or with the assistance of their foreign parents.

4 Empirical analysis

Our empirical analysis proceeds in three main steps. First, we estimate what we call the *ownership differential* of the financial crisis, i.e., the differential effect of the crisis on export shares of foreign relative to domestically owned firms, using a difference-in-differences (DiD) framework. Second, we focus explicitly on the credit channel by estimating the ownership differential as a function of the financial vulnerability of the firm, measured just before the crisis, using a triple differences (DiDiD) framework. Third, we scrutinize various aspects of our analysis: We distinguish the DiDiD effects at the extensive vs. intensive margin of exports; we contrast the financial advantage of foreign ownership with the advantage of belonging to a corporate group more generally, to learn about the role of *foreignness* of the parent firm as such; we explore the possibility that foreign-owned firms could export their goods through the distributional network of the foreign parent (market access channel); and we investigate potential ownership differences in input costs (input price channel). We conclude the section with an extensive robustness analysis.

4.1 The effect of foreign ownership

We begin by estimating the following DiD model:

$$(\textit{exports}/\textit{sales})_{it} = \sum_{r=2006}^{2012} \phi_r \cdot (\textit{Foreign}_{it} \cdot Y_r) + \gamma \cdot \textit{Foreign}_{it} + D_i + D_{st} + \varepsilon_{it}, \qquad (1)$$

where the dependent variable is the export share of firm i in year t, $\textit{Foreign}_{it}$ is a dummy variable for foreign ownership with a corresponding coefficient γ, and Y_r is a dummy variable equal to one if $r = t$, so that the sum collects interaction terms between the foreign ownership dummy and a comprehensive set of year dummies with corresponding coefficients ϕ_r (indexed by $r = 2006, \ldots, 2012$). The parameter D_i is a firm fixed effect, while D_{st} is an industry-year fixed effect, corresponding to the 2-digit industry code first reported by the firm in our sample period (typically in the base year 2005). Finally, ε_{it} is an error term with zero conditional mean. Statistical inference will be based on robust standard errors clustered by firm, robust to serial correlation and heteroskedasticity.

This model allows us to study the evolution of firm-level export shares through the financial crisis in a systematic and flexible way, and to exploit the credit crunch in 2008/09 as a source of exogenous variation in credit supply. Our main interest is in whether the response to the crisis was contingent on foreign ownership. Against the backdrop of Proposition 1(i), we expect foreign-owned firms to outperform their domestically owned peers on export markets in the financial crisis. The flexible specification (1) has three advantages. First, we do not need to take a stance on whether the crisis first hit Spain in one of the years 2008, 2009, or 2010; instead we let the data speak as to when the crisis actually left a mark on exports. Second, we can test for differences in the evolution of export shares across ownership groups in the years before the crisis, which serves as an important plausibility check for the identifying assumption of a common trend. Third, we can investigate whether the ownership differential is persistent over time, or whether it fades out.

Crucial for the interpretation of our estimates is the variation in the data we use for identification. Notice that the sets of fixed effects included in the model absorb a wide variety of potential confounding factors. In particular, the firm fixed effects capture any time-invariant heterogeneity in observable or unobservable firm characteristics, such as firm-specific productivity, management quality, or the fixed cost of exporting.[19] The industry-year fixed effects flexibly account for the industry-specific evolution of comparative advantage and arbitrary domestic or foreign demand shocks across industries in the crisis. The interaction effects ϕ_r in equation (1) are hence identified from differences in within-firm variation over time across the two ownership groups, after controlling for industry-specific shocks.

A fundamental endogeneity problem stems from selection into foreign ownership based on past firm characteristics. The same factors that explain why firms are foreign owned might also explain why their exports are more resilient in the financial crisis. To tackle this problem, we follow the literature and combine the fixed effects model in equation (1) with a propensity score reweighting approach (Hirano et al., 2003). Specifically, we construct propensity scores and reweight each observation in order to generate a similar distribution of key observable characteristics across foreign and domestically owned firms. The intention of this approach is to match also the distribution of important unobservable characteristics across the two groups. To estimate the propensity scores, we first consider the year 2007 in our panel and sort those firms that are foreign owned into the treatment group and those that are domestically owned into the control group. Importantly, this approach allows us to focus on firms for which we can properly model the relationship between treatment assignment and covariates *before* the crisis, but study their export response *during* the

[19] Manova et al. (2015) point out several potential reasons why foreign-owned firms are doing better on export markets than domestically owned firms. Apart from enjoying better financing conditions, foreign-owned firms may e.g. have access to their parents' superior distribution network, an aspect that we investigate further in Section 4.5. The use of firm fixed effects in the estimation of (1) allows us to control for such factors to the extent that they are constant through time. Later we allow these factors to have varying impacts over time.

crisis. Inspired by the literature studying selection into foreign ownership (e.g. Guadalupe et al., 2012), we then obtain the propensity scores by running cross-sectional probit regressions of foreign ownership in 2007 (the treatment) on firm-specific sales, sales growth, capital intensity (all in logs), export share, and a full set of industry dummies. The firm-specific variables are all lagged by one year, i.e., they are observed in 2006. Each treated firm is reweighted by $1/\hat{p}$ and each control group firm by $1/(1-\hat{p})$, where $\hat{p}$ is the estimated propensity score.[20] Importantly, $\hat{p}$ reflects the estimated probability that the firm is in foreign ownership shortly before the crisis materialized (i.e., in 2007), and is thus orthogonal to the crisis itself.

Columns (1) and (2) of Table 2 present estimates of γ and $\phi_r, r = 2006, \ldots, 2012$, based on the fixed effects (FE) estimator and the propensity score reweighting (PSR) estimator, respectively. The results show a significant increase in the export share of foreign-owned relative to domestically owned firms in the crisis, as predicted by Proposition 1(i). The fixed effects estimator identifies an ownership differential of 2.3 percentage points in 2009 (significant at the 10% level), which increases further in the two subsequent years, peaking at 3.9 percentage points in 2011 (significant at the 1% level) relative to the base year. The PSR estimator confirms this effect in a considerably smaller sample and yields slightly larger point estimates: 3.7 percentage points in 2009 and 5.3 percentage points in 2011. These changes are quite sizeable, implying an increase in the foreign ownership premium of around 9–15% in 2009 compared to 2005.[21] Importantly, our estimates also support the idea that foreign and domestically owned firms share a common trend in export shares *before* the crisis, as we find no significant differences between the two types of firms over the years 2005–2008.[22] Moreover, we have run additional regressions that separately identify the effects of foreign ownership in the crisis on total sales, domestic sales, and export sales. We find that the ownership differential is driven by a differential evolution, not in domestic sales, but in the export volume between foreign and domestically owned firms; see Online Appendix B.4 for detailed regression results.

While these results are consistent with a financial advantage of foreign ownership that helped in

[20] We only keep those observations in the analysis that are in the region of common support, and we have checked that the balancing property is supported in the data. More specifically, after stratifying the panel into different subsamples according to their propensity scores, all observed characteristics of foreign and domestically owned firms are balanced within each subsample. This means that within each subsample we cannot reject the null hypothesis (at any conventional significance level) that the means of the variables are identical across treatment and control group. We also winsorize the propensity scores at the 99th percentile, following Guadalupe et al. (2012). Detailed results of the balancing tests for differences between foreign and domestically-owned firms are relegated to Online Appendix B.3.

[21] These numbers are obtained by dividing the estimates of ϕ_{2009} from columns (1) and (2) of Table 2 by the unconditional difference in weighted averages for the two groups in 2005, which amounts to 24 percentage points (see Figure 1).

[22] Notice that γ is identified only through a small number of firms switching into and out of foreign ownership. We have verified that our results are not driven by these firms, as they remain virtually unchanged when we exclude switchers from the sample altogether.

Table 2: The effect of foreign ownership on the export share (DiD)

	Dependent variable: Export share (*exports/sales*)					
	Full sample		Small firms		Large firms	
	FE	PSR	FE	PSR	FE	PSR
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign	-0.00630	-0.0118	-0.0217	-0.0182	-0.000952	0.00146
	(0.0154)	(0.0200)	(0.0291)	(0.0299)	(0.0202)	(0.0239)
Foreign $\cdot Y_{2006}$	0.00309	-0.00123	0.0245	0.0213*	-0.00782	-0.0221*
	(0.00766)	(0.00846)	(0.0162)	(0.0118)	(0.0128)	(0.0125)
Foreign $\cdot Y_{2007}$	0.0000387	-0.0114	0.0246	-0.00612	-0.0132	-0.0190
	(0.00938)	(0.00933)	(0.0215)	(0.0152)	(0.0132)	(0.0118)
Foreign $\cdot Y_{2008}$	-0.000428	-0.00154	0.0188	0.00975	-0.00217	-0.00984
	(0.0104)	(0.0106)	(0.0220)	(0.0160)	(0.0145)	(0.0145)
Foreign $\cdot Y_{2009}$	0.0230*	0.0374*	0.0524*	0.0658	0.0260	0.0195
	(0.0123)	(0.0213)	(0.0281)	(0.0420)	(0.0174)	(0.0199)
Foreign $\cdot Y_{2010}$	0.0284**	0.0511**	0.0732**	0.103**	0.0148	0.0144
	(0.0133)	(0.0244)	(0.0306)	(0.0477)	(0.0179)	(0.0183)
Foreign $\cdot Y_{2011}$	0.0388***	0.0532**	0.0690**	0.102*	0.0240	0.0163
	(0.0141)	(0.0250)	(0.0329)	(0.0536)	(0.0200)	(0.0201)
Foreign $\cdot Y_{2012}$	0.0313*	0.0450*	0.0726*	0.0970*	0.00698	0.00561
	(0.0161)	(0.0271)	(0.0370)	(0.0574)	(0.0218)	(0.0214)
Observations	15,627	8,859	11,541	5,507	4,086	3,352
R^2 (within)	0.055	0.099	0.058	0.146	0.092	0.106

Notes: The table shows estimates of equation (1). The dependent variable is the firm-specific export share. *Foreign* is a dummy variable indicating foreign ownership. All estimations include firm fixed effects and industry-year fixed effects. The even columns apply propensity score reweighting (PSR). Robust standard errors (in parentheses) are clustered at the firm level. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

supporting exports in the crisis, they could be caused by factors unrelated to credit constraints. For example, the international distribution network maintained by MNEs might have helped foreign-owned firms to channel their sales into foreign markets that fared better than the Spanish market during the crisis (e.g. emerging-market economies). Therefore, we must aim to exploit an additional margin of variation in the data in order to clearly disentangle the credit channel from other potential explanations.

One such margin could be firm size. The evidence suggests that small firms are more likely to be credit constrained than large firms (see Gertler and Gilchrist, 1994; Guiso et al., 2004; Beck et al., 2008). This observation is fully consistent with our theory. In the model in Section 2, only the less productive and thus smaller exporting firms are credit constrained, while the most productive and thus larger firms can always export at first-best levels. Hence, we next estimate specification (1) separately for small and large firms (with up to 200 vs. more than 200 employees,

respectively).

Columns (3) to (6) in Table 2 report the results. We find that the above-described ownership differential is strongly confirmed in the sample of small firms, but not in the sample of large firms. The larger coefficient estimates in the sample of small firms further suggest a more important role for foreign ownership among small firms. While we believe that these results serve as an indication for the credit channel to be at work, we cannot rule out the possibility that other benefits of foreign ownership also gained importance for small firms' exports in the crisis. An alternative and more promising route to pin down the credit channel is suggested by our model: to focus on a firm's financial situation rather than on firm size. The financial advantage of foreign ownership should be more important for exports among financially vulnerable firms that are highly indebted at the onset of the crisis. Therefore, we directly focus on firms' financial vulnerability in the next section.

4.2 The credit channel of foreign ownership

To identify the credit channel of foreign ownership in promoting firm exports, we propose a triple differences (DiDiD) identification strategy that exploits three margins: variation in the ownership structure of firms (foreign vs. domestic), variation in credit supply caused by the financial crisis, and variation in financial vulnerability across firms prior to the crisis. The estimation equation reads as follows:

$$(\textit{exports/sales})_{it} = \sum_{r=2006}^{2012} \theta_r \cdot (\textit{Foreign}_{it} \cdot \textit{FinVul}_i \cdot Y_r) + \sum_{r=2006}^{2012} \phi_r \cdot (\textit{Foreign}_{it} \cdot Y_r) + \gamma \cdot \textit{Foreign}_{it}$$
$$+ \rho \cdot (\textit{Foreign}_{it} \cdot \textit{FinVul}_i) + \sum_{r=2006}^{2012} \delta_r \cdot (\textit{FinVul}_i \cdot Y_r) + D_i + D_{st} + \varepsilon_{it}, \qquad (2)$$

where $\textit{Foreign}_{it}$ is the foreign ownership dummy (as before), $\textit{FinVul}_i$ is our firm-specific measure of pre-crisis financial vulnerability, and the main parameters of interest are the coefficients of the triple interaction terms with year dummies: $\theta_r,\ r = 2006, \ldots, 2012$.[23] From Proposition 1(ii), we expect $\theta_r > 0$ in the crisis years.

