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FIRM EXPORTS AND MULTINATIONAL ACTIVITY UNDER CREDIT CONSTRAINTS

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ABSTRACT

This paper provides firm-level evidence that credit constraints restrict international trade flows and affect the sectoral pattern of multinational activity. Using detailed customs data from China, we show that foreign affiliates and joint ventures have better export performance than private domestic firms in financially more vulnerable sectors. These results are stronger for destinations with higher trade costs and not driven by variation in firm size or by other sector determinants of FDI. Our findings are consistent with multinational subsidiaries being less liquidity constrained because they can tap additional funding from their parent company and/or access foreign capital markets. More broadly, they suggest that FDI can alleviate the impact of domestic financial market imperfections on aggregate growth, trade and private sector development.

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1 Introduction

Growing evidence suggests that financial underdevelopment severely impedes countries' participation in international trade. Given the challenges of reforming financial institutions, this has raised the question whether cross-border capital flows can offset these detrimental consequences. The 2007-2009 financial crisis has renewed interest in these issues, with recent studies affirming that credit tightening was an important factor in the collapse of global trade.[1] However, firm-level evidence remains limited and elusive. Moreover, the finance and trade literature has evolved largely independently of that on the optimal production and organizational decisions of multinational corporations (MNCs).

We fill this void by providing an integrated analysis of the impact of credit constraints both on firms' export activity and on the pattern of foreign direct investment (FDI). Using rich customs data from China, we show that foreign affiliates and joint ventures have better export performance than private domestic firms in financially more vulnerable sectors. This is consistent with MNC subsidiaries being less credit constrained because they can tap additional funding from their parent company and/or access foreign capital markets. Our results imply that financial frictions hinder firms' trade flows and shape the sectoral composition of MNC activity. More broadly, they suggest that FDI can be a powerful export engine in financially underdeveloped economies, and offer new insights on the extraordinary rise of China's trade.

While it might be intuitive that multinational firms should have a comparative advantage over local producers in financially vulnerable industries, we present the first direct evidence of this phenomenon and quantify its economic significance. We estimate that foreign affiliates (joint ventures) export 62% (50%) more than domestic firms in sectors highly dependent on the financial system relative to financially less sensitive sectors. This is on par with or greater than the impact of other known determinants of MNC operations, such as factor cost minimization, contractual imperfections, and property rights protection. These large magnitudes have important policy implications for developing countries that aspire to attract foreign investment in order to bring in financial resources and enable technological spillovers.

We use data on the universe of China's international transactions in 2005 to assess the impact of credit conditions on different trade margins. We find that financial frictions restrict firm selection into exporting and limit exporters' global sales, product scope, number of destinations, and sales within each destination-product market. Foreign ownership, however, mitigates these distortions and allows firms (and presumably the country as a whole) to expand along all of these margins. These results indicate that companies face binding liquidity constraints in the financing of both fixed and variable trade costs, since the former affect market entry while the latter influence the scale of foreign sales. This informs how constrained exporters would respond to trade reforms, exchange rate movements, and other cost or demand

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[1] See Chor and Manova (2012), Freund and Klapper (2009), and (on past crises) Iacovone and Zavacka (2009).

shocks. The evidence for firms' extensive margin also validates priors that exporting entails market-specific fixed costs of entry, and that it is more sensitive to financial frictions than domestic operations.[2]

We identify the effects of credit constraints at the firm level by including firm fixed effects and exploiting the exogenous variation in financial vulnerability across sectors within multi-sector exporters. We thus evaluate how profit-maximizing companies allocate their limited capital across industries with different credit sensitivities. As we discuss in Section 2.2, this empirical strategy circumvents endogeneity concerns that have posed an important challenge in the prior literature: Our conclusions do not require that foreign ownership be exogenous to financial frictions, and would in fact be reinforced by a likely form of endogeneity (that more FDI systematically goes into financially more vulnerable sectors). We examine the distortions to firm selection into exporting by removing the firm fixed effects from the regression.

We perform a series of robustness checks to guard against sample selection and omitted variable biases. First, while bigger firms export more in financially more vulnerable industries, the role of foreign ownership is independent from that of firm size. Second, our results are not driven by other industry determinants of FDI such as R&D, contract, physical capital or human capital intensity. Third, MNCs' comparative advantage in financially sensitive sectors is greater for destinations with higher trade costs (bilateral distance; bureaucratic export costs), but does not vary with non-finance related market features (rule of law; natural resources). Finally, our findings survive various perturbations to the firm sample.

We make three contributions to the literature. First, we provide new firm-level evidence that credit constraints hinder international trade. Prior work has shown that countries with stronger financial institutions have a comparative advantage in financially more vulnerable sectors.[3] Early studies at the micro level have used credit-worthiness scores, balance-sheet variables, and credit-rationing surveys to link liquidity constraints to firms' export capacity.[4] A challenge for this approach has been the endogeneity of such measures of financial health to companies' export activity.[5] More recently, scholars have explored exogenous shocks to firms' availability of external finance to establish a causal effect of credit conditions on trade.[6] We offer consistent support for these findings using a novel source of identification (foreign

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[2] For example, Manova (2013) shows that only 20%-25% of the total effect of financial market imperfections on aggregate trade is due to general disruption to production, while 75%-80% is trade specific.

[3] See Kletzer and Bardhan (1987), Beck (2002), Matsuyama (2005), Manova (2013), Chaney (2013), Ju and Wei (2005, 2010 and 2011) and Becker et al. (2013) for theoretical models; and Beck (2002, 2003), Svaleryd and Vlachos (2005), Hur et al. (2006), Manova (2013) and Becker et al. (2013) for empirical evidence.

[4] See Muûls (2008) and Minetti and Zhu (2011) for evidence on Belgium and Italy respectively, and Berman and Héricourt (2010) for a study of 5,000 firms in 9 developing and emerging economies.

[5] For example, Greenaway et al. (2007) find that the financial health of UK firms improves after they start exporting, but at the time of entry into exporting, future exporters do not appear financially healthier than non-exporters.

[6] For instance, Amiti and Weinstein (2011) and Paravisini et al. (2012) use matched firm-bank data and identify shocks to banks' financial health during the systemic crises in 1990s Japan and during the recent global crisis, respectively. Bricongne et al. (2012) study the effect of the latter on French firms.

ownership status) combined with the variation in financial dependence across sectors. We also highlight the importance of foreign direct investment, rather than of local financial institutions.

Our second and primary contribution is to the literature on the determinants of FDI activity, and the role of finance in particular. Evidence suggests that MNC subsidiaries use internal capital markets to overcome liquidity constraints and react to profitable opportunities.[7] After large real exchange rate devaluations, the affiliates of US multinationals abroad expand sales and investment more than domestic companies (Desai et al. 2008). Foreign-owned firms also fared better during the recent financial crisis relative to local establishments (Alfaro and Chen 2012). Separately, MNCs can arise endogenously in response to credit market imperfections to relax constraints faced by input suppliers (Antràs et al. 2009). To this line of work we add the first direct evidence and estimate of the effect of financial frictions on the sectoral composition of MNC activity. Implicitly, we also corroborate that foreign affiliates are less capital constrained than domestic enterprises using export success as a different dimension of firm performance.

Since we examine Chinese exports, we effectively study the behavior of multinational companies pursuing vertical or export-platform FDI. This complements work on the impact of credit conditions on the choice between exporting and horizontal FDI, as well as on the trade-offs between horizontal, vertical and export-platform FDI (Buch et al. 2009, Bilir et al. 2013).

Finally, our third contribution is to the large literature on the role of international financial integration in promoting growth, trade, investment and entrepreneurship in host countries. While financial openness can bring much needed foreign capital to emerging markets with weak financial systems, it can also generate two-way capital flows and flight to quality (Antràs and Caballero 2009, Ju and Wei 2010). For example, the 2007-2009 crisis resulted in milder liquidity shocks for firms in economies that had previously relied more on FDI than on international bank borrowing (Tong and Wei 2010). Foreign capital inflows are generally associated with a reduction in domestic firms' credit constraints (Harrison et al. 2004, Héricourt and Poncet 2009). At the same time, the growth effects of FDI appear stronger in financially developed nations due to their greater absorptive capacity and ability to allocate resources (Alfaro and Charlton 2007, Alfaro et al. 2010). With regards to international trade, equity market liberalizations increase countries' exports disproportionately more in financially more vulnerable sectors, especially when stock markets were less active prior to reform (Manova 2008). We show that not only foreign equity flows, but also foreign direct investment can lessen the damaging effects of financial underdevelopment on trade. This offers concrete empirical support for the theoretical notion that openness to FDI allows countries to partially bypass the constraints of weak local financial institutions (Ju and Wei 2010).

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[7] Desai et al. (2004a) and Feinberg and Phillips (2004) find that MNC affiliates employ internal capital markets opportunistically to overcome frictions in external capital markets: they raise less outside finance in financially underdeveloped countries, and compensate by borrowing more from the parent company. Bertrand et al. (2002), however, highlight the "dark side" of internal capital markets, i.e. the inefficient tunneling of resources between connected firms and within conglomerates.

The remainder of the paper is organized as follows. The next section discusses the mechanisms through which financial frictions can affect international trade and MNC activity. We introduce the data in Section 3 and present our empirical results in Section 4. The last section concludes.

2 Motivation and Theoretical Background

2.1 Financial frictions and international trade

Domestic producers and exporters routinely rely on external capital because they have to incur large upfront costs that cannot be financed out of retained earnings or internal cash flows from operations. These costs may be sunk or recur each period. They are mostly fixed in nature, such as expenditures on product R&D, market research, advertising, and fixed capital equipment. Some variable outlays such as intermediate input purchases, advance payments to salaried workers, and land or equipment rental fees are also typically sustained before production and sales take place.

