Exporting and Frictions in Input Markets: Evidence from Chinese Data

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Abstract

This paper investigates the impact of international trade on input market distortions. We focus on a specific friction, binding borrowing constraints in capital markets. We propose a theoretical model where a firm's demand for capital is constrained by an initial asset allocation and past sales. While the initial distribution of assets induces misallocation if the asset endowment at more productive firms does not fully cover their demand for capital, the dependence of the borrowing constraint from past sales proxies for cross-firm differences in the cost of default, which is empirically higher at larger firms. Overtime, an increase in sales relaxes the borrowing constraint; similarly, shocks to market access–such as opening to trade–contribute to easing the financial constraints, thus accelerating the convergence toward the frictionless allocation. To analyze the empirical relationship between market access and credit frictions, we draw on the annual surveys conducted by the Chinese National Bureau of Statistics (NBS) for 1998 to 2007, and we construct firm-level measures of distortions that control for firm heterogeneity. We find smaller labor and capital distortions across exporting firms; such distortions are even smaller in sectors where firms face lower tariffs or are more dependent on external financing, a proxy for the presence of binding financial constraints. Our empirical analysis also shows that market access shocks significantly reduce the dispersion across input returns over time, with the effect mostly occurring at constrained firms. Our findings point to within-sector input reallocation as an important channel to overcome misallocation in open economies.

Key words: Heterogeneous Firms, Financial Frictions, Misallocation, International Trade.

JEL classification: F12, F14, O40.

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1 Introduction

Removing barriers to trade contributes to the reallocation of inputs toward successful exporters. Do standard estimates that rely on import shares and trade elasticities fully capture the welfare gains arising from those reallocations? The answer relies on whether the quantitative welfare equivalence proven by Arkolakis et al. [2012] between heterogenous-firm and traditional models continues to hold in presence of frictions in input markets. If shifting resources across firms overcomes the misallocation of capital and labor inputs,[1] these reallocations may magnify model estimates of the productivity gains occurring after episodes of trade liberalization. Our paper highlights the link between opening to trade, misallocation, and productivity; in particular, we study whether trade enhances productivity by inducing firms to modify their input choices, thus lowering aggregate distortions.[2]

We focus on a specific friction, binding borrowing constraints in capital markets. We propose a model where a firm's demand for capital is constrained by an initial distribution of assets and past sales. While the initial asset distribution induces misallocation if the asset endowment at more productive firms does not fully cover their demand for capital, the dependence of the borrowing constraint from past sales proxies for cross-firm differences in the cost of default. As shown by Gopinath et al. [2017], such dependence implies that larger firms are allowed to borrow more as they face larger costs of disruption in case of default, and it is consistent with empirical evidence and a non-default equilibrium in a microfoundation with limited contract enforcement. In our framework, an increase in sales relaxes the borrowing constraints over time; similarly, shocks to market access, such as opening to trade, contribute to easing the financial constraints, thus accelerating the convergence toward the frictionless allocation.

To analyze the empirical relationship between market access and credit frictions, we draw on the annual surveys conducted by the Chinese National Bureau of Statistics (NBS) for 1998 to 2007. Following the intuition behind the measures proposed by Hsieh and Klenow [2009], we then construct a firm-level measure of distortions based on the dispersion across firm-level average input products within a sector. Our measure also controls for cross-firm heterogeneity in productivity and mark-ups, two spurious factors that may influence the dispersion across firm-level average input products;

[1] Hsieh and Klenow [2009], for example, calculate that removing the divergence in the marginal products of capital and labor across firms increases total factor productivity (TFP) in China by 86-115 percent. Their exercise, however, does not single out the effect of opening to trade on the reduction of capital and labor wedges.

[2] To the best of our knowledge, evidence on the interactions between opening to trade, misallocation, and productivity is scant. Notable exceptions are Epifani and Gancia [2011], Eslava et al. [2013], and Edmond et al. [2015], which highlight the mark-up channel.

we interpret the residual dispersion in input returns as capturing the extent of misallocation in the economy.

In our empirical analysis, we document that our measures of labor and capital distortions decline, on average, over 1998 to 2007, a period during which Chinese firms experienced large tariff cuts in export markets. We also test two implications of our model. First, looking within age-sector-year cells, we find that the dispersion across average products is smaller for exporters compared to non-exporters; moreover, the dispersion is even smaller in sectors where firms face lower tariffs. Second, we find that becoming an exporter induces firms to significantly alter their input choices in order to overcome frictions in input markets; this effect is robust to a strategy that exploits the variation in firm-level export tariffs, a measure of market access less likely to suffer from endogeneity bias.

To provide direct evidence on the link between misallocation and credit constraints, we identify heterogeneous effects of exporting across sectors varying in their degree of financial dependence. We find that shocks to market access are associated with larger and significant reductions in distortions in sectors more dependent on external finance. As a falsification test for our analysis, we exploit differences in ownerships. Anecdotal evidence suggests that state-owned enterprises (SOEs) face lower frictions in capital markets. We confirm that entering into foreign markets reduces the distortions only across private firms, while the effect has the opposite sign for SOEs.

This paper contributes to the growing literature on misallocation and productivity, which is surveyed in a recent chapter by Restuccia and Rogerson [2013]. More specifically, our analysis combines the *direct* and the *indirect* approaches–i.e., we identify the residual within-sector dispersion as a measure of distortion, although we suggest that frictions in financial markets are the underlying cause of such distortions. In terms of modeling, our theoretical framework is similar, in spirit, to Gopinath et al. [2017], who introduce size-dependent financial constraints.

Our paper is also related to the literature on financial constraints and trade. Recent contributions suggest that exporting improves firm access to external funds: Campa et al. [2002] and Bridges and Guariglia [2008] point to the effect of international diversification, while Ganesh-Kumar et al. [2001] argue that, in presence of asymmetric information, exporting signals firm productivity to investors. Greenaway et al. [2007] provide empirical evidence of the effect of exporting on firm financial health. Our paper is based on a similar premise, but we focus on the effect of trade on reducing misallocation through the financial constraint channel. Papers that highlight the role of the financial constraints in hindering access to foreign markets complement our story.[3] A closely related paper, Besedeš

[3] Several contributions highlight the role of financial constraints in hindering participation in export markets. See, for example, Beck [2002], Beck [2003], Bellone et al. [2010], Amiti and Weinstein [2011], Manova [2013], Feenstra et al. [2014], Manova et al. [2015], Chaney [2016], Kohn et al. [2016], and Manova and Yu [2016].

et al. [2014], develops a dynamic model with borrowing constraints and asymmetric project risk for exporters. While the authors aim at explaining how financial constraints affect export growth, we look at the effect of trade in alleviating input misallocation due to those same constraints.

The mechanism described in our paper is consistent with other evidence on productivity growth in China. Brandt et al. [2012] carefully analyze productivity growth in China over 1998 to 2007. They suggest that productivity growth is significantly lower during 1998 to 2001 than in the period following China's accession to the WTO. In a follow-up paper, Brandt et al. [2017] find that opening to trade played an important role in the growth of the Chinese economy. Our paper complements their findings; we shift the focus to a specific channel, resource reallocation occurring after episodes of trade liberalization.

The rest of the paper is organized as follows. We develop our theoretical framework in section 2. Section 3 develops the empirical strategy, describing the data and the construction of our measures of distortions. Section 4 presents the regression analysis and section 5 concludes.

2 Theory

The role of the theory is to develop a simple framework to explain how exporting affects the dispersion across input returns. We follow Hsieh and Klenow [2009], with a focus on a single sector, s, as our analysis aims at emphasizing the within-sector dispersion across labor and capital. Output in sector s is a CES aggregator of the output produced by each firm,[4]

$$Y_{st} = \left[\int_{i \in I_s} Y_{ist}^{\frac{\sigma-1}{\sigma}} \mathrm{d}i \right]^{\frac{\sigma}{\sigma-1}}$$

where I_s denotes the set of active firms. The output of firm i is produced according to a Cobb-Douglas technology,

$$Y_{ist} = z_{is} L_{ist}^{\alpha_s} K_{ist}^{1-\alpha_s}$$

where z_{is} is the initial productivity draw for firm i. We allow labor and capital shares to be different across sectors, but we assume that the technology does not vary across firms within a sector and over time. The assumption of sector-specific time-invariant capital and labor shares is probably too strong for a period in which the Chinese industrial sector was undergoing large structural reforms; in our empirical analysis, we will introduce firm-fixed effects, measures of firm size, TFP estimates,

[4]We maintain the underlying assumption that the aggregate output of final product coincides with utility aggregator of a representative consumer–i.e., utility is linear in Y_{st}.

and sector-time dummies to control for changes in labor and capital shares.

Our framework departs from Hsieh and Klenow [2009] in that we focus on a specific factor that distorts labor and capital choices: financial frictions in capital markets. We assume that firms are subject to credit constraints, which depend on the firm asset endowment, A_{is}, and past sales, $P_{is,t-1}Y_{is,t-1}$,

$$K_{ist} \leq A_{is} + h\left(P_{is,t-1}Y_{is,t-1}\right) \tag{1}$$

In our model, the initial distribution of assets is an additional source of heterogeneity that is uncorrelated with productivity draws; this hypothesis guarantees that even firms with high productivity would be constrained if their initial asset endowment were sufficiently low. Therefore, the initial asset distribution induces capital misallocation as it prevents capital from flowing toward the most productive firms.

In addition, we allow firms to pledge past performance against capital borrowing. The term $h\left(P_{is,t-1}Y_{is,t-1}\right)$ captures the cost from disruption in production in the case of default. Gopinath et al. [2017] propose a model with limited enforcement of contracts where equation (1) results from the requirement that firms do not default in equilibrium; in their microfoundation, the cost of default, $h\left(\cdot\right)$, is an increasing and convex function of firm size. Empirical evidence confirms that the cost of default is larger for bigger firms: measures of leverage are positively correlated with past revenues in our data (table B1), consistent with the findings in Arellano et al. [2012] and Gopinath et al. [2017].[5] Under the assumption of larger disruptions for bigger firms in the case of default, firms with larger revenues are less likely to default and are allowed to borrow more; similarly, improvements in firm performance relax the borrowing constraints over time. As those constraints become less binding, capital is able to flow toward the most productive firms, thus attenuating the level of misallocation in the economy.

In what follows, we assume $h\left(P_{is,t-1}Y_{is,t-1}\right) = P_{is,t-1}Y_{is,t-1}$, as our interest mainly lies in the qualitative predictions of the theoretical model. Linking borrowing constraints to past sales induces path dependence in the firm profit optimization problem,

$$\max_{L_{ist},K_{ist}} \sum_{t=0}^{T} \beta^t \left[P_{ist}Y_{ist} - wL_{ist} - rK_{ist}\right] \quad \text{s.to} \quad K_{ist} \leq A_{is} + P_{is,t-1}Y_{is,t-1},\ t = 0, 1, \ldots, T$$

[5] Section A.5 provides additional empirical evidence on size-dependent credit constraints.

The optimal allocation for labor and capital requires that

$$\alpha_{is}\frac{\sigma-1}{\sigma}\frac{P_{ist}Y_{ist}}{L_{ist}}\left(1+\mu_{is,t+1}\right)=w$$
$$\left(1-\alpha_{is}\right)\frac{\sigma-1}{\sigma}\frac{P_{ist}Y_{ist}}{K_{ist}}\left(1+\mu_{is,t+1}\right)=r+\mu_{ist}$$

where μ_{ist} denotes the Lagrange multiplier on the time t constraint.[6] The first-order conditions show that borrowing constraints distort both labor and capital choices through two channels. First, the dependence of borrowing on past sales creates an incentive for firms to increase the demand for both inputs in an attempt to ease future constraints. In particular, the term $(1+\mu_{is,t+1})$ is equivalent to an output distortion–more precisely, an output subsidy–in the Hsieh and Klenow [2009] framework, as it affects the marginal products of capital and labor proportionally. Second, borrowing constraints raise the marginal product of capital relative to labor through the term μ_{ist}, which corresponds to the capital distortion in the Hsieh and Klenow [2009] framework.

In our model, output and capital wedges adjust in response to shocks to market conditions. In particular, changes in market access–e.g., opening to trade–affect the incidence of borrowing constraints and, therefore, the level of misallocation in the economy. Before describing the features of the open economy, we determine the close economy equilibrium and compare this outcome to the frictionless allocation. Profit maximization implies that firms set prices that are constant markups over the marginal cost,

$$P_{ist}=\theta\frac{\sigma}{\sigma-1}\frac{w^{\alpha_s}\left[r+\mu_{ist}\right]^{1-\alpha_s}}{z_{is}\left(1+\mu_{is,t+1}\right)}$$

with $\theta\equiv\left[\left(\frac{1-\alpha_s}{\alpha_s}\right)^{\alpha_s}+\left(\frac{\alpha_s}{1-\alpha_s}\right)^{1-\alpha_s}\right]$. The revenues, the labor and the capital allocation at firm i are given by

$$P_{ist}Y_{ist}=\Psi E\frac{z_{is}^{\sigma-1}\left(1+\mu_{is,t+1}\right)^{\sigma-1}}{w^{\alpha_s(\sigma-1)}\left[r+\mu_{ist}\right]^{(1-\alpha_s)(\sigma-1)}}$$
$$L_{ist}=\tilde{\theta}_L\frac{z_{is}^{\sigma-1}\left(1+\mu_{is,t+1}\right)^{\sigma}}{w^{\alpha_s\sigma+1-\alpha_s}\left[r+\mu_{ist}\right]^{(\sigma-1)(1-\alpha_s)}}E$$
$$K_{ist}=\tilde{\theta}_K\frac{z_{is}^{\sigma-1}\left(1+\mu_{is,t+1}\right)^{\sigma}}{w^{\alpha_s(\sigma-1)}\left[r+\mu_{ist}\right]^{\sigma(1-\alpha_s)+\alpha_s}}E$$

where $\Psi\equiv\left[\theta\frac{\sigma}{\sigma-1}\right]^{1-\sigma}$, $\tilde{\theta}_L\equiv\left(\frac{\alpha_s}{1-\alpha_s}\right)^{1-\alpha_s}\left(\theta\frac{\sigma}{\sigma-1}\right)^{-\sigma}$, $\tilde{\theta}_K\equiv\left(\frac{1-\alpha_s}{\alpha_s}\right)^{\alpha_s}\left(\theta\frac{\sigma}{\sigma-1}\right)^{-\sigma}$, and E denotes the market access. In a frictionless allocation, $\mu_{ist}=0$ for all t; therefore, in presence of frictions, the variation in capital and labor choices over time is driven only by the evolution of distortions. At

[6] We normalize the value of the Lagrangean multiplier by the discount rate-i.e., $\mu_{is,t}\equiv\beta^t\tilde{\mu}_{is,t}$.

each t, the $\left(z_{is}^{\sigma-1}, A_{is}\right)$-space can be partitioned across three regions:[7]

- firms with $\mu_{ist} > 0$ and $\mu_{is,t+1} > 0$: this set includes all constrained firms.
- firms with $\mu_{ist} > 0$ and $\mu_{is,t+1} = 0$: this set includes the marginally constrained firms, i.e., firms which are constrained at t but will be unconstrained at $t+1$ and for every period thereafter.
- firms with $\mu_{ist} = 0$ and $\mu_{is,t+1} = 0$: this set includes all unconstrained firms.

To complete the characterization of the equilibrium, we describe the evolution of the sets of constrained and unconstrained firms over time. The following proposition establishes an important step,

Proposition 2.1. *Given* $\left(z_{is}^{\sigma-1}, A_{is}\right)$, $\exists\, t \in [0, \infty]$ *such that* $\mu_{ist} = 0$

Proof. Let $K_{is}^{*} \equiv \tilde{\theta}_K \frac{z_{is}^{\sigma-1}}{w^{\alpha_s(\sigma-1)} r^{\sigma(1-\alpha_s)+\alpha_s}} E$ denote the unconstrained capital allocation. We consider two cases.

Case 1: $A_{is} \geq K_{is}^{*}$. Firms with sufficient collateral are unconstrained over their entire lifetime and borrow the optimal amount of capital. In this case, $t = 0$.

Case 2: $A_{is} < K_{is}^{*}$. Proving the existence of t requires determining the equilibrium path of Lagrangean multipliers. Such path is a solution to the following system of equations, which collects all the constraints faced by firm i,

$$\begin{cases} \tilde{\theta}_K \frac{z_{is}^{\sigma-1}(1+\mu_{is,1})^{\sigma}}{w^{\alpha_s(\sigma-1)}[r+\mu_{is0}]^{\sigma(1-\alpha_s)+\alpha_s}} E = A_{is} \\ \tilde{\theta}_K \frac{z_{is}^{\sigma-1}(1+\mu_{is,j+1})^{\sigma}}{w^{\alpha_s(\sigma-1)}[r+\mu_{isj}]^{\sigma(1-\alpha_s)+\alpha_s}} E - \Psi E \frac{z_{is}^{\sigma-1}(1+\mu_{is,j})^{\sigma-1}}{w^{\alpha_s(\sigma-1)}[r+\mu_{is,j-1}]^{(1-\alpha_s)(\sigma-1)}} = A_{is}, \quad j = 1, \cdots \end{cases}$$

As the Jacobian matrix of the system with the first $t-1$ equation is non singular for all t, a solution exists.[8]. We will define t such that

$$t \equiv \inf \left\{[0, \infty] : \mu_{ist} \leq 0\right\}$$

□

[7] See section A.1.1 for a proof of this result.