This model allows us to see whether the ownership differential identified in the previous section is larger among financially vulnerable firms. The main rationale behind this approach is that firms with a higher financial vulnerability in 2008 will have found it more difficult to finance their export activities when liquidity dried out in the financial crisis. Importantly, we measure financial vulnerability in 2008, based on credit contracts signed in or before 2007, in the manner described

[23] Further parameters to be estimated in equation (2) are the coefficients of the two-way interaction terms, i.e., ρ, ϕ_r and $\delta_r,\ r = 2006, \ldots, 2012$, as well as the coefficient of the foreign ownership dummy γ. The fixed effects D_i and D_{st} absorb $\textit{FinVul}_i$ and $Y_r,\ r = 2006, \ldots, 2012$. These estimates are not reported below to economize on space.

in Section 3.3. Hence, this variable is independent of the credit crunch in the financial crisis, which came unexpected and the severity of which had not been anticipated.[24] Moreover, as shown in Figure 2, there was virtually no difference in the degree of financial vulnerability between foreign and domestically owned firms in any of the pre-crisis years 2005–2008. The foreign ownership status of firms was thus orthogonal to our measure of financial vulnerability.

One concern could be that financial vulnerability is endogenous in specification (2). In particular, one may worry that omitted factors, such as management quality, allow the firm both to expand its exports and to raise more external finance (thus increasing its ratio of debt to sales). This potential endogeneity problem can indeed lead to biased estimates of the *direct* effect of financial vulnerability on the export-to-sales ratio. Yet, our focus is not on the effect of financial vulnerability itself, but rather on the ownership differential *as a function of* financial vulnerability. Crucially, the identification of this triple interaction effect does not require exogeneity of financial vulnerability. As shown by Nizalova and Murtazashvili (2016), such an interaction effect is correctly identified as long as the potentially endogenous variable (financial vulnerability) and the omitted factors (such as management quality) are jointly independent of the 'treatment', which in specification (2) is the interaction effect between foreign ownership and the financial crisis (as captured by the year dummies). Since the financial crisis is exogenous beyond doubt, this sufficient condition is fulfilled if we have successfully accounted for selection into foreign ownership. To achieve this, we continue to follow a large literature (Guadalupe et al., 2012; Wang and Wang, 2015; Fons-Rosen et al., 2021) applying propensity score methods (as in Section 4.1). Hence, under the identifying assumptions of the PSR approach, our estimates of the coefficients of the triple interaction terms ($\theta_r,\ r = 2006, \ldots, 2012$) are consistent regardless of whether or not financial vulnerability is strictly exogenous.

Table 3 reports our main estimation results. It demonstrates that it was especially the group of financially vulnerable firms for which the adverse effect of the financial crisis on firms' export shares was mitigated by foreign ownership. In other words, the ownership differential identified above is increasing in a firm's degree of financial vulnerability. The table reports estimates of the triple interaction effects $\theta_r,\ r = 2006, \ldots, 2012$ in equation (2), first for the full sample (columns (1) and (2)), and then separately for the samples of small firms (columns (3) and (4)) and large firms (columns (5) and (6)). In each case, we first use the FE estimator and then the PSR estimator described in the previous section. We find economically and statistically significant triple interaction effects for 2009 and the subsequent years in the full sample. As in the case of our DiD results, the DiDiD effects are greater among small firms, which were more likely to face binding

[24] We carefully explore the timing of our measure of financial vulnerability and its implications for our main results in Online Appendix B.5. In Online Appendix B.6, we show that our main results are also robust to using alternative measures of financial vulnerability.

Table 3: The credit channel of foreign ownership (DiDiD)

	Dependent variable: Export share (*exports*/*sales*)					
	Full sample		Small firms		Large firms	
	FE	PSR	FE	PSR	FE	PSR
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign · *FinVul* · Y_{2006}	-0.0170	-0.0307	-0.0183	-0.0384	0.0632	0.0210
	(0.0255)	(0.0263)	(0.0336)	(0.0297)	(0.0572)	(0.0504)
Foreign · *FinVul* · Y_{2007}	-0.00374	-0.0169	0.00978	-0.0139	0.00537	-0.0241
	(0.0257)	(0.0225)	(0.0329)	(0.0256)	(0.0529)	(0.0481)
Foreign · *FinVul* · Y_{2008}	0.0176	-0.00792	0.0199	-0.0196	0.0650	0.0518
	(0.0264)	(0.0198)	(0.0392)	(0.0194)	(0.0541)	(0.0518)
Foreign · *FinVul* · Y_{2009}	0.102**	0.175***	0.187***	0.182***	0.0619	0.102
	(0.0492)	(0.0319)	(0.0207)	(0.0134)	(0.0668)	(0.0881)
Foreign · *FinVul* · Y_{2010}	0.109*	0.173***	0.206***	0.188***	0.0553	0.0774
	(0.0592)	(0.0365)	(0.0240)	(0.0167)	(0.0710)	(0.0677)
Foreign · *FinVul* · Y_{2011}	0.107**	0.148***	0.203***	0.173***	0.0352	0.0118
	(0.0494)	(0.0313)	(0.0283)	(0.0156)	(0.0803)	(0.0695)
Foreign · *FinVul* · Y_{2012}	0.0920*	0.133***	0.195***	0.166***	-0.0138	-0.0424
	(0.0491)	(0.0300)	(0.0324)	(0.0173)	(0.0668)	(0.0639)
Observations	12,536	8,604	8,872	5,333	3,664	3,271
R^2 (within)	0.071	0.202	0.094	0.350	0.105	0.113

Notes: The table shows estimates of equation (2). The dependent variable is the export share. *Foreign* is a dummy variable indicating foreign ownership. *FinVul* is the financial vulnerability of the firm in 2008. Y_t are year dummies. All estimations include the *Foreign* dummy, a full set of two-way interaction terms between *Foreign*, *FinVul*, and the year dummies, as well as firm fixed effects and industry-year fixed effects. The even columns apply propensity score reweighting (PSR). Robust standard errors (in parentheses) are clustered at the firm level. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

credit constraints. In the sample of large firms, the DiDiD effects are not statistically significant. Overall, these results provide strong support for Proposition 1(ii) and the financial advantage of foreign ownership on export markets.

To provide a quantitative perspective on our estimates, we evaluate the ownership differential at different degrees of financial vulnerability. Focusing on the sample of small firms, we find that the estimated ownership differential is larger by 4.9 percentage points at the 75th percentile of financial vulnerability compared to the 25th percentile.[25] This triple interaction effect is substantial, reflecting an increase by one-third compared to the mean export share of 14.5% in the underlying

[25]The 25th and 75th percentiles of financial vulnerability in the estimation sample of small firms are 0.213 and 0.484, respectively, after applying sampling weights. We compute the differential effect as $\hat{\theta}_{2009} \cdot (0.484 - 0.213)$, using the estimate $\hat{\theta}_{2009} = 0.182$ from column (4). Note that these effects are estimated relative to the base year 2005. However, we find no evidence of differential effects before 2009, consistent with a common pre-crisis trend. Thus, the reported magnitudes are approximately equal to the effect in 2009 relative to 2008.

estimation sample. And it is more than twice as large, amounting to 10.4 percentage points, if we compare firms at the 90th to the 10th percentile of financial vulnerability.

Note that in the sample of small firms, the results are very similar across the two different estimators, both in terms of magnitudes and significance levels. Moreover, we cannot reject the null hypothesis that $\theta_{2009} = \theta_{2010} = \theta_{2011} = \theta_{2012}$, i.e., the coefficients of the triple interaction terms are remarkably stable over the period 2009–2012. For the remaining part of our analysis, we therefore define a *Crisis* dummy variable which takes on the value zero for the period 2005–2008 and the value one for the period 2009–2012.

4.3 Extensive versus intensive margin of exports

We proceed by investigating the precise firm-level margin that is driving our results. In particular, we distinguish between the extensive and the intensive margin of exports in our DiDiD analysis. This allows us to see whether, among financially vulnerable firms, foreign ownership helped firms to continue (or even start) exporting in the crisis, or to maintain high volumes of exports, or both. This distinction is important: If the effect is concentrated at the extensive margin of exports, then it must be the fixed rather than the variable costs of exporting that matter in the presence of financial market imperfections (see e.g. the discussions in Minetti and Zhu, 2011; Muûls, 2015). It also connects our findings to the literature on the micro structure of the great trade collapse, which has found predominantly intensive-margin adjustments in the crisis (Behrens et al., 2013; Bricongne et al., 2012; Eppinger et al., 2018).

We estimate the DiDiD model using two different dependent variables: For the extensive margin, we define an exporter dummy which is equal to one if the firm has positive exports in a given year and zero otherwise. For the intensive margin, we use the volume of exports (deflated and in logs), which implies that we only include exporting firms in this regression.

Our estimates in Table 4 reveal that the export-promoting effect of foreign ownership in the crisis was concentrated at the intensive rather than the extensive margin. This suggests that problems with financing the fixed costs of exporting played a minor role in the crisis. Before dissecting the two margins, we estimate our benchmark specification (2) using the export share as the main dependent variable as well as the *Crisis* dummy instead of the year dummies in the main interaction terms. We find our main results confirmed; see columns (1) and (2). When using the export dummy as the dependent variable in columns (3) and (4), we find no evidence of a differential effect at the extensive margin of exports. The triple interaction effect is not significantly different from zero, and the same applies to the two-way interaction effect between *Foreign* and *Crisis* in this model or in a DiD model (not reported). By contrast, at the intensive margin, foreign ownership had a large and highly significant differential effect on the volume of exports for financially vulnerable firms,

as revealed in columns (5) and (6). In terms of magnitude, the estimated triple interaction effect in column (6) suggests that foreign ownership raised export volumes in the crisis by 19.2% more for firms at the 75th percentile of financial vulnerability compared to those at the 25th percentile.

Table 4: Extensive versus intensive margin of exports (DiDiD)

	Export share		Exporter dummy		ln *exports*	
	FE	PSR	FE	PSR	FE	PSR
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign · FinVul · Crisis	0.106**	0.174***	0.0112	-0.0107	0.470**	0.713***
	(0.0523)	(0.0311)	(0.0175)	(0.0179)	(0.184)	(0.118)
Observations	12,536	8,604	12,536	8,604	8,105	6,466
R^2 (within)	0.066	0.198	0.017	0.030	0.051	0.105

Notes: The table shows estimates of variants of equation (2). The dependent variable is the export share in columns (1) and (2), an export dummy in columns (3) and (4), and the log of export sales in columns (5) and (6). *Foreign* is a dummy variable indicating foreign ownership. *FinVul* is the financial vulnerability of the firm in 2008. *Crisis* is a dummy variable indicating the period 2009–2012. All estimations include the *Foreign* dummy, a full set of two-way interaction terms between *Foreign*, *FinVul*, and *Crisis*, as well as firm fixed effects and industry-year fixed effects. Robust standard errors (in parentheses) are clustered at the firm level. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

4.4 Foreign versus domestic corporate groups

Our analysis builds on the idea that foreign-owned firms can tap into additional funds via internal capital markets. However, domestically owned firms might also have access to such internal capital markets if they belong to a corporate group able to reallocate funds across multiple firms. Therefore, an interesting question is whether the financial advantage identified above derives from *foreignness* of the parent firm as such, or from membership in a corporate group of firms regardless of location (foreign or domestic).

The ESEE data set allows us to address this question. It directly asks firms every fourth year whether they belong to a corporate group (i.e., a group of multiple firms). We thus use this piece of information from the pre-crisis year 2006 in our analysis. In that year, around 14.5% of firms in Spanish manufacturing belonged to a corporate group (compared to 4.2% in foreign ownership). To understand how membership in a corporate group affected firm exports in the crisis, we augment our DiD and DiDiD specifications (with the year dummies collapsed into a *Crisis* dummy) by two interaction terms: *Corporate group · Crisis* and *Corporate group · FinVul · Crisis*, where *Corporate group* is a dummy variable indicating membership in a corporate group in 2006.

Table 5: Foreign versus domestic corporate groups

	Dependent variable: Export share (*exports/sales*)			
	FE	PSR	FE	PSR
	(1)	(2)	(3)	(4)
Foreign · Crisis	0.0258**	0.0394**	-0.0203	-0.0352**
	(0.0107)	(0.0182)	(0.0225)	(0.0177)
Foreign · FinVul · Crisis			0.104*	0.159***
			(0.0533)	(0.0376)
Corporate group · Crisis	0.0130*	0.0262**	0.0140	-0.00159
	(0.00744)	(0.0131)	(0.0122)	(0.0169)
Corporate group · FinVul · Crisis			-0.00127	0.0419
			(0.0238)	(0.0355)
Observations	12,574	8,882	11,900	8,570
R^2 (within)	0.060	0.101	0.069	0.200

Notes: The table shows estimates of equation (1) in columns (1) and (2) and of equation (2) in columns (3) and (4), with the additional interaction terms listed. The dependent variable is the export share. *Foreign* is a dummy variable indicating foreign ownership. *FinVul* is the financial vulnerability of the firm in 2008. *Crisis* is a dummy variable indicating the period 2009–2012. All estimations include the *Foreign* dummy, a full set of two-way interaction terms between *Foreign*, *FinVul*, and *Crisis*, as well as firm fixed effects and industry-year fixed effects. Robust standard errors (in parentheses) are clustered at the firm level. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

The results are reported in Table 5. The estimates from the augmented DiD model in columns (1) and (2), with and without reweighting, reveal that membership a corporate group was associated with higher export shares in the crisis. Importantly, the positive interaction effect between *Foreign* and *Crisis* is confirmed in these regressions, and it is evidently more important than corporate group membership, as the point estimates are almost twice the size of the differential corporate group membership effect. To investigate whether the latter is associated with internal capital markets, we add triple interaction terms with financial vulnerability (and all relevant two-way interactions) in columns (3) and (4). While our main finding on the financial advantage of foreign ownership is confirmed, the role of membership in a corporate group in the crisis is less clear, as we see no significant interaction effect with financial vulnerability. Hence, the evidence remains inconclusive as to whether the ability to reallocate funds across *domestic* firms in internal capital markets benefits exports. Rather, we find clear evidence suggesting that *foreignness* of the parent firm is crucial.