All manufacturers have to incur these costs, whether they sell domestically or abroad. However, exporting is even more dependent on external financing than serving the home country for three reasons.[8] First, entering foreign markets is associated with additional upfront expenses. Sunk and fixed trade costs include studying the profitability of potential markets; making market-specific investments in capacity, product customization and regulatory compliance; and setting up and maintaining foreign distribution networks. Variable trade costs comprise shipping, duties and freight insurance. As with production costs, most of these expenditures have to be incurred before export revenues are realized. Second, cross-border shipping and delivery typically take 60 days longer than domestic orders. This further aggravates exporters' working capital needs relative to those of domestic producers. Finally, the greater risk inherent in transnational operations requires exporters to obtain trade insurance. For these three reasons, a very active market exists for the financing and insurance of international transactions, reportedly worth $10-$12 trillion in 2008. Up to 90% of world trade has been estimated to rely on some form of trade finance (Auboin 2009).

While access to external finance is important in all industries, some sectors depend considerably more on the financial system. This variation will be an important source of identification in our empirical analysis. The literature has identified two key determinants of sectors' financial vulnerability that are technologically driven, exogenous from the perspective of individual firms, and innate to the manufacturing process. First, firms in some sectors require substantially more outside capital because they face higher upfront costs for long-term investments (Rajan and Zingales 1998). Industries also differ in the length of their production cycles and therefore in their reliance on external finance for meeting liquidity needs in the short-run (Raddatz 2006). Second, sectors vary in their endowment of tangible assets that can be pledged as collateral to raise external finance (Braun 2003, Claessens and Laeven 2003).

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[8] See Feenstra et al. (2011) for a model incorporating these three mechanisms and related evidence for China.

Given these realities, a number of theoretical papers have examined how credit market imperfections affect international trade. Here we summarize the predictions of a model that incorporates financial frictions and firm heterogeneity in the spirit of Melitz (2003) and Manova (2013). For now, we take firms' foreign ownership status as exogenously given and discuss its endogeneity in Section 2.2.

Assume that exporters require external capital, which they can obtain in the financial market by pledging collateral. Contracts between firms and investors are imperfectly enforced and depend on the strength of financial institutions. When a financial contract is honored, the borrower repays the investor; otherwise, the firm defaults and the creditor takes possession of the collateral. Industries, however, differ in their intrinsic reliance on outside finance and in their availability of collateralizable assets.

In the absence of liquidity constraints, all firms with productivity above a certain cut-off become exporters. Financial frictions, however, raise this threshold: Because more efficient companies earn bigger revenues, they can offer creditors a higher return in case of repayment, and are thus more likely to secure the necessary outside capital. Importantly, the export cut-off is systematically higher in financially more vulnerable industries. Credit constraints thus preclude potentially profitable firms from engaging in international trade and result in inefficiently low aggregate trade flows.

When companies rely on outside funds only for their fixed costs, credit conditions affect selection into exporting but not the value of firm sales abroad. If variable costs are also subject to liquidity constraints, limited access to capital restricts exporters' operation scale as well. While the most productive (and thus least constrained) firms can still export at first-best levels, less productive firms are unable to obtain enough credit to do so. Instead, they export lower quantities than in the first-best to reduce their variable costs. Once again, the extent of this distortion is greater in financially more vulnerable industries.

If exporters pay a fixed cost in every market they enter, credit frictions will also affect the number of firms' export destinations. In the absence of liquidity constraints, firms' decision to sell in a particular country is independent of the decision to service other markets. By contrast, when firms have limited access to financing, they optimally add export destinations in decreasing order of profitability until they hit their budget constraint and use up their resources. Conditional on firm productivity, exporters in financially more vulnerable sectors therefore transact with fewer trade-partner countries.

Credit constraints similarly influence the range of products exporters trade. The literature on multi-product firms suggests that profitability varies across goods within a firm based on production efficiency, product quality and consumer demand (Bernard et al. 2011, Manova and Zhang 2012). With good-specific fixed export costs and limited access to capital, firms must rationalize their product scope. While the number of goods a firm ships will differ across destinations depending on importer characteristics, exporters will offer a narrower set of products overall and sell fewer goods to any given market when they face tighter credit conditions. These effects will be magnified in financially more sensitive sectors.

Firms' organizational structure can importantly affect their financing practices and need for outside credit. Unlike domestic enterprises, foreign-owned companies are not restricted to borrowing externally in China, but can also tap deeper internal capital markets and obtain funds from their parent company. They can potentially raise external finance abroad as well.[9] To the extent that foreign affiliates are less credit constrained than domestic firms, they should have higher export sales, more destinations, and broader product scope. This advantage should moreover be greater in financially more dependent industries.

MNC headquarters plausibly have greater monitoring rights or managerial control over affiliate activities, and the allocation of financial resources in particular, at higher levels of foreign ownership. If so, headquarters would arguably be more willing to extend financing to wholly-owned parties relative to partially-controlled subsidiaries. This suggests that fully-integrated affiliates of multinational corporations should outperform domestic firms in financially vulnerable sectors by more than joint ventures.

If a firm operates in multiple industries, financial considerations would affect how it allocates resources across industries. *Ceteris paribus*, producers with limited access to external finance would concentrate on sectors with lower requirements for outside capital and on sectors with more collateralizable assets. They would add sectors in increasing order of financial vulnerability until they exhaust their funds. This is not only optimal for a given level of external credit, but can also increase the financing lenders are willing to offer. We thus expect that foreign-invested enterprises will export relatively more than domestic companies in financially more sensitive sectors even controlling for firm fixed effects.

The discussion so far has assumed that firm productivity is fixed and set by an exogenous draw. However, companies might be able to improve their productivity by investing in superior technologies. Firms might also choose to upgrade product quality by employing more expensive inputs of higher quality, better skilled workers, or novel production processes. Credit constraints can curb such investments in productivity[10] and quality, especially in financially vulnerable sectors. Since export demand increases in firm productivity and product quality, financial frictions can therefore not only restrict firms' production capacity for given export potential, but also directly limit firms' export potential.

These predictions continue to hold if firms require external finance for both their domestic and foreign operations. As Manova (2013) and Feenstra et al. (2011) show, credit market imperfections then raise the productivity cut-offs both for domestic production and for exporting. In addition, constrained producers sell less locally and constrained exporters sell less abroad. Although we focus on firms' export performance, our results will suggest that financial frictions have a disproportionately large effect on international trade above and beyond that on domestic output.

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[9] This is of course a sufficient but not a necessary assumption. All that is required is that multinationals are better equipped to raise finance in foreign capital markets or to tap internal capital markets than domestic producers.
[10] Girma et al. (2008) find that Chinese firms with foreign capital participation innovate more than domestic firms.

To summarize, we expect credit constraints to impede both the extensive margin (firm selection into exporting, firms' number of export products and destinations) and the intensive margin of trade (firm exports of a given product to a specific market). These effects should be magnified in financially more vulnerable sectors, but mitigated by foreign ownership. With some abuse of terminology, MNC affiliates can be said to have a comparative advantage in financially dependent industries relative to domestic firms.

2.2 Financial frictions and multinational activity

Firms offshore (parts of) their production activities for various reasons, such as seeking market access and saving on manufacturing costs.[11] Multinational companies emerge when this location decision is accompanied by the decision to integrate the production facility abroad within the boundaries of the firm. The trade-off between arms' length and intra-firm outsourcing has been studied in the context of imperfect contractibility and relationship-specific investments; limited property rights protection and imitation risk; or tax incentives and profit shifting.[12] We emphasize that financial frictions can also influence companies' choice to become multinational. We discuss three possible mechanisms for this effect, all based on the assumption that domestic firms have more limited access to capital than foreign subsidiaries.

First, when financial institutions in the host country are weak, MNCs could have an incentive to enter financially more vulnerable industries that attract fewer local enterprises. Foreign affiliates would then face less competition in the host and export markets for their final products, and/or in the local market for sector-specific inputs. Both of these forces would generate relatively higher profits for multinational corporations in financially more sensitive sectors. This argument takes foreign ownership as given and is consistent with theory and evidence in Bilir et al. (2013).

Second, firms' ownership status can be endogenous to financial frictions. Consider foreign headquarters that would like to move the production of an input to China. If this input requires relationship-specific investments that cannot be funded internally, the Chinese supplier would face greater credit constraints if it is active in a financially more vulnerable sector. To ensure production takes place, the foreign company can integrate the Chinese supplier to help finance its activities. As Antràs et al. (2009) argue, MNC headquarters then either directly fund the affiliate or monitor its operations so that host-country banks are willing to finance it. They show theoretically and empirically that foreign integration is more likely to occur when the supplier is located in a financially less developed economy. Their model could, however, be reformulated to predict that integration will be more prevalent in financially more dependent industries. Extending this line of reasoning, wholly-owned affiliates might be favored by foreign

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[11] See Markusen (1984), Brainard (1997), Markusen and Venables (2000), and Helpman et al. (2004) on horizontal FDI, and Helpman (1984) and Yeaple (2003) on vertical FDI.

[12] See for example Antràs (2003), Branstetter et al. (2006), and Desai et al. (2004b).

headquarters in such sectors relative to joint ventures. This could occur, for example, if control over managerial decisions and the use of financial resources increases with the degree of foreign ownership.

Third, enterprises can become multinational by acquiring an existing foreign firm. The literature on mergers and acquisitions suggests that companies look for arbitrage opportunities in choosing targets, and that such opportunities reside in the synergies from the partnership. Given their comparative advantage in overcoming credit constraints, foreign parents might be more interested in becoming stake-holders in Chinese firms in financially more sensitive industries. While this mechanism may amplify the effect of other non-finance factors, it is separate from them. For example, multinationals might be more likely to buy companies with stronger export potential ("cherry-picking"). Alternatively, Chinese exporters with greater presence abroad might be better at attracting foreign investors. By themselves, these forces would not affect the incidence of foreign ownership differentially across sectors. If MNC headquarters target better Chinese firms (or stronger Chinese exporters solicit foreign investment) specifically in financially more vulnerable sectors, this would be consistent with the idea that the best arbitrage opportunities combine the strengths of both parties: the export capacity of the target and the financial resources of the acquirer.[13] In practice, while joint ventures in China sometimes arise through partial foreign acquisitions, most wholly-owned subsidiaries are set up as de novo MNC affiliates through greenfield investment.[14]

These three mechanisms have important implications for our analysis. While one might normally worry about the endogeneity of the regressors, in our case the potential endogeneity of firms' ownership status in fact reinforces the prediction of Section 2.1: Foreign enterprises should have a comparative advantage in financially more vulnerable sectors relative to domestic companies. Moreover, fully-integrated subsidiaries should outperform local producers by more than joint ventures. By comparing firms with different organizational structures and sectors with different degrees of financial dependence, we can thus simultaneously analyze the impact of financial frictions on international trade and on MNC activity.