[8] See section A.1.2 for a complete proof on the existence of a constrained solution.

Proposition 2.1 implies that the set of unconstrained firms tend to expand over time as firms are able to rely on past sales to increase their borrowing; over an infinite horizon, all firms would become unconstrained. Similarly, shocks to sales alleviate the impact of future borrowing constraints, while initially increasing the demand for inputs and forcing firms to hit their constraints. The following proposition summarizes our main result,[9]

Proposition 2.2. *Higher productivity and higher demand are positively correlated with the tightness of contemporaneous constraints and negatively correlated with the tightness of future constraints.*

Intuitively, higher final good demand and positive productivity shocks increase the firm's demand for inputs. However, for a given level of assets, firms are unable to contemporaneously expand their borrowing and, therefore, experience a tightening of their constraints in the period when the shock hits. However, the shock to market access eases the borrowing constraints over time and allows firms to expand their input choices.[10] A similar argument applies to the effect of trade liberalizations, which we will describe in the next section.

2.1 Open Economy Equilibrium

We consider a world with two symmetric countries, a domestic and a foreign economy; we index foreign economy variables with the superscript ^{x}. Within each country, firms face the additional decision to export. We introduce exporting à la Melitz [2003], with fixed (f) and variable ($\tau \geq 1$) costs of exporting, common to all firms. The fixed cost of exporting captures the cost of establishing a distribution network abroad, searching for customers, etc., while the variable cost has the usual form of an iceberg melting cost, with $\tau \geq 1$ units to be shipped for one unit to be received by the foreign consumer.[11] An exporting firm allocates its output between the domestic and foreign markets,

$$Y_{ist} = Q^d_{ist} + Q^x_{ist}$$

where Q^d_{ist} is the quantity demanded on the domestic market and Q^x_{ist} is the quantity demanded on the foreign market. If a firm decides to produce exclusively for the domestic market, its output has to meet only the domestic demand

$$Y_{ist} = Q^d_{ist}$$

[9] See section A.1.3 for a proof.

[10] Such an effect is stronger the higher the degree of substitution between capital and labor in production.

[11] We maintain the hypothesis that the utility function of the final consumer coincides with the sector aggregator.

We maintain the monopolistic competition structure à la Krugman [1979] for aggregate output in sector s with constant elasticity $\sigma > 1$, common to both countries. An exporting firm maximizes its total revenues by equalizing marginal revenues across markets; with CES residual demand, this condition requires that the producer prices be equalized across the two markets. Therefore, revenues at an exporting firm are given by

$$P_{ist}Y_{ist} = \Psi \left[E + \tau^{-1/\sigma} E^x\right] \frac{z_{is}^{\sigma-1} \left(1 + \mu_{is,t+1}\right)^{\sigma-1}}{w^{\alpha_s(\sigma-1)} \left[r + \mu_{ist}\right]^{(1-\alpha_s)(\sigma-1)}}$$

If a firm operates only on the domestic market, its revenues amount to

$$P_{ist}Y_{ist} = \Psi E \frac{z_{is}^{\sigma-1} \left(1 + \mu_{is,t+1}\right)^{\sigma-1}}{w^{\alpha_s(\sigma-1)} \left[r + \mu_{ist}\right]^{(1-\alpha_s)(\sigma-1)}}$$

In this framework, exporting is isomorphic to a shock to productivity; therefore, ceteris paribus, the revenues at an exporting firm are larger. As entering the foreign market requires the per-period payment of a fixed cost, $f > 0$, only firms able to generate revenues large enough to cover the fixed costs self-select into exporting. In particular, a marginal exporter is indifferent between operating only at home and selling its products on both the domestic and foreign markets. Because of the linearity of revenues in aggregate market size, the marginal exporter is identified by the non-zero profit condition for foreign revenues,

$$z_{ist}^{*,\sigma-1} = \frac{\sigma}{\Psi} \frac{f}{\tau^{-\frac{1}{\sigma}}} \frac{w^{\alpha_s(\sigma-1)} \left[r + \mu_{ist}\right]^{(\sigma-1)(1-\alpha_s)}}{\left(1 + \mu_{is,t+1}\right)^{\sigma-1} E^x} \tag{2}$$

As in standard models with heterogeneous firms, the productivity of the marginal exporter depends on the local production costs, the foreign market size, and the export costs. In our model, the productivity cutoff also depends on the initial asset endowment (through the Lagrangean multipliers). At an unconstrained firm, the productivity of the marginal exporter reduces to a formulation similar to Bernard et al. [2007],

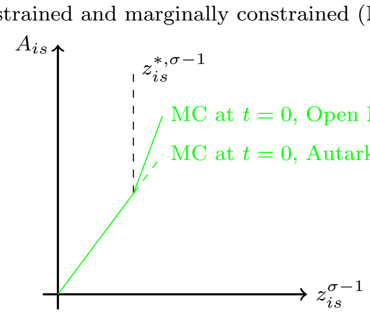
$$z_{is}^{*,\sigma-1} = \frac{\sigma}{\Psi} \frac{f}{\tau^{-\frac{1}{\sigma}}} \frac{w^{\alpha_s(\sigma-1)} r^{(\sigma-1)(1-\alpha_s)}}{E^x}$$

However, in our framework, the productivity cutoff for firms facing borrowing constraints depends also on the initial endowment. As in the closed economy, the state space can be partitioned into three sets–constrained, marginally constrained, and unconstrained firms–with the set of unconstrained firms expanding over time. The linearity of revenues in aggregate market size implies that proposition 2.2 also applies to firms that become exporters. Higher demand on entering the export market is translated into higher input demand that firms with insufficient collateral are unable to fulfill. However, higher demand supports higher sales and borrowing over time. To clarify the implications of proposition 2.2 in the open economy framework, let us derive the equilibrium conditions in a 2-period model. A firm is marginally unconstrained at $t = 0$ if

$$\begin{aligned} A_{is} &= \tilde{\theta}_K \frac{z_{is}^{\sigma-1}}{w^{\alpha_s(\sigma-1)} r^{\sigma(1-\alpha_s)+\alpha_s}} E, && \text{for a non-exporter} \\ A_{is} &= \tilde{\theta}_K \frac{z_{is}^{\sigma-1}}{w^{\alpha_s(\sigma-1)} r^{\sigma(1-\alpha_s)+\alpha_s}} \left[E + \tau^{-\frac{1}{\sigma}} E^x\right], && \text{for an exporter} \end{aligned}$$

Figure M.1 characterizes the conditions for marginally constrained firms at $t = 0$ and compares it with autarky. Firms with $\left(z_{is}^{\sigma-1}, A_{is}\right)$ above the green line are unconstrained as they own sufficient collateral to borrow their optimal amount of capital. The positive slope suggest that more productive firms require more assets to cover their demand for capital. With the additional need to meet foreign demand, exporters demand more labor and capital relative to autarky and are therefore more likely to face borrowing constraints; thus, the condition for marginally constrained exporters is steeper relative to autarky,

Figure M.1: Set of unconstrained and marginally constrained (MC) firms in open economy at $t = 0$



Firms with $\left(z_{is}^{\sigma-1}, A_{is}\right)$ below the solid green line are constrained at $t = 0$, $\mu_{is0} > 0$. If $\mu_{is1} = 0$, the firm is unconstrained at $t = 1$; marginally constrained firms at $t = 1$ satisfy

$$\frac{\Psi}{\tilde{\theta}_K^{\frac{(\sigma-1)(1-\alpha_s)}{\sigma(1-\alpha_s)+\alpha_s}}} \left[\hat{E} \frac{z_{is}^{\sigma-1}}{w^{\alpha_s(\sigma-1)}}\right]^{\frac{1}{\sigma(1-\alpha_s)+\alpha_s}} A_{is}^{\frac{(\sigma-1)(1-\alpha_s)}{\sigma(1-\alpha_s)+\alpha_s}} + A_{is} = \tilde{\theta}_K \frac{z_{is}^{\sigma-1}}{w^{\alpha_s(\sigma-1)} r^{\sigma(1-\alpha_s)+\alpha_s}} \hat{E} \tag{3}$$

$$\text{where } \hat{E} = \begin{cases} E & \text{for non-exporters} \\ \left[E + \tau^{-\frac{1}{\sigma}} E^x\right] & \text{for exporters} \end{cases}$$

As the pairs $\left(z_{is}^{\sigma-1}, A_{is}\right)$ that satisfy equation (3) are not influenced by changes in market access, the condition for marginally constrained firms at $t = 1$ is equivalent to the condition under autarky.[12] While the equivalence is trivial for non-exporting firms, it also applies to firms that exported at

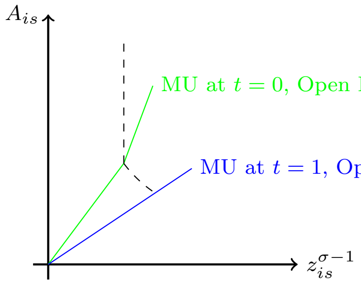
[12]See section A.1.4 for a proof.

$t = 0$, due to their ability to reach a larger market and generate higher sales. Therefore, market access shocks are reflected in a relatively looser borrowing constraints at $t = 1$ for exporters. The ability to access a larger market implies that the change in the set of unconstrained firms is bigger in an open economy compared to autarky, suggesting that shocks to market access accelerate the convergence toward a frictionless allocation.

Finally, the export cutoff for marginally constrained firms is obtained by imposing $\mu_{is,1} = 0$ and substituting the expression for $\mu_{is,0}$ in equation (2),

$$z_{is1}^{*,\sigma-1} = \left[\frac{\sigma}{\Psi}\frac{f}{\tau^{-\frac{1}{\sigma}}}\frac{w^{\alpha_s(\sigma-1)}}{E^x}\right]^{\sigma(1-\alpha_s)+\alpha_s}\left(\frac{\tilde{\theta}_K \cdot E}{w^{\alpha_s(\sigma-1)}A_{is}}\right)^{(\sigma-1)(1-\alpha_s)}$$

Figure M.2: Set of unconstrained and marginally constrained firms in open economy at $t = 0, 1$.



The export cutoff condition across marginally constrained firms (dashed black line in figure M.2) is negatively related to the initial endowment: firms with more assets tend to become exporters even if their productivity is lower. Firms with $\left(z_{is}^{\sigma-1}, A_{is}\right)$ below the blue line are constrained in both periods. Among those firms, exporting firms with higher productivity require more assets to be able to export.[13]

2.2 Theoretical Implications

Before moving to the empirical analysis, we derive two testable implications from our model. First, shocks to export opportunities affect input choices, inducing firms to move closer to the frictionless allocation.[14] Therefore, we will investigate what happens to the within-firm evolution of the distortions in presence of market access shocks. Second, shocks in export markets also induce cross-sectional differences between exporters and non-exporters. In fact, with the set of unconstrained firms expanding at a faster rate across exporters, distortions tend to be smaller across exporters compared to non-exporters at any given point in time.[15] In our cross-sectional analysis, we exploit

[13] See Appendix A.2 for a proof.
[14] See section A.3 for the derivation of the estimating equation.
[15] See section A.4 for a derivation of the variance across groups as a measure of distortions.

additional sources of market access heterogeneity. In fact, if the entire history of sales were to affect firm credit constraints, we would be able to further disentangle the variation in distortions by looking across firms that differ in the numbers of years they have been operating abroad: We would then expect that the distortions should be even smaller for firms with longer experience in export markets. In what follows, we elaborate on the empirical analysis, describing the data, how to measure distortions, and the empirical strategy.

3 Empirical Strategy

Our empirical analysis proceeds in two steps. First, we construct measures of distortions in output and capital markets that rely on cross-firm variation in average input products. Second, we test the cross-sectional and time-series implications of our model. Before going into details, we describe our data.

3.1 Data

The empirical analysis draws on the Annual Survey of Industry (AIS) conducted by China's National Bureau of Statistics. This dataset collects the balance sheet information of all state-owned enterprises and of non-state-owned firms with revenues above five million RMB ($\sim$ USD 700,000) in the industrial sector. Our data extract is restricted to manufacturing firms sampled between 1998 and 2007; it contains 2,226,109 observations (here an observation is a firm-year combination).

The survey collects data on revenues, employment, investments, and material purchases. We follow Brandt et al. [2012] to construct a real capital stock series from investments; moreover, we use their deflators for gross output, input, and capital. Following Yu [2015], we exclude all firms with fewer than 8 employees and with long-term assets above the total reported assets. After also dropping those firms with missing observations, we are left with a working sample of 1,001,582 observations.

We combine balance-sheet information with customs data for 2000 to 2007. Using matching techniques similar to Yu [2015], we are able to match around 50 percent of the total number of observations.

Finally, we complement firm-level customs data with aggregate trade flows and tariff levels from COMTRADE and WITS, respectively. Aggregate trade flows and applied tariff levels are used to compute sector shocks and to construct proxies for market openness for non-exporters.

3.2 Measuring Distortions: Firm-Level Measures

Hsieh and Klenow [2009] show that the presence of frictions in capital and output markets induce within-sector variation in the average products of labor and capital across firms. Thus, within-sector measures of dispersion proxy for the presence of distortions in a sector. Following a similar intuition, we propose firm-level measures of distortions that exploit the deviation of firm-level outcomes from sector averages. We construct our measures in two steps. First, we normalize the firm-level input product by the sector return and take log-s; for the labor return, for example,

$$\ln \lambda_{ist} = \ln \frac{\frac{P_{ist}Y_{ist}}{L_{ist}}}{\frac{P_{st}Y_{st}}{L_{st}}} = \ln \left[\frac{1}{(1+\mu_{is,t+1})} \int_{i \in I} (1+\mu_{is,t+1})\, \mathrm{d}i \right]$$

This log-normalization conveniently shifts the distribution of relative labor products around zero. Second, we consider the deviation of relative labor returns from zero by constructing its absolute value, with zero representing an approximation of the frictionless equilibrium. In absence of heterogeneous financial frictions in capital markets, the labor return of each individual firm would coincide with the sector return–i.e., $\ln \lambda_{ist} = 0$ for all firms in sector s at time t. Positive and negative deviations of individual returns from zero reveal the presence of heterogeneous wedges affecting labor choices; thus, $|\ln \lambda_{ist}|$ identifies the deviation from the sectoral averages and captures firm-level frictions in output markets.[16] Similarly, the log product of capital relative to the sector aggregate, $\ln \kappa_{ist}$

$$\ln \kappa_{ist} = \ln \frac{\frac{P_{ist}Y_{ist}}{K_{ist}}}{\frac{P_{st}Y_{st}}{K_{st}}} = \ln \left[\frac{r+\mu_{ist}}{(1+\mu_{is,t+1})} \int_{i \in I} \frac{(1+\mu_{is,t+1})}{r+\mu_{ist}} \mathrm{d}i \right]$$

measures, in absolute value, distortions in capital markets.

While our measures have the advantage of describing firm-level outcomes, they capture the same variation as other proxies commonly used in the literature. In fact, the sectoral version of our measures, constructed as the within-sector average of $|\ln \lambda_{ist}|$ and $|\ln \kappa_{ist}|$, is highly correlated with the within-sector dispersion across input products; in particular, we find correlations around 0.9 between our sectoral measures and the standard deviation across input returns. Such high correlation is not surprising, as the within-sector average absolute deviation is itself a measure of

[16] The absolute relative log-return captures changes in firm-level input choices that bring a firm closer to the average sector returns. While the average returns could be thought of an approximation of the optimal sectoral allocation if negative and positive distortions tend to compensate, our measure does not require that the sectoral averages perfectly reflect the optimal allocation. To control for changes in average returns at the sector level, we add sector-time dummies to our main regressions. In addition, we find that market access shocks have no significant effect on sectoral averages.

dispersion across input products.

However, as with other measures of frictions, the variability of $|\ln \lambda_{ist}|$ and $|\ln \kappa_{ist}|$ might reflect not only the presence of distortions, but also firm heterogeneity in productivity, labor shares, or markups. Controlling for differences in productivity, labor shares, and mark-ups isolates the role of firm-level distortions in generating the dispersion across labor and capital products.

To analyze the importance of firm heterogeneity in shaping the variability of input returns, we take a step back and compare the distribution of relative (log-) returns, $\ln \lambda_{ist}$ and $\ln \kappa_{ist}$, with a distribution of residuals (figures 1 and 2). We construct relative (log-) returns as the ratio between the firm-level and the sector return within each 4-digit industry (CIC classification). Then, we compute the residual returns from a regression that includes the profit margin, TFP, and a proxy for firm size as controls: while the profit margin captures cross-firm variation in markups due to heterogeneous demand elasticities, we proxy for differences in productivity and labor shares by controlling for TFP and total capital stock or employment.[17] In our specification, we also include firm fixed effects and sector-time dummies to control for unobserved firm heterogeneity and shocks common to all firms within a sector in a given year. Although a sizable part of the variation in input returns is captured by the dispersion across markups and by technological factors, figures 1 and 2 show that significant dispersion persists across residual returns. Capital returns appear more dispersed than labor returns, and they preserve a larger variability even after controlling for sources of firm heterogeneity.

Thus, in our empirical strategy, we need to extract the effect of firm characteristics–such as the profit margin, TFP, and firm size–from our measures of misallocation to effectively capture the presence of within-sector frictions.