4.5 The market access channel

In this section we shed light on the role of foreign MNEs in providing their subsidiaries with access to export markets in the crisis (the market access channel). To this end we exploit a specific question in the ESEE survey that directly asks whether firms rely on the distribution network of their foreign parents for exporting. This question is unique to the ESEE data set and makes it a particularly valuable tool for studying the role of foreign ownership for exports (for other studies exploiting this feature of the data set see Guadalupe et al., 2012; Koch and Smolka, 2019). The question appears in the survey every four years, which allows us to study two related yet distinct aspects of the market access channel: First, we study the evolution of export shares through the crisis conditional on the use of the parent's distribution network as reported in 2006 (i.e., before the crisis). Second, we consider also changes in this variable between 2006 and the crisis year 2010, and focus on firms that started to use their foreign parent's distribution network in the crisis.

While the role of market access in promoting exports of foreign-owned firms in the crisis is interesting by itself, it is also of crucial importance in the context of our analysis for two reasons. First, the market access channel could be a confounding factor explaining our finding of a sizable and significant ownership differential in our DiD model that we might falsely attribute to the financial channel. Second, and more importantly, the market access channel and the financial channel of foreign ownership might be intertwined, in the sense that firms relying on their foreign parent's distribution channels face lower cost of exporting and hence have less financing needs. This would imply a twin financial advantage for foreign-owned firms: On the one hand, they can finance their export activities through funds available from their foreign parents, and on the other hand, they can reduce their financing needs by relegating distribution and marketing activities associated with exporting to their foreign parents.[26] In the following we explore these aspects in detail.

We start by investigating whether firms' exports performed better in the crisis if they used their foreign parents' distribution networks in 2006, which is pre-determined and hence exogenous to the crisis. Columns (1) and (2) in panel A of Table 6 report estimates of the DiD model augmented by an interaction term between *Use parent network*$_{2006}$ and *Crisis*, where the former is a firm-specific and time-constant dummy variable for the use of the foreign parent's distribution network for exporting in 2006.[27] Whether we look at the FE estimator or the PSR estimator, the results provide no indication that using this distribution channel on average helped to promote exports beyond the effect of foreign ownership per se. We obtain the same result in the DiDiD specification in columns (3) and (4), where our previous finding on the financial advantage of foreign owner-

[26] While the theoretical modeling of the market access channel is beyond the scope of our paper, it is clear that optimal decision-making on the part of the foreign MNE must involve the efficient allocation of scarce financial resources across subsidiaries as well as the efficient integration of subsidiaries into the MNE's distribution network.

[27] By definition, the foreign ownership dummy is equal to one in 2006 when *Use parent network*$_{2006}$ is one, but not vice versa.

ship is confirmed, but the interaction effect between *Use parent network*$_{2006}$ and *Crisis* remains insignificant.

An interesting pattern emerges as we focus explicitly on the firm's financial vulnerability. The specification in columns (5) and (6) augments the DiDiD model with a triple interaction term *Use parent network*$_{2006}$ $\cdot$ *FinVul* $\cdot$ *Crisis*, and thus provides insights into potential interdependencies between the market access channel and the financial channel. Specifically, if using the foreign parent's distribution network serves to reduce the cost of exporting, this should lower the financial burden on firms using this network, and hence the role of financial vulnerability in the crisis should be diminished for these firms. This intuition is confirmed in our regressions. The triple interaction effect *Foreign* $\cdot$ *FinVul* $\cdot$ *Crisis* is positive and significant, as before. By contrast, the triple interaction effect between *Use parent network*$_{2006}$, *FinVul*, and *Crisis* is negative and highly significant, at least when using the PSR estimator, indicating a less important role of financial vulnerability among firms that are exporting via their foreign parent's distribution network. These results suggest that foreign ownership fostered firm exports in the crisis by providing both credit and market access — but the use of the distribution network seems to be diminishing the value of internal capital markets.

To open up another perspective on the link between the financial channel and MNEs' distribution networks, we next exploit changes in the use of the market access channel over time. Given the difficulties in raising finance in the financial crisis, it seems reasonable to expect that the parent's distribution network has become a more attractive vehicle for exporting in the crisis. Indeed, our data reveal that the share of foreign-owned firms using this distribution channel increased considerably between 2006 and 2010, from 43.1% to 54.9%. This constitutes highly suggestive evidence that foreign-owned firms started using their parent's distribution network in response to the financial crisis in order to reduce exporting costs and mitigate liquidity problems. To identify the effect on exports, we run a series of regressions on a reduced sample, restricted to the years 2006 and 2010 (i.e., the two years around the crisis in which we have data on the market access channel). The central variable of interest that we add to our benchmark DiDiD model is the time-varying dummy variable *Use parent network*$_t$, the coefficient of which is identified only from within-firm variation over time. Notably, these regressions should not be interpreted as causal evidence on the market access channel, since the use of distribution networks plausibly changed due to the crisis and may hence be endogenous to exports.

Panel B of Table 6 investigates whether increased reliance on foreign parents' distribution networks helped in promoting exports in the crisis. To benchmark our estimates, columns (1) and (2) first validate our previous result on the financial channel of foreign ownership in the reduced sample for 2006 and 2010 using the FE and PSR estimators, respectively. Columns (3) and (4)

Table 6: Export market access via foreign parent's distribution network

	Dependent variable: Export share (*exports/sales*)					
	FE	PSR	FE	PSR	FE	PSR
	(1)	(2)	(3)	(4)	(5)	(6)
A. Using foreign parent's distribution network before the crisis (full panel)						
Foreign · Crisis	0.039***	0.063**	-0.009	-0.031	-0.011	-0.037**
	(0.0129)	(0.0304)	(0.0220)	(0.0160)	(0.0249)	(0.0154)
Foreign · FinVul			0.104**	0.173***	0.109*	0.179***
· Crisis			(0.0520)	(0.0311)	(0.0570)	(0.0271)
Use parent network 2006	-0.0215	-0.0347	-0.0159	-0.0096	-0.00304	0.0375*
· Crisis	(0.0149)	(0.0302)	(0.0138)	(0.0152)	(0.0259)	(0.0221)
Use parent network 2006					-0.0285	-0.109***
· FinVul · Crisis					(0.0540)	(0.0413)
Observations	15,627	8,859	12,536	8,604	12,536	8,604
R^2 (within)	0.055	0.101	0.067	0.198	0.067	0.201
B. Start using foreign parent's distribution network in the crisis (2006 vs. 2010)						
Foreign · Crisis	-0.046*	-0.061***	-0.075***	-0.075***	-0.054***	-0.043*
	(0.0259)	(0.0202)	(0.0257)	(0.0191)	(0.0209)	(0.023)
Foreign · FinVul · Crisis	0.156***	0.231***	0.202***	0.259***	0.157***	0.175***
	(0.0582)	(0.0372)	(0.0549)	(0.0319)	(0.0420)	(0.0497)
Use parent network$_t$			0.0429**	0.0437*	0.00949	-0.00123
			(0.0216)	(0.0236)	(0.0286)	(0.0302)
Use parent network$_t$ *· FinVul*					0.0820	0.0995**
					(0.0541)	(0.0465)
Observations	3,211	2,193	2,034	1,630	2,034	1,630
R^2 (within)	0.086	0.264	0.147	0.327	0.151	0.337

Notes: The table shows estimates of equation (1) in columns (1) and (2) of panel A and of equation (2) in all remaining columns, with the additional covariates listed. Panel A is based on the full estimation sample, while panel B is restricted to the years 2006 and 2010 when firms report their use of the foreign parent's distribution network. The dependent variable in all regressions is the export share. *Use parent network*$_{2006}$ is constant within firms, while *Use parent network*$_t$ is a time-varying variable. *Foreign* is a dummy variable indicating foreign ownership. *FinVul* is the financial vulnerability of the firm in 2008. *Crisis* is a dummy variable indicating the period 2009–2012. All estimations include the *Foreign* dummy, a full set of two-way interaction terms between *Foreign*, *FinVul*, and *Crisis*, as well as firm fixed effects and industry-year fixed effects. Robust standard errors (in parentheses) are clustered at the firm level. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

add the market access channel and show that firms which *started* using their parent's distribution network significantly improved their export performance in 2010. This is novel evidence that highlights the value of MNEs' distribution networks in the crisis.

In the final two columns of panel B, we interact the time-varying variable *Use parent network*$_t$ with the firm's financial vulnerability. The positive and significant interaction effect demonstrates

that the exports of financially vulnerable firms benefited the most from adopting the market access channel in the crisis. This is intuitive because doing so serves to lower the cost of exporting and thus to sidestep the associated financing requirements, which is especially beneficial for financially vulnerable firms. Note that this interpretation is in line with our conclusions from panel A, since we use a different type of variation in the data here. Firms that *already* relied on the parent's distribution network before the crisis (as measured in panel A) benefited less from internal capital markets because they had lower trade costs that required financing. Those that *started* using the parent's distribution network (in panel B) benefited the most if they were financially vulnerable.

Taken together, the evidence in Table 6 paints a consistent picture according to which foreign-owned firms were able to mitigate the impact of credit constraints in the crisis in two different ways: by borrowing abroad through the foreign parent, and by using the parent's distribution network to reduce exporting costs and the associated financing needs. Both of these channels have been important for foreign-owned firms in Spain during the global financial crisis.

4.6 The input price channel

One may conjecture that foreign ownership helped firms to reduce the costs of other inputs besides capital during the financial crisis. For instance, it is possible that firms were able to negotiate lower input prices with the backing of a multinational parent and that this benefit of foreign ownership became more important in the crisis. These considerations suggest an input price channel besides the credit channel and the market access channel that we have focused on so far.

It is another key advantage of the ESEE data set that it allows us to directly observe annual changes in firm-specific input prices, separately for energy, materials, and services inputs. Using this information, we can test for a differential evolution of input prices across ownership groups by estimating the DiD model (1) with the input price indices as alternative dependent variables. We also consider the log wage per worker as an outcome variable to examine changes in labor costs.

Online Appendix B.7 shows the estimation results of the DiD model (with and without PSR) in Panel A of Table B.7. There is no indication that energy prices or wages evolved differently for foreign vs. domestically owned firms over the crisis years. However, for materials and services the estimates suggest that foreign-owned firms indeed reduced their input prices compared to their domestically owned peers. Understanding the precise nature of these differential input price changes and investigating their relationship with the export performance of firms is beyond the scope of our paper. In the following, our focus is on ensuring that these changes do not compromise our strategy of identifying the credit channel of foreign ownership.

Specifically, our main analysis in Section 4.2 has exploited the fact that among foreign-owned firms some were more financially vulnerable than others. The goal of this DiDiD identification

strategy is to isolate the financial advantage from other, general benefits of foreign ownership that apply equally to all foreign-owned firms regardless of their financial situation. We now show that the input price channel constitutes such a general benefit, since it is uncorrelated with the firms' financial vulnerability, and hence our DiDiD strategy can successfully account for it.

We first consider unconditional correlations in the raw data between our measure of pre-crisis financial vulnerability and the input price changes over the crisis years, which are all close to zero.[28] We then implement a more ambitious, conditional test by estimating the DiDiD model (2) with firm-specific input prices and wages as alternative dependent variables. Panel B of Table B.7 reports the results. The triple interaction effects in the crisis years are estimated to be small and insignificant, which dispels concerns that price changes might bias our main analysis. There are two minor exceptions: First, the material input prices in 2008 increased by around 3% less for more financially vulnerable foreign-owned firms (compared to less financially vulnerable ones). Second, the PSR estimator points to higher wage increases among foreign-owned firms in 2007–2009. Although these differences are small and concern mainly the pre-crisis years, they may have implications for our main analysis; hence we account for them in a robustness check below (in Table 7).

To sum up, foreign-owned firms did benefit in the crisis from a reduction in the prices that they paid for materials and services inputs relative to other firms. But the differences in these (and other) input price changes were largely orthogonal to financial vulnerability and are therefore controlled for in our DiDiD analysis of the credit channel.

4.7 Robustness analysis

In this section, we offer several robustness checks supporting our main DiDiD result on the credit channel of foreign ownership. In particular, we address potential concerns related to (i) confounding factors at the firm level, (ii) the role of demand shocks in export markets, and (iii) the fractional response variable in our empirical model.

4.7.1 Confounding factors at the firm level

We begin by tackling concerns that firm-specific factors correlated with foreign ownership or financial vulnerability might confound our estimates. To do so, we modify our DiDiD specification in three different ways. First, we augment the model to include a comprehensive set of industry-size-year fixed effects, distinguishing between six different size groups of firms in terms of their number of employees ($\leq$20; 21–50; 51–100; 101–200; 201–500; $>$500).

[28]The correlation coefficients between financial vulnerability and price changes for the year 2009 are -0.091 for energy, 0.069 for materials, and 0.012 for services inputs.

Second, we include additional control variables at the firm level, viz. total factor productivity (TFP, in logs), capital intensity (in logs), skill intensity (in logs), R&D intensity, a direct measure of process innovation, and management quality (all lagged by one year), and we interact these variables with year dummies in order to allow for differential effects over time, especially during the financial crisis.[29] All of these variables account for the fact that foreign-owned firms innovate and invest in skills and technology to increase productivity when accessing new export markets, as shown by Guadalupe et al. (2012) and Koch and Smolka (2019). Including them in the regression shields our estimates against the possibility that these firm-level activities might have made the export demand of foreign-owned firms more resilient in the crisis. To directly exclude the possibility that our measure of financial vulnerability is inadvertently picking up the role of firm productivity as an underlying correlate, we also include a triple interaction of foreign ownership, TFP, and the crisis. In addition, we include firm-level price indices for energy, materials, and services inputs (also lagged and interacted with year dummies), which serves to clearly separate the credit channel from the input price channel discussed in Section 4.6.