3 Data

We use detailed customs data on the universe of China's international trade transactions in 2005 from the Chinese Customs Office.[15] They report the free-on-board value of firm exports (in US dollars) by product and country for 231 destinations and 6,908 products in the 8-digit Harmonized System. The records explicitly distinguish between state-owned enterprises (SOEs), private domestic firms (including

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[13] Huang et al. (2007), Manova and Yu (2012), and Javorcik and Spatareanu (2009) show respectively that more credit constrained firms are more likely to be acquired by foreign firms (China) and to conduct processing trade for foreign buyers (China), but less likely to become arms-length suppliers for MNCs (Czech Republic). Bustos (2007) finds that FDI in Argentina is more likely in financially dependent sectors. See also Poncet et al. (2010).

[14] Note that if credit-constrained Chinese firms could completely overcome their credit constraint by soliciting foreign ownership, the firms that choose to remain domestic would not be constrained and we would not observe a differential performance between domestic and foreign firms in financially vulnerable sectors.

[15] Manova and Zhang (2009) describe the data and present stylized facts about firm heterogeneity in Chinese trade.

collectively-owned firms), fully foreign-owned affiliates of multinational firms, and joint ventures (foreign ownership under 100%).[16] We drop SOEs from our baseline sample because we are interested in the export decisions of profit-maximizing firms that operate in a financially constrained environment. Since the Chinese government exerts considerable control over the activities of state-owned enterprises, especially with regards to which industries they are allowed to operate in, SOEs are not necessarily profit-maximizing entities. Despite their preferential access to financing from state-owned banks, they also appear less efficiently managed than private companies (Dollar and Wei 2007, Song et al. 2011, Khandelwal et al. 2013). We also exclude export-import companies that do not engage in manufacturing but serve exclusively as intermediaries between domestic producers (buyers) and foreign buyers (suppliers).[17]

3.1   Measuring sectors' financial vulnerability

Our estimation approach requires a measure of sectors' financial vulnerability $FinVuln_i$. We employ a number of proxies to capture different factors that affect firms' sensitivity to the availability of outside capital. These variables are meant to reflect technologically determined characteristics of each sector that are inherent to the manufacturing process and beyond the control of individual firms. They are available for 36 ISIC 3-digit sectors, which we match to the Chinese HS 8-digit product codes.

Our first two measures quantify firms' reliance on external finance. Industries differ greatly in the importance of up-front costs and the lag between the time when various expenses are incurred and the time when revenues are realized. We gauge these differences with sectors' external finance dependence ($ExtFin_i$), defined as the share of capital expenditures not financed with cash flows from operations. $ExtFin_i$ captures the outside funding firms require for long-term investment projects and thus relates mostly to fixed costs. We also exploit the ratio of inventories to sales ($Invent_i$) to proxy the duration of the production process and the liquidity necessary to maintain inventories and meet demand. $Invent_i$ signals producers' working capital needs in the short run, associated mainly with variable costs.

Our third measure of financial vulnerability recognizes the fact that sectors vary in the endowment of collateralizable assets that enable firms to raise outside finance. We assess the availability of tangible assets ($Tang_i$) with the share of net plant, property and equipment in total book-value assets.

Our last indicator of financial vulnerability distinguishes between different sources of external capital. On the one hand, when companies can more easily access buyer or supplier trade credit, they may be less dependent on the formal financial market. On the other hand, trade credit may be complementary to formal credit, for example if both formal lenders and buyers/suppliers prefer more trustworthy borrowers.

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[16] Product classification is consistent across countries at the 6-digit HS level. The number of distinct product codes in the Chinese 8-digit HS classification is comparable to that in the 10-digit HS trade data for the United States.

[17] Since the data do not directly flag trade intermediaries, we follow standard practice and use keywords in firm names to identify them (Ahn et al. 2011). We drop 23,073 wholesalers that mediate a quarter of China's trade.

We remain agnostic about the net effect of these two forces, although evidence suggests that the former one dominates (Chor and Manova 2012). We use the ratio of the change in accounts payable to the change in total assets ($TrCredit_i$) to characterize the availability and frequency of trade credit in an industry.

Consistently with the idea that these sector measures capture conceptually distinct dimensions of financial vulnerability, they are not highly correlated with each other (Appendix Table 2). It is thus informative to explore all of them in order to shed light on the mechanisms through which credit constraints operate. Having said that, $ExtFin_i$ and $Tang_i$ are the most common and standard measures in the literature because their interpretation can most directly and naturally be linked to firms' exposure to and ability to overcome financial frictions. By contrast, the role of $TrCredit_i$ is ex ante ambiguous. As for $Invent_i$, some companies might flourish in an inventory-intensive sector not because they are less liquidity constrained, but because they have superior inventory management practices for reasons unconnected to finance.

Given these considerations, we also compute three summary measures to aggregate the information contained in the individual proxies and thus the various aspects of sectors' financial vulnerability. Our preferred one is the first principal component of external finance dependence and asset tangibility, $FPC2_i$. It intuitively increases with $ExtFin_i$ and falls with $Tang_i$, such that industries are more financially sensitive if they require more outside funds but dispose of less collateralizable assets. We also obtain the first principal component of all four indicators, $FPC4_i$. Since statistical and not economics principles govern the construction of $FPC4_i$, we cannot control the sign of its loadings on the constituent measures. In practice, it meaningfully places a positive weight on $Invent_i$ and negative weights on $Tang_i$ and $TrCredit_i$, but it also assigns an unexpected negative weight on $ExtFin_i$ that is difficult to rationalize or interpret. We therefore also calculate the standardized average of the four measures, $AVG4_i$, where we impose the economically intelligible sign on each component. In particular, we first standardize each variable by subtracting its cross-sector mean and dividing by its cross-sector standard deviation. We then take the unweighted average of the standardized values of $+ExtFin_i$, $+Invent_i$, $-Tang_i$ and $-TrCredit_i$. Reassuringly, our results turn out to be not sensitive to the exact choice of $FinVuln_i$ measure.

Our $FinVuln_i$ measures are based on data for all publicly traded U.S. companies from Compustat's annual industrial files.[18] This approach is motivated by three considerations. First, the United States have one of the most advanced and sophisticated financial systems. The behavior of U.S. firms thus plausibly reflects their optimal asset structure and use of external capital in the absence of binding credit constraints. Second, choosing a reference country ensures that sectors' financial vulnerability is not measured endogenously to China's financial development. In fact, if financially more dependent industries in the U.S. employ more internal finance and tangible assets in China because of the worse financial conditions there,

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[18] $ExtFin_i$, $Invent_i$ and $Tang_i$ come directly from Kroszner et al. (2007), who follow the methodology of Rajan and Zingales (1998) and Claessens and Laeven (2003). They are averages over the 1980-1999 period for the median U.S. firm in each sector. $TrCredit_i$ is from Fisman and Love (2003), who base it on the same data for 1980-1989.

our results would be biased downwards. Finally, identification does not require that sectors have the same financial sensitivity in the U.S. and China, but rather that their ranking remain relatively stable across countries. Rajan and Zingales (1998), Claessens and Laeven (2003) and Kroszner et al. (2007), among others, argue that the $FinVuln_i$ indicators capture a large technological component that is innate to a sector and therefore a good proxy for ranking industries in all countries. Consistent with this argument, the measures vary substantially more across sectors than across firms within a sector, and the hierarchy of sectors is quite stable over time.

We aim to assess the impact of credit constraints on (1) firm exports and (2) MNC activity. For the purposes of (1), we would ideally observe how much firms rely on external finance for their export expenses (of both producing and trading the exported goods). By contrast, studying (2) in principle does not require that the $FinVuln_i$ measures be trade specific: While we explore the sectoral composition of foreign affiliates' trade flows relative to that of domestic firms, the same predictions would apply to their total output as well. For both (1) and (2), however, it is important to keep in mind that money is fungible within a firm. It is thus not obvious conceptually whether the use of external funds for domestic production can be separated from the use of external funds for export activities.

In practice, our sector measures reflect firms' overall reliance on the financial system, whether they produce for home or abroad. Since firms report consolidated balance sheets, it is not possible to compute $FinVuln_i$ separately for domestic and export operations. No systematic data on the funding of international transactions is available from sources other than firms' balance sheets either. This is primarily because a wide range of financial institutions provide such financing, including regular commercial banks, specialized export-import banks, and credit agencies.

Given these data limitations, our industry indicators have been considered appropriate proxies and widely used in the prior literature on trade, growth and finance.[19] Firms need to incur the same production costs and use the same tangible assets in manufacturing for the foreign market as in manufacturing for the home country. In addition, products that entail a lot of R&D, marketing research and distribution costs at home plausibly require similarly large trade costs of product customization, marketing and distribution abroad. Both of these factors suggest that whatever forces a firm in a particular industry to fund its domestic operations with outside capital will likely also force it to use external funds for its foreign sales. Finally, the sector measures are based on large US companies that are typically big exporters. They thus reflect firms' overall financing practices and not just those for their domestic activities.

In sum, we exploit a number of standard, best-practice measures of sectors' financial vulnerability. To the extent that they are imperfect proxies, measurement error would tend to bias our results downwards.