3.3 Firm-Level Distortions, Financial Constraints, and Export Status

After controlling for sources of firm heterogeneity, what are our measures capturing? Our theoretical model suggests that wedges in the average product of labor and capital are due to the presence of binding borrowing constraints. This section provides some evidence on the relation between our measures of distortion and traditional measures of constraints. To study the role of financial constraints on firm behaviour, the literature has suggested many measures, including firm's leverage and cash flow.[18] As our dataset does not contain information on firms' cash flow, we mainly rely

[17]Hsieh and Song [2015] show that the profit margin is a proxy of mark-ups.

[18]Other proxies include the investment-cash flow sensitivities, the Kaplan and Zingales index of constraints, and the White and Wu index of constraints. However, Hadlock and Pierce [2010] find that, after controlling for size and age, only firm's leverage and cash flow consistently predict the firm constraint status.

on debt and assets to capture the presence of binding borrowing constraints. In particular, we will look at cross-firm differences in assets, leverage ratios, interest paid on the debt out of total assets, and the share of fees paid for access to external credit as a fraction of total assets.[19]

Table 1 shows the partial correlations between our measures and proxies of financial constraints, after controlling for firm productivity and markups; the correlations exploit both cross-sectional and time-series variations. All correlations are significant and have the expected signs: Firm with more assets display lower distortions in both output and capital markets, while firms with higher debt-to-asset ratios or facing larger interest and fees as a share of their total assets experience larger distortions.

However, our findings should be interpreted with caution. Farre-Mensa and Ljungqvist [2016] point out that indirect proxies of borrowing–such as the leverage ratios–do not necessarily identify firms constrained in their ability to raise external funding. Differences in leverage across firms may reflect differences in growth and financing policies of firms at different stages in their life cycle. Thus, as a last exercise, we construct time averages of our proxies and looked only at the patterns of average cross-firm correlations. We find that firms with a higher debt-to-asset ratio display, on average, higher distortions: The partial correlation between the debt-to-asset ratio and the average output distortion is 0.18, while the correlation with the average capital distortion is 0.06. While the correlations remain low, we believe that our measures are indeed capturing some form of financial constraints. In the regression analysis, we will provide more direct evidence on the credit channel.

How does the presence of constraints interact with export status? While the literature suggests that credit market imperfections have a more adverse affect on exporters, our model implies that credit constraints ease off over time as the number of exporting years increases, similar to the findings in Besedeš et al. [2014], who document that financial constraints become lower for exporting firms as they gain experience.[20] Figure 3 confirms the implications of our model. We classify firms based on whether their debt-to-asset ratio is above the median, and we show the probability estimates, based on a linear model, of having a debt-to-asset ratio above the median for different groups of exporters relative to non-exporting firms. The results are for 2007. Firms which have just started exporting–i.e., with zero years of continuous presence in the foreign market–are more likely to face constraints relative to non-exporters. Firms that have exported for one or more years continuously, instead, are less likely to face borrowing constraints; in particular, firms that have been exporting

[19] We loosely follow Manova and Yu [2016] to derive our measures of financial constraints.

[20] Static frameworks with financial constraints (e.g., Amiti and Weinstein, 2011 and Berman et al., 2013) point to longer time to ship and higher repayment risk as reasons for different credit allocation between domestic producers and exporters.

for at least 9 continuous years face 0.1 percentage points lower probability of having an debt-to-asset ratio above the median. Thus, averaging over all groups of exporters, our evidence is also consistent with the findings in Greenaway et al. [2007], who show that exporting firms enjoy better financial health.

3.4 Preliminary Evidence

Despite tariff reductions were implemented since the mid-nineties, Chinese firms experienced notable tariff declines in export markets in the early 2000s. Figure B1 reveals a decreasing trend in export tariffs during 1997 to 2011; the decline accelerated in 2001, after China's entry into the World Trade Organization. Export tariffs fell 3 percentage points between 2001 and 2004, from 12.4 percent in 2001 to 9.8 percent in 2004; they continued declining to 8.9 percent by 2007, the last year in our sample.

Looking at measures of firm-level frictions over 1998 to 2007, we find similar trends. Figures 4 and 5 summarize the evolution of the average within-industry distortions in output and capital markets. We construct those measures by regressing the $|\ln \lambda_{ist}|$ and $|\ln \kappa_{ist}|$ on time dummies after controlling for the effect of the profit margin, TFP, and firm size: the estimates represent the average distortion in a particular year relative to 1998, the base year. While distortions in output markets declined in the early part of the sample and partially recovered in the last years, frictions in capital markets declined throughout the sample period: our proxy suggests that capital distortions were 40 percent lower in 2007 relative to 1998, the base year.

We also detect large declines in our measures of frictions if looking within prefectures. Figures B2-B5 compare residual labor and capital returns within prefectures between 1998 and 2007: The color-coded maps show the average distortion in each prefecture–obtained from a regression of residual returns on prefecture dummies–with darker colors denoting larger distortions. Lighter shades in 2007 suggest that the level of capital and labor misallocation declined substantially over time.

While our analysis so far has only been suggestive of a link between trade liberalization and misallocation, we will investigate this relationship in more details in next sections.

4 Regression Analysis

4.1 Cross-Sectional Analysis

Our first specification relates a measure of within-sector misallocation to an export status indicator,

$$\text{Disp}\,(\ln y)_{jast} = \beta_0 + \beta_1 \cdot \text{Export}_{jast} + D_{as} + D_t + \eta_{jast} \tag{4}$$

where $\text{Disp}\,(\ln y)_{jast}$ denotes a proxy for distortions in output or input markets–with y referring to either λ or κ–and Export_{jast} is a dummy indicating whether the dispersion is computed across exporters of age a in sector s at time t.

β_1 is our coefficient of interest; it captures differences in distortions between exporters and non-exporters within an age-sector cell. Following our model, our unit of observation is an export status-age-sector-year cell: we look across groups of similar age within a sector to control for sectoral characteristics and differences in age composition that could spuriously affect our measures.[21] We expect $\beta_1 < 0$: The ability to sell in a bigger market helps exporters overcome financial frictions at a faster pace compared to that of firms operating only on the domestic market.

For our baseline results, we proxy misallocation with the sectoral version of our firm-level measure of distortions, constructed as the age-sector-year average of $|\ln \lambda_{iast}|$ and $|\ln \kappa_{iast}|$; in the appendix, we also report results based on the standard deviation across input products, the measure of distortions traditionally used in the literature.

In addition to sector-age and time dummies, we enrich our specification to capture sources of firm heterogeneity that could cause dispersion across average products of labor and capital. We include measures capturing the dispersion across mark-ups, $\text{Sd}\,(\ln \psi)_{jast}$, and we use $\text{Sd}\,(\text{TFP})_{jast}$ and the dispersion across proxies for firm size to control for heterogeneity in productivity, which would bias β_1 downwards if technological time-varying factors correlate with past trade shocks.

As an alternative cross-sectional test of within-sector differences in measures of dispersion, we compare the dispersion across groups of firms differing by the number of years they have been exporting. If the entire sales history affected access to credit, firms with longer experience in export markets would face lower frictions; thus, we would expect firms that have been exporting for more years to display even smaller dispersions across capital and labor returns.

Results

[21] As an immediate corollary to proposition 2.1, our model suggests that credit constrains tend to become less binding over time.

This subsection summarizes cross-sectional comparisons. Table 2 reports the results for model 4; columns (1)-(3) show the results for the dispersion across labor returns, while columns (4)-(6) illustrate the effect on the dispersion across capital returns, using the average absolute deviation from sectoral outcomes as a proxy for distortions.[22] We dropped all export status-age-sector-year cells with less than 10 firms; our results are robust to this constraint. The coefficient on the export dummy is negative and significant across all columns, indicating that the within-age-sector dispersion across labor and capital returns is, on average, lower for exporters compared with non-exporters. Our analysis at the age-sector level controls for differences in age composition that may induce differences in dispersions across groups: In our sample, exporters are, on average, 1.5 years older than non-exporters, and, consistent with our model, we find that older firms tend to display a significantly smaller dispersion across capital returns (table B5).

The magnitude of the export coefficient is not significantly affected by the addition of other controls. Cross-firm differences in mark-ups and productivity contribute to the dispersion across labor and capital returns, while capital endowment and employment are negatively correlated with our dependent variables.

Looking at magnitudes, we find that the dispersion across labor returns is 13 percent of a standard deviation (sd) and the dispersion across capital returns 26 percent of a sd lower for exporters compared to non-exporters.

To investigate the effects of a longer foreign sales history, we spliced the group of exporters by the length of their experience abroad and analyzed differences in distortions of each additional exporting year. We restrict our sample to firms active in 2007; the time span of our data implies that firms could have been exporting for at most 10 years by 2007. Figures 6 and 7 show the estimates from a regression of residual returns on an indicator variable for each group; we also report the 95 percent confidence interval. As shown in figure 6, the dispersion in labor returns across firms that have exported for one year is significantly smaller than that across non-exporters; the point estimates indicate further reductions in dispersion for each additional year in the export market until reaching 8 years of experience. The effect partially rebounds for firms with the longest export experience, but it is not significantly different from that of firms that have just entered the export market. Figure 7 focuses on measures of distortions based on capital returns. Our estimates indicate a roughly monotonic decline in the dispersion across capital returns over the length of the export experience. Each additional year of exporting is associated, on average, with a 5.7 percent of a sd smaller dispersion across capital returns; firms that have been exporting for at least 10 years display

[22] Table B3 shows the results for the standard deviation across input returns.

more than 50 percent of a sd lower capital distortions relative to non-exporters.

To provide an alternative test of the effect of cross-firm differences in market access, we exploit cross-sectoral variation in openness. We construct industry-specific export tariffs, and we augment model (4) with an interaction between *Export* and industry-level tariffs to investigate whether the effect of export on dispersion is larger in more open sectors, i.e. sectors where Chinese exporters face lower tariffs. Table 3 supports the presence of heterogeneous effects across sectors. While the export dummy remains negative in all specifications, the interaction between the export dummy and the sector tariff is positive and significant in columns (4)-(6), confirming that exporters experience lower frictions in sectors with lower tariffs: Exporters in sectors with one-standard-deviation higher tariffs display 15.2 percent of a sd lower dispersion. The interaction, instead, is negative in columns (1)-(3) but loses its significance in column (3), after including all controls. The baseline effect of the export tariff is insignificant; in fact, it captures two contrasting effects. On the one hand, lower tariffs stimulate growth in the intensive export margin. On the other hand, a reduction in tariffs changes the composition of the groups of exporters and non-exporters, allowing some firms to start selling abroad. While the first effect reduces the dispersion over time, the second induces a temporary increase; overall, these effects are consistent with an insignificant coefficient.

Although our findings are generally consistent with the implications of our model, we'll next present direct evidence tying the effect of openness on distortions to the presence of borrowing constraints. Table 4 documents differences across groups in sectors more dependent on external financing. We augment our model with a measure of financial dependence, proxied by the average debt-to-assets ratio, $Lev.\,Ratio$, interacted with our export dummy.[23] With the interaction between *Export* and $Lev.\,Ratio$, the export dummy in our extended model captures differences between exporters and non-exporters in sectors with an average debt-to-assets ratio equal to zero–i.e., *unconstrained* sectors. In our results, the export dummy display a positive, although insignificant, coefficient, consistent with the idea that the mechanism operates only in presence of binding credit constraints. Differences in dispersion between exporters and non-exporters are larger in sectors more dependent on external financing: Exporters have 6.3 percent of a sd lower dispersions in sectors with a one-standard-deviation higher debt-to-asset ratio. In an alternative specification, we rely on a measure of external financial dependence, $Fin.\,Dep$, from Braun [2005] and Manova [2013], which is based on data for all publicly listed U.S.-based companies.[24] Using industry proxies based

[23]Our financial dependence measure is the average debt-to-assets ratio over 1998-2007 and across all firms within a sector.

[24]External finance dependence is constructed as the share of capital expenditures not financed with cash flows from operations.

on U.S. data alleviates concerns of endogeneity on the interaction between exporting, financial development, and financial dependence. Our results, shown in table B4, seem robust to the choice of a proxy for financial dependence. While the export dummy remains negative and significant, the interaction between $Export$ and $Fin.\,Dep$ is also negative; the effect, however, is only significant on the dispersion across capital returns, with a magnitude suggesting that exporters display 10.7 percent of a sd lower capital dispersion in sectors with one-standard-deviation higher financial dependence. Characterizing financial dependence with measures of tangibility or capital shares, other proxies from Manova [2013], delivers similar (unreported) results: the interaction between the export dummy and the sectoral measures of dependence on external financing tends to be negative, although not always significant.

4.2 Time-Series Analysis

This section analyzes the impact of changes in market access on firm-level frictions. Our second specification follows directly from our model and relates firm-level measures of input distortion to proxies of market access shocks,[25]

$$|\ln y_{ist}| = \gamma_0 + \gamma_1 \cdot \text{Mkt Access Shock}_{is,t-1} + D_i + D_{st} + \varepsilon_{ist} \tag{5}$$

where y denotes either λ or κ. The dependent variable, the absolute value of normalized input returns, captures firm-level distortions in input markets. In absence of frictions, $\ln \lambda_{ist}$ or $\ln \kappa_{ist}$ would be zero, after controlling for other sources of firm heterogeneity; positive and negative deviations from zero reveal the presence of frictions affecting labor and capital choices.

Our main regressor, $\text{Mkt Access Shock}_{is,t-1}$, captures firm-level trade shocks, which we will proxy with lagged export status, export shipments, and tariffs. While also mitigating concerns of endogeneity, we follow the theory and use a one-period lag for our main explanatory variable: In our model, shocks to market access tend to initially increase distortions as access to a bigger market translates into higher demand for labor and capital, causing firms to hit their borrowing constraints; those shocks, however, ease the constraints over time, accelerating the convergence toward a frictionless allocation. Our model suggests that $\gamma_1 < 0$–that is, trade shocks favor the reallocation of resources toward more productive firms by easing frictions they face in capital markets.

[25] See section A.1.4 for a derivation of equation 5. Our empirical specification adds sector-time dummies as we allow shocks to aggregate market size to be sector-specific or labor shares to vary over time.

Our specification also includes firm fixed effects and sector-time dummies to absorb all time-invariant firm characteristics and aggregate shocks that might cause a spurious correlation between firm-level openness and input returns. As in our cross-sectional specification, we include in equation (5) the profit margin, to control for demand factors; and TFP and measures of size, to absorb idiosyncratic technology shocks that would bias the coefficient on Export_{ist} downwards if they correlated with past export choices.

Results

This section summarizes the impact of market access shocks on firm-level measures of frictions. We proxy shocks to market access with three variables: export status, export shipments, and tariffs; the results are shown in tables 5-7, respectively. All tables share the same structure, with columns (1)-(3) showing the results for the dispersion across labor returns, and columns (4)-(6) illustrating the effect on the dispersion across capital returns.

Table 5 reports the results for regression (5) with the export status proxying for changes in market access. Our main regressor, the export dummy, shows a negative and significant coefficient in all columns: in the year after entering the export market, the ability to sell in a bigger market allows firms to adjust their input choices and to lower the deviation of their input returns from sectoral averages. Older firms experience similar reductions in dispersion: the coefficient on $\ln \text{Age}$ is negative and significant, consistent with the mechanism in our model, where older firms capitalize on their past experience and face less binding constraints.

Using the results from columns (3) and (6) as our baseline estimates, we find that becoming an exporter decreases output distortions by 1.3 percent of a sd and capital distortions by 1.5 percent of a sd the period after entering into the export market. The effect of being in the sample for one additional year is comparable: a continuing firm experiences, on average, a 0.7 percent of a sd reduction in output distortions and a 1.9 percent of a sd reduction in capital distortions per year of presence in the market.

Firm size, measured by either the capital stock or total employment, also negatively affects the level of frictions faced by firms in input markets; the negative sign is likely to capture the effect of larger asset endowments. Productivity, instead, tends to magnify deviations from sectoral averages; in fact, more productive firms display higher input demand, which, for a given level of assets, forces the firm to hit its constraints.

Finally, columns (2) and (4) add the profit margin among the regressors. While our model does not offer any specific prediction on the effect of mark-ups, the profit margin is an important control to extract sources of demand heterogeneity; we find that heterogeneous mark-ups translate into opposing outcomes, increasing dispersion across labor returns but reducing deviations across capital returns.

The effect of becoming an exporter may vary by the length of the experience abroad if the entire sales history affects the borrowing constraints. To identify the effect of the export history, we relate within-firm changes in their presence abroad to firm-level distortions. We focus on the years of continuous presence and excluded all firms with gaps in their exporting history. Figure 8 and 9 show our estimates and the associated confidence interval; the estimates are relative to the year prior to entry into the foreign market. The x-axis identifies the number of continuous years a firm has been exporting: given the time span of our data, a firm could have been exporting for at most 10 continuous years by 2007. While there is no additional effect on the dispersion across labor returns beyond the first year, each additional year of presence abroad significantly reduces the dispersion across capital returns: A firm that has been exporting for at least 10 years experiences 4.4 percent of a sd lower frictions in capital choices relative to the year prior to entry. Interestingly, the effect in the first exporting year is not significantly different from the year before entry: This finding is consistent with the firms' inability to respond to contemporaneous shocks to market access due to the presence of borrowing constraints; however, as past sales mimic the behavior of additional collateral, firms are able to gradually overcome their borrowing constraints and expand their input demands over time.

Table 6 exploits the variation embedded in export shipments. As with the export status, the coefficient on $\ln \text{Exports}_{t-1}$ tends to be negative–with the exception of column (3)–implying that not only accessing the foreign market but also higher export shipments are associated with a reduction in distortions. The effect of foreign sales is robust only for capital returns, with a one-standard-deviation higher exports associated with a 1.8 percent of a sd lower capital frictions.