Third, we extend the PSR approach by including proxies of financial health in the propensity score estimation, to account for the possibility that MNEs target financially vulnerable exporting firms (Manova et al., 2015).[30] In this extended PSR approach, we also allow for a firm's foreign ownership status to be influenced by its R&D intensity, its share of high-skilled workers, and the size group of the firm (included as a fixed effect). As in the baseline propensity score estimation, all of these variables are observed in 2006.

Columns (1) to (3) of Table 7 report the results corresponding to these different modifications. In the last column of the table, we combine all modifications in one estimation, i.e., we augment the model to include a richer set of fixed effects, we bring in additional firm-level covariates and interactions, and we use our extended PSR approach. The bottom line is that the estimated coefficient of our main triple interaction term proves to be highly robust to all of these modifications.

[29] Our measure of TFP is the index used by Delgado et al. (2002) based on the ESEE data. It is constructed as the log of the firm's output minus a cost-share weighted sum of the log of the firm's inputs. This approach goes back to Caves et al. (1982). We use a firm's average wage to proxy for its skill intensity, as this variable is available for every year in our data set, while a direct measure of skill intensity based on workers' educational background is available only for every fourth year. As for the firm's process innovation, the ESEE data include a dummy variable that indicates whether the firm implemented a process innovation in a given year. Our measure of process innovation sums across all past innovations from when the firm entered the sample up to the current period in order to represent the current level of technology. Differences in the level of technology when the firm entered the sample are accounted for through firm fixed effects. To measure management quality, we compute the average of all management innovations the firm reports across the years 2005–2012. Management innovations include innovations regarding a firm's sales channel, product design, pricing strategies, promotion activities, external relations management, and labor organization.

[30] We measure financial health by the firm's short-term debt (in logs) and debt ratio (total debt over total assets).

Table 7: Robustness – Controlling for confounding factors

	Dependent variable: Export share (*exports/sales*)			
	Richer FE structure	Firm-level controls	Extended PSR	All combined
	(1)	(2)	(3)	(4)
Foreign · FinVul · Crisis	0.173***	0.188***	0.172***	0.181***
	(0.0293)	(0.0267)	(0.0342)	(0.0272)
Foreign · TFP · Crisis		-0.0414		-0.0386
		(0.0344)		(0.0358)
Observations	8,604	7,105	7,513	6,197
R^2 (within)	0.277	0.200	0.217	0.373

Notes: The table shows estimates of variants of equation (2). The dependent variable is the export share. *Foreign* is a dummy variable indicating foreign ownership. *FinVul* is the financial vulnerability of the firm in 2008. *Crisis* is a dummy variable indicating the period 2009–2012. *TFP* is firm-level TFP (in logs and lagged by one year). All estimations include the *Foreign* dummy, a full set of two-way interaction terms between *Foreign*, *FinVul*, and the *Crisis* dummy, as well as firm fixed effects and industry-year fixed effects. Column (1) controls for industry-size-year fixed effects. Column (2) controls for *TFP* (in logs), capital intensity (in logs), skill intensity (in logs), R&D intensity, process innovation, management quality, and separate price index variables for energy, materials, and services (all lagged by one year and interacted with year dummies). It also includes the interaction between *Foreign* and *TFP*. Columns (1) and (2) employ PSR as described in the main empirical analysis; column (3) augments the propensity score estimation by adding a firm's short-term debt (in logs), debt ratio (total debt over total assets), R&D intensity, share of high-skilled workers (in logs), and size group as a fixed effect (all observed in 2006). Column (4) combines all modifications introduced in columns (1) to (3) in one estimation. Robust standard errors (in parentheses) are clustered at the firm level. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

4.7.2 Market-specific demand shocks

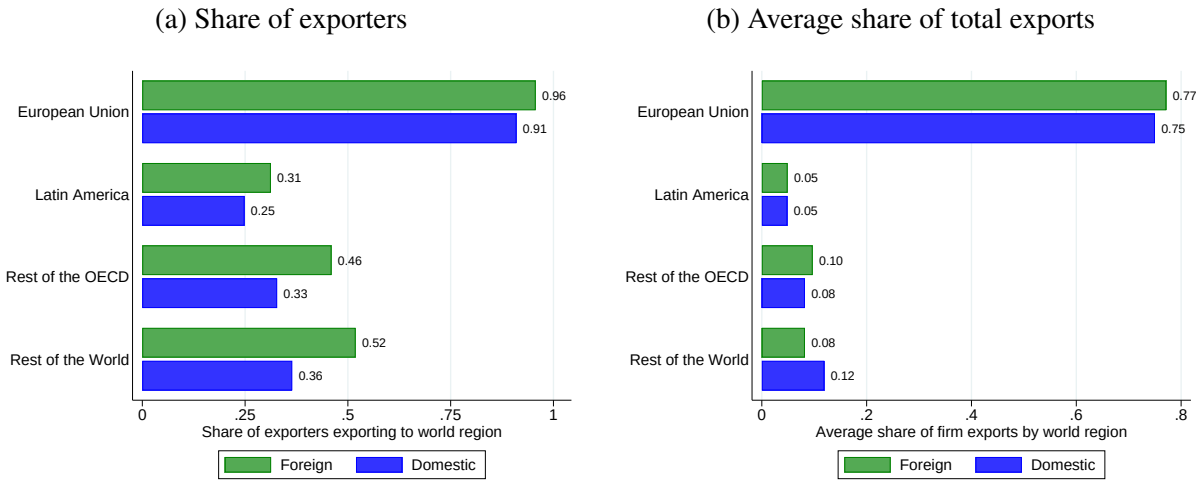
Next, we investigate whether the fact that some countries were hit much harder by the global financial crisis than others may confound our main estimation results. This could be the case if foreign-owned firms in Spain had a different geographic composition of exports than domestically owned firms already before the crisis. In particular, if foreign-owned firms were relatively more engaged in serving markets that turned out to be more robust in the crisis, then we should expect their exports to be more stable. In fact, more geographically distant markets, in particular across Asia, experienced a much smaller drop in aggregate demand than markets across Europe. And as we see in our data, foreign-owned firms are more likely to serve more distant markets. Hence, market-specific demand shocks could provide an alternative rationale for the superior export performance of foreign-owned firms in the crisis, besides the financial channel that we have stressed in our main analysis.[31]

Our data allow us to investigate the role of market-specific demand shocks by exploiting information on the composition of firms' exports by world region. We can distinguish firm exports

[31] However, we have no reason to expect that market-specific demand shocks are correlated with Spanish firms' financial vulnerability. Hence, our DiDiD results are not easily attributable to heterogeneous demand shocks.

in 2006 (before the crisis) and 2010 (during the crisis) to the following four world regions:[32] the European Union (EU), Latin America, other OECD countries, and the rest of the world (Africa, most of Asia, and Eastern Europe). While admittedly broad, this aggregation groups together countries with similar levels of income per capita and at a similar geographic and cultural distance to Spain. Also, the financial crisis had a very strong adverse effect on aggregate demand in the EU and other OECD countries, since the crisis originated in the U.S. and spilled over quickly to Western Europe, whereas Latin America and the rest of the world were less affected. This fact is clearly reflected in our micro data, which show that Spanish firms' real exports to other EU countries declined between 2006 and 2010, while they were growing for the other three destinations, at average annualized rates between 5% and 11%.

Figure 3: Regional composition of exports by ownership status (2006)



Notes: This figure illustrates the composition of exports by world region for the year 2006, distinguished by firms in foreign vs. domestic ownership. Panel (a) shows the share of exporters with positive export sales for each world region; panel (b) shows the average share of an exporter's total exports for each world region. Sampling weights apply. *Source:* Authors' computations based on ESEE data.

Figure 3 illustrates the composition of firm exports by world region, separately for exporters in foreign vs. domestic ownership. Panels (a) and (b) show the respective shares of exporters (the extensive margin) and export volumes (the intensive margin) for each world region in the pre-crisis year 2006. Three observations are important in the context of our analysis. First, the overall picture looks rather similar across the two ownership groups: the EU is by far the dominant export market independent of ownership status. It is served by more than 90% of exporters and receives on average around three quarters of a firm's total exports. At the intensive margin, the shares of exports going to each world region are almost identical for firms in foreign and domestic ownership,

[32] Data at a higher frequency or on exports disaggregated by country of destination are not available in the ESEE.

with the difference between the two ownership groups never exceeding four percentage points. Second, conditional on being an exporter, foreign-owned firms are more likely to serve any given market (including the EU). This also implies that foreign-owned firms are more likely to serve multiple markets simultaneously.[33] Third, foreign-owned firms are more likely to export to more distant world regions than domestically owned firms. The gap is largest for the geographically and culturally distant markets in the rest of the world (36% vs. 52%). This observation is consistent with the presumption that foreign-owned firms are better able to cover the higher costs of accessing more distant markets. These differences at the extensive margin point to the possibility that foreign-owned firms were on average exposed to more favorable demand shocks in the crisis than domestically owned firms.

We now assess whether these differences in the composition of exports coupled with market-specific demand shocks have any bearing on our main findings. To this end, we augment our DiDiD specification (2), with the *Crisis* dummy replacing the year dummies, by a set of interaction terms of the *Crisis* dummy with the shares of exports destined for each world region (as observed in 2006). These pre-crisis shares capture the exposure of a firm to demand shocks in different world regions. Since the four shares are perfectly multicollinear, we omit the EU share as a base category. This analysis is restricted to firms with positive exports in 2006, as the shares are not defined for non-exporters.

The estimates are reported in Table 8. For the sake of comparison, the first two columns show the results from estimating our baseline DiDiD specification in the sample of firms with positive exports in 2006. The results are similar to the ones we obtain when using the full sample of firms; see columns (1) and (2) of Table 4. In columns (3) and (4), we add the interaction terms controlling for the regional composition of firm exports in 2006. The estimates show that shipping a larger share of exports to the rest of the world (e.g. Asia) *before* the crisis was clearly conducive to firm exports *during* the crisis. However, our estimates of the triple interaction effects are virtually identical to those in columns (1) and (2) for each estimator. These findings suggest that the differential exposure to market-specific demand shocks across firms does not confound our main estimates of the financial benefit of foreign ownership for firm exports in the crisis.

A related issue concerns the fact that foreign and domestically owned firms might differ in terms of the number and location of their foreign affiliates. The presence of foreign affiliates might help firms to switch from serving a foreign market via exporting to serving it via horizontal FDI. To see whether this possibility is relevant in the context of our analysis, we estimate a specification that further includes a set of interaction terms between the *Crisis* dummy and dummy variables

[33] We have also checked that this difference in the scope and diversification of exports per se is not driving our results. The positive estimate for our main triple interaction effect is robust to controlling for interaction terms of the *Crisis* dummy with the number of international markets served by a firm before the crisis.

Table 8: Robustness – Controlling for demand shocks by world regions

	Dependent variable: Export share (*exports/sales*)					
	FE	PSR	FE	PSR	FE	PSR
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign · FinVul · crisis	0.124**	0.192***	0.125**	0.193***	0.126**	0.194***
	(0.0530)	(0.0296)	(0.0529)	(0.0291)	(0.0527)	(0.0285)
Export share Latin America · crisis			0.00797	0.0387	0.00734	0.0296
			(0.0249)	(0.0334)	(0.0253)	(0.0328)
Export share rest of OECD · crisis			0.0144	0.0219	0.0157	0.0218
			(0.0186)	(0.0249)	(0.0185)	(0.0244)
Export share rest of world · crisis			0.0503***	0.0702***	0.0518***	0.0728***
			(0.0178)	(0.0239)	(0.0178)	(0.0239)
Affiliates EU · crisis					0.0115	0.0067
					(0.0114)	(0.0134)
Affiliates Latin America · crisis					0.00395	0.0211
					(0.0164)	(0.0186)
Affiliates rest of OECD · crisis					-0.00707	-0.00978
					(0.0219)	(0.0281)
Affiliates rest of world · crisis					-0.0201	-0.0388
					(0.0239)	(0.0239)
Observations	7,482	6313	7,482	6,313	7,482	6,313
R^2 (within)	0.083	0.218	0.085	0.221	0.086	0.223

Notes: The table shows estimates of variants of equation (2) augmented by the listed interaction terms. The dependent variable is the export share. *Foreign* is a dummy variable indicating foreign ownership. *FinVul* is the financial vulnerability of the firm in 2008. *Crisis* is a dummy variable indicating the period 2009–2012. All estimations include the *Foreign* dummy, a full set of two-way interaction terms between *Foreign*, *FinVul*, and *Crisis*, as well as firm fixed effects and industry-year fixed effects. Robust standard errors (in parentheses) are clustered at the firm level. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

indicating the presence of foreign affiliates in each world region in 2006. We find no evidence that firms with foreign affiliates in a given world region experienced a more or less pronounced decline in exports during the crisis; see columns (5) and (6) of Table 8.