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[19] For example, see Beck (2003), Manova (2008, 2013), Iacovone and Zavacka (2009), Carluccio and Fally (2012), Tong and Wei (2010), Bricongne et al. (2012), and Chor and Manova (2012) for applications to trade.

The same argument applies if the production practices of domestic and multinational firms differ. In other words, we can identify the effects of financial frictions on exports and MNC activity only if sectors' financial dependence for international activities is correlated with their financial dependence for domestic operations. Our empirical results thus also provide indirect evidence supporting this assumption.

3.2   A first glance at the data

Table 1 overviews the distribution of Chinese trade flows across firms with different ownership structure. Two patterns in particular stand out. First, the lion's share of Chinese trade is conducted by firms with partial or full foreign ownership. Private domestic firms were responsible for 13% of China's $531.4 billion exports in 2005. Joint ventures accounted for slightly over a quarter, while foreign affiliates contributed more than half of China's exports. These statistics speak volumes about the importance of multinational companies and foreign direct investment for China's tremendous export success in the recent past.

The second pattern that emerges from Table 1 is that foreign-owned firms capture a systematically bigger fraction of Chinese trade in financially more vulnerable industries. MNC affiliates channel 60.1% of exports in sectors with external finance dependence above the median, compared to 32.3% in sectors below the median. On the other hand, private domestic firms mediate almost thrice as big a share of exports in sectors with limited need for outside finance, relative to sectors that rely more heavily on external capital. The contribution of joint ventures to China's trade is more equally balanced across industries, and its distribution falls between that for fully foreign-owned and fully domestic firms.

We observe analogous sorting behaviors when we group industries according to our other measure of firms' requirement for external funds, the inventories to sales ratio. Foreign affiliates account for 55.7% of exports in sectors with high liquidity needs, compared to only 29.2% in sectors with limited liquidity needs. By contrast, private domestic firms carry 11.6% of trade flows in industries with high inventories ratio and 18.8% in industries with laxer credit constraints, while joint ventures contribute about a quarter of Chinese exports in all sectors. Similar patterns obtain when we distinguish among sectors with low and high levels of asset tangibility or trade credit intensity, with a greater proportion of trade conducted by foreign firms relative to domestic firms in financially more vulnerable sectors.

These summary statistics are broadly consistent with our credit-constraints view of international trade and investment, and anticipate the results from the econometric analysis in the next section.

4   Empirical Analysis

4.1   Empirical design

Our goal is twofold: to assess the effect of financial frictions (1) on firm exports and (2) on the pattern of MNC activity. We design an estimation strategy that allows us to simultaneously address both questions. It

is based on the prior that (3) foreign affiliates are less credit constrained than domestic companies, and hence the impact of sectors' financial vulnerability on firm decisions will vary across ownership types. Implicitly, this estimation approach thus also tests the validity of (3).

We study the variation in trade flows across sectors and firm types with the following specification:

$$\log Exports_{fi} = \alpha + \beta \cdot FinVuln_i \cdot D_f^{JV} + \gamma \cdot FinVuln_i \cdot D_f^{MNC} + \varphi_f + \varphi_i + \varepsilon_{fi} \tag{1}$$

Here $Exports_{fi}$ give the exports of firm f in industry i, pooled across all of f's export destinations. D_f^{JV} and D_f^{MNC} are indicator variables set to 1 for joint ventures and fully foreign-owned affiliates respectively, such that the omitted category is domestic firms. $FinVuln_i$ reflects sector i's level of financial vulnerability. We proxy the latter alternatively with i's external finance dependence, inventories-to-sales ratio, asset tangibility, trade credit intensity, or first principal components of these measures. At this level of aggregation, our sample comprises 221,801 observations spanning 88,004 companies and 36 sectors.

We employ industry fixed effects φ_i to control for systematic differences in trade activity across sectors that do not depend on companies' organizational structure. If China has a comparative advantage in textiles for example, all textile makers might earn higher export revenues than manufacturers of electrical machinery, regardless of whether they are domestic or foreign owned. Similarly, within each multi-sector firm, global textile sales might exceed exports of electrical machines, irrespectively of its ownership status. The φ_i's account for various determinants of China's comparative advantage, as well as for sector-specific demand and cost shocks that affect all firms. They also absorb the level effect of $FinVuln_i$.

Our regression specification further includes firm fixed effects φ_f. These capture all firm characteristics that affect a company's export performance equally across sectors. These may include its size, productivity, managerial competence, labor skill composition, or access to foreign distribution networks. The φ_f's also subsume the ownership dummies. They thus account for any distinction in average export performance between firms of different ownership types that are invariant across industries. For instance, MNC affiliates may use their parent companies' distribution network, enjoy preferential tax treatment, be more productive, have better management practices, employ more skilled workers, or offer higher-quality products relative to domestic companies.

The main coefficients of interest are those on the two interaction terms. They are identified purely from the variation across sectors within multi-sector exporters.[20] Note that the firm fixed effects implicitly condition on firms' total availability of financial capital, be it from banks in China, banks abroad, buyer/supplier relationships, or a foreign parent company. Hence, β and γ reflect the profit-maximizing

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[20] 49% of the firms in our sample export in multiple sectors and account for 80% of the firm-sector level observations.

way in which companies allocate their limited financial resources across industries: by adding industries in increasing order of financial vulnerability until they exhaust their liquid capital.

Importantly, β and γ lend themselves to two closely related yet distinct interpretations which correspond to our two hypotheses. On the one hand, β and γ quantify the effect of credit constraints on firm exports (goal 1). Conceptually, we want to show that firms' access to finance affects their trade activity. The former might however be endogenous to the latter. Exploiting the variation in financial conditions across sectors (which is exogenous to individual firms) helps establish causality. To this end, specification (1) interacts a firm measure of financial health (ownership status) with a sector measure of financial dependence. This is in the spirit of earlier papers that have interacted other proxies for firms' financial health with sectors' financial vulnerability. If credit frictions restrict trade, we anticipate lower exports in financially more sensitive sectors, but this distortion would be smaller for foreign subsidiaries than for domestic firms. We thus expect that $\gamma > \beta > 0$, where the first inequality reflects the notion that fully integrated MNC affiliates may benefit from deeper internal capital markets than joint ventures.

At the same time, β and γ also indicate how financial considerations affect the pattern of multinational activity (goal 2). The interaction terms compare the sectoral composition of MNCs' sales to that of domestic firms. This gauges MNCs' proclivity to operate in different industries. It is in the tradition of prior studies that interact ownership dummies with other sector characteristics. As discussed in Section 2, multiple mechanisms can make financially vulnerable sectors relatively more attractive for foreign affiliates. Conditional on their ownership status, they might have a comparative advantage in such sectors due to their superior access to finance. In addition, foreign ownership could endogenously arise in response to credit market imperfections. Both mechanisms would be consistent with $\gamma > \beta > 0$ and we do not distinguish between them.

The theoretical framework in Section 2 implies that firm size would reflect firms' access to external finance if it is correlated with firm productivity and financiers favor more productive firms. A strict interpretation of the Manova (2013) model in fact predicts a one-to-one mapping between firm productivity, size, and financial health. This aligns with evidence in the finance literature that smaller firms tend to be more credit constrained than larger companies.[21] In view of goal (1), the size dispersion across firms thus provides another source of variation in the data that we can exploit to identify the effect of credit frictions on firm exports. In particular, we can use firm size as an additional proxy for financial health and include its interaction with sectors' financial vulnerability in the regression, $FinVuln_i \cdot Size_f$.

As for goal (2), there are two countervailing forces to consider. On the one hand, MNC affiliates might be larger than domestic exporters for reasons unrelated to financial concerns. If bigger firms have a comparative advantage in financially sensitive sectors, β and γ might thus capture the role of firm size

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[21] See for example Gertler and Gilchrist (1994), Beck et al. (2008), and Guiso et al. (2004).

rather than that of foreign ownership *per se*. While still consistent with goal (1), this would run counter goal (2). Controlling for the size interaction would then ensure that we isolate the response of foreign-owned firms to the variation in financial vulnerability across sectors, instead of the response of bigger firms. On the other hand, MNC affiliates might be larger than domestic firms precisely because the former are less financially constrained. If so, adding size interactions to the regression would be over-controlling and underestimate the economic mechanism behind goal (2).

Given these considerations, we opt to include $FinVuln_i \cdot Size_f$ in specification (1) in order to be comprehensive with respect to goal (1) and conservative with respect to goal (2). To do so, we would ideally use information on firms' total output. As standard with customs data, however, we do not observe firms' sales in China. As a proxy for firm size, we take firms' log global exports summed across all destinations and sectors. While imperfect, this measure is arguably appropriate given the prior literature on firm heterogeneity and the strong correlation between firm size and firm exports in the data.[22]

As common with our difference-in-differences estimation technique, the covariance matrix of the error term ε_{fi} can be quite complex. From an economics perspective, the ε_{fi}'s are likely correlated across sectors within firms due to unobserved firm characteristics. If these affect activity uniformly in all sectors, they would be captured with the firm fixed effects. Otherwise, Bertrand et al. (2004) advocate clustering errors by firm. In our case, this is complicated by the fact that the regression also includes industry fixed effects, and errors might also be correlated across firms within sectors due to sector-level unobservables. From an econometric perspective, Moulton (1990) argues that errors should be clustered at the most aggregate level at which the relevant explanatory variable varies in the data. We study the interaction of a firm attribute with a sector characteristic, where the latter is arguably the exogenous one. To remain conservative and consistent, we cluster standard errors by sector throughout the paper. We have confirmed that all our results become significantly stronger when we instead cluster by firm or use Hubert-White heteroskedasticity-robust errors. These approaches typically deliver t-statistics that are 3-4 times as big.