Several contributions document that financial constraints prevent firms from engaging in international trade. In particular, Chaney [2016] builds a model where firms face liquidity constraints to finance the fixed costs of exporting; the empirical relation between access to finance and exporting founds support in various papers.[26] Therefore, the simultaneity between the level of financial development, liquidity constraints, and exporting decisions may lead to bias and inconsistent estimates. To mitigate these concerns, we consider a third proxy of market access, firm-level export tariffs. We construct firm-specific tariffs for all firms in our sample. We assign to non-exporters the tariff of

[26] For example, Manova and Yu [2016] show that Chinese firms with worse financial health (proxied by lower liquidity or higher leverage ratio) tend to choose lower value-added exporting modes.

the industry in which they are classified. For exporting firms, instead, we compute export-weighted tariffs, using as weights the firm export shares in 2000.[27] To identify tariff variability associated with sizable market access shocks, we construct a tariff indicator based on the distribution of firm-level tariffs within an industry in a given year; in particular, we singled out firms facing tariffs above the 75th percentile of the tariff distribution. Our firm-level indicator of facing tariffs above the 75th percentile is highly correlated with the firm export status and is likely to be exogenous.[28] Table 7 shows the results for our reduced-form tariffs regressions. We restrict our sample to 2001 through 2007 to avoid possible endogeneity problems arising from the choice of export weights in 2000. The coefficient on our tariff indicator is positive and significant in all column; the positive sign is consistent with our previous findings, as changes in tariffs are negatively related to the variation in openness. Firms facing tariffs above the 75th percentile experience a 0.7 percent of sd higher output distortions and a 0.8 percent of a sd increase in capital distortions. Alternatively, table B6 shows the IV specification, where export status is instrumented with a dummy equal to 1 if the firm faces tariffs above the 75th percentile. The first-stage F-statistics suggests that the weakness of the instrument is not a concern. The coefficient on the lagged export status remain negative and significant, as in the baseline specification, implying that exporters tend to display lower distortions in labor and capital markets. The effect is larger than what is implied by table 5; this result is consistent with the presence of self-selection and serial correlation in the decision to sell abroad that bias the OLS coefficient toward zero. In particular, firms that became exporters at $t-1$ because of lower tariffs face 23 percent of a sd lower distortions in the output market and 28 percent of a sd lower distortions in the capital market.

While our analysis so far has considered both positive and negative deviations from sector averages as distortions, table 8 focuses only on the deviations which are consistent with our model. In particular, the presence of a capital wedge implies that the demand for capital at constrained firms should be below the optimum; on the other hand, the incentive to affect next period's borrowing constraint should distort the demand for labor above the optimum. Thus, we restrict our sample to firms with $\ln \lambda_{ist} < 0$ and $\ln \kappa_{ist} > 0$. The coefficient on our main regressor should display a different sign depending on the sign of the distortions. In fact, for the negative labor distortions, Tariffs above 75 displays a negative coefficient, implying that firms facing larger tariffs tend to move further away from the frictionless equilibrium; the coefficient on Tariffs above 75 is, instead, positive

[27] Our export shares are relative to total production and, thus, account for the tariff of the industry in which a firm is classified, as with non-exporters.

[28] Our results tend to be robust to the use of different percentiles, although the coefficients on the tariff dummy are not always significant.

as larger tariffs further distort firms' capital choices. Thus, our results are robust to the set of model-consistent distortions; in what follows, we'll continue to use the entire sample, although the results are qualitatively similar for the firms with $\ln \lambda_{ist} < 0$ and $\ln \kappa_{ist} > 0$.

To get a sense of the importance of trade liberalization in easing the financial constraints, we added asset size and the leverage ratio to our baseline model. The results are shown in table B7. Our firm-level proxies of financial constraints have the expected signs: firms with larger assets or lower debt-to-asset ratio face lower distortions in input markets. Including the financial controls lowers the effects of our variable of interest: while the effect of facing higher tariffs on the output distortion is only 3 percent lower, the effect on the capital distortions is reduced by 1/3, suggesting that part of the effect of trade occurs through changes in firm-level access to credit. Our firm-level proxy for financial constraints, however, may not necessarily capture the presence of such constraints. Farre-Mensa and Ljungqvist [2016] argue that traditional measures of financial constraints, such as total assets or the long-term leverage ratio, tend to reflect differences in growth or financial practices at firms over different stages of their life cycles.

To more precisely identify constrained vs. unconstrained firms, we rely on the sector-level average of the debt-to-asset ratio. Averaging across all firms in a sector and over time smooths through firm-level life-cycle differences and provides a more robust proxy for the presence of binding borrowing constraints. If the interaction between changes in market access and firm-level distortions is connected to the presence of borrowing constraints, we should not expect similar reductions at unconstrained firms that experience a shock to market access. Table 9 separates the effect at constrained firms from that at unconstrained firms. The tariff dummy captures the impact of shocks to market access at firms in sectors with a debt-to-assets ratio equal to zero on average: While the coefficient on Tariffs Above 75 remains positive for labor returns, it becomes negative for capital returns, indicating that unconstrained firms facing lower tariffs experience higher deviations of capital returns from the sectoral averages, consistent with the idea that our mechanism applies only to firms facing binding borrowing constraints. At constrained firms, instead, we continue to find that the shocks to market access lower the burden of capital frictions: firms in sectors with a debt-to-asset ratio one sd above the average experience a 1.4 percent of a sd easing of their borrowing constraints the year after they are likely to enter the export market.

We also adopt two alternative strategies. First, we rely on the measures of financial dependence from Braun [2005] and Manova [2013]. Table B8 shows the results of a specification where we proxy the financial dependence of a sector with the measure constructed by Braun [2005] and Manova [2013]. While the result is not robust for the output distortions, we confirm a differential effect of tariff shocks on the capital distortions in sectors more dependent on external finance. Second, we look at differences between state-owned enterprises (SOEs) and private firms. Anecdotal evidence suggests that state-owned enterprises have easier access to credit and, thus, face lower financial frictions.[29] Table B9 highlights the presence of differential effects of tariff shocks by ownership groups. Private firms facing tariffs above the 75th percentile continue to experience smaller output and capital frictions. SOEs, instead, tend to be adversely affected by export shocks: the coefficient on the interaction SOE*Tariffs Above 75 tends to be negative–with the exception of the first two columns– suggesting that opening to trade increases the distortions faced by SOEs; the effect, however, is significant only in column (6).

Alternative Specifications

Our results are robust to two alternative strategies. First, we follow the empirical approach proposed by Petrin and Sivadasan [2013] to construct alternative measures of misallocation. In their framework, the degree of resource misallocation at the firm level is specified as the gap between the marginal input product and its marginal cost,[30]

$$G^j_{ist} = \left| MP^j_{ist} - p_{ist} \right|, \quad j = L, K$$

Petrin and Sivadasan [2013]'s measures are positively correlated with ours; in particular, we find a correlation of 0.25 between G^L_{ist} and $|\ln \lambda_{ist}|$ and a correlation of 0.46 between G^K_{ist} and $|\ln \kappa|$.

Table B10 reports the results when adopting the Petrin and Sivadasan [2013] measure as dependent variable in model 5. Firms facing tariffs above the 75th percentile display larger distortions, measured by the gap between the marginal input product and its marginal cost. The results are less robust for labor, as the coefficient on the tariff dummy is significant only in column (3), after including all controls. The magnitudes are comparable to our main findings: Firms that face tariffs above the 75th percentile display 1.2 percent of a sd higher output distortions and 1.5 percent of a sd higher capital distortions.

The second strategy exploits an indirect implications of our theoretical framework. If positive shocks to market access allow firms to ease their borrowing constraints over time, we should expect constrained firms to grow faster after experiencing such shocks, especially in those sectors more

[29] Until 1998, the largest Chinese banks were instructed, by law, not to lend to private firms. Using data for 1998-2005, Poncet et al. [2010] confirms that state-owned firms in China are not constrained while private firms are.

[30] We proxy the marginal wage with the average wage and the rental rate of capital with the average interest rate.

dependent on external finance. In particular, we consider the following specification

$$\ln x_{is,t+1} = \delta_0 + \delta_1 \cdot \text{Mkt Acc. Shock}_{is,t-1} + \delta_2 \cdot \text{Mkt Acc. Shock}_{is,t-1} \cdot \text{Constr}_s + D_i + D_{st} + \nu_{ist}$$

where $x_{is,t+1}$ denotes a firm outcome at $t+1$ and Lev. Ratio$_s$, the average debt-to-asset ratio for sector s, represents a sector-level measure of the presence of borrowing constraint. δ_2 is our coefficient of interest; if we proxy Mkt Acc. Shock$_{is,t-1}$ with Tariffs Above 75, we expect $\delta_2 < 0$, as facing larger tariffs causes firms to hit their borrowing constraints, especially in sectors more dependent on external finance; thus, in those sectors, constrained firms would expand at an even slower rate. Table B11 shows the results. We consider four outcomes: total revenues, value added, total capital stock, and employment. All specifications include controls for demand heterogeneity (the profit margin) and productivity, in addition to firm and sector-time dummies. We find that firms facing tariffs above the 75th percentile tend to experience slower growth, with a more negative effect in sectors more dependent on external finance. The effect, however, is significant only for capital.[31] These results highlight the robustness of our findings for misallocation in capital markets.

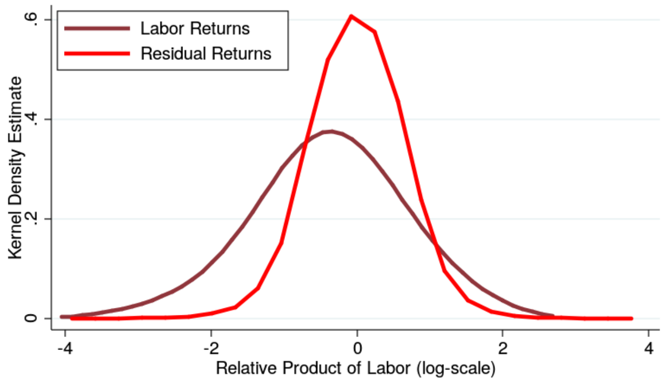
5 Conclusions

This paper investigates the impact of international trade on input market distortions. We focus on a specific friction, binding borrowing constraints in capital markets. In our model, a firm's demand for capital is constrained by an initial asset allocation and past sales. While the initial distribution of assets induces misallocation if the asset endowment at more productive firms does not fully cover their demand for capital, the dependence of the borrowing constraint from past sales proxies for cross-firm differences in the cost of default. Overtime, an increase in sales relaxes the borrowing constraint; similarly, shocks to market access, such as opening to trade, contribute to easing the financial constraints, thus accelerating the convergence toward the frictionless allocation. To analyze the empirical relationship between market access and credit frictions, we draw on the annual surveys conducted by the National Bureau of Statistics (NBS) for 1998 to 2007 to construct firm-level measures of distortions that control for firm heterogeneity in productivity and mark-ups. We find smaller labor and capital dispersion across exporting firms; the dispersion is even smaller in sectors where firms face lower tariffs or are more dependent on external financing. Our empirical

[31] A possible explanation for this result is that the firms may substitute towards other inputs when capital constraints are binding

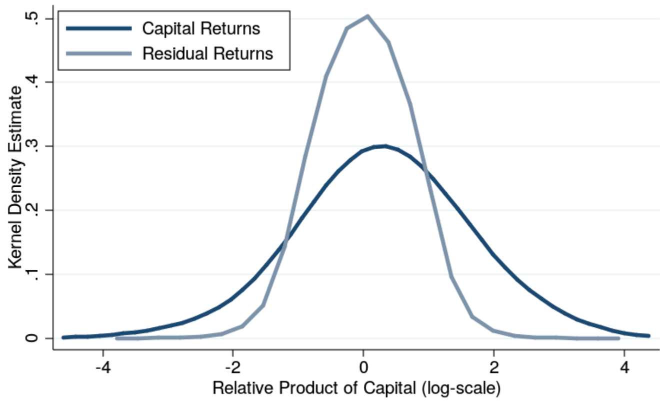
analysis also suggests that export shocks significantly reduce the dispersion across input returns over time, with the effect mostly occurring at constrained firms. Our findings are robust to exploiting the variation in firm-level export tariffs, which are less likely to suffer from endogeneity bias.

While our paper focuses on the link between trade liberalization and frictions, our findings also imply aggregate productivity gains through changes in labor and capital choices. As shown by Hsieh and Klenow [2009], industry-level TFP is significantly lower in presence of frictions if compared to a frictionless equilibrium. Table B12 confirms the negative correlation between TFP and the measures of distortions in our data; the effect, however, is only significant for capital frictions: a one-standard-deviation reduction in capital distortions is associated with a 15 percent of a sd increase in productivity, a magnitude roughly comparable to the overall gains from import competition documented by Pavcnik [2002] and Trefler [2004]. Using a simple back-of-the-envelope calculation, our firm-level estimates imply that trade shocks increase productivity by 1.3 percent through the reduction of input misallocation at the firm level. As the presence of frictions breaks the quantitative welfare equivalence between the Melitz-type frameworks and traditional models of trades, our findings suggest that the Arkolakis et al. [2012] measure of gains from trade might be a lower bound of the overall effects of trade liberalizations.



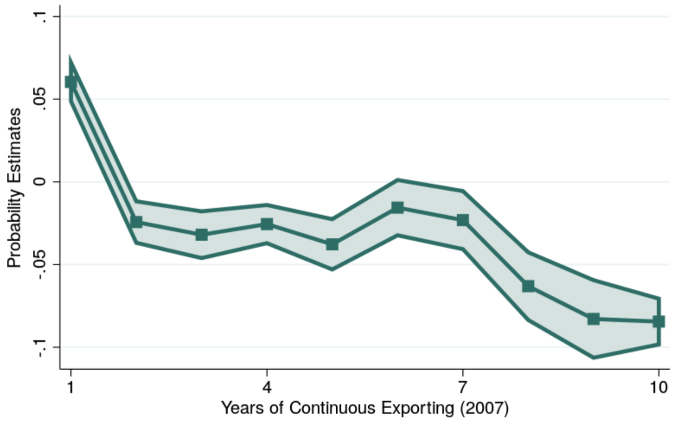
Source: China's National Bureau of Statistics (NBS), Annual Survey of Industry (AIS) data, 1998-2007.
Note: Labor returns are relative to industry averages; residual returns are obtained from a regression of labor returns on profit margin, TFP, capital stock, firm and sector-time fixed effects.

Figure 1: Comparing the Distributions of Firm-level Labor Returns and Residuals



Source: China's NBS, AIS data, 1998-2007.
Note: Capital returns are relative to industry averages; residual returns are obtained from a regression of capital returns on profit margin, TFP, total employment, firm and sector-time fixed effects.

Figure 2: Comparing the Distributions of Firm-level Capital Returns and Residuals



Source: China's NBS, AIS Data, 2007.
Notes: Probability of above median debt-to-equity relative to non-exporters; emerald-shaded area denotes 95 percent confidence interval.