4.7.3 Fractional probit estimations

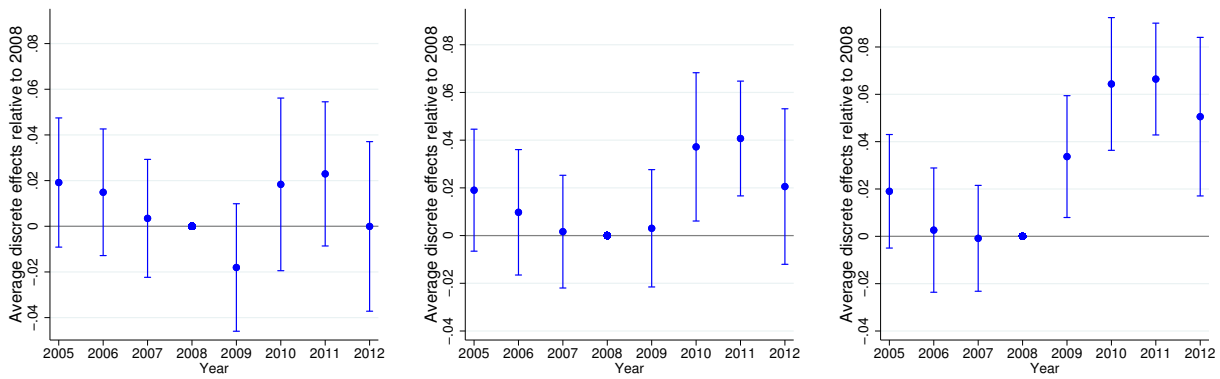
Next, we account for the fact that our dependent variable, the export share, is a fractional response variable that is naturally bounded between zero and one. For this reason, our linear fixed effects estimator may deliver inconsistent estimates of the treatment effect. To evaluate whether this is a problem in our application, we estimate a fractional probit model. Two complications arise with this approach: First, it does not allow controlling for firm fixed effects without introducing an incidental parameters problem into the estimation. Second, due to the non-linearity of the model, the triple interaction effect that we are interested in is not simply equal to the coefficient of the

interaction term.

To address the first issue, we use a Mundlak–Chamberlain device in estimating a correlated random effects version of equation (2). This approach replaces the firm fixed effects by firm-specific averages of all time-varying covariates (including all interaction terms), as in Papke and Wooldridge (2008). We also reweight the fractional probit regression by the estimated propensity scores. To address the second issue, we compute average discrete effects of foreign ownership, evaluated in different years and at different levels of financial vulnerability.

Figure 4: Fractional probit – Average discrete effects of foreign ownership relative to 2008

(a) Low financial vulnerability (b) Medium financial vulnerability (c) High financial vulnerability



Notes: This figure illustrates the average discrete effects of *Foreign* on the *Export share* in each year relative to 2008, evaluated at low, medium, and high levels of financial vulnerability, as represented by the 25th percentile (Figure 4(a)), the median (Figure 4(b)), and the 75th percentile (Figure 4(c)) of the short-term debt-to-sales ratio (*FinVul*) in 2008. They are estimated from fractional probit models with the same control variables as in equation (2), reweighted by the estimated propensity score, and accounting for firm-specific effects by including firm-specific averages of all time-varying covariates.

Figure 4 summarizes the estimation results from the fractional probit model. It displays the effect of foreign ownership on the export share in each year relative to 2008. The effects are evaluated at different levels of financial vulnerability, corresponding to the 25th, 50th, and 75th percentile of the in-sample distribution of *FinVul*, in panels (a), (b), and (c), respectively. For a low level of financial vulnerability, we find no significant differences in the effects, neither before nor after 2008. For a medium level of financial vulnerability, we continue to find no significant differences over the pre-crisis years, but the effects are positive and significant for 2010 and 2011. For a high level of financial vulnerability, we find that foreign ownership caused a significant increase in the export share in all years from 2009 through 2012 relative to 2008. These results strongly support our main conclusions based on the linear model.

5 Conclusions

Foreign-owned firms are exceptionally successful on export markets along various margins. In this paper, we argue theoretically and empirically that this fact can be explained by the role of foreign ownership in mitigating financial constraints. In terms of theory, we introduce ownership differences in access to finance into a canonical trade model featuring firm heterogeneity and financial market imperfections (Manova, 2013). In the model, foreign-owned firms can raise export finance by tapping into additional funds via their foreign parent's internal capital market, an option that is unavailable to domestically owned firms. This provides foreign-owned firms with a financial advantage that allows them to maintain higher export levels and shares than their domestically owned competitors. Crucially, the model predicts that this financial advantage of foreign ownership will be more pronounced among financially vulnerable firms.

In our empirical analysis, we exploit rich firm-level data from Spain and leverage the global financial crisis as an exogenous shock to financial market conditions. We propose a triple differences identification strategy that exploits variation in the ownership structure of firms (foreign vs. domestic), the timing of the financial crisis, and firms' financial vulnerability just before the crisis. Our estimations reveal clear-cut evidence that the credit supply shock in the financial crisis increased the exports of foreign-owned compared to domestically owned firms. Consistent with a financial advantage of foreign ownership, we find that this differential effect was significantly larger among firms that entered the crisis with higher degrees of financial vulnerability.

We further contribute to the literature by investigating how using the distribution network of their foreign parent contributed to promoting the exports of foreign-owned firms in the crisis. This allows us to shed light on hitherto unexplored interdependencies between this market access channel and the credit channel discussed before. The evidence suggests that using their parent's distribution network serves to reduce the exporting costs of foreign-owned firms and thereby mitigates financial problems. Consistent with this interpretation, exports in the crisis were increasingly channeled through the foreign parents' distribution network.

Our findings point to significant firm-level complementarities between FDI and trade, which gained particular importance in the crisis. More specifically, the financial advantage of foreign ownership that we have identified suggests that multinational firms can play an important role in circumventing cross-border frictions in financial markets, which in turn proves to be particularly beneficial for international trade. These interdependencies should be duly taken into account in designing effective policies regulating FDI and trade.

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Online Appendix to: Firm Exports, Foreign Ownership, and the Global Financial Crisis *(not for publication)*

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A Theory Appendix

In this appendix, we formalize the theoretical argument presented in Section 2 in the paper.

A.1 General setup

Consider a world of two countries.[34] Consumers are homogenous and identical across countries with preferences given by a Cobb-Douglas aggregate over industries j:

$$U = \prod_j \left[\int_{\omega \in \Omega_j} q_j(\omega)^{\frac{\sigma-1}{\sigma}} \mathrm{d}\omega \right]^{\theta_j \frac{\sigma}{\sigma-1}},$$

where $\omega \in \Omega_j$ refers to a specific variety of industry j, $\sigma > 1$ is the constant elasticity of substitution (CES) between any two varieties, and $\theta_j \in (0,1)$ is the consumer's expenditure share on industry j. Demand for each variety follows as

$$q_j(\omega) = p_j(\omega)^{-\sigma} \theta_j Y P_j^{\sigma-1}, \tag{A.1}$$

where Y is aggregate income, $p_j(\omega)$ is the price of variety ω in industry j, and $P_j = \left[\int_{\omega \in \Omega_j} p_j(\omega)^{1-\sigma} \mathrm{d}\omega \right]^{\frac{1}{1-\sigma}}$ is the CES price index.

[34] We focus on the two-country case for simplicity. Extending the setup to a large number of countries is straightforward. In anticipation of our empirical analysis, the two countries in our setup may be thought of as Spain and the rest of the world. We neglect the country index where it is not essential to keep the notation simple.

Each industry is characterized by a continuum of heterogeneous firms in monopolistic competition. As in Melitz (2003), firms are identical ex ante and may choose to pay a sunk entry cost equal to $b_j f_E$. Upon entry, each firm draws its productivity $1/a$ from a known distribution $G(a)$ with support $[\underline{a}, \overline{a}]$, $\overline{a} > \underline{a} > 0$. For a high enough productivity draw, the firm will start producing; otherwise it will exit immediately. Since a is specific to the firm and each firm produces a distinct variety, we henceforth use a to index variety ω. The minimum unit-cost function is given by $b_j a$, where b_j is the cost of a cost-minimizing input bundle.

To service a specific market, the firm has to incur fixed market-access costs and variable trade costs. More precisely, fixed costs are equal to $b_j f_X$ for exporting and $b_j f_H$ for servicing the home market. We make the standard assumption that the fixed costs of market access, marketing, and distribution are higher in the export market: $f_X > f_H > 0$. Variable costs of exporting take the usual iceberg form, such that $\tau > 1$ units of the good need to be shipped in order for one unit to arrive in the other country. These assumptions imply the standard Melitz-type selection into exporting.

A.2 Trade finance

As in Manova (2013), we relax the assumption of perfect capital markets that is implicit in Melitz (2003). We assume that firms must finance a share $d(a) \in (0, 1)$ of all costs associated with exporting (production costs as well as fixed and variable trade costs) through an investor, while all other costs are financed internally. The parameter $d(a)$ thus reflects a firm's financial vulnerability, which will play a key role in our analysis. Since the availability of internal funds may differ across firms, we assume that $d(a)$ is firm specific. The investor will be repaid with exogenous probability $\lambda \in (0, 1)$ due to frictions in the capital market. This notion of credit constraints is agnostic about the underlying source of the financial friction, but simply invokes that credit will not be repaid with certainty if financial markets function imperfectly.

We first consider the profit-maximization problem of a domestically owned firm. Such a firm must, by assumption, borrow the required funds from a domestic bank. We assume that there is a large number of domestic banks in perfect competition and that all parties are risk neutral. As a result, the firm maximizes its expected profits from exporting:

$$\Pi_X(a) = p_j(a)q_j(a) - [1 - d(a)]\,[q_j(a)\tau b_j a + f_X b_j] - \lambda R(a) \tag{A.2}$$

$$\text{subject to} \quad R(a) \leq p_j(a)q_j(a) - [1 - d(a)]\,[q_j(a)\tau b_j a + f_X b_j]\,, \tag{FC}$$

$$\text{and} \quad \lambda R(a) \geq (1 + r_D)\,[d(a)\,(q_j(a)\tau b_j a + f_X b_j)]\,, \tag{PC-D}$$

and subject to demand from equation (A.1).[35] The financial constraint (FC) states that the firm cannot repay more than its total export revenue. The participation constraint of the domestic investor (PC-D) states that her net return (expected repayment minus credit) must exceed her outside option. The investor's outside option reflects the returns from investing the amount of credit (the term in brackets) into an alternative project at the real interest rate $r_D > 0$ that prevails in the domestic capital market.

Since capital markets are perfectly competitive, investors are paid their outside option and equation (PC-D) holds with equality in equilibrium. We can plug this condition and demand from equation (A.1) into equation (A.2). Solving this maximization problem for highly productive firms that face no binding financial constraint yields optimal prices $p_j^*(a)$ and quantities $q_j^*(a)$:

$$p_j^*(a) = \frac{\sigma}{\sigma - 1}\left[1 - d(a) + (1 + r_D)d(a)\right]\tau b_j a \quad \text{and} \tag{A.3}$$

$$q_j^*(a) = \left(\frac{\sigma}{\sigma - 1}\left[1 - d(a) + (1 + r_D)d(a)\right]\tau b_j a\right)^{-\sigma} \theta_j Y P_j^{\sigma-1}. \tag{A.4}$$

Some domestically owned firms have a high enough productivity to become exporters, but face a binding financial constraint, so they cannot export at first-best levels. These constrained exporters have productivity levels below the threshold $1/a_H^D$, which is obtained by plugging the optimal price and quantity along with the binding participation constraint into the binding financial constraint:

$$\frac{1}{a_H^D} = \left[\frac{\left[1 - d(a) + (1 + r_D)d(a)/\lambda\right]\left(\frac{\sigma}{\sigma-1}\left[1 + r_D d(a)\right]\right)^{\sigma}}{\frac{\sigma}{\sigma-1}\left[1 + r_D d(a)\right] - \left[1 - d(a)\right] - (1 + r_D)d(a)/\lambda}\right]^{\frac{1}{\sigma-1}} \left(\frac{f_X b_j^{\sigma}}{\theta_j Y}\right)^{\frac{1}{\sigma-1}} \frac{\tau}{P_j}. \tag{A.5}$$

Firms with productivity levels just below this threshold will export a smaller quantity (at a higher price) than in the first-best case, in order to lower the repayment required by the investor. The optimal prices $p_j^{**}(a)$ for constrained exporters are determined by the binding financial constraint and can be obtained by plugging equation (A.1) and equation (PC-D) into equation (FC), all holding with equality:

$$p_j^{**}(a)^{1-\sigma} - p_j^{**}(a)^{-\sigma}\tau b_j a\left[1 - d(a) + (1 + r_D)d(a)/\lambda\right] = \frac{f_X b_j\left[1 - d(a) + (1 + r_D)d(a)/\lambda\right]}{\theta_j Y P_j^{\sigma-1}}. \tag{A.6}$$

As demonstrated in Section A.3, the left-hand side of equation (A.6) is increasing in the optimal price, while the right-hand side is constant. Hence, equation (A.6) implicitly pins down the optimal

[35] We depart from the program formulated by Manova (2013, her Web Appendix, equation 2) in two ways. First, we abstract from collateral since it plays no role in our empirical analysis. Allowing for firms to pledge a certain share of the fixed entry costs as collateral is straightforward, but does not change our theoretical predictions. Second, we allow for a non-zero outside option of the investor, such that the interest rate can play a relevant role in the model.

prices $p_j^{**}(a)$ for constrained exporters, which are negatively related to the quantity sold (via the demand schedule in equation (A.1)) and the associated export revenues.