4.2 Baseline results

Our empirical analysis proceeds in four steps. We first estimate equation (1) and document evidence consistent with our hypotheses. We then establish that our results are not driven by confounding factors such as sample selection or other sector characteristics that might affect MNC activity. We next examine the impact of financial frictions on the extensive and intensive margins of firms' exports to shed light on the

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[22] In standard heterogeneous-firm trade models (e.g. Melitz 2003), firm size and total exports are perfectly correlated as both are driven by a single firm attribute (often interpreted as productivity). In reality, firms differ along multiple dimensions, but numerous empirical papers have documented very high correlations among productivity, size and total exports for a wide range of developed and developing countries (c.f. Bernard et al. 2007 for the US). We thank Zhihong Yu at Nottingham University for confirming that, in a matched sample of customs and balance-sheet data for China, the correlation between firm sales and exports is 0.62 (significant at 1%) in logs and higher yet in levels.

underlying economic mechanisms. Finally, we show that our findings are stronger for export destinations with higher trade costs, but do not vary with other destination characteristics in placebo tests.

Table 2 presents our baseline results for specification (1). Foreign enterprises export significantly more than domestic firms in financially more sensitive sectors, relative to financially less sensitive sectors. In particular, MNC affiliates have a bigger comparative advantage over Chinese-held companies in industries with greater dependence on external finance and in industries with higher inventories-to-sales ratios (columns 1-2). Conversely, foreign subsidiaries outperform local firms by more in industries with fewer tangible assets and in industries with scarcer trade credit (columns 3-4). As expected, the interactions in columns 3-4 enter with the opposite sign to those in columns 1-2. This is consistent with the idea that financially more vulnerable sectors require more outside capital due to more severe liquidity needs, but dispose of less buyer-supplier trade credit and collateralizable assets.

We corroborate these conclusions when we use the three summary measures that aggregate the information contained in the various industry indicators of financial vulnerability: the first principal component of external finance dependence and asset tangibility $FPC2_i$, the first principal component of all four indices $FPC4_i$, and the standardized average of these four indices $AVG4_i$ (columns 5-7). To streamline the exposition and in view of the discussion in Section 3.1, we report results only for $FPC2_i$ in the remainder of the paper. Qualitatively similar patterns however obtain for our other sector measures.

Of note, we systematically find that $\gamma > \beta > 0$. In other words, fully integrated MNC affiliates enjoy a greater advantage over domestic companies in financially dependent industries than joint ventures. This ranking also emerges in all other regressions below: we either observe statistically higher point estimates for the D_f^{MNC} interaction than for the D_f^{JV} interaction, or cannot reject their equality at standard levels of confidence (10%). This accords with the prior that a greater degree of foreign ownership increases access to internal capital markets and/or capital markets outside of China.

These results are highly significant both statistically and economically, with the exception of those for trade credit intensity which are less precisely estimated.[23] The export advantage of firms with full (partial) foreign ownership over domestic companies is 31% (29%) larger in sectors with high requirements for external capital relative to sectors with low dependence on outside finance. The corresponding estimates reach 84% and 59% when comparing sectors with few collateralizable assets to sectors with high asset tangibility. Using $FPC2_i$ as a summary measure, MNC subsidiaries and joint ventures export 62% and 50% more than local firms in financially vulnerable sectors relative to financially less sensitive sectors.

Separately, Table 2 also confirms that bigger exporters trade relatively more in financially more dependent industries. This pattern suggests that firm size is indeed associated with laxer credit constraints.

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[23] We report estimates based on columns 1, 3 and 5 in Table 2 that compare sectors at the 25th and 75th percentiles of the distribution of the relevant measure of financial vulnerability.

To gauge the extent to which controlling for it might lead us to underestimate β and γ, we re-run specification (1) without the size interactions (columns 1 vs. 2 in Appendix Table 3). The point estimates of interest increase slightly by 9% and 15% respectively. This indicates that foreign ownership plays an important and independent role that is not subsumed by firm size. Moreover, the effects of full and partial foreign ownership are on average 65% and 8% bigger than that of firm size in Table 2.[24]

Specification (1) includes firm fixed effects and identifies the impact of financial frictions on trade and MNC activity at the firm level. Per Section 2, credit constraints can also distort the selection of firms into exporting. To shed light on this mechanism, we re-estimate (1) without firm fixed effects, adding the main effects of the ownership dummies. This perturbation lowers β and γ by 46% and 19% (columns 2 vs. 3 in Appendix Table 3). This validates our predictions: Now β and γ are identified from the variation across firms of different ownership types within sectors, and the variation across sectors among firms of a given ownership type. They reflect the gap between the exports of the average foreign affiliate and the average domestic firm in a sector, and how this gap varies across sectors. These estimates therefore capture the combined effect of credit constraints on firm-level exports and on firm selection into exporting. Since foreign subsidiaries are less credit constrained than domestic firms, they face a lower productivity cut-off for exporting, especially in financially more vulnerable sectors. This implies that a MNC affiliate might be able to sell abroad when a domestic manufacturer of the same productivity level cannot. Because less productive firms export less, this effect tends to reduce the average trade value of foreign-owned firms relative to local companies in financially more dependent industries. This selection mechanism explains why the regressions without firm fixed effects produce lower point estimates.

To summarize, our results strongly suggest that financial frictions hamper companies' export performance but foreign ownership alleviates this effect. Our analysis thus serves three purposes. First, it corroborates prior evidence on the detrimental consequences of capital market imperfections for firms' participation in international trade. Second, it indicates that financial considerations are an important determinant of the sectoral composition of MNC activity abroad. Third, it provides indirect evidence that multinational subsidiaries and joint ventures are less credit constrained than domestic enterprises.

4.3   Sensitivity analysis

Our baseline results survive a series of sensitivity checks that alleviate concerns with potential omitted variable or sample selection biases (all available on request). While the regressions in Table 2 include single-sector firms, identical point estimates of higher statistical significance obtain if we omit them from the sample. This is because with firm fixed effects, all coefficients are identified from the variation across industries within multi-sector manufacturers. The same holds for all other specifications below when the

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[24] We compute comparative statics for each *FinVuln$_i$* measure by comparing sectors and firm sizes at the 25th and 75th percentile of their respective distributions. We report the average comparative static across all columns in Table 2.

unit of observation is the firm-sector pair. When the outcome of interest varies by firm-sector-destination or firm-product-destination triplet, removing the single-sector sellers leads to virtually identical results of higher significance.[25,26] Our findings are also robust to adding state-owned enterprises to the sample, who do not appear systematically different from private domestic firms (column 4 of Appendix Table 3).

The prior literature has identified a number of factors unrelated to financial frictions that affect MNC incentives. Our estimates might thus spuriously capture the role of industry characteristics other than financial vulnerability. For example, cross-country differences in factor costs and sectors' factor intensity shape headquarters' decision to offshore manufacturing within the boundaries of the firm (Helpman 1984, Yeaple 2003, Antràs 2003). In the presence of imperfect contractibility and relationship-specific investments, multinational activity is also more likely than arms-length outsourcing in R&D- and contract intensive sectors (Antràs 2003). R&D intensive companies might similarly prefer to offshore production in-house if they are concerned about the expropriation of their intellectual property (Javorcik and Wei 2009).

Appendix Table 3 indicates that these alternative determinants of MNC activity are orthogonal to credit frictions. We expand specification (1) to include the interactions of firm size and the ownership dummies with sectors' physical and human capital intensity (column 5), R&D intensity (column 6), or contract intensity (column 7).[27,28] Our results for β and γ remain unchanged. Moreover, the economic effect of financial vulnerability is on par with that of human capital intensity, about three times that of physical capital intensity, and as much as ten times that of contract sensitivity.[29] These comparative statics illustrate the importance of financial factors to the operations of multinational companies.

Separately, foreign-owned firms could face either more or less severe agency problems than Chinese domestic exporters. On the one hand, if MNCs come from countries with stronger corporate governance institutions than China, they may better handle conflicts among shareholders or between shareholders, managers and other stakeholders. On the other hand, if MNCs are larger on average and have more dispersed shareholders, they may suffer more severe agency problems. Our results could reflect an effect other than financial frictions if *both* multinationals better manage corporate governance issues *and* such issues are more prevalent in financially more dependent sectors.

We perform three checks for this possibility and find no support for this alternative governance explanation. First, we construct an index of industries' corporate governance intensity and confirm that it is

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[25] When we estimate column 3 of Appendix Table 3 separately for single- and multi-sector exporters, we obtain lower point estimates for the former. This implies that the effect of financial frictions on selection into exporting is stronger for single-sector (and presumably most constrained) firms close to the export cut-off, consistent with Section 2.1.

[26] Separately, we have also found qualitatively similar patterns for new and continuing exporters.

[27] Data on sectors' factor, R&D and contract intensity from Braun (2003), Kroszner et al. (2007) and Nunn (2007).

[28] Since most R&D expenses are incurred up front, high R&D intensity may generate greater needs for external finance. Controlling for R&D intensity might thus be over-controlling and underestimate the effect of credit frictions.

[29] For each sector measure, we calculate the advantage that foreign affiliates enjoy over domestic firms in a sector at the 75th percentile relative to a sector at the 25th percentile. We then compare this static across sector measures.

not significantly correlated with industries' financial vulnerability $FPC2_i$ (correlation coefficient -0.13, p-value 0.60).[30] Second, we add interactions of firm size and ownership with sectors' governance intensity to regression (1). This not only does not affect β and γ, but also reveals no differential performance of foreign and domestic firms in governance intensive sectors. Finally, we see no evidence that financially more vulnerable sectors attract more MNCs from countries with superior corporate governance institutions, nor that MNCs from such countries enjoy a comparative advantage in financially sensitive sectors.[31]

4.4 Intensive vs. extensive margin

We next explore the mechanisms through which credit constraints affect firms' export performance and multinational activity by examining their effect on different margins of trade. As described in Section 2.1, frictions in the financing of variable costs would distort the intensive margin by reducing the value of firm sales to individual export markets. By contrast, frictions in the financing of fixed trade costs would act on the extensive margin by restricting the number of markets that firms enter.