Figure 3: Probability Estimates of Facing Constraints by number of exporting years, 2007

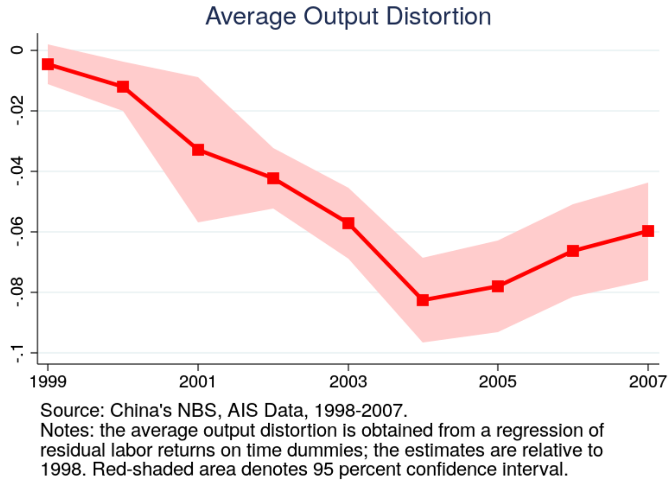


Figure 4: Dispersion across Labor Returns

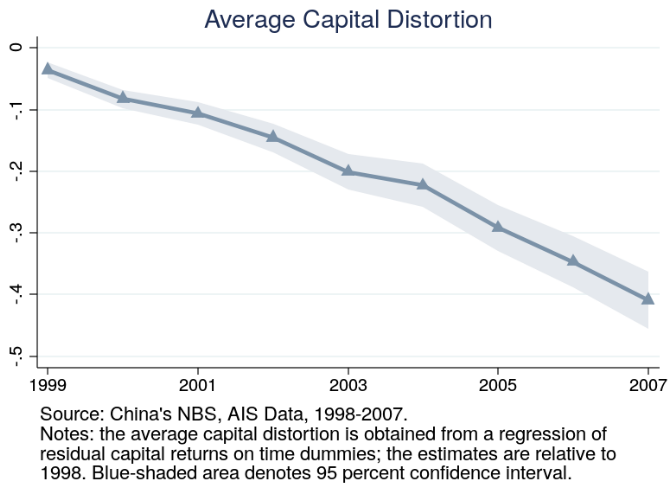


Figure 5: Dispersion across Capital Returns

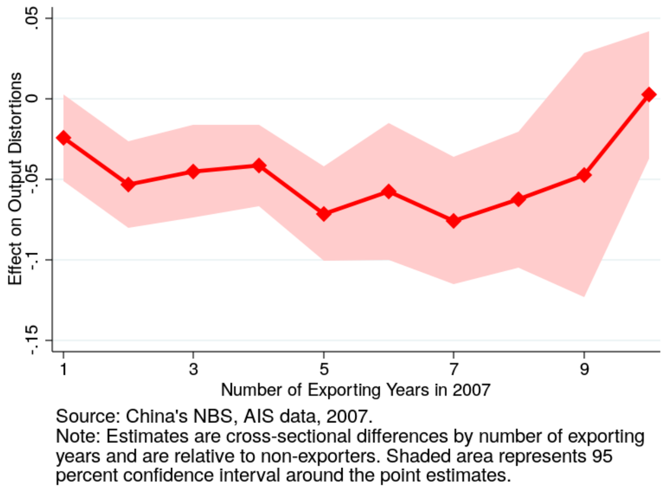


Figure 6: Dispersion across Labor Returns by Number of Exporting Years: Cross-Sectional Comparison

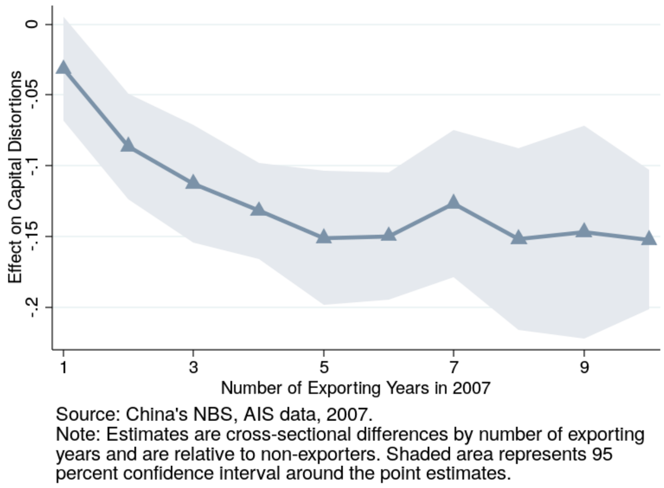


Figure 7: Dispersion across Capital Returns by Number of Exporting Years: Cross-Sectional Comparison

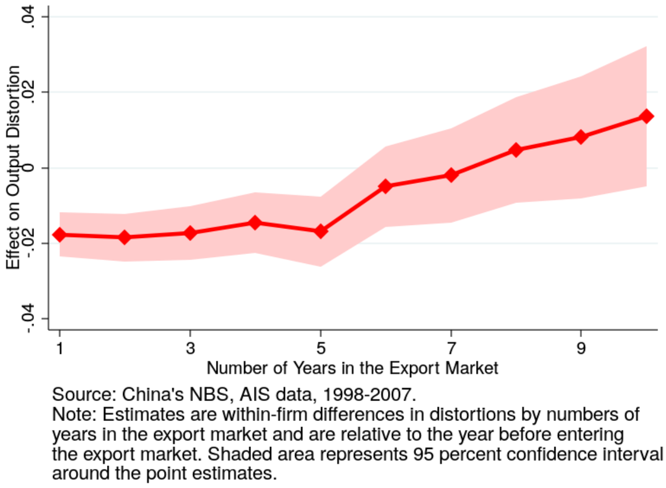


Figure 8: Output Distortion: Effect of Number of Years in Export Market

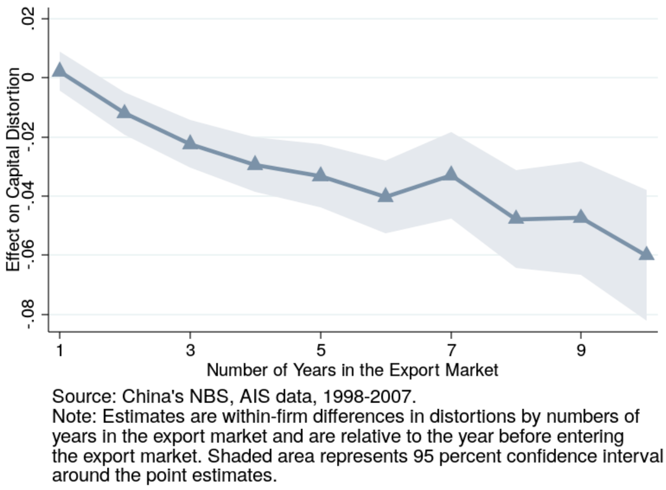


Figure 9: Capital Distortion: Effect of Number of Years in Export Market

Table 1: *Partial Correlations*

	$\lvert\ln \lambda\rvert$	$\lvert\ln \kappa\rvert$
ln Assets	-0.04	-0.23
Debt-to-Assets	0.003	0.01
Fee Sh	0.01	0.02
Interest Sh	0.01	0.02

$\ln \lambda$: log return to labor relative to the sector.
$\ln \kappa$: log return to capital relative to the sector.
Debt/Assets: ratio of debts to assets.
Fee Sh: financial fees relative to assets.
Interest Sh: interest payments relative to assets
Notes: Partial correlation between measures of distortions and proxies of firms' financial constraints. The correlations control for the profit margin, firm size, and TFP. All correlations are significantly different from zero.

Table 2: Industry-level Regressions: Exporting and the Dispersion across Input Returns, dropping cells with fewer than 10 firms

Variables	(1)	(2) Avg $\lvert ln\lambda \rvert$	(3)	(4)	(5) Avg $\lvert ln\kappa \rvert$	(6)
Export	-0.047***	-0.045***	-0.039***	-0.112***	-0.110***	-0.102***
	(0.008)	(0.008)	(0.007)	(0.010)	(0.010)	(0.010)
sd $\ln\psi$		0.033***	0.031***		0.027***	0.025***
		(0.004)	(0.004)		(0.005)	(0.005)
sd TFP			0.188***			0.232***
			(0.007)			(0.010)
sd K			-0.021***			
			(0.005)			
sd Empl						-0.041***
						(0.011)
Sector[a]-Age	y	y	y	y	y	y
Year	y	y	y	y	y	y
Obs.	47,526	47,526	47,526	47,526	47,526	47,526
R^2	0.472	0.475	0.509	0.494	0.495	0.523

[a] : 4-digit industry codes.

Avg $|ln\lambda|$: average within-age-sector absolute deviation between firm labor returns and sectoral allocation.

Avg $|ln\kappa|$: average within-age-sector absolute deviation between firm capital returns and sectoral allocation.

Export: dummy equal to one if the measure of distortion applies to exporters.

sd $\ln\psi$: standard deviation across profit margins; the measure is computed with each export status-age-sector-year cell.

sd TFP: standard deviation across productivities; the measure is computed with each export status-age-sector-year cell.

sd K: standard deviation across capital endowments; the measure is computed with each export status-age-sector-year cell.

sd Empl: standard deviation across total employment; the measure is computed with each export status-age-sector-year cell.

Legend: *** significant at 1%, ** at 5%, * at 10%.

Notes: Sector-level regressions, 1998-2007. The unit of observation is an export status-age-sector-year cell; the regression drops cells with fewer than 10 firms. Standard errors are clustered at the 4-digit CIC level.

Table 3: Industry-level Regressions: Exporting and the Dispersion across Input Returns, dropping cells with fewer than 10 observations

Variables	(1)	(2) Avg $\lvert ln\lambda \rvert$	(3)	(4)	(5) Avg $\lvert ln\kappa \rvert$	(6)
Export	-0.010	-0.004	-0.022	-0.216***	-0.212***	-0.233***
	(0.023)	(0.023)	(0.020)	(0.030)	(0.030)	(0.028)
W Exp Tariff	0.017	0.009	0.053	-0.188	-0.194	-0.136
	(0.199)	(0.203)	(0.171)	(0.290)	(0.293)	(0.248)
Export*W Exp Tariff	-0.364*	-0.404**	-0.163	1.021***	0.992***	1.279***
	(0.203)	(0.202)	(0.175)	(0.294)	(0.293)	(0.265)
sd $\ln \psi$		0.034***	0.032***		0.025***	0.022***
		(0.004)	(0.004)		(0.005)	(0.005)
sd TFP			0.186***			0.235***
			(0.007)			(0.010)
sd K			-0.021***			
			(0.005)			
sd Empl						-0.034***
						(0.011)
Sector[a]-Age	y	y	y	y	y	y
Year	y	y	y	y	y	y
Obs.	45,720	45,720	45,720	45,720	45,720	45,720
R^2	0.474	0.476	0.509	0.496	0.497	0.527

[a] : 4-digit industry codes.

Avg $|ln\lambda|$: average within-age-sector absolute deviation between firm labor returns and sectoral allocation.

Avg $|ln\kappa|$: average within-age-sector absolute deviation between firm capital returns and sectoral allocation.

Export: dummy equal to one if the measure of distortion applies to exporters.

W Exp Tariff: average industry tariffs; the measure is weighted by export flows.

sd $\ln \psi$: standard deviation across profit margins; the measure is computed with each export status-age-sector-year cell.

sd TFP: standard deviation across productivities; the measure is computed with each export status-age-sector-year cell.

sd K: standard deviation across capital endowments; the measure is computed with each export status-age-sector-year cell.

sd Empl: standard deviation across total employment; the measure is computed with each export status-age-sector-year cell.

Legend: *** significant at 1%, ** at 5%, * at 10%.

Notes: Sector-level regressions, 1998-2007. The unit of observation is an export status-age-sector-year cell; the regression drops cells with fewer than 10 firms. Standard errors are clustered at the industry level.

Table 4: Financial Dependence, Exporting, and the Dispersion across Input Returns, dropping cells with fewer than 10 firms

Variables	(1)	(2) Avg $\|ln\lambda\|$	(3)	(4)	(5) Avg $\|ln\kappa\|$	(6)
Export	0.064	0.062	0.095	0.165	0.163	0.210*
	(0.086)	(0.085)	(0.082)	(0.118)	(0.118)	(0.117)
Export*Lev Ratio	-0.185	-0.178	-0.224	-0.461**	-0.456**	-0.520***
	(0.147)	(0.146)	(0.140)	(0.198)	(0.197)	(0.196)
sd $\ln\psi$		0.033***	0.031***		0.027***	0.025***
		(0.004)	(0.004)		(0.005)	(0.005)
sd TFP			0.188***			0.232***
			(0.007)			(0.010)
sd K			-0.020***			
			(0.005)			
sd Empl						-0.039***
						(0.010)
Sector[a]-Age	y	y	y	y	y	y
Year	y	y	y	y	y	y
Obs.	47,526	47,526	47,526	47,526	47,526	47,526
R^2	0.472	0.475	0.509	0.495	0.496	0.524

[a] : 4-digit industry codes.
Avg $|ln\lambda|$: average within-age-sector absolute deviation between firm labor returns and sectoral allocation.
Avg $|ln\kappa|$: average within-age-sector absolute deviation between firm capital returns and sectoral allocation.
Export: dummy equal to one if the measure of distortion applies to exporters.
Lev Ratio: average debt-to-asset ratio; the measure is computed as average across all firms within an industry.
sd $\ln\psi$: standard deviation across profit margins; the measure is computed with each export status-age-sector-year cell.
sd TFP: standard deviation across productivities; the measure is computed with each export status-age-sector-year cell.
sd K: standard deviation across capital endowments; the measure is computed with each export status-age-sector-year cell.
sd Empl: standard deviation across total employment; the measure is computed with each export status-age-sector-year cell.
Legend: *** significant at 1%, ** at 5%, * at 10%.
Notes: Sector-level regressions, 1998-2007. The unit of observation is an export status-age-sector-year cell; the regression drops cells with fewer than 10 firms. Standard errors are clustered at the sector level.

Table 5: Firm-Level Regressions: Exporting and Financial Frictions

Variables	(1)	(2) $\lvert\ln\lambda\rvert$	(3)	(4)	(5) $\lvert\ln\kappa\rvert$	(6)
Export_{t-1}	-0.012***	-0.012***	-0.014***	-0.013***	-0.013***	-0.020***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
ln Age	-0.053***	-0.051***	-0.042***	-0.168***	-0.169***	-0.154***
	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)	(0.005)
$\ln\psi$		0.012***	0.012***		-0.006***	-0.008***
		(0.001)	(0.001)		(0.001)	(0.001)
TFP			0.055***			0.248***
			(0.003)			(0.004)
$\ln K$			-0.035***			
			(0.002)			
ln Empl						-0.137***
						(0.003)
Sector-Year	y	y	y	y	y	y
Prov-Year	y	y	y	y	y	y
Firm FE	y	y	y	y	y	y
Obs.	1,001,582	1,001,582	1,001,582	1,001,582	1,001,582	1,001,582
R^2	0.011	0.011	0.015	0.015	0.015	0.050
Number of Firm IDs	309,905	309,905	309,905	309,905	309,905	309,905

$\ln\lambda$: log return to labor relative to the sector.
$\ln\kappa$: log return to capital relative to the sector.
Export_{t-1}: export status for firm i at $t-1$.
ln Age: log firm age.
$\ln\psi$: profit margin.
TFP: total factor productivity, calculated according to the Wooldrige (2009) extension to the Levinshon-Petrin methodology.
$\ln K$: log capital.
ln Empl: log employment.
Legend: *** significant at 1%, ** at 5%, * at 10%.
Notes: FE firm-level regressions, 1998-2007. Standard errors are clustered at the firm level.

Table 6: Firm-Level Regressions: Exporting and Financial Frictions, Intensive Margin

Variables	(1)	(2)	(3)	(4)	(5)	(6)
		$\lvert\ln\lambda\rvert$			$\lvert\ln\kappa\rvert$	
ln Exports_{t-1}	-0.003*	-0.003**	0.001	-0.004**	-0.004**	-0.014***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
ln Age	-0.053***	-0.049***	-0.032***	-0.245***	-0.244***	-0.213***
	(0.008)	(0.008)	(0.008)	(0.011)	(0.011)	(0.011)
$\ln\psi$		0.023***	0.023***		0.005**	0.001
		(0.002)	(0.002)		(0.002)	(0.002)
TFP			-0.015***			0.192***
			(0.004)			(0.007)
$\ln K$			-0.037***			
			(0.003)			
ln Empl						-0.126***
						(0.005)
Sector-Year	y	y	y	y	y	y
Prov-Year	y	y	y	y	y	y
Firm FE	y	y	y	y	y	y
Obs.	307,716	307,716	307,716	307,716	307,716	307,716
R^2	0.012	0.014	0.015	0.022	0.022	0.042
Number of Firm IDs	95,087	95,087	95,087	95,087	95,087	95,087

$\ln\lambda$: log return to labor relative to the sector.
$\ln\kappa$: log return to capital relative to the sector.
ln Exports_{t-1}: value of export shipments for firm i at $t-1$.
ln Age: log firm age.
$\ln\psi$: profit margin.
TFP: total factor productivity, calculated according to the Wooldrige (2009) extension to the Levinshon-Petrin methodology.
$\ln K$: log capital.
ln Empl: log employment.
Legend: *** significant at 1%, ** at 5%, * at 10%.
Notes: FE firm-level regressions, 1998-2007. Standard errors are clustered at the firm level.

Table 7: Firm-Level Regressions: Tariffs and Input Market Distortions

Variables	(1)	(2) $\lvert\ln \lambda\rvert$	(3)	(4)	(5) $\lvert\ln \kappa\rvert$	(6)
Tariffs Above 75_{t-1}	0.007**	0.007**	0.007**	0.010***	0.010***	0.011***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
ln Age	-0.040***	-0.039***	-0.033***	-0.156***	-0.157***	-0.155***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
$\ln \psi$		0.014***	0.014***		-0.006***	-0.007***
		(0.001)	(0.001)		(0.001)	(0.001)
TFP			0.055***			0.259***
			(0.003)			(0.004)
$\ln K$			-0.033***			
			(0.002)			
ln Empl						-0.131***
						(0.003)
Sector-Year	y	y	y	y	y	y
Prov-Year	y	y	y	y	y	y
Firm FE	y	y	y	y	y	y
Obs.	893,613	893,613	893,613	893,613	893,613	893,613
R^2	0.011	0.012	0.015	0.013	0.013	0.050
Number of Firm IDs	297,718	297,718	297,718	297,718	297,718	297,718

$\lvert\ln \lambda\rvert$: log return to labor relative to the sector, in absolute value.
$\lvert\ln \kappa\rvert$: log return to capital relative to the sector, in absolute value.
Tariffs Above 75_{t-1}: dummy equal to one if firm tariff is above 75th percentile within an industry.
ln Age: log firm age.
$\ln \psi$: profit margin.
TFP: total factor productivity, Wooldrige (2009) extension to Levinshon-Petrin methodology.
$\ln K$: log capital.
ln Empl: log employment.
Legend: *** significant at 1%, ** at 5%, * at 10%.
Notes: FE firm-level regressions, 2001-2007. Firm-level tariffs are constructed using export shares in 2000; non-exporters are assigned their industry tariffs. Standard errors are clustered at the firm level.