Another productivity threshold for domestically owned firms, $1/a_L^D$, separates exporters from firms serving only the domestic market. The highest price that constrained exporters may want to set is

$$p_L(a) = \frac{\sigma}{\sigma - 1} \tau b_j a \left[1 - d(a) + (1 + r_D) d(a)/\lambda\right], \tag{A.7}$$

which maximizes the left-hand side of equation (A.6). Firms with productivity levels below $1/a_L^D$ cannot compensate the investor even if they set this price and offer all revenues as a repayment to the investor. Formally, we obtain $1/a_L^D$ by plugging $p_L(a)$ from equation (A.7) back into equation (A.6):

$$\frac{1}{a_L^D} = \frac{\sigma}{\sigma - 1} \left[1 - d(a) + (1 + r_D) d(a)/\lambda\right]^{\frac{\sigma}{\sigma-1}} \left(\frac{\sigma f_X b_j^\sigma}{\theta_j Y}\right)^{\frac{1}{\sigma-1}} \frac{\tau}{P_j}. \tag{A.8}$$

Our assumptions imply that domestically owned firms sort into different activities based on their productivity levels. This is illustrated in Figure A.1 (above the horizontal line). While the least productive firms below the entry cut-off $1/a_E$ exit the market immediately, those with productivity levels equal to $1/a \in [1/a_E, 1/a_L^D)$ remain active, but serve only the domestic market. Constrained exporters with productivity levels equal to $1/a \in [1/a_L^D, 1/a_H^D)$ serve both the domestic and the export market, but they export lower quantities at higher prices than in the first-best case. Only the most productive firms export at first-best levels.

A.3 Foreign ownership and internal capital markets

We now proceed by adding foreign-owned firms to the picture. Our focus is exclusively on the *financial aspects* of foreign ownership. In particular, we assume that foreign-owned firms have access to the foreign capital market through their foreign parent (at zero cost). This assumption is motivated by ample evidence showing that MNEs use internal capital markets to finance the activities of their subsidiaries (see e.g. Desai et al., 2004; Egger et al., 2014). For domestically owned firms, in contrast, we make the simplifying assumption that the cost of finding and contracting a suitable investor abroad is prohibitively high.

To keep matters simple, all differences between the domestic and foreign capital markets are summarized by the real interest rate differential. We denote the real interest rate in the foreign capital market by r_F. In the context of our analysis, it can be interpreted as the lowest interest rate at which the multinational parent can borrow foreign capital and lend to its affiliate in the domestic economy.

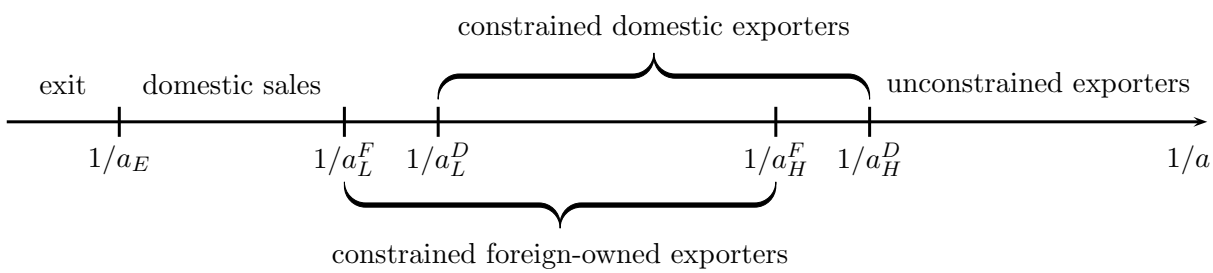
The optimization problem of a foreign-owned firm is identical to that of a domestically owned firm except for that fact the foreign-owned firm must additionally decide between domestic and for-

eign capital to finance its export activities. Depending on this choice, the firm faces either (PC-D) or the participation constraint of the foreign investor:

$$\lambda R(a) \geq (1 + r_F) \left[d(a) \left(q_j(a) \tau b_j a + f_X b_j \right) \right]. \tag{PC-F}$$

It is obvious from comparing the two participation constraints (PC-D) and (PC-F) that foreign-owned firms will opt for foreign capital if $r_F < r_D$, and for domestic capital if $r_F > r_D$.[36] While in principle both cases are possible, we will focus below on the interesting case of $r_F < r_D$ for three reasons. First, this case seems more likely to arise in view of the fact that MNEs can potentially raise funds in multiple foreign countries, by virtue of their international scope, and can raise funds directly in the financial market via the issuance of corporate bonds, by virtue of their size. Second, this case is consistent with our firm data, which show that foreign-owned firms pay a lower average interest rate on their debt in all years (see Figures 2(e) and 2(f) in the paper). Third, and most importantly, the case of $r_F < r_D$ implies a financial advantage of foreign ownership and can therefore deliver differential predictions for the effect of a credit shock across ownership groups.[37]

Figure A.1: Sorting of firms by productivity for $r_F < r_D$



As a consequence, the foreign interest rate r_F replaces r_D in the (otherwise unchanged) equilibrium conditions (A.5) and (A.8) for foreign-owned firms. These conditions pin down two productivity cut-offs for foreign-owned firms in analogy to those derived for domestically owned firms, namely the export cut-off $1/a_L^F$ and the first-best export cut-off $1/a_H^F$. Crucially, we obtain $1/a_L^F < 1/a_L^D$ and $1/a_H^F < 1/a_H^D$, so the two cut-offs for foreign-owned firms lie strictly to the left of the corresponding cut-offs for domestically owned firms, as illustrated in Figure A.1. This sorting pattern arises because the cut-offs are strictly increasing in the interest rate. Since foreign-owned firms have access to cheaper credit, they are not only more likely to export, but they are also

[36] For the knife-edge case of $r_F = r_D$, firms are indifferent between domestic and foreign capital.

[37] A situation with $r_D \leq r_F$ may arise in case the MNE is itself liquidity constrained and the outside option of investing the available funds in another affiliate promises higher returns than r_D. However, even in this case, foreign-owned firms are not worse off than domestically owned firms because they can always choose to borrow from domestic banks at r_D.

more likely to export first-best quantities.

A.4 The impact of the financial crisis as a deterioration of financial market conditions

We are interested in how the credit crunch in the financial crisis affected the export shares (*exports/sales*) of domestically owned relative to foreign-owned firms. In our framework, the credit crunch can impact firms via two channels. The first channel is an efficiency loss in the capital market, reflected in a drop in the repayment probability λ. The second channel is an increase in credit costs modeled by a rise in the interest rates r_D and r_F (or the interest rate differential $r_D - r_F$). We choose to focus on the first case in this section and consider the second case in Section A.5. Our first approach is motivated by the fact that the financial crisis substantially increased the uncertainty of loan repayments, beyond the uncertainty associated with firms' fundamental characteristics. Around the peak of the financial crisis, marked by the bankruptcy of Lehman Brothers in September 2008, even loan repayments by major financial institutions were perceived as uncertain, which brought the interbank lending market to the verge of collapse. We view the deterioration of capital market efficiency reflected in the drop in λ as a temporary but global shock.

We know from the analysis above that firms of ownership type $f \in \{D, F\}$ with productivity levels below $1/a_L^f$ will not export at all, and those with very high productivity levels above the cut-off $1/a_H^f$ are not credit constrained and hence export at first-best levels. The model predicts that the drop in λ will raise these cut-offs and induce some firms to exit the export market. Empirically speaking, these effects of the financial crisis on export market entry and exit turn out to be small and insignificant in Spain (see Section 4.3 and Eppinger et al., 2018). Hence, our discussion focuses on those firms that are constrained exporters before and after the credit shock. These are the firms with productivity levels in the critical interval $\left[1/a_L^D(\lambda_{crisis}), 1/a_H^F(\lambda_{initial})\right)$.[38]

Since $r_F < r_D$, all foreign-owned exporters choose foreign financing both before and after the shock. Equation (A.6) delivers an implicit solution for $p_j^{**}(a)$ for constrained exporters depending on their ownership type, which determines the interest rate they are facing $r_f, f \in \{D, F\}$, and depending on their internal funds $d(a)$. It allows us to derive the effect of a change in λ on prices $p_j^{**}(a)$ conditional on these characteristics. Comparative statics for export quantities $q_j^{**}(a)$ and export revenues $p_j^{**}(a)q_j^{**}(a)$ follow from this, as they are inversely related to $p_j^{**}(a)$ via the demand schedule from equation (A.1).

These considerations imply that a deterioration in capital market efficiency λ reduces the export revenues of all constrained exporters. Since domestic sales are financed internally and remain un-

[38]The effects operating through export market entry and exit generally work in the same direction as the ones we focus on here. They can be thought of as reinforcing the adverse effect of the financial crisis on total exports and its differential effect across foreign and domestically owned firms.

affected by changes in λ, this translates directly into a reduction of firms' export shares. Crucially, the effect is larger for domestically owned firms, since they face a higher interest rate r_D. Intuitively, as financial frictions worsen, the financial advantage of foreign ownership becomes more important. By a similar logic, the differential effect will be larger among more financially vulnerable firms that have less internal funds available (a high $d(a)$). These predictions are summarized in Proposition 1, restated here for convenience:

Proposition 1 *Among constrained exporters, (i) a deterioration in capital market efficiency raises the export shares of foreign-owned firms relative to domestically owned firms, and (ii) this differential effect is larger among more financially vulnerable firms.*

Proof. The left-hand side (LHS) of equation (A.6) is increasing in the price in the relevant range $p_j^{**}(a) \in [p_j^*(a), p_L(a)]$:

$$\begin{aligned}\frac{\partial LHS}{\partial p_j^{**}(a)} &= (1-\sigma)p_j^{**}(a)^{-\sigma} + \sigma p_j^{**}(a)^{-1-\sigma}\tau b_j a\left[1-d(a)+(1+r_D)d(a)/\lambda\right] \\ &\geq \left((1-\sigma)\frac{\sigma}{\sigma-1}\left[1-d(a)+(1+r_D)d(a)\right]\tau b_j a + \sigma\tau b_j a\left[1-d(a)+(1+r_D)d(a)/\lambda\right]\right)p_j^{**}(a)^{-1-\sigma} \\ &= (1+r_D)d(a)\left(\frac{1-\lambda}{\lambda}\right)\sigma\tau b_j a p_j^{**}(a)^{-1-\sigma} > 0\end{aligned}$$

where the first inequality follows from plugging in the lowest optimal price $p_j^*(a)$ from equation (A.3) for $p_j^{**}(a)$ and the second follows from the fact that all parameters and prices are non-negative and $\lambda \in (0,1)$. Trivially, the right-hand side (RHS) of equation (A.6) is independent of the price.

To determine the impact of a deterioration in capital market efficiency λ on the optimal price of constrained exporters, we take the derivatives of LHS and RHS with respect to λ:

$$\begin{aligned}\frac{\partial LHS}{\partial \lambda} &= p_j^{**}(a)^{-\sigma}\tau b_j a(1+r)d(a)/\lambda^2 > 0, \qquad \text{and} \qquad \frac{\partial RHS}{\partial \lambda} = -\frac{f_X b_j(1+r)d(a)}{\theta_j Y P_j^{\sigma-1}\lambda^2} < 0, \\ \frac{\partial^2 LHS}{\partial \lambda \partial r} &= p_j^{**}(a)^{-\sigma}\tau b_j a d(a)/\lambda^2 > 0, \qquad \text{and} \qquad \frac{\partial^2 RHS}{\partial \lambda \partial r} = -\frac{f_X b_j d(a)}{\theta_j Y P_j^{\sigma-1}\lambda^2} < 0.\end{aligned}$$

Hence, a decrease in λ increases the optimal price for constrained exporters and this effect is stronger for higher interest rates. Due to $r_F < r_D$, the effect will be stronger for domestically owned firms compared to foreign-owned firms (while both types of firms are equally affected for $r_F \geq r_D$). Also, the effect is stronger for more financially vulnerable firms that need to finance a larger share $d(a)$ of exporting costs:

$$\frac{\partial^3 LHS}{\partial \lambda \partial r \partial d(a)} = p_j^{**}(a)^{-\sigma}\tau b_j a/\lambda^2 > 0, \quad \text{and} \quad \frac{\partial^3 RHS}{\partial \lambda \partial r \partial d(a)} = -\frac{f_X b_j}{\theta_j Y P_j^{\sigma-1}\lambda^2} < 0.$$

The comparative statics for quantities $q_j^{**}(a)$ and export revenues $p_j^{**}(a)q_j^{**}(a)$ follow from these results. They are the opposite of the price effects because quantities sold are inversely related to the price $p_j^{**}(a)$ via the demand schedule in equation (A.1). Thus, both export quantities and export revenues (i) decrease in response to a decrease in λ, (ii) they decrease more for domestically owned firms facing the higher interest rate, and (iii) this differential effect is stronger for more financially vulnerable firms.

Since firms finance all domestic activities internally and foreign-owned firms borrow at the unaffected foreign interest rate $r_F < r_D$, the comparative statics regarding the export revenues translate directly into the export share $=$ *exports*$/($*exports* $+$ *domestic sales*$)$ because domestic sales are unaffected by financial market conditions. ■

A.5 The impact of the financial crisis as an increase in the real interest rate

In this section, we pursue an alternative modeling of the financial crisis as an increase in the domestic interest rate r_D relative to the foreign interest rate r_F (rather than a drop in λ). To keep the analysis simple, we model the financial crisis in this scenario as an increase in r_D, while r_F remains constant. The smaller drop in the foreign interest rate, at which foreign-owned firms can borrow, may be rationalized by a combination of three facts: the sheer size of most multinational firms, the large liquidity of international capital markets, and the geographical asymmetry of the crisis. In general, large multinational firms have multiple sources of financing, could offer substantial collateral also in the crisis, and continued to have access to thicker foreign capital markets. Most importantly, the financial crisis had an asymmetric effect across world regions, leaving banks in some countries (notably in East Asia and Eastern Europe) hardly affected at all. Arguably, multinational firms, and hence their affiliates, are more likely to have access to credit from such banks. They could tap the source of finance for which the interest rate remained lowest in the crisis.