We first analyze the impact of financial frictions on the intensive margin. Defining export markets at the country-sector level, we consider firm f's exports to destination d in industry i, $Exports_{fdi}$:

$$\log Exports_{fdi} = \alpha + \beta \cdot FinVuln_i \cdot D_f^{JV} + \gamma \cdot FinVuln_i \cdot D_f^{MNC} + \varphi_f + \varphi_d + \varphi_i + \varepsilon_{fdi} \qquad (2)$$

In addition to sector and firm fixed effects, this specification allows us to now also control for unobserved market characteristics with country fixed effects, to more cleanly isolate the impact of credit constraints. For example, the φ_d's account for the cross-country variation in market size, consumer income, exchange rates, and trade costs (such as tariff and non-tariff barriers, quality of ports and other infrastructures, etc.). With this exhaustive set of fixed effects, the coefficients on the interaction terms are identified from the variation in financial vulnerability across sectors and in ownership types across firms within destination markets, and from the variation across sectors and destinations within firms. At this level of disaggregation, 978,140 observations span 88,004 companies, 231 importing countries and 36 sectors.

As Table 3 indicates, MNC affiliates and joint ventures have systematically higher bilateral exports in financially more vulnerable industries than private domestic firms (column 1). These results are highly statistically and economically significant, with point estimates about 90% as large as those for firms' global exports in Table 2. Bigger sellers also conduct more bilateral trade in financially more sensitive sectors, and the magnitude of this effect is 86% of that in Table 2. Similar patterns obtain when we explore the full

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[30] We measure sector i's natural dependence on effective corporate governance with the average governance index across all US firms in sector i using data from Gompers et al. (2003). We are able to do this for 20 industries.
[31] We conducted online searches to manually identify the parent country for the largest 4,557 MNC affiliates in our data based on firm names, location in China, and industry affiliation. We follow La Porta et al. (1998, 2002) in measuring the strength of countries' corporate governance institutions with a dummy for common-law legal origin or a continuous index of anti-director rights.

dimensionality of the data and identify the intensive margin as firms' bilateral exports by HS 8-digit product, for a sample of 1,824,950 observations (column 2).[32]

We next evaluate the consequences of financial market imperfections for the extensive margin of firm exports. The granularity of the data allows us to define this margin in different ways. This has the advantage that we do not have to take a stance on the specific level at which firms incur fixed trade costs or the potential cost synergies across destinations within a product or across products within a destination.

We first consider three measures of the extensive margin at the firm-sector level, and re-estimate specification (1) using each of them as the outcome variable. Exporters' product scope ($\log \#Products_{fi}$) counts the number of HS-8 products that firm f sells (to at least one market) in industry i. The number of destinations ($\log \#Dest_{fi}$) gives the number of countries that firm f serves (with at least one product) in sector i. The total number of destination-product markets ($\log \#ProdDest_{fi}$) represents the overall number of trading relationships that f maintains in industry i. It sums the number of bilaterally traded products to country d across all destinations d, i.e. $\log \#ProdDest_{fi} = \log(\sum_d \#Products_{fdi})$. As a fourth indicator of firms' extensive margin, we finally study $\log \#Products_{fdi}$ itself and use it in place of the outcome variable in equation (2). This allows us to include destination fixed effects φ_d to control for unobserved importer characteristics that might affect exporters' optimal product scope in d.

The evidence in Table 3 suggests that in financially more vulnerable sectors, bigger and foreign-owned firms tend to serve more destinations than domestic enterprises (column 4). They usually also export a broader range of products in the markets they enter (column 6). As a result, they establish more trading relationships in total (column 3). On the other hand, exporters' overall product scope appears less responsive to the variation in financial conditions across sectors (column 5).[33] These regressions impose a specific functional form by applying OLS to logged dependent variables. If we instead adopt the negative binomial model, or if we cluster by firm, very significant coefficients obtain for all extensive margins.[34]

Together, these patterns imply that credit constraints restrict firms' ability to enter more markets, to widen their product scope, and to expand their trade volumes. This has three implications in view of the model in Section 2.1. First, our results are consistent with firms facing constraints in the financing of both

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[32] Decomposing bilateral sales by product into unit values and quantities traded, we have found that foreign firms export bigger quantities than domestic firms in financially more sensitive sectors. This suggests that financial frictions prevent firms from operating at their full export potential. The evidence for export prices is mixed, indicating that credit constraints curtail companies' export potential by limiting both productivity and quality improvements.

[33] The results for the extensive margin depend on the measure of $FinVuln_i$. They hold when we consider the reliance on external finance for fixed costs (external finance dependence), but only the size interaction enters significantly when we focus on the financing of variable costs (inventories ratio). This is consistent with the idea that fixed costs are more relevant to firms' extensive-margin decisions than variable costs.

[34] NBM allows the dispersion parameter for the distribution of the outcome variable to vary across firms. However, it is not a linear estimator and does not permit firm fixed effects. In OLS, these act as slope-preserving shifts in the intercept and allow us to estimate and naturally interpret the effect of credit constraints across sectors within firms.

fixed and variable export costs, as reflected in the distortions to the extensive and the intensive margins, respectively. Financial frictions appear to operate mainly through the intensive margin (bilateral exports by product, 80%), with a more moderate effect on the extensive margin (number of destination-product markets, 20%): the point estimates for $\#ProdDest_{fi}$ are about 20% of those for total exports in Table 2.

Second, our findings indirectly confirm priors that firms face a fixed export entry cost in each destination-product market. If these costs were instead market specific but independent of product scope, or were constant at the product level regardless of the number of destinations, credit constraints would have affected either only $\#Dest_{fi}$ or $\#Products_{fi}$, but not both $\#ProdDest_{fi}$ and $\#Products_{fdi}$.

Finally, the results for firms' export product scope and trade-partner intensity suggest that credit market imperfections distort trade flows above and beyond their effect on firms' domestic production. If cross-border sales were only as sensitive to financial frictions as domestic activities, distortions to trade volumes would be proportional to distortions to total production but there would be no adjustments along the extensive margin of trade. Our findings are thus aligned with earlier evidence that exporters are more reliant on external finance than domestic producers.

4.5   Additional evidence

Trade costs across destinations

We have argued that financial frictions restrict cross-border trade because firms are unable to cover up-front expenses associated with exporting. Were these expenses negligible or not borne up-front, access to finance would be irrelevant and credit constraints not binding. As further evidence for the credit mechanism, we now show that foreign affiliates outperform domestic companies not just in financially more vulnerable sectors in general, but specifically when firms face higher export costs.

We exploit the fact that some destinations are costlier to serve than others. The availability of financial capital will be more important to exporters when both a market entails higher trade costs and they rely more on the financial system for meeting these costs. We therefore construct a finer indicator of the credit conditions pertinent to firms in sector i selling to country d as the product of two variables, $TradeCost_d \cdot FinVuln_i$. Using this measure in place of $FinVuln_i$, we estimate a modified version of specification (2) for firms' bilateral exports by industry:

$$\log Exports_{fdi} = \alpha + \beta \cdot (TradeCost_d \cdot FinVuln_i) \cdot D_f^{JV} + \gamma \cdot (TradeCost_d \cdot FinVuln_i) \cdot D_f^{MNC}$$
$$+ \delta \cdot (TradeCost_d \cdot FinVuln_i) + \varphi_f + \varphi_d + \varphi_i + \varepsilon_{fi} \tag{3}$$

As before, we include firm, sector and destination fixed effects. These still subsume the main effects of the ownership dummies D_f^{JV} and D_f^{MNC}, but not that of $TradeCost_d \cdot FinVuln_i$.

We employ four common proxies for $TradeCost_d$. Log bilateral distance to China reflects the variable transportation costs associated with trade transactions. It might also correlate with taste similarity across borders and hence the cost of product customization. For the fixed costs of shipping, setting up and maintaining foreign distribution networks, we use three estimates from the World Bank's *Doing Business Report*: the log nominal cost (per shipping container), the log number of days, and the log number of documents required to export to destination *d*. These four variables deliver very sharp results consistent with our conclusion that financial frictions distort international trade flows and affect the sectoral composition of MNC activity (Table 4). In financially more vulnerable industries, bigger and foreign-owned firms export more than smaller domestic companies to countries associated with higher trade costs.

Placebo: other variation across destinations

We next perform a falsification exercise: We confirm that MNCs are not differentially sensitive to financial vulnerability when it comes to outcomes for which finance shouldn't matter. To this end, we explore the variation in destination characteristics $Placebo_d$ that cannot influence exporters' decisions through the credit channel. This requires that $Placebo_d$ do not affect export revenues, trade costs and/or the financial burden of these trade costs, since these would all enter the profit maximization problem of credit constrained firms. We consider countries' endowment of natural resources and general rule of law, and expand specification (2) to include triple interactions (the main effect of $Placebo_d$ is subsumed by φ_d):

$$\log Exports_{fdi} = \alpha + \beta \cdot (FinVuln_i \cdot D_f^{JV}) + \gamma \cdot (FinVuln_i \cdot D_f^{MNC}) \tag{4}$$
$$+\delta_1 \cdot (FinVuln_i \cdot D_f^{JV}) \cdot Placebo_d + \delta_2 \cdot (FinVuln_i \cdot D_f^{MNC}) \cdot Placebo_d + \varphi_f + \varphi_d + \varphi_i + \varepsilon_{fdi}$$

Reassuringly, in Table 5 we find that the sensitivity of foreign affiliates to sectors' financial vulnerability (relative to that of domestic enterprises) indeed does not vary with the placebo measures (Columns 1-2).

Financial development across Chinese provinces

The banking sector in China is known to be geographically segmented (as in most other countries), with firms typically borrowing from banks in their home province (Boyreau-Debray et al. 2005), at least until recently. At the same time, there is substantial variation in financial development across Chinese provinces in terms of access to credit. We now explore this variation to shed light on the financing practices of foreign and domestic companies and on their interaction in the local capital market.