Table 8: Firm-Level Regressions: Model-Consistent Distortions

Variables	(1)	(2) $\ln\lambda < 0$	(3)	(4)	(5) $\ln\kappa > 0$	(6)
Tariffs Above 75_{t-1}	-0.009**	-0.010**	-0.010**	0.022***	0.021***	0.018***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
ln Age	0.049***	0.039***	0.059***	-0.202***	-0.208***	-0.191***
	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)
$\ln\psi$		-0.086***	-0.097***		-0.090***	-0.089***
		(0.002)	(0.002)		(0.001)	(0.001)
TFP			0.399***			0.912***
			(0.003)			(0.003)
$\ln K$			1.223***			
			(0.084)			
ln Empl			-0.243***			-0.112***
			(0.004)			(0.003)
Sector-Year	y	y	y	y	y	y
Prov-Year	y	y	y	y	y	y
Firm FE	y	y	y	y	y	y
Obs.	483,284	483,284	483,284	575,776	575,776	575,776
R^2	0.026	0.062	0.149	0.366	0.391	0.396
Number of Firm IDs	208,116	208,116	208,116	226,641	226,641	226,641

$\ln\lambda$: log return to labor relative to the sector.
$\ln\kappa$: log return to capital relative to the sector.
Tariffs Above 75_{t-1}: dummy equal to one if firm tariff is above 75 percentile within an industry.
ln Age: log firm age.
$\ln\psi$: profit margin.
TFP: total factor productivity, calculated according to the Wooldrige (2009) extension to the Levinshon-Petrin methodology.
$\ln K$: log capital.
ln Empl: log employment.
Legend: *** significant at 1%, ** at 5%, * at 10%.
Notes: FE firm-level regressions, 1998-2007. Standard errors are clustered at the firm level.

Table 9: Firm-Level Regressions: Tariffs, Credit Constraints, and Input Market Distortions

Variables	(1)	(2) $\lvert\ln\lambda\rvert$	(3)	(4)	(5) $\lvert\ln\kappa\rvert$	(6)
Tariffs Above 75_{t-1}	0.079*	0.077*	0.077*	-0.153***	-0.152***	-0.152***
	(0.044)	(0.044)	(0.044)	(0.051)	(0.051)	(0.051)
Tariffs Above 75_{t-1}*Lev. Ratio	-0.121	-0.118	-0.118	0.275***	0.274***	0.275***
	(0.074)	(0.074)	(0.074)	(0.086)	(0.086)	(0.086)
ln Age	-0.041***	-0.040***	-0.034***	-0.156***	-0.156***	-0.155***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
$\ln\psi$		0.014***	0.014***		-0.007***	-0.008***
		(0.001)	(0.001)		(0.001)	(0.001)
TFP			0.055***			0.261***
			(0.003)			(0.004)
$\ln K$			-0.033***			
			(0.002)			
ln Empl						-0.132***
						(0.003)
Sector-Year	y	y	y	y	y	y
Prov-Year	y	y	y	y	y	y
Firm FE	y	y	y	y	y	y
Obs.	898,817	898,817	898,817	898,817	898,817	898,817
R^2	0.011	0.012	0.015	0.013	0.013	0.050
Number of Firm IDs	298,746	298,746	298,746	298,746	298,746	298,746

$\lvert\ln\lambda\rvert$: log return to labor relative to the sector, in absolute value.
$\lvert\ln\kappa\rvert$: log return to capital relative to the sector, in absolute value.
Tariffs Above 75_{t-1}: dummy equal to one if firm tariff is above 75th percentile within an industry.
Lev Ratio: average debt-to-asset ratio; the measure is computed as average across all firms within an industry.
ln Age: log firm age.
$\ln\psi$: profit margin.
TFP: total factor productivity, Wooldrige (2009) extension to Levinshon-Petrin methodology.
$\ln K$: log capital.
ln Empl: log employment.
Legend: *** significant at 1%, ** at 5%, * at 10%.
Notes: FE firm-level regressions, 2001-2007. Firm-level tariffs are constructed using export shares in 2000; non-exporters are assigned their industry tariffs. Standard errors are clustered at the firm level.

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A Mathematical Derivations

A.1 Closed Economy

A.1.1 Partition of the State Space

Lemma 1. The set of firms with $\mu_{is,t-1} > 0$, $\mu_{ist} = 0$ and $\mu_{is,t+1} > 0$ has measure zero.

Proof. By contradiction, suppose not. Then, firms capital choices at $t-1$ and at t will be the following

$$K_{is,t-1} = \tilde{\theta}_K \frac{z_{is}^{\sigma-1}}{w^{\alpha_s(\sigma-1)}\left[r+\mu_{is,t-1}\right]^{\sigma(1-\alpha_s)+\alpha_s}} < K_{is}^*$$
$$K_{is,t} = \tilde{\theta}_K \frac{z_{is}^{\sigma-1}\left(1+\mu_{is,t+1}\right)^{\sigma}}{w^{\alpha_s(\sigma-1)}r^{\sigma(1-\alpha_s)+\alpha_s}} > K_{is}^*$$

Similarly for labor. The capital and labor allocations at t imply that while the frictionless allocations are available, a firm would *not* choose those. This behavior, however, is suboptimal. A similar argument can be used to prove that sequences such that firms become constrained at future periods are of measure zero. □

A.1.2 Existence of a Constrained Solution

Lemma 2. The Jacobian matrix of the system with t-1 constraints is non-singular.

Proof. The Jacobian matrix, J, associated with the system of the first t-1 constraints is tridiagonal,

$$J = \begin{bmatrix} a_{11} & a_{12} & 0 & \dots & 0 \\ a_{21} & a_{22} & a_{23} & \dots & 0 \\ \vdots & \ddots & \ddots & \ddots & \vdots \\ 0 & \dots & a_{t-2,t-3} & a_{t-2,t-2} & a_{t-2,t-1} \\ 0 & \dots & 0 & a_{t-1,t-2} & a_{t-1,t-1} \end{bmatrix}$$

with the determinant of a tridiagonal matrix satisfying the following recurrence,

$$\det J_n = a_{n,n} \det J_{n-1} - a_{n,n-1}a_{n-1,n} \det J_{n-2}, \qquad \text{for } n = 0, 1, \dots, t-1 \tag{6}$$

In particular,

$$\begin{aligned} \det J_n = & -\frac{\left[(\sigma-1)(1-\alpha_s)+1\right]}{\left[r+\mu_{is,n-1}\right]^{(\sigma-1)(1-\alpha_s)+2}} \det J_{n-1} \\ & - \frac{\Psi}{\tilde{\theta}_K} \frac{(\sigma-1)\left(1+\mu_{is,n}\right)^{\sigma-2}}{\left[r+\mu_{is,n-1}\right]^{(\sigma-1)(1-\alpha_s)}} \left[\det J_{n-1} + \frac{\sigma(1-\alpha_s)\left(1+\mu_{is,n}\right)^{\sigma}}{\left[r+\mu_{is,n-1}\right]^{(\sigma-1)(1-\alpha_s)+1}} \det J_{n-2}\right] \end{aligned}$$

In our case, it is sufficient to show if $\det J_{n-1} < 0$, then

$$\det J_{n-1} < -\frac{\sigma(1-\alpha_s)\left(1+\mu_{is,n}\right)^{\sigma}}{\left[r+\mu_{is,n-1}\right]^{(\sigma-1)(1-\alpha_s)+1}} \det J_{n-2}$$

and viceversa if $\det J_{n-1} > 0$. This result follows immediately from equation (6) as $\frac{\sigma(1-\alpha_s)(1+\mu_{is,n})^{\sigma}}{[r+\mu_{is,n-1}]^{(\sigma-1)(1-\alpha_s)+1}} = \frac{\sigma(1-\alpha_s)}{\sigma(1-\alpha_s)+\alpha_s} a_{n,n}$. □

A.1.3 Effect of Market Access on Constraints

Proposition 2.2. Higher productivity and larger demand are positively correlated with the tightness of contemporaneous constraints and negatively correlated with the tightness of future constraints.

Proof. Let $E = \{E_0, E_1, \dots, E_T\}$ be the sequence of market size indicators. The n-th borrowing constraints satisfies

$$\frac{(1+\mu_{is,n+1})^{\sigma}}{[r+\mu_{is,n}]^{\sigma(1-\alpha_s)+\alpha_s}} - \frac{\Psi}{\tilde{\theta}_K}\frac{E_{n-1}}{E_n}\frac{(1+\mu_{is,n})^{\sigma-1}}{[r+\mu_{is,n-1}]^{(1-\alpha_s)(\sigma-1)}} = \frac{A_{is}}{z_{is}^{\sigma-1}} w^{\alpha_s(\sigma-1)}$$

In particular, let

$$j(\mu_{is,n}, E_n) = \frac{(1+\mu_{is,n+1})^{\sigma}}{[r+\mu_{is,n}]^{\sigma(1-\alpha_s)+\alpha_s}} - \frac{\Psi}{\tilde{\theta}_K}\frac{E_{n-1}}{E_n}\frac{(1+\mu_{is,n})^{\sigma-1}}{[r+\mu_{is,n-1}]^{(1-\alpha_s)(\sigma-1)}} - \frac{A_{is}}{z_{is}^{\sigma-1}} w^{\alpha_s(\sigma-1)}$$

Then, by the Implicit Function Theorem,

$$\frac{\partial \mu_{is,n}}{\partial E_n} > 0$$
$$\frac{\partial \mu_{is,n}}{\partial E_{n-1}} < 0$$

□

A.1.4 Comparative Statics

The condition

$$\frac{\Psi}{\tilde{\theta}_K^{\frac{(\sigma-1)(1-\alpha_s)}{\sigma(1-\alpha_s)+\alpha_s}}}\left[E\frac{z_{is}^{\sigma-1}}{w^{\alpha_s(\sigma-1)}}\right]^{\frac{1}{\sigma(1-\alpha_s)+\alpha_s}} A_{is}^{\frac{(\sigma-1)(1-\alpha_s)}{\sigma(1-\alpha_s)+\alpha_s}} + A_{is} = \tilde{\theta}_K \frac{z_{is}^{\sigma-1}}{w^{\alpha_s(\sigma-1)} r^{\sigma(1-\alpha_s)+\alpha_s}} E$$

implies a positive relationship between A_{is} and z_{is}. In fact, the left-hand side of the above expression is increasing in A_{is}. Moreover, let

$$f\left(A_{is}, z_{is}^{\sigma-1}\right) \equiv \frac{\Psi}{\tilde{\theta}_K^{\frac{(\sigma-1)(1-\alpha_s)}{\sigma(1-\alpha_s)+\alpha_s}}}\left[E\frac{z_{is}^{\sigma-1}}{w^{\alpha_s(\sigma-1)}}\right]^{\frac{1}{\sigma(1-\alpha_s)+\alpha_s}} A_{is}^{\frac{(\sigma-1)(1-\alpha_s)}{\sigma(1-\alpha_s)+\alpha_s}} + A_{is} - \tilde{\theta}_K \frac{z_{is}^{\sigma-1}}{w^{\alpha_s(\sigma-1)} r^{\sigma(1-\alpha_s)+\alpha_s}} E$$

Then,

$$\begin{aligned}
\frac{\partial f\left(A_{is}, z_{is}^{\sigma-1}\right)}{\partial z_{is}^{\sigma-1}} &= \frac{\Psi}{\tilde{\theta}_K^{\frac{(\sigma-1)(1-\alpha_s)}{\sigma(1-\alpha_s)+\alpha_s}}} \left[\frac{E}{w^{\alpha_s(\sigma-1)}}\right]^{\frac{1}{\sigma(1-\alpha_s)+\alpha_s}} \frac{A_{is}^{\frac{(\sigma-1)(1-\alpha_s)}{\sigma(1-\alpha_s)+\alpha_s}} \left(z_{is}^{\sigma-1}\right)^{\frac{1}{\sigma(1-\alpha_s)+\alpha_s}-1}}{\sigma\left(1-\alpha_s\right)+\alpha_s} - \frac{\tilde{\theta}_K \cdot E}{w^{\alpha_s(\sigma-1)} r^{\sigma(1-\alpha_s)+\alpha_s}} \\
&= z_{is}^{1-\sigma} \left[\frac{1}{\sigma\left(1-\alpha_s\right)+\alpha_s} \left(\frac{\tilde{\theta}_K \cdot z_{is}^{\sigma-1} E}{w^{\alpha_s(\sigma-1)} r^{\sigma(1-\alpha_s)+\alpha_s}} - A_{is}\right) - \frac{\tilde{\theta}_K \cdot z_{is}^{\sigma-1} E}{w^{\alpha_s(\sigma-1)} r^{\sigma(1-\alpha_s)+\alpha_s}}\right] \\
&= -z_{is}^{1-\sigma} \left[\frac{(\sigma-1)\left(1-\alpha_s\right)}{\sigma\left(1-\alpha_s\right)+\alpha_s} \frac{\tilde{\theta}_K \cdot z_{is}^{\sigma-1} E}{w^{\alpha_s(\sigma-1)} r^{\sigma(1-\alpha_s)+\alpha_s}} + \frac{A_{is}}{\sigma\left(1-\alpha_s\right)+\alpha_s}\right] \\
&< 0
\end{aligned}$$

Therefore, by the Implicit Function Theorem, $\frac{\partial A_{is}}{\partial z_{is}} > 0$ across marginally unconstrained firms at $t = 1$. Moreover, $\frac{\partial A_{is}}{\partial z_{is}}$ does not depend on E. In fact,

$$\frac{\partial A_{is}}{\partial z_{is}} = \frac{A_{is}}{z^{\sigma-1}}$$

A.2 Export Cutoff Conditions in a Two-Period Model

In a two-period model, export cutoff conditions differ across unconstrained marginal exporters, marginal exporters constrained only in the first period, and marginal exporters constrained in both periods. While the main text reports those conditions for the first two cases, we will derive here on the condition for the third set of firms. At a marginal exporter,

$$\frac{\Psi}{\sigma} \frac{z_{ist}^{*,\sigma-1}\left(1+\mu_{is,t+1}\right)^{\sigma-1}}{w^{\alpha_s(\sigma-1)}\left[r+\mu_{ist}\right]^{(\sigma-1)(1-\alpha_s)}} \tau^{-\frac{1}{\sigma}} E^x - f = 0$$

Combining this condition with the system of equation faced by a constrained firm in a two-period model, it is possible to solve for the explicit values of the Lagrangean multiplier

$$\begin{aligned}
1+\mu_{is1} &= \frac{\frac{\tilde{\theta}_k}{\Psi}\left[1+\frac{E}{\tau^{-1/\sigma}E^x}\right] f}{A_{is}+\left[1+\frac{E}{\tau^{-1/\sigma}E^x}\right] f} + 1 - r \\
r+\mu_{is0} &= \frac{1}{A_{is}}\left[1+\frac{E}{\tau^{-1/\sigma}E^x}\right] f\left[1+\mu_{is1}\right]
\end{aligned}$$

Substituting those values into the equation (2), we are able to derive the relationship between productivity and assets at a constrained marginal exporter. The productivity cutoff is positively related to the level of assets: firms that become exporters increase their demand for labor and capital inputs and, thus, require more assets to be able to meet foreign demand.

A.3 Deriving Equation (5)

Our model specification implies equation 5. In fact, from the borrowing constraint,

$$\begin{aligned}\frac{K_{is,t}}{P_{is,t}Y_{is,t}} &= \frac{P_{is,t-1}Y_{is,t-1}}{P_{is,t}Y_{is,t}} + \frac{A_{is0}}{P_{is,t}Y_{is,t}} \\ \frac{\tilde{\theta}_k}{\psi}\frac{1+\mu_{is,t+1}}{r+\mu_{is,t}} &= \frac{[r+\mu_{is,t}]^{(\sigma-1)(1-\alpha_s)}}{[1+\mu_{is,t+1}]^{(\sigma-1)}}\left[\frac{E_{t-1}}{E_t}\frac{z_{is,t-1}^{\sigma-1}}{z_{is,t}^{\sigma-1}}\frac{[1+\mu_{is,t}]^{\sigma-1}}{[r+\mu_{is,t-1}]^{(\sigma-1)(1-\alpha_a)}} + \frac{w^{\alpha_s(\sigma-1)}}{\psi}\frac{A_{is0}}{E_t z_{is,t}^{\sigma-1}}\right]\end{aligned}$$

Let $\frac{1}{\kappa} \equiv \frac{1+\mu_{is,t+1}}{r+\mu_{is,t}}$.[32] Taking log-s of the expression above and rearranging,

$$\ln\kappa_{ist} = -\frac{1}{\sigma}\ln\frac{\tilde{\theta}_k}{\psi} - \frac{\alpha_s}{\sigma}\ln[r+\mu_{ist}] + \frac{1}{\sigma}\ln\left[\frac{E_{t-1}}{E_t}\frac{z_{is,t-1}^{\sigma-1}}{z_{is,t}^{\sigma-1}}\frac{[1+\mu_{is,t}]^{\sigma-1}}{[r+\mu_{is,t-1}]^{(\sigma-1)(1-\alpha_a)}} + \frac{w^{\alpha_s(\sigma-1)}}{\psi}\frac{A_{is0}}{E_t z_{is,t}^{\sigma-1}}\right]$$

Using the approximation $\ln(a+b) = \ln a + \ln(1+\frac{b}{a}) \approx \ln a + \frac{b}{a}$,

$$\ln\kappa_{ist} \approx -\frac{1}{\sigma}\ln\frac{\tilde{\theta}_k}{\psi} - \frac{\alpha_s}{\sigma}\ln[r+\mu_{ist}] + \frac{1}{\sigma}\ln\left[A_{is0}\frac{w^{\alpha_s(\sigma-1)}}{\psi}\right] + \frac{1-\sigma}{\sigma}\ln z_{is,t} - \frac{1}{\sigma}\ln E_t - \frac{1}{\sigma}\frac{P_{is,t-1}Y_{is,t-1}}{A_{is0}}$$

This implies

$$\ln\kappa_{ist} = \gamma_0 + \gamma_1 \text{Mkt Access Shock}_{is,t-1} + D_i + D_s + D_t + \varepsilon_{ist}$$

where[33]

$$\begin{aligned}\gamma_0 &\equiv -\frac{1}{\sigma}\ln\tilde{\theta}_k \\ \gamma_1 &\approx -\frac{1}{\sigma} \\ D_i &\equiv \frac{1}{\sigma}\ln A_{is0} \\ D_s &\equiv \frac{\alpha_s(\sigma-1)}{\sigma}\ln w \\ D_t &\equiv -\frac{1}{\sigma}\ln E_t\end{aligned}$$

We proxy past sales shocks with past market access shocks. Our model implies that $\gamma_1 < 0$. Note that our error term is a result of an approximation strategy and it includes $\frac{\alpha_s}{\sigma}\ln[r+\mu_{ist}] + \frac{1-\sigma}{\sigma}\ln z_{is,t}$, thus, we need to control for productivity shocks and identify market access shocks which are exogenous to $\ln[r+\mu_{ist}]$, a term that directly enters into the expression for firm current and past sales. We claim that the tariffs firm face in export markets are exogenous to whether a firm faces constraint at time t. Following similar steps, we can derive a similar estimating equation for $\ln\lambda_{ist}$.