For $r_F < r_D$, all foreign-owned firms access the foreign capital market both before and after the shock. In this case, we only need to consider how an increase in the real interest rate r_D affects the export shares of domestically owned firms: $\partial(\textit{exports}/\textit{sales})/\partial r_D$. If the sign of this derivative is negative, foreign-owned firms will *ceteris paribus* maintain a higher export share in the crisis.

To determine the impact of an increase in r_D on the optimal price of constrained exporters, we take the derivatives of LHS and RHS with respect to r_D. It is easy to see from equation (A.6), that LHS is decreasing in r_D, while RHS is increasing in r_D:

$$\frac{\partial LHS}{\partial r_D} = -p_j^{**}(a)^{-\sigma}\tau b_j a d(a)/\lambda < 0, \quad \text{and} \quad \frac{\partial RHS}{\partial r_D} = \frac{f_X b_j d(a)}{\theta_j Y P_j^{\sigma-1}\lambda} > 0.$$

Constrained exporters will increase their optimal price in response to an increase in r_D and this

differential effect is stronger for more financially vulnerable firms:

$$\frac{\partial^2 LHS}{\partial r_D \partial d(a)} = -p_j^{**}(a)^{-\sigma}\tau b_j a/\lambda < 0, \quad \text{and} \quad \frac{\partial^2 RHS}{\partial r_D \partial d(a)} = \frac{f_X b_j}{\theta_j Y P_j^{\sigma-1}\lambda} > 0.$$

It follows by a similar argument as in Section A.4 that export quantities, export revenues, and export shares for constrained exporters decrease in response to an increase in r_D. Foreign-owned firms' exports, in contrast, are unaffected by this shock as long as they can borrow at $r_F < r_D$. The resulting, differential effect is larger for financially vulnerable firms, in analogy to Proposition 1.

Interestingly, the optimal prices and quantities for unconstrained exporters also depend on the interest rate via the investor's participation constraint. This can be easily seen from the optimality conditions (A.3) and (A.4). Thus, if the r_D increases in the crisis, also *un*constrained *domestic* exporters have to reduce their export revenues and shares. This prediction differs from the scenario where λ changes, and it implies a differential effect of the financial crisis across domestic and foreign-owned firms' export shares also among highly productive firms.

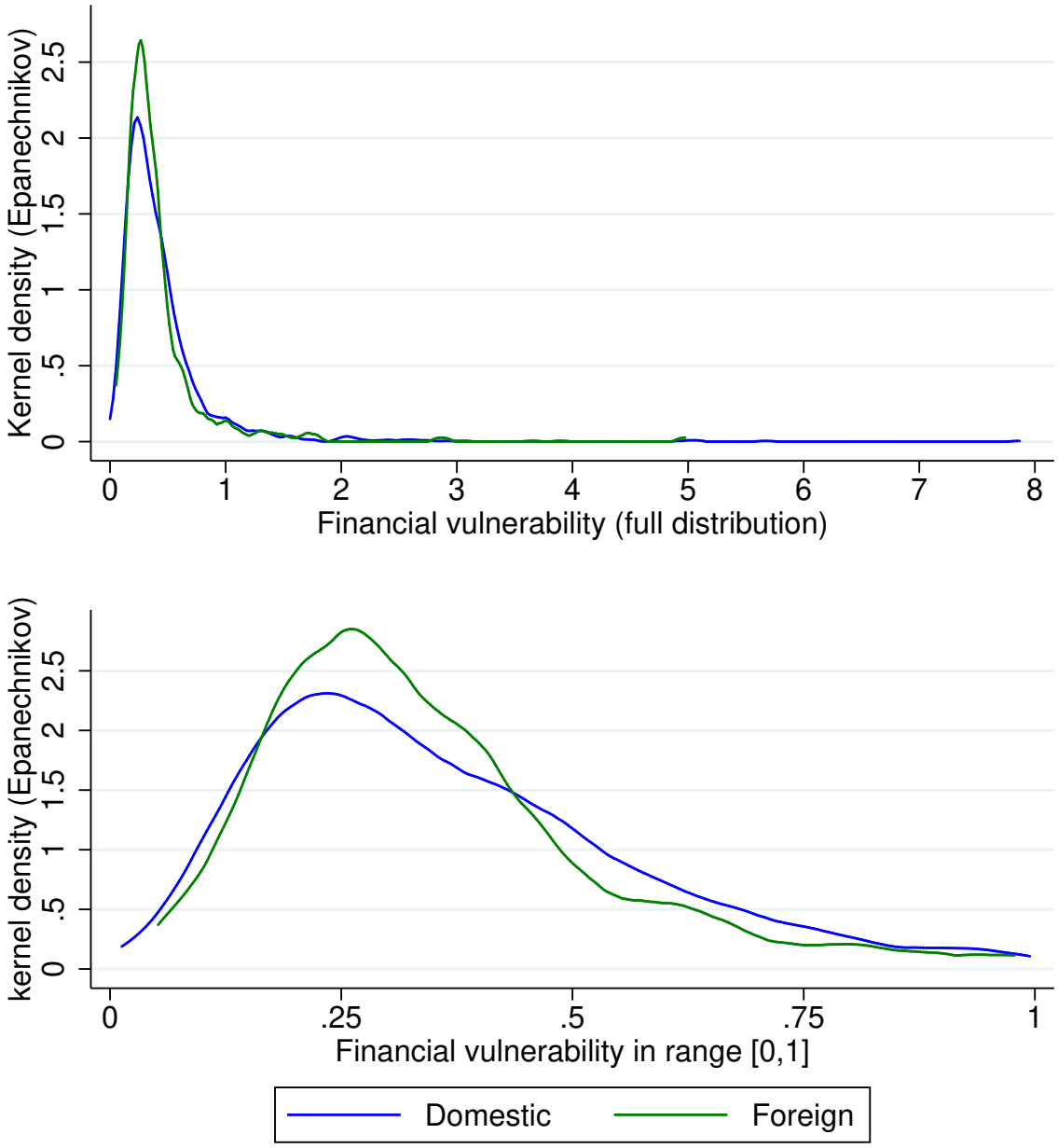
B Empirical Appendix

B.1 Further descriptive statistics

Table B.1: Summary statistics

Variable	Mean	Std. dev.	Min.	Max.	Observations
Export share *(exports/sales)*	0.206	0.278	0	1	15,627
Foreign	0.140	0.347	0	1	15,627
FinVul	0.436	0.456	0	7.868	12,536
Total debt/ assets	0.552	0.237	0	1.704	14,980
Newly issued debt/ assets	0.467	0.360	0	33.321	15,022
New debt from 'other' creditors/ assets	0.339	0.22	0	2.102	15,022
Interest rate on new debt	2.928	2.200	0	18	15074
Interest rate on long-term debt	3.834	1.742	0	17	13,022
Exporter dummy	0.648	0.478	0	1	15,627
ln *exports*	14.653	2.754	1.561	22.558	10,121
Corporate group (2006)	0.354	0.478	0	1	12,574
Use parent network$_{2006}$	0.069	0.254	0	1	15,627
Use parent network$_t$	0.110	0.313	0	1	3,380
ln TFP	-0.102	0.279	-2.424	2.04	15,310
ln capital intensity	3.597	1.148	-8.981	10.657	15,370
ln R&D intensity	0.789	2.704	0	98.900	15,594
ln skill intensity	10.251	0.389	7.897	12.117	15,568
ln share of high-skilled workers	-2.135	0.856	-6.348	0	12,880
Export share EU (2006)	0.469	0.432	0	1	12,494
Export share Latin America (2006)	0.032	0.108	0	1	12,494
Export share rest of OECD (2006)	0.061	0.152	0	1	12,494
Export share rest of world (2006)	0.068	0.172	0	1	12,494
Affiliates EU (2006)	0.109	0.312	0	1	12,619
Affiliates Latin America (2006)	0.052	0.221	0	1	12,619
Affiliates rest of OECD (2006)	0.040	0.195	0	1	12,619
Affiliates rest of world (2006)	0.034	0.182	0	1	12,619

Figure B.2: Distributions of financial vulnerability by ownership status (2008)



Notes: This figure depicts the distributions (Epanechnikov kernel density estimates) of financial vulnerability in 2008 by ownership (domestic vs. foreign). The top panel shows the full distribution, while the bottom panel shows the distribution over the interval $[0, 1]$ in the interest of visibility. *Source:* Authors' computations based on ESEE data.

B.2 Conditional foreign ownership premia

This Appendix reports OLS regressions of the export share on the foreign ownership dummy and the following set of control variables: size class fixed effects, distinguishing between six different size groups of firms in terms of their number of employees ($\leq$20; 21–50; 51–100; 101–200; 201–500; $>$500); industry-size fixed effects (the former interacted with industry fixed effects); and two dummy variables indicating the types of good produced by the firm: final good or intermediate good (with the residual category being: undefined). All regressions use ESEE data for the year 2006, when direct questions on the types of good were included in the survey. Table B.2 summarizes the results. It shows that a highly significant foreign ownership premium of at least 6 percentage points prevails, even after conditioning on the combination of these control variables.

Table B.2: Conditional foreign ownership premia

	Dependent variable: Export share (*exports/sales*)				
	(1)	(2)	(3)	(4)	(5)
Foreign	0.228***	0.113***	0.0607***	0.219***	0.0602***
	(0.0158)	(0.0166)	(0.0165)	(0.0158)	(0.0164)
Final good			-0.0949***	-0.0505***	
				(0.0154)	(0.0152)
Intermediate good				-0.0138	-0.00538
				(0.0130)	(0.0125)
Size fixed effects	no	yes	no	no	no
Industry-size fixed effects	no	no	yes	no	yes
Observations	2,020	2,020	2,018	2,011	2,009
R^2	0.093	0.211	0.355	0.110	0.359

Notes: The table shows OLS estimates of foreign ownership premia with the indicated control variables. The dependent variable is the export share. *Foreign* is a dummy variable indicating foreign ownership. *Final good* and *Intermediate good* are dummy variables indicating the type of good produced by the firm. Robust standard errors (in parentheses) are clustered at the firm level. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

B.3 Balancing tests for differences between foreign and domestically-owned firms *before* the crisis

Table B.3: Testing the balancing property after propensity score estimation

PS Block	Sales (in logs)	Sales growth (in logs)	Export share	Capital intensity (in logs)
1	0.078	-0.083	-0.004	-0.341
	(0.332)	(0.089)	(0.064)	(0.394)
2	-0.121	0.031	-0.117	0.090
	(0.260)	(0.091)	(0.079)	(0.272)
3	-0.276	0.040	0.0957*	0.032
	(0.200)	(0.046)	(0.056)	(0.183)
4	0.069	0.004	-0.014	0.013
	(0.115)	(0.028)	(0.039)	(0.105)
5	-0.008	0.000	0.013	-0.008
	(0.137)	(0.031)	(0.051)	(0.144)
6	-0.145	-0.041	0.016	0.086
	(0.204)	(0.054)	(0.077)	(0.259
7	0.193	-0.010	-0.406	-1.115
	(0.512)	(0.072)	(0.229)	(0.919)
Observations	1,297	1,297	1,297	1,297

Notes: The table shows differences in variable means between control and treatment group in each propensity score block (standard errors in parentheses). A positive value means that domestically-owned firms have a higher average than foreign-owned firms. The higher the number of the PS block, the larger the estimated propensity scores. * denotes significant differences at the 10% level.

B.4 Separating the effect on total sales, domestic sales, and export sales

Table B.4: The effect of foreign ownership on total sales, domestic sales, and export sales (DiD)

	Export share	Total sales	Domestic sales	Export sales
	FE	FE	FE	FE Poisson
	(1)	(2)	(3)	(4)
Foreign	-0.00630	0.0427	0.0743	0.0542
	(0.0154)	(0.0421)	(0.0551)	(0.0930)
Foreign $\cdot Y_{2006}$	0.00309	0.0155	-0.00584	0.0152
	(0.00766)	(0.0173)	(0.0319)	(0.0586)
Foreign $\cdot Y_{2007}$	0.0000387	-0.00983	-0.0529	-0.0325
	(0.00938)	(0.0309)	(0.0487)	(0.0712)
Foreign $\cdot Y_{2008}$	-0.000428	-0.0151	-0.0271	-0.00583
	(0.0104)	(0.0337)	(0.0477)	(0.0859)
Foreign $\cdot Y_{2009}$	0.0230*	0.0490	-0.0287	0.233*
	(0.0123)	(0.0381)	(0.0611)	(0.141)
Foreign $\cdot Y_{2010}$	0.0284**	0.0804**	-0.0456	0.102
	(0.0133)	(0.0406)	(0.0642)	(0.119)
Foreign $\cdot Y_{2011}$	0.0388***	0.114**	0.00331	0.111
	(0.0141)	(0.0444)	(0.0639)	(0.122)
Foreign $\cdot Y_{2012}$	0.0313*	0.129***	0.0149	0.122
	(0.0161)	(0.0490)	(0.0733)	(0.127)
Observations	15,627	15,645	15,565	11,025
R^2 (within)	0.055	0.275	0.222	

Notes: The table shows estimates of variants of equation (1). The dependent variable is the firm-specific export share in column (1), the log of total sales in column (2), the log of domestic sales in column (3), and the volume of export sales in column (4). *Foreign* is a dummy variable indicating foreign ownership. All columns include firm fixed effects and industry-year fixed effects. Column (4) employs the fixed effects Poisson estimator where the dependent variable appears in levels rather than logs and thus allows keeping observations with zero exports in the sample. Robust standard errors (in parentheses) are clustered at the firm level. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

B.5 Placebo analysis

We have used the short-term debt-to-sales ratio in 2008 to measure a firm's financial vulnerability in our main analysis. Notably, we have chosen this local measure because it accurately reflects the firm's financial conditions at the onset of the financial crisis. However, a skeptical reader might suspect that this particular timing could be driving our results. More precisely, it is at least conceivable that in any given year export shares diverge between firms that were more vs. less financially vulnerable in the preceding year. While the financial crisis came unexpected and its timing can be considered random, our choice of measurement is not. To ensure that our findings

indeed reflect the interaction between financial conditions and the crisis, and are not merely a statistical artifact of our choice of measurement, we run a series of placebo tests.