One might be tempted to think that domestic firms face less credit constraints in regions with a higher level of financial development. However, it is in principle ambiguous how the relative export performance of foreign and local firms will differ between financially more and less advanced provinces. This ambiguity arises because MNC affiliates can potentially raise capital from multiple sources: from

banks in China, from banks in other countries, and from their parent companies. By contrast, most domestic enterprises can only borrow locally. It is thus instructive to distinguish between a few possible cases.

(Case 1) If foreign subsidiaries do not borrow in China at all, provincial credit conditions would affect the financial health of local companies only. In financially more advanced regions, we would then expect MNCs to enjoy less of an advantage over domestic firms in financially more dependent sectors.

(Case 2) Evidence however suggests that multinationals use financial markets opportunistically: Affiliates typically obtain capital locally if they can, normally in host economies with strong financial systems, and rely on parent financing otherwise (Desai et al. 2004a). If MNCs' bank borrowing in China is a perfect substitute for funding obtained elsewhere, then MNC subsidiaries would be financially unconstrained regardless of the province in which they operate. We would then again predict that their performance relative to domestic firms would be stronger in financially less developed provinces.

(Case 3) In practice, this is not guaranteed as MNC affiliates are not completely immune to credit constraints (Feinberg and Phillips 2004). In other words, finance raised in China may not be just a substitute for other funding sources, but an additional source of capital for MNC subsidiaries. (Case 3a) If foreign and domestic firms are equally less credit constrained in financially more advanced parts of China, the effects we have identified would not vary across provinces. (Case 3b) They might even be stronger in financially more developed regions if banks favor multinational affiliates, because they are more profitable, more trustworthy, or less likely to default since their parent can bail them out. Anecdotal evidence in the media suggests that this is in fact happening. (Case 3c) Conversely, state-owned local banks might treat domestic enterprises preferentially for political reasons, or if they have relatively less information about and monitoring power over foreign entities. If so, the patterns we have found would be weaker in provinces with superior financial systems.

We explore these questions empirically by expanding our baseline equation (1) to include triple interactions with provincial financial development, $FinDevt_p$.[35] We measure $FinDevt_p$ with the ratio of total bank loans to GDP, available from the Almanac of China's Finance and Banking. In Table 5, we find some suggestive but inconclusive evidence that MNC affiliates export relatively more than domestic firms in financially more vulnerable sectors when they are based in financially less developed provinces (Column 3). We have found similar patterns for firms' exports by sector, as well as for firms' exports by destination-sector (intensive margin) and number of destinations (extensive margin). While the sign of the triple

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[35] We have found similar results when conducting this exercise in two different ways. One option is to adopt a variant of equation (4) where $Placebo_d$ is replaced by $FinDevt_p$; the main effect of $FinDevt_p$ is then subsumed by the firm fixed effects. An alternative is to fully saturate the model by including all pair-wise double interactions between the ownership dummies, provinces' financial development, and sectors' financial vulnerability; the interaction between the first two is then subsumed by the firm fixed effects. To be conservative, we report the latter in Table 5.

interactions is stable across these outcomes for fully foreign-owned affiliates, however, the coefficients are not always precisely estimated. We also observe no significant results for joint ventures.[36,37]

Although we use a conventional measure of $FinDevt_p$, a caveat is in order. Provinces with a higher measured level of financial development may also offer more business opportunities and higher returns. Private firms' demand for loans may thus also be bigger in such regions. In addition, large banks have started to systematically re-channel funding from lower-return to higher-return areas. Therefore, the true extent of financial constraints may no longer be well captured by the traditional loan-to-local GDP ratio.

Without direct information on firms' financing practices, our results do not cleanly distinguish between the cases summarized above. We therefore leave a more thorough inspection of the mechanisms through which regional financial development affects firm behavior in China to future work. What we can, however, conclude is that local financial development does not fully compensate for domestic firms' worse access to banks abroad and to deeper internal capital markets relative to foreign affiliates. Were that the case, we would not find our baseline results that MNCs have a comparative advantage in financially vulnerable sectors. Also, comparing the point estimates on the double and triple interactions in Table 5, this pattern holds even in Chinese regions with very high levels of financial development.

5 Conclusion

This paper provides micro-level evidence on the harmful consequences of financial market imperfections for firms' ability to engage in international trade. We show that credit constraints severely restrict companies' total exports, prevent them from entering more markets, and limit their export product range.

We also demonstrate that MNC subsidiaries and joint ventures in China have superior export performance compared to private domestic firms, and that this advantage is systematically higher in financially more vulnerable sectors. This is consistent with foreign affiliates accessing internal capital markets in order to overcome binding credit constraints, and thereby enjoying a comparative advantage in financially sensitive industries. Our findings thus highlight the importance of credit conditions in determining the organizational and production activities of multinational corporations.

A broader implication of our results is that FDI can alleviate the effects of credit frictions on growth, trade and private sector development in financially immature economies. Yet the 2007-2009 global crisis raises concerns about the spread of financial shocks via MNCs' network of affiliates. Whether

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[36] Similar patterns emerge if we aggregate the data and study total exports by province, sector and ownership type. This is consistent with subsequent evidence in Jarreau and Poncet (2012).

[37] We have also found that provincial financial development supports more SOEs relative to private domestic firms in financially more vulnerable sectors, but not higher SOE firm-level exports. This suggests that state-owned banks might favor SOEs, but SOEs do not optimally allocate resources in response to sectors' financial vulnerability.

multinational activity and foreign capital flows improve steady-state credit conditions in host countries at the expense of greater volatility and exposure to world crises presents a fruitful area for future research.

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Table 1. Distribution of Trade Flows across Firms and Sectors

This table examines the distribution of Chinese trade flows across firms with different organizational structure and across sectors with different levels of financial vulnerability in 2005. *External Finance Dependence* is the share of capital expenditures not financed with cash flows from operations. *Inventories Ratio* is the ratio of inventories to sales. *Asset Tangibility* is the share of fixed assets in total assets. *Trade Credit Intensity* is the ratio of the change in accounts payable to the change in total assets. These measures come from Kroszner-Laeven-Klingebiel (2007) or Fisman-Love (2003), and are based on Compustat data for U.S. firms. The trade values in the first column are in billion US Dollars. The percentage shares reported in each row sum to 1.

Firm Type:	All Firms	State-Owned	Private Domestic	Joint Ventures	Foreign-Owned
	(1)	(2)	(3)	(4)	(5)
Total Exports	531.36	9.8%	12.9%	26.3%	51.0%
Panel A. Classifying sectors by external finance dependence					
Low	173.47	14.9%	23.4%	29.4%	32.3%
High	357.89	7.3%	7.8%	24.8%	60.1%
Panel B. Classifying sectors by inventories ratio					
Low	94.01	19.9%	18.8%	32.1%	29.2%
High	437.35	7.6%	11.6%	25.1%	55.7%
Panel C. Classifying sectors by asset tangibility					
Low	423.04	6.2%	9.9%	25.9%	58.0%
High	108.32	23.8%	24.4%	28.1%	23.7%
Panel D. Classifying sectors by trade credit intensity					
Low	285.63	4.9%	7.5%	24.8%	62.8%
High	245.73	15.5%	19.1%	28.1%	37.3%

Table 2. Foreign Ownership, Firm Size and Firm Exports

This table examines the effect of credit constraints on firm exports across sectors within firms. *JV* and *MNC* are indicator variables for joint ventures and fully foreign-owned MNC affiliates respectively. *Firm size* is proxied by firms' (log) total exports. The measure of sectors' financial vulnerability is indicated in the column heading and defined as in Table 1. In Colmn 5 (Column 6) it is the first principal component of the individual measures in Columns 1-2 (Columns 1-4). In Column 7, it is the standardized average of the measures in Columns 1-4. All regressions include a constant term, firm fixed effects, and sector fixed effects. Standard errors clustered by sector. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Dependent variable: (log) firm exports by sector

Fin vuln measure:	Ext Finance Dependence	Inventories Ratio	Asset Tangibility	Trade Credit Intensity	First Principal Component (FinDep,Tang)	First Principal Component (All Measures)	Sandardized Average (All Measures)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
JV x Fin vuln	0.88	6.76	-2.94	-1.56	0.54	0.25	0.74
	(4.09)***	(1.96)*	(-3.05)***	(-0.40)	(4.68)***	(1.85)*	(3.35)***
MNC x Fin vuln	0.94	7.20	-4.18	-5.40	0.67	0.35	0.95
	(3.40)***	(2.56)**	(-4.69)***	(-1.46)	(6.37)***	(2.72)***	(4.85)***
Size x Fin vuln	0.21	2.93	-1.16	-0.72	0.16	0.11	0.25
	(1.84)*	(3.35)***	(-3.96)***	(-0.76)	(3.42)***	(2.94)***	(3.32)***
Sector FE	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y
R-squared	0.51	0.51	0.52	0.51	0.52	0.51	0.52
# observations	221,801	221,801	221,801	221,801	221,801	221,801	221,801
# firms	88,004	88,004	88,004	88,004	88,004	88,004	88,004
# sectors	36	36	36	36	36	36	36

Table 3. Extensive and Intensive Margins of Firm Exports

This table examines the effect of credit constraints on the intensive and extensive margins of firm exports. The dependent variable is indicated in the column heading. Financial vulnerability is measured by the first principal component of *External Finance Dependence* and *Asset Tangibility*. All other variables are defined as in Table 2. All regressions include a constant term, firm fixed effects, and sector fixed effects. Columns 1, 2, and 6 also include destination fixed effects. Standard errors clustered by sector. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Dep variable:	Intensive Margin		Extensive Margin			
	(log) Exports by firm-sector-dest	(log) Exports by firm-product-dest	(log) # Dest-prod by firm-sector	(log) # Dest by firm-sector	(log) # Prod by firm-sector	(log) # Prod by firm-sector-dest
	(1)	(2)	(3)	(4)	(5)	(6)
JV x Fin vuln	0.47	0.41	0.11	0.11	0.02	0.03
	(5.09)***	(4.56)***	(1.93)*	(2.41)**	(0.36)	(1.50)
MNC x Fin vuln	0.62	0.54	0.12	0.10	0.02	0.04
	(7.49)***	(6.60)***	(2.00)*	(2.33)**	(0.45)	(1.78)*
Size x Fin vuln	0.14	0.09	0.04	0.03	0.03	0.02
	(3.98)***	(3.71)***	(2.84)***	(3.02)***	(2.49)**	(3.32)***
Firm, Sector FE	Y	Y	Y	Y	Y	Y
Destination FE	Y	Y	--	--	--	Y
R-squared	0.37	0.34	0.52	0.55	0.57	0.35
# observations	978,140	1,824,950	221,801	221,801	221,801	978,140
# firms	88,004	88,004	88,004	88,004	88,004	88,004
# sectors	36	36	36	36	36	36
# destinations	231	231	--	--	--	231