[32] Note that the exact definition of κ requires a normalization by the industry-level capital returns. However, the term would be absorbed by the sector dummies after taking log-s and we will ignore it here.

[33] Our specification includes sector-time dummies, allowing shocks to aggregate market size to be sector-specific or labor shares to vary over time.

A.4 Variance decomposition

Let I_0 be the set of unconstrained firms and I_1 the set of constrained firms, such that $I = I_0 \cup I_1$ denotes the universe of firms. We can decompose the variance of capital distortion, κ_i, across all firms as follows:[34]

$$
\begin{aligned}
\text{var}(\kappa) &= \frac{1}{\chi(I)}\int_I (\kappa_i - \bar{\kappa})^2 \mathrm{d}\chi \\
&= \frac{\chi(I_0)}{\chi(I)}\frac{1}{\chi(I_0)}\int_{i\in I_0}(\kappa_i - \bar{\kappa})^2\mathrm{d}\chi + \frac{\chi(I_1)}{\chi(I)}\frac{1}{\chi(I_1)}\int_{i\in I_1}(\kappa_i - \bar{\kappa})^2\mathrm{d}\chi \\
&= \frac{\chi(I_0)}{\chi(I)}\frac{1}{\chi(I_0)}\int_{i\in I_0}[(\kappa_i - \bar{\kappa}_0)^2 + (\bar{\kappa}_0 - \bar{\kappa})^2 + 2(\kappa_i - \bar{\kappa}_0)(\bar{\kappa}_0 - \bar{\kappa})]\mathrm{d}\chi + \\
&\quad + \frac{\chi(I_1)}{\chi(I)}\frac{1}{\chi(I_1)}\int_{i\in I_1}[(\kappa_i - \bar{\kappa}_1)^2 + (\bar{\kappa}_1 - \bar{\kappa})^2 + 2(\kappa_i - \bar{\kappa}_1)(\bar{\kappa}_1 - \bar{\kappa})]\mathrm{d}\chi \\
&= \frac{\chi(I_0)}{\chi(I)}\frac{1}{\chi(I_0)}\int_{i\in I_0}[(\kappa_i - \bar{\kappa}_0)^2 + (\bar{\kappa}_0 - \bar{\kappa})^2]\mathrm{d}\chi + \\
&\quad + \frac{\chi(I_1)}{\chi(I)}\frac{1}{\chi(I_1)}\int_{i\in I_1}[(\kappa_i - \bar{\kappa}_1)^2 + (\bar{\kappa}_1 - \bar{\kappa})^2]\mathrm{d}\chi \\
&= \frac{\chi(I_1)}{\chi(I)}\text{var}(\kappa)_{I_1} + \left[\frac{\chi(I_0)}{\chi(I)}(\bar{\kappa}_0 - \bar{\kappa})^2 + \frac{\chi(I_1)}{\chi(I)}(\bar{\kappa}_1 - \bar{\kappa})^2\right] \\
&= \frac{\chi(I_1)}{\chi(I)}\text{var}(\kappa)_{I_1} + \frac{\chi(I_0)\,\chi(I_1)}{\chi^2(I)}\left(\bar{\kappa}_0 + \frac{\chi(I_0)}{\chi(I_1)}\bar{\kappa}_0 - \frac{1}{\chi(I_1)}\right)^2 \\
&= \frac{\chi(I_1)}{\chi(I)}\text{var}(\kappa)_{I_1} + \frac{\chi(I_0)}{\chi^2(I)\,\chi(I_1)}\left(\chi(I)\,\bar{\kappa}_0 - 1\right)^2
\end{aligned}
$$

where χ denotes the Lebesgue measure and $\bar{\kappa} \equiv \frac{1}{\chi(I)}\int_I \kappa_i \mathrm{d}\chi$. Assuming a unit mass of firm, $\chi(I) \equiv 1$. Thus, the total variance of capital distortion depends on three elements: $\text{var}(\kappa)_{I1}$, the variance of the distortion across constrained firms; $\chi(I_1)$ and $\chi(I_0)$, the proportion of constrained and unconstrained firms; and $(\bar{\kappa}_0 - 1)^2$, the deviation between the average size of the distortion at unconstrained firms and the average distortion for the whole economy.

Exporters vs. Non-exporters

To derive our cross-sectional equation, we need to compare the variance across exporters, $\text{var}^x(\kappa)$, with the variance across non-exporters, $\text{var}^d(\kappa)$.[35] For simplicity, we assume that the mass of exporters is equal to the mass of non-exporters, and we normalize the size of both groups to unity, $\chi^x(I) = \chi^d(I) = 1$. Since $\bar{\kappa}_0^x = \bar{\kappa}_0^d$, differences in variance are related only to the variance across constrained firms and the proportion of constrained vs. unconstrained firms. Our framework suggests that export shocks tend to expand the set of unconstrained firms over time; this result implies that the set of constrained firms for exporters tends to shrink faster relative to that of non-exporters. Differences across $\text{var}^x(\kappa)_{I_1^x}$ and $\text{var}^d(\kappa)_{I_1^d}$ can be solved after specifying the time horizon of the

[34] Note that the variance of κ_i over I_0 is 0.

[35] We will denote variables for exporters with ^{x} and variables that refer to non-exporters with ^{d}.

model. In a single period model,

$$\frac{\text{var}^x(\kappa)_{I_1^x}}{\text{var}^d(\kappa)_{I_1^d}} = \left[1 + \frac{\tau^{-1/\sigma}E^*}{E}\right]^{\frac{2}{\sigma(1-\alpha_s)+\alpha_s}} \frac{\text{var}^x\left(\frac{z_{is}^\sigma}{A_{i0}}\right)_{I_1^x}}{\text{var}^d\left(\frac{z_{is}^\sigma}{A_{i0}}\right)_{I_1^d}}$$

A necessary condition for lower variance across exporters is that $\text{var}^x\left(\frac{z_{is}^\sigma}{A_{is0}}\right) < \text{var}^d\left(\frac{z_{is}^\sigma}{A_{is0}}\right)$. With the set of constrained firms shrinking faster across exporters, this condition is verified if the tail of the assets and productivity distribution decays at a sufficiently fast rate. Therefore, $\text{var}^x(\kappa) < \text{var}^d(\kappa)$, implying that $\beta_1 < 0$ in equation (4).

A.5 Size-Dependent Credit Constraints: Additional Empirical Evidence

Our results largely rely on the dependence of the borrowing constraints on past sales. While the positive correlations shown in table B1 are consistent with our assumption and other evidence from Arellano et al. [2012] and Gopinath et al. [2017], we analyze the model-implied relationship between capital accumulation and firm characteristics to provide additional supporting evidence on our framework of choice. The capital accumulation equation implies that the change in the capital stock reflects past changes in revenues; in particular, such changes depend on firm productivity, market access, and within-firm variation in frictions, in addition to other characteristics that do not vary across firms,

$$\begin{aligned} K_{is,t+1} - K_{is,t} &= P_{ist}Y_{ist} - P_{is,t-1}Y_{is,t-1} \\ &= \psi \frac{z_{is}^{\sigma-1}}{w^{\alpha_s(\sigma-1)}} \left[\frac{(1+\mu_{is,t+1})^{\sigma-1}}{[r+\mu_{ist}]^{(1-\alpha_s)(\sigma-1)}} - \frac{(1+\mu_{ist})^{\sigma-1}}{[r+\mu_{ist-1}]^{(1-\alpha_s)(\sigma-1)}} \right] \left(E + D_i^x \tau^{-\frac{1}{\sigma}} E^x\right) \end{aligned} \tag{7}$$

where D_i^x is a dummy equal to 1 for exporting firms. Thus, we estimate an approximate version of equation (7), after taking log-s and proxying cross-firm differences in market access with the firm export status,[36]

$$\ln K_{is,t+1} = \alpha_0 + \alpha_1 \Delta \ln \kappa_{ist} + \alpha_2 \text{Export}_{is,t} + D_i + D_{st} + u_{ist} \tag{8}$$

Equation (8) implies that the future capital stock is influenced by the change in a measure of capital distortion, $\Delta \ln \kappa_{ist}$, and shocks to revenues, proxied by the firm's export status.[37] D_i captures time-invariant firm productivity and other unobservable characteristics that are not changing over time, while D_{st} identifies sector-time-specific factors, such as differences in labor shares across sectors. Results from estimating equation (8) are shown in table B2. Next period capital stock is significantly affected by the firm export status and changes in frictions; their signs are consistent with our specification: Firms becoming exporters or facing lower frictions increase their capital investment. The addition of other controls does not alter the significance of these relationships. In columns (2)-(5), we control for the number of years a firm has been in the market, as our framework implies the

[36] The error term, u_{ist}, in our estimating equation captures the approximation and measurement errors.

[37] See section 3.1 for more details on the construction of our measure of distortions.

easing of the borrowing constraint over time, an effect that is orthogonal to market access shocks. While our baseline estimates capture cross-firm productivity differences using firm fixed effects, we include TFP and total employment in columns (3)-(5) as proxies for productivity shocks. Column (5) also adds net assets, a standard control for the capital accumulation equation: while our framework adopts the simplifying assumption of no change in the asset endowment, the availability of larger assets may also relax the borrowing constraint over time.[38] All additional controls do not affect the sign and the significance of our two main regressors: Our results suggest that our main assumption is consistent with the empirical evidence.

B Additional Empirical Results

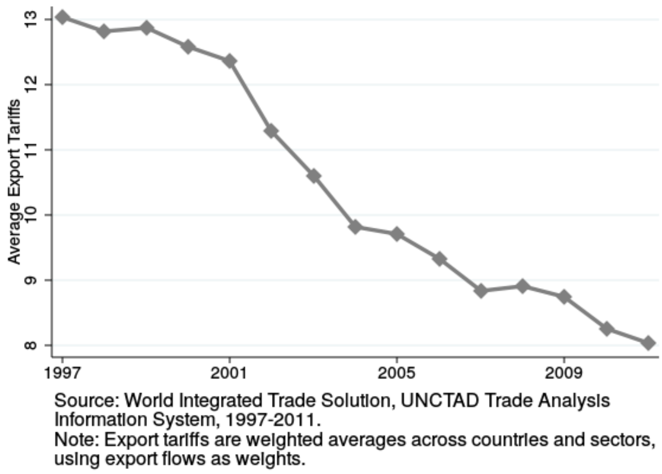

Figure B1: Export Tariffs, 1997-2011

[38]See, for example, Gopinath et al. [2017].

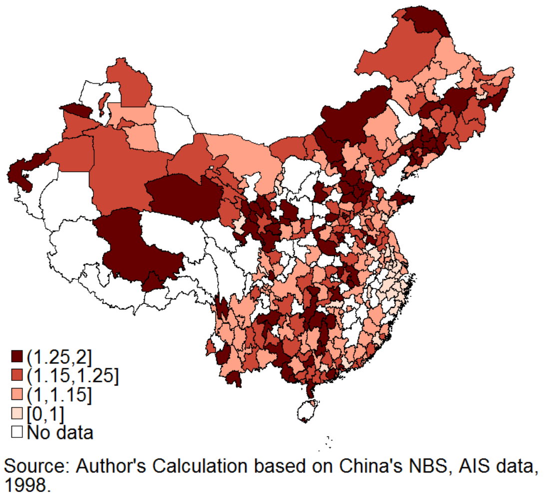

Figure B2: Dispersion across Labor Returns, 1998

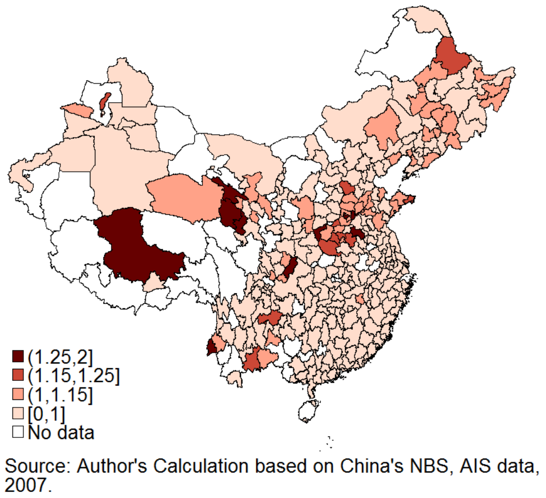

Figure B3: Dispersion across Labor Returns, 2007

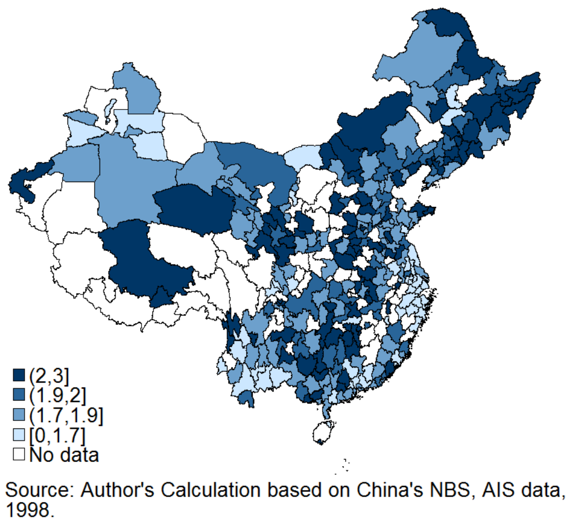

Figure B4: Dispersion across Capital Returns, 1998

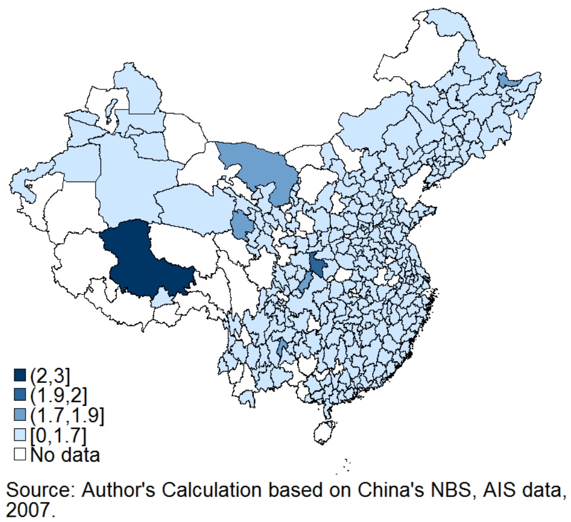

Figure B5: Dispersion across Capital Returns, 2007

Table B1: Firm Size and Measures of Leverage

Variables	(1) Debt/Assets	(2) Debt/Equity	(3) Fee Share	(4) Interest Share
Revenues_{t-1}	0.029***	0.016***	0.002***	0.002***
	(0.001)	(0.002)	(0.0004)	(0.0004)
Sector-Year	y	y	y	y
Prov-Year	y	y	y	y
Obs.	1,212,190	1,212,190	1,212,190	1,212,190
R^2	0.062	0.056	0.002	0.002

Debt/Assets: ratio of total debts to assets.
Debt/Equity: ratio of total debts to equity.
Fee Share: financial fees relative to total assets.
Interest Share: interest payments relative to total assets
Legend: *** significant at 1%, ** at 5%, * at 10%.
Notes: Firm-level cross-sectional regressions, 1998-2007. Standard errors are clustered at the firm level.

Table B2: Firm Level Regressions: Capital Accumulation, Exporting, and Financial Frictions

Variables	(1)	(2)	(3) $\ln K_{i,t+1}$	(4)	(5)
$\Delta \ln \kappa_t$	-0.029***	-0.030***	-0.030***	-0.031***	-0.026***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Export_t	0.061***	0.056***	0.055***	0.029***	0.023***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$\ln \text{Age}_t$		0.294***	0.295***	0.231***	0.203***
		(0.006)	(0.006)	(0.006)	(0.006)
$\ln \psi_t$			0.011***	0.009***	0.000
			(0.001)	(0.001)	(0.001)
TFP_t				0.048***	0.021***
				(0.002)	(0.002)
$\ln \text{Empl}_t$				0.235***	0.191***
				(0.003)	(0.003)
$\ln \text{Net Assets}_t$					0.156***
					(0.002)
Sector-Year	y	y	y	y	y
Prov-Year	y	y	y	y	y
Firm FE	y	y	y	y	y
Obs.	786,279	786,279	786,279	786,279	786,279
R^2	0.119	0.131	0.132	0.177	0.219
Number of Firm IDs	265,174	265,174	265,174	265,174	265,174

$\ln K_{i,t+1}$: log capital stock at $t+1$.
$\Delta \ln \kappa_t$: change in firm-level distortions.
Export: export status for firm i at $t-1$.
$\ln \text{Age}_t$: firm's age.
$\ln \psi$: profit margin.
$\ln \text{Empl}_t$: log employment.
$\ln \text{Net Assets}_t$: assets minus debts.
Legend: *** significant at 1%, ** at 5%, * at 10%.
Notes: FE firm-level regressions, 1998-2007. Standard errors are clustered at the firm level.