Table B.5: Placebo tests – Measuring financial vulnerability in different years

	Dependent variable: Export share (*exports/sales*)						
	2006	2007	2008	2009	2010	2011	2012
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Foreign \cdot FinVul \cdot Y_{2006}$	0.0272	0.0179	-0.0307	-0.0290**	-0.0132	0.000584	-0.00045
	(0.0437)	(0.0297)	(0.0263)	(0.0119)	(0.0131)	(0.0132)	(0.00575)
$Foreign \cdot FinVul \cdot Y_{2007}$	0.0320	0.0459	-0.0169	0.0190	0.0160	0.0267	0.0118
	(0.0396)	(0.0284)	(0.0225)	(0.0160)	(0.0104)	(0.0224)	(0.0140)
$Foreign \cdot FinVul \cdot Y_{2008}$	0.0115	0.0241	-0.00792	0.0228	0.0141	0.00681	0.00492
	(0.0369)	(0.0257)	(0.0198)	(0.0180)	(0.00922)	(0.0164)	(0.0101)
$Foreign \cdot FinVul \cdot Y_{2009}$	0.140	0.254**	0.175***	0.0687	0.0600	0.150	0.0697
	(0.0952)	(0.118)	(0.0319)	(0.0538)	(0.0499)	(0.105)	(0.0582)
$Foreign \cdot FinVul \cdot Y_{2010}$	0.142	0.250*	0.173***	0.0541	0.0318	0.110	0.0428
	(0.130)	(0.128)	(0.0365)	(0.0600)	(0.0477)	(0.105)	(0.0537)
$Foreign \cdot FinVul \cdot Y_{2011}$	0.185	0.250**	0.148***	0.0830	0.0580	0.162	0.0800
	(0.137)	(0.122)	(0.0313)	(0.0624)	(0.0505)	(0.103)	(0.0567)
$Foreign \cdot FinVul \cdot Y_{2012}$	0.194	0.243*	0.133***	0.141	0.108	0.130	0.0499
	(0.163)	(0.133)	(0.0300)	(0.0963)	(0.102)	(0.122)	(0.0667)
Observations	8,859	8,859	8,604	8,119	7,579	7,075	6,370
R^2 (within)	0.116	0.159	0.202	0.128	0.124	0.133	0.126

Notes: The table shows PSR estimates of equation (2). The dependent variable is the export share. See the notes to Table 3 for the definition of all included covariates. Robust standard errors (in parentheses) are clustered at the firm level. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

In these placebo tests, we measure a firm's financial vulnerability by the short-term debt-to-sales ratios in all possible years in our sample, ranging from 2006 to 2012. Table B.5 present the results of estimating equation (2) for these alternative measures of *FinVul* by the PSR estimator. Column (3) replicates the baseline results with measurement in 2008. Reassuringly, we see no significant differential effects subsequent to the respective year of measurement in any of the placebo regressions. Only the short-term debt-to-sales ratio in 2007 constitutes an alternative, valid proxy for financial vulnerability, which is plausibly exogenous to the crisis. The regression in column (2) shows that this measure also serves to confirm our main finding on the triple interaction effect in 2009 and thereafter, though statistical significance is weaker than for the preferred measure from 2008. To a lesser extent, the same pattern is also visible in the point estimates for measurement in 2006 in column (1). We are aware that measures of financial vulnerability based on later years (2010–2012) are endogenous to the crisis, hence we abstain from interpreting these regressions. The bottom line is that these non-results dispel any concerns related to the timing of measurement.

B.6 Broad measure of financial vulnerability

In constructing our baseline measure of financial vulnerability, we have focused on short-term debt. In a robustness check, we construct a broader measure of financial vulnerability that includes also debt service on long-term debt. More specifically, we compute the ratio of total debt service to total sales in 2008, where total debt service is the sum of debt repayments and interest payments on both short-term debt (due within one year) and long-term debt (due after more than one year). Importantly, total debt service in 2008 is determined through both short-term and long-term debt contracts signed in previous (pre-crisis) years.

Debt service arising from short-term debt is precisely reported in our data and used to compute the baseline measure. Debt service arising from long-term debt can be approximated using the yearly stock of long-term debt as well as the average interest rate the firm pays on its long-term debt, both of which are reported in the ESEE data separately for debt with financial and non-financial institutions, respectively. Since we have no information on the number and maturity of the firm's long-term credit contracts, we assume that in each year the firm pays back one tenth of its stock of long-term debt reported in the previous year plus the interest payment.[39]

Table B.6 replicates the main triple differences analysis of Table 3 using this broad measure of financial vulnerability, which includes long-term debt. We find the estimates hardly changed.

[39] Our main results are also robust if we vary our assumption on the share of long-term debt that is due each year using other plausible values in the range between $1/8$ and $1/12$.

Table B.6: Broad measure of financial vulnerability including long-term debt

	Dependent variable: Export share (*exports/sales*)					
	Full sample		Small firms		Large firms	
	FE	PSR	FE	PSR	FE	PSR
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign · *FinVul* (broad) · Y_{2006}	-0.0161	-0.0306	-0.0168	-0.0380	0.0689	0.0210
	(0.0234)	(0.0262)	(0.0335)	(0.0292)	(0.0622)	(0.0556)
Foreign · *FinVul* (broad) · Y_{2007}	-0.00273	-0.0154	0.00989	-0.0140	0.0254	-0.00220
	(0.0235)	(0.0226)	(0.0323)	(0.0249)	(0.0568)	(0.0491)
Foreign · *FinVul* (broad) · Y_{2008}	0.0117	-0.00682	0.0178	-0.0192	0.0681	0.0551
	(0.0219)	(0.0196)	(0.0369)	(0.0191)	(0.0571)	(0.0508)
Foreign · *FinVul* (broad) · Y_{2009}	0.0828*	0.163***	0.187***	0.182***	0.0767	0.108
	(0.0464)	(0.0393)	(0.0207)	(0.0134)	(0.0650)	(0.0773)
Foreign · *FinVul* (broad) · Y_{2010}	0.0860	0.155***	0.203***	0.187***	0.0639	0.0767
	(0.0546)	(0.0466)	(0.0243)	(0.0170)	(0.0648)	(0.0607)
Foreign · *FinVul* (broad) · Y_{2011}	0.0816*	0.136***	0.201***	0.173***	0.0510	0.0329
	(0.0484)	(0.0401)	(0.0265)	(0.0154)	(0.0764)	(0.0642)
Foreign · *FinVul* (broad) · Y_{2012}	0.0796	0.129***	0.196***	0.167***	0.0224	-0.0126
	(0.0494)	(0.0348)	(0.0315)	(0.0170)	(0.0716)	(0.0649)
Observations	12,487	8,555	8,872	5,333	3,615	3,222
R^2 (within)	0.069	0.196	0.094	0.349	0.106	0.116

Notes: The table shows estimates of equation (2). The dependent variable is the export share. *Foreign* is a dummy variable indicating foreign ownership. *FinVul* (broad) is the financial vulnerability of the firm measured by the ratio of total debt service to sales in 2008. Y_t are year dummies. All estimations include the *Foreign* dummy, a full set of two-way interaction terms between *Foreign*, *FinVul*, and the year dummies, as well as firm fixed effects and industry-year fixed effects. The even columns apply propensity score reweighting (PSR). Robust standard errors (in parentheses) are clustered at the firm level. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

B.7 Evolution of input prices and wages

Table B.7: Evolution of input prices and wages

	Energy price index		Materials price index		Services price index		Wage per worker	
	FE	PSR	FE	PSR	FE	PSR	FE	PSR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Difference-in-differences								
Foreign $\cdot Y_{2006}$	0.0249***	0.0162*	-0.0125	-0.0163**	-0.00115	-0.00244	-0.00985	0.00995
	(0.00810)	(0.00915)	(0.00779)	(0.00722)	(0.00274)	(0.00306)	(0.00985)	(0.0115)
Foreign $\cdot Y_{2007}$	0.0199*	0.00444	-0.0276**	-0.0339***	-0.00458	-0.00634	-0.00737	0.0163
	(0.0106)	(0.0106)	(0.0137)	(0.0121)	(0.00414)	(0.00503)	(0.0116)	(0.0154)
Foreign $\cdot Y_{2008}$	0.0252*	0.00573	-0.0437***	-0.0409**	-0.00960*	-0.00934	-0.0172	-0.0123
	(0.0130)	(0.0143)	(0.0165)	(0.0172)	(0.00546)	(0.00655)	(0.0131)	(0.0127)
Foreign $\cdot Y_{2009}$	0.0157	0.00534	-0.0530**	-0.0178	-0.0189***	-0.0110	0.00308	0.0194
	(0.0153)	(0.0189)	(0.0210)	(0.0232)	(0.00657)	(0.00752)	(0.0135)	(0.0173)
Foreign $\cdot Y_{2010}$	0.00354	-0.0141	-0.0663***	-0.0176	-0.0207**	-0.0176*	0.00360	0.0303*
	(0.0183)	(0.0234)	(0.0253)	(0.0374)	(0.00805)	(0.00909)	(0.0144)	(0.0173)
Foreign $\cdot Y_{2011}$	-0.000179	-0.0284	-0.0847***	-0.0522	-0.0263***	-0.0218*	-0.0188	-0.0170
	(0.0221)	(0.0289)	(0.0291)	(0.0351)	(0.00986)	(0.0117)	(0.0138)	(0.0176)
Foreign $\cdot Y_{2012}$	-0.000865	-0.0416	-0.0823**	-0.0403	-0.0282**	-0.0165	0.0162	0.0314*
	(0.0250)	(0.0338)	(0.0346)	(0.0451)	(0.0112)	(0.0144)	(0.0149)	(0.0185)
Observations	15,049	8,543	15,191	8,593	15,296	8,668	15,585	8,849
R^2 (within)	0.618	0.629	0.360	0.344	0.531	0.542	0.223	0.272
B. Triple differences								
Foreign $\cdot$ *FinVul* $\cdot Y_{2006}$	0.0125	0.00200	0.00139	0.0119	0.00531	-0.00210	0.0131	0.00917
	(0.0182)	(0.0146)	(0.0104)	(0.00764)	(0.00588)	(0.00367)	(0.0180)	(0.0160)
Foreign $\cdot$ *FinVul* $\cdot Y_{2007}$	0.0117	-0.00802	-0.0188	-0.00260	0.00361	-0.0104*	0.0398	0.0503***
	(0.0261)	(0.0209)	(0.0148)	(0.0112)	(0.0103)	(0.00609)	(0.0243)	(0.0178)
Foreign $\cdot$ *FinVul* $\cdot Y_{2008}$	-0.00604	-0.0166	-0.0356**	-0.0199	-0.000282	-0.0154*	0.0914	0.0440*
	(0.0284)	(0.0253)	(0.0173)	(0.0143)	(0.0120)	(0.00869)	(0.0607)	(0.0257)
Foreign $\cdot$ *FinVul* $\cdot Y_{2009}$	-0.0222	-0.0242	-0.0179	-0.00928	-0.00194	-0.0208**	0.0356	0.0558***
	(0.0294)	(0.0293)	(0.0226)	(0.0198)	(0.0144)	(0.0103)	(0.0267)	(0.0209)
Foreign $\cdot$ *FinVul* $\cdot Y_{2010}$	-0.0208	-0.00929	-0.0262	-0.0156	-0.00877	-0.0213*	-0.0127	-0.0252
	(0.0298)	(0.0263)	(0.0291)	(0.0263)	(0.0157)	(0.0119)	(0.0240)	(0.0256)
Foreign $\cdot$ *FinVul* $\cdot Y_{2011}$	-0.00322	0.0127	-0.0317	0.00104	-0.000329	-0.0172	-0.00329	-0.0240
	(0.0371)	(0.0326)	(0.0304)	(0.0302)	(0.0214)	(0.0162)	(0.0250)	(0.0229)
Foreign $\cdot$ *FinVul* $\cdot Y_{2012}$	-0.0377	0.0212	-0.0488	-0.0196	-0.00791	-0.0273*	-0.00870	-0.0326
	(0.0332)	(0.0337)	(0.0378)	(0.0303)	(0.0217)	(0.0159)	(0.0283)	(0.0254)
Observations	12,086	8,290	12,174	8,340	12,289	8,415	12,507	8,594
R^2 (within)	0.623	0.631	0.363	0.347	0.539	0.547	0.245	0.281

Notes: The table shows FE and PSR estimates of equation (1) in Panel A and of equation (2) in Panel B, with the firm-specific price indices and wages indicated in the header as the respective dependent variables. See the notes to Table 3 for the definition of all included covariates. Robust standard errors (in parentheses) are clustered at the firm level. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.