Table 4. Trade Costs across Export Destinations

This table examines the effect of credit constraints on firm exports across destinations with different trade costs. Trade costs (*Cost*) are measured by log bilateral distance, the log nominal cost of importing per shipping container, the log number of required import documents, or the log number of days necessary for import procedures as indicated in the column heading. These come from CEPII and the World Bank's "Doing Business Report". All other variables are defined as in Table 3. All regressions include a constant term, firm-, sector- and destination fixed effects. Standard errors clustered by sector. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Dependent variable: (log) firm exports by sector and destination

Trade cost measure:	(log) Distance	(log) Import Cost	(log) Import Docs	(log) Import Days
	(1)	(2)	(3)	(4)
Cost x Fin vuln	-0.30	-0.38	-1.25	-0.83
	(-3.34)***	(-3.17)***	(-4.28)***	(-4.29)***
JV x Cost x x Fin vuln	0.05	0.07	0.23	0.15
	(5.06)***	(5.10)***	(4.47)***	(4.13)***
MNC x Cost x x Fin vuln	0.07	0.09	0.29	0.18
	(7.42)***	(7.61)***	(6.41)***	(5.28)***
Size x Cost x x Fin vuln	0.02	0.02	0.06	0.04
	(3.91)***	(3.97)***	(3.94)***	(3.88)***
Firm, Sector FE	Y	Y	Y	Y
Destination FE	Y	Y	Y	Y
R-squared	0.37	0.37	0.37	0.37
# observations	977,119	956,320	956,320	956,320
# firms	88,001	87,640	87,640	87,640
# sectors	36	36	36	36
# destinations	210	171	171	171

Table 5. Placebo Variation across Export Destinations
and Financial Development across Chinese Provinces

This table examines the effect of credit constraints on firm exports across export destinations with different non-finance related characteristics, and across Chinese provinces with different levels of financial development. The dependent variable is indicated in the column heading. Destinations' *Natural Resources* endowment and *Rule of Law* come from the World Bank's "Expanding the Measure of Wealth" and La Porta-Lopez de Silanes-Shleifer-Vishny (1998). *Financial Development* is measured by the ratio of total bank loans to GDP by province. All other variables are defined as in Table 3. All regressions include a constant term, firm fixed effects, and sector fixed effects. Columns 1-2 also include destination fixed effects. Standard errors clustered by sector. T-statistics in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Dest / prov characteristic	(log) Natural Resources in Destination	Rule of Law in Destination	Financial Development in Province
Dep Variable	(log) Exports by firm-sector-dest	(log) Exports by firm-sector-dest	(log) Exports by firm-sector
	(1)	(2)	(3)
JV x Fin vuln	0.72	0.42	0.62
	(3.09)***	(2.46)**	(2.32)**
MNC x Fin vuln	0.83	0.38	0.98
	(2.80)***	(2.01)*	(5.99)***
Size x Fin vuln	0.13	0.13	0.15
	(3.49)***	(3.85)***	(3.33)***
JV x Fin vuln x x Dest or Prov char	-0.03	0.01	-0.08
	(-1.25)	(0.48)	(-0.48)
MNC x Fin vuln x x Dest or Prov char	-0.02	0.05	-0.29
	(-0.83)	(1.59)	(-2.77)***
Size x Fin vuln x x Dest or Prov char	0.00	0.00	0.01
	(1.32)	(2.37)**	(1.28)
Firm, Sector FE	Y	Y	Y
Destination FE	Y	Y	--
R-squared	0.39	0.37	0.52
# observations	693,771	953,655	221,801
# firms	76,976	87,572	88,004
# sectors	36	36	36

Appendix Table 1. Industry Characteristics

This table lists the different sector measures of financial vulnerability used in the empirical analysis, as defined in Table 1. The bottom two rows of the table report the mean and standard deviation of these measures across the 36 sectors.

ISIC	Industry	Ext Finance Dependence	Inventory Ratio	Asset Tangibility	Trade Credit Intensity
311	Food products	-0.15	0.10	0.37	0.06
313	Beverages	0.03	0.10	0.40	0.05
314	Tobacco	-1.14	0.28	0.19	0.04
321	Textiles	0.01	0.17	0.31	0.08
322	Apparel	-0.21	0.21	0.15	0.08
323	Leather products	-0.95	0.23	0.12	0.02
324	Footwear	-0.74	0.22	0.13	0.04
331	Wood products	0.05	0.11	0.32	0.08
332	Furniture	-0.38	0.15	0.28	0.05
341	Paper products	-0.35	0.13	0.42	0.06
342	Printing and publishing	-0.42	0.07	0.21	0.05
352	Other chemical products	-0.30	0.15	0.27	0.07
353	Petroleum refineries	-0.02	0.07	0.62	0.22
354	Petroleum and coal products	0.13	0.12	0.46	0.07
355	Rubber products	-0.02	0.15	0.36	0.13
356	Plastic products	-0.02	0.13	0.38	0.10
361	Pottery, china, earthenware	-0.41	0.17	0.28	0.03
362	Glass products	0.03	0.15	0.42	0.04
369	Non-metallic products	-0.29	0.15	0.48	0.07
371	Iron and steel	0.05	0.17	0.44	0.09
372	Non-ferrous metals	-0.12	0.16	0.32	0.08
381	Fabricated metal products	-0.25	0.17	0.28	0.08
382	Machinery, except electrical	-0.04	0.20	0.22	0.09
383	Electrical machinery	0.24	0.18	0.21	0.08
384	Transport equipment	-0.08	0.18	0.23	0.06
385	Prof and scient equipment	0.72	0.21	0.16	0.05
390	Other manufactured products	0.28	0.20	0.18	0.08
3211	Spinning	-0.05	0.16	0.38	0.18
3411	Pulp and paper	-0.07	0.12	0.60	0.06
3511	Industrial chemicals	-0.19	0.14	0.43	0.06
3513	Synthetic resins	0.03	0.13	0.40	0.07
3522	Drugs	2.43	0.13	0.16	0.03
3825	Office and computing	0.54	0.17	0.14	0.06
3832	Radio products	0.70	0.19	0.14	0.07
3841	Ship building	0.38	0.15	0.28	0.08
3843	Motor vehicles	0.06	0.14	0.28	0.10
	Average across Industries	-0.01	0.16	0.31	0.07
	St Dev across Industries	0.57	0.04	0.13	0.04

Appendix Table 2. Correlations between Industry Characteristics

This table reports the two-way correlations between different measures of sectors' financial vulnerability as defined in Table 1 and Table 2. Correlations in bold are significant at 5%.

	First Princ Component (FinDep,Tang)	Ext Finance Dependence	Inventory Ratio	Asset Tangibility	Trade Credit Intensity
First Princ Component (FinDep,Tang)	1.00				
Ext Finance Dependence	**0.75**	1.00			
Inventory Ratio	0.27	-0.23	1.00		
Asset Tangibility	**-0.75**	-0.12	**-0.64**	1.00	
Trade Credit Intensity	-0.29	0.03	-0.32	**0.45**	1.00

Appendix Table 3. Firm Size, Selection into Exporting, and Other Sector Characteristics

This table examines the contribution of firm size and selection into exporting to the effect of credit constraints on firm exports by sector, and the robustness of this effect to controlling for other sector characteristics. *Factor Intensity* refers to sectors' physical and human capital intensity, from Braun (2003); the columns with these controls report interaction coefficients for these two measures in that order. *R&D Intensity* is the share of R&D expenditures in total sales, from Kroszner-Laeven-Klingebiel (2007). *Contract Intensity* reflects the importance of relationship-specific investments in the production of inputs for a given sector, from Nunn (2007). All other variables are defined as in Table 3. All regressions include a constant term, firm fixed effects, and sector fixed effects; Column 3 excludes the firm fixed effects. Standard errors clustered by sector. T-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Dependent variable: (log) firm exports by sector

	Baseline	No Size Interaction	No Firm Fixed Effects	With SOEs	Factor Intensity Control	R&D Intensity Control	Contract Intensity Control
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
JV x Fin vuln	0.54 (4.68)***	0.62 (4.41)***	0.33 (3.95)***	0.56 (4.77)***	0.41 (2.64)**	0.56 (3.31)***	0.56 (4.34)***
MNC x Fin vuln	0.67 (6.37)***	0.73 (5.94)***	0.60 (6.45)***	0.70 (6.50)***	0.57 (3.73)***	0.66 (5.35)***	0.67 (6.36)***
Size x Fin vuln	0.16 (3.42)***			0.13 (3.16)***	0.17 (2.96)***	0.20 (3.86)***	0.15 (3.27)***
JV			0.52***				
MNC			0.25***				
SOE x Fin vuln				-0.17			
JV x Control					-7.5, 1.5**	-1.0	-1.1
MNC x Control					-5.6, 1.3**	0.4	0.3
Size x Control					1.0, -0.2	-1.3	0.4**
Sector FE	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	N	Y	Y	Y	Y
R-squared	0.52	0.51	0.15	0.51	0.52	0.52	0.52
# observations	221,801	221,801	221,813	246,426	216,473	221,801	221,801
# firms	88,004	88,004	88,005	93,580	87,291	88,004	88,004
# sectors	36	36	36	36	35	36	36