Table B3: Industry-level Regressions: Exporting and the Standard Deviation across Input Returns, dropping cells with fewer than 10 firms

Variables	(1)	(2) Sd $ln\lambda$	(3)	(4)	(5) Sd $ln\kappa$	(6)
Export	-0.106***	-0.103***	-0.094***	-0.112***	-0.109***	-0.095***
	(0.008)	(0.008)	(0.007)	(0.009)	(0.009)	(0.009)
sd $\ln\psi$		0.060***	0.057***		0.059***	0.056***
		(0.005)	(0.005)		(0.006)	(0.006)
sd TFP			0.281***			0.423***
			(0.009)			(0.011)
sd K			-0.021***			
			(0.006)			
sd Empl						-0.053***
						(0.012)
Sector[a]-Age	y	y	y	y	y	y
Year	y	y	y	y	y	y
Obs.	47,526	47,526	47,526	47,526	47,526	47,526
R^2	0.386	0.391	0.437	0.381	0.384	0.454

[a] : 4-digit industry codes.
Sd $ln\lambda$: dispersion across labor returns within export status-age-sector-year cells.
Sd $ln\kappa$: dispersion across capital returns within export status-age-sector-year cells.
Export: dummy equal to one if the measure of distortion applies to exporters.
sd $\ln\psi$: standard deviation across profit margins; the measure is computed with each export status-age-sector-year cell.
sd TFP: standard deviation across productivities; the measure is computed with each export status-age-sector-year cell.
sd K: standard deviation across capital endowments; the measure is computed with each export status-age-sector-year cell.
sd Empl: standard deviation across total employment; the measure is computed with each export status-age-sector-year cell.
Legend: *** significant at 1%, ** at 5%, * at 10%.
Notes: Sector-level regressions, 1998-2007. The unit of observation is an export status-age-sector-year cell; the regression drops cells with fewer than 10 firms. Standard errors are clustered at the 4-digit CIC level.

Table B4: Financial Dependence, Exporting, and the Dispersion across Input Returns

Variables	(1)	(2) Avg $\|ln\lambda\|$	(3)	(4)	(5) Avg $\|ln\kappa\|$	(6)
Export	-0.076***	-0.072***	-0.064***	-0.169***	-0.166***	-0.155***
	(0.013)	(0.013)	(0.012)	(0.017)	(0.017)	(0.017)
Export*Fin Dep	-0.070	-0.061	-0.040	-0.546**	-0.540**	-0.512**
	(0.090)	(0.094)	(0.089)	(0.227)	(0.221)	(0.219)
sd ln ψ		0.047***	0.045***		0.033***	0.030***
		(0.006)	(0.006)		(0.006)	(0.006)
sd TFP			0.159***			0.206***
			(0.012)			(0.017)
sd K			-0.016***			
			(0.006)			
sd Empl						-0.036**
						(0.015)
Sector[a]-Age	y	y	y	y	y	y
Year	y	y	y	y	y	y
Obs.	21,590	21,590	21,590	21,590	21,590	21,590
R^2	0.323	0.329	0.359	0.338	0.340	0.369

[a] : 4-digit industry codes.

Avg $|ln\lambda|$: average within-age-sector absolute deviation between firm labor returns and sectoral allocation.

Avg $|ln\kappa|$: average within-age-sector absolute deviation between firm capital returns and sectoral allocation.

Export: dummy equal to one if the measure of distortion applies to exporters.

Fin Dep: average debt-to-asset ratio; the measure is based on U.S. firms. See Braun [2005] and Manova [2013].

sd ln ψ: standard deviation across profit margins; the measure is computed with each export status-age-sector-year cell.

sd TFP: standard deviation across productivities; the measure is computed with each export status-age-sector-year cell.

sd K: standard deviation across capital endowments; the measure is computed with each export status-age-sector-year cell.

sd Empl: standard deviation across total employment; the measure is computed with each export status-age-sector-year cell.

Legend: *** significant at 1%, ** at 5%, * at 10%.

Notes: Sector-level regressions, 1998-2007. The unit of observation is an export status-age-sector-year cell; the regression drops cells with fewer than 10 firms. Standard errors are clustered at the sector level.

Table B5: Age and the Dispersion across Input Returns, 2007, dropping cells with fewer than 10 firms

Variables	(1)	(2) Avg $\|ln\lambda\|$	(3)	(4)	(5) Avg $\|ln\kappa\|$	(6)
Age	0.0003	0.0003	-0.0004	-0.006***	-0.006***	-0.006***
	(0.0004)	(0.0004)	(0.0003)	(0.001)	(0.001)	(0.001)
sd ln ψ		0.038***	0.039***		0.052***	0.053***
		(0.009)	(0.009)		(0.010)	(0.010)
sd TFP			0.148***			0.273***
			(0.018)			(0.024)
sd K			-0.025**			
			(0.011)			
sd Empl						-0.152***
						(0.021)
Sector	y	y	y	y	y	y
Year	y	y	y	y	y	y
Obs.	5,562	5,562	5,562	5,562	5,562	5,562
R^2	0.417	0.421	0.439	0.373	0.378	0.415

[a] : 4-digit industry codes.

Avg $|ln\lambda|$: average within-sector absolute deviation between firm labor returns and sectoral allocation.

Avg $|ln\kappa|$: average within-sector absolute deviation between firm capital returns and sectoral allocation.

sd ln ψ: standard deviation across profit margins; the measure is computed with each sector-year cell.

sd TFP: standard deviation across productivities; the measure is computed with each sector-year cell.

sd K: standard deviation across capital endowments; the measure is computed with each sector-year cell.

sd Empl: standard deviation across total employment; the measure is computed with each sector-year cell.

Legend: *** significant at 1%, ** at 5%, * at 10%.

Notes: Sector-level regressions, 2007. The unit of observation is a sector-year cell; the regression drops cells with fewer than 10 firms. Standard errors are clustered at the sector level.

Table B6: IV Regressions: Export status and Input Market Distortions

Variables	(1)	(2) $\ln\lambda$	(3)	(4)	(5) $\ln\kappa$	(6)
Export_{t-1}	-0.154**	-0.159**	-0.162**	-0.230***	-0.228***	-0.255***
	(0.072)	(0.072)	(0.073)	(0.082)	(0.082)	(0.082)
ln Age	-0.029***	-0.028***	-0.022***	-0.140***	-0.140***	-0.139***
	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)
$\ln\psi$		0.014***	0.014***		-0.007***	-0.008***
		(0.001)	(0.001)		(0.001)	(0.001)
TFP			0.057***			0.263***
			(0.003)			(0.004)
$\ln K$			-0.030***			
			(0.002)			
ln Empl						-0.125***
						(0.004)
Sector-Year	y	y	y	y	y	y
Prov-Year	y	y	y	y	y	y
Firm FE	y	y	y	y	y	y
First-stage F stat	403.17	403.43	392.87	403.17	403.43	392.87
Obs.	893,613	893,613	893,613	893,613	893,613	893,613
R^2	0.026	0.067	0.217	0.045	0.085	0.438
Number of Firm IDs	297,718	297,718	297,718	297,718	297,718	297,718

$\ln\lambda$: log return to labor relative to the sector.
$\ln\kappa$: log return to capital relative to the sector.
Export_{t-1}: export status for firm i at $t-1$, instrumented with the dummy capturing whether firms face tariffs above the 75th percentile within a sector.
ln Age: log firm age.
$\ln\psi$: profit margin.
TFP: total factor productivity, calculated according to the Wooldrige (2009) extension to the Levinshon-Petrin methodology.
$\ln K$: log capital.
ln Empl: log employment.
Legend: *** significant at 1%, ** at 5%, * at 10%.
Notes: IV regressions, 2001-2007. Instruments are based on firm-level tariffs, which are constructed using export shares in 2000; non-exporters are assigned their industry tariffs. Standard errors are clustered at the firm level.

Table B7: Firm-Level Regressions: Tariffs, Financial Constraints, and Input Market Distortions

Variables	(1)	(2) $\lvert\ln\lambda\rvert$	(3)	(4)	(5) $\lvert\ln\kappa\rvert$	(6)
Tariffs Above 75_{t-1}	0.006*	0.006**	0.007**	0.007**	0.007**	0.008**
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
ln Assets	-0.023***	-0.025***	-0.031***	-0.107***	-0.107***	-0.157***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
ln Lev. Ratio	0.001	0.002	0.0003	0.011***	0.011***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ln Age	-0.035***	-0.033***	-0.031***	-0.130***	-0.130***	-0.127***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
$\ln\psi$		0.015***	0.015***		-0.004***	-0.004***
		(0.001)	(0.001)		(0.001)	(0.001)
TFP			0.062***			0.285***
			(0.003)			(0.004)
$\ln K$			-0.018***			
			(0.002)			
ln Empl						-0.087***
						(0.003)
Sector-Year	y	y	y	y	y	y
Prov-Year	y	y	y	y	y	y
Firm FE	y	y	y	y	y	y
Obs.	893,613	893,613	893,613	893,613	893,613	893,613
R^2	0.0116	0.0125	0.0153	0.0187	0.0187	0.0603
Number of Firm IDs	297,718	297,718	297,718	297,718	297,718	297,718

$\lvert\ln\lambda\rvert$: log return to labor relative to the sector, in absolute value.
$\lvert\ln\kappa\rvert$: log return to capital relative to the sector, in absolute value.
Tariffs Above 75_{t-1}: dummy equal to one if firm tariff is above 75 percentile within an industry.
$\ln\psi$: profit margin.
TFP: total factor productivity, Wooldrige (2009) extension to Levinshon-Petrin methodology.
$\ln K$: log capital.
ln Empl: log employment.
Legend: *** significant at 1%, ** at 5%, * at 10%.
Notes: FE firm-level regressions, 2001-2007. Firm-level tariffs are constructed using export shares in 2000; non-exporters are assigned their industry tariffs. Standard errors are clustered at the firm level.

Table B8: Firm-Level Regressions: Tariffs, Credit Constraints (U.S. Measure), and Input Market Distortions

Variables	(1)	(2) $\lvert\ln\lambda\rvert$	(3)	(4)	(5) $\lvert\ln\kappa\rvert$	(6)
Tariffs Above 75_{t-1}	-0.002	-0.001	-0.000	0.051**	0.051**	0.049**
	(0.019)	(0.019)	(0.019)	(0.022)	(0.022)	(0.021)
Tariffs Above 75_{t-1}*Fin Dep	-0.001	-0.001	-0.001	0.009**	0.009**	0.009**
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.004)
ln Age	-0.057***	-0.054***	-0.040***	-0.229***	-0.230***	-0.199***
	(0.014)	(0.014)	(0.014)	(0.017)	(0.017)	(0.017)
$\ln\psi$		0.021***	0.021***		-0.007**	-0.007**
		(0.003)	(0.003)		(0.003)	(0.003)
TFP			0.038***			0.237***
			(0.007)			(0.010)
$\ln K$			-0.033***			
			(0.005)			
ln Empl						-0.125***
						(0.008)
Sector-Year	y	y	y	y	y	y
Prov-Year	y	y	y	y	y	y
Firm FE	y	y	y	y	y	y
Obs.	127,064	127,064	127,064	127,064	127,064	127,064
R-squared	0.016	0.018	0.020	0.046	0.046	0.053
Number of Firms	38,661	38,661	38,661	38,661	38,661	38,661

$\lvert\ln\lambda\rvert$: log return to labor relative to the sector, in absolute value.
$\lvert\ln\kappa\rvert$: log return to capital relative to the sector, in absolute value.
Tariffs Above 75_{t-1}: dummy equal to one if firm tariff is above 75 percentile within an industry.
Fin Dep: average debt-to-asset ratio; the measure is based on U.S. firms. See Braun [2005] and Manova [2013].
$\ln\psi$: profit margin.
TFP: total factor productivity, Wooldrige (2009) extension to Levinshon-Petrin methodology.
$\ln K$: log capital.
ln Empl: log employment.
Legend: *** significant at 1%, ** at 5%, * at 10%.
Notes: FE firm-level regressions, 2001-2007. Firm-level tariffs are constructed using export shares in 2000; non-exporters are assigned their industry tariffs. Standard errors are clustered at the firm level.

Table B9: Firm-Level Regressions: Tariffs, SOE, and Input Market Distortions

Variables	(1)	(2) $\|\ln\lambda\|$	(3)	(4)	(5) $\|\ln\kappa\|$	(6)
SOE	-0.040	0.033	0.111**	0.021	0.130***	0.681***
	(0.031)	(0.032)	(0.053)	(0.036)	(0.036)	(0.060)
Tariffs Above 75_{t-1}	0.007**	0.007**	0.008**	0.011***	0.011***	0.014***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
SOE*Tariffs Above 75_{t-1}	0.010	0.014	-0.014	-0.032	-0.026	-0.082***
	(0.018)	(0.018)	(0.018)	(0.020)	(0.020)	(0.021)
ln Age	-0.042***	-0.040***	-0.040***	-0.155***	-0.154***	-0.165***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
SOE*ln Age	0.015*	0.024***	0.018**	-0.002	0.010	0.013
	(0.008)	(0.008)	(0.009)	(0.010)	(0.010)	(0.011)
$\ln\psi$		0.011***	0.011***		-0.011***	-0.013***
		(0.001)	(0.001)		(0.001)	(0.001)
SOE*$\ln\psi$		0.035***	0.040***		0.053***	0.064***
		(0.004)	(0.004)		(0.004)	(0.004)
TFP			0.065***			0.280***
			(0.003)			(0.004)
SOE*TFP			-0.160***			-0.280***
			(0.010)			(0.012)
$\ln K$			-0.035***			
			(0.00)			
SOE*$\ln K$			0.048***			
			(0.006)			
ln Empl						-0.140***
						(0.003)
SOE*ln Empl						0.072***
						(0.009)
Sector-Year	y	y	y	y	y	y
Prov-Year	y	y	y	y	y	y
Firm FE	y	y	y	y	y	y
Obs.	898,817	898,817	898,817	898,817	898,817	898,817
R^2	0.011	0.013	0.017	0.013	0.014	0.056
Number of Firm IDs	298,746	298,746	298,746	298,746	298,746	298,746

$|\ln\lambda|$: log return to labor relative to the sector, in absolute value.
$|\ln\kappa|$: log return to capital relative to the sector, in absolute value.
SOE: dummy equal to one for State-owned enterprises.
Tariffs Above 75_{t-1}: dummy equal to one if firm tariff is above 75 percentile within an industry.
$\ln\psi$: profit margin.
TFP: total factor productivity, Wooldrige (2009) extension to Levinshon-Petrin methodology.
$\ln K$: log capital.
ln Empl: log employment.
Legend: *** significant at 1%, ** at 5%, * at 10%.
Notes: FE firm-level regressions, 2001-2007. Firm-level tariffs are constructed using export shares in 2000; non-exporters are assigned their industry tariffs. Standard errors are clustered at the firm level.

Table B10: Firm-Level Regressions: Alternative Measures of Distortions

Variables	(1)	(2) G^L	(3)	(4)	(5) G^K	(6)
Tariffs Above 75_{t-1}	0.068	0.064	0.303***	0.034**	0.034**	0.057***
	(0.121)	(0.121)	(0.114)	(0.016)	(0.016)	(0.014)
ln Age	2.287***	2.272***	0.144	-0.260***	-0.261***	-0.454***
	(0.201)	(0.201)	(0.184)	(0.026)	(0.026)	(0.023)
$\ln \psi$		-0.286***	-0.409***		-0.024***	-0.038***
		(0.028)	(0.026)		(0.003)	(0.003)
TFP			15.668***			2.534***
			(0.109)			(0.015)
$\ln K$			1.223***			
			(0.084)			
ln Empl						-0.533***
						(0.012)
Sector-Year	y	y	y	y	y	y
Prov-Year	y	y	y	y	y	y
Firm FE	y	y	y	y	y	y
Obs.	732,065	732,065	732,065	732,065	732,065	732,065
R^2	0.079	0.079	0.216	0.028	0.028	0.266
Number of Firm IDs	263,592	263,592	263,592	263,592	263,592	263,592

G^L: labor gap from Petrin and Sivadasan [2013].
G^K: capital gap from Petrin and Sivadasan [2013].
Tariffs Above 75_{t-1}: dummy equal to one if firm tariff is above 75 percentile within an industry.
ln Age: log firm age.
$\ln \psi$: profit margin.
TFP: total factor productivity, calculated according to the Wooldrige (2009) extension to the Levinshon-Petrin methodology.
$\ln K$: log capital.
ln Empl: log employment.
Legend: *** significant at 1%, ** at 5%, * at 10%.
Notes: FE firm-level regressions, 1998-2007. Observations are weighted by the average firm share in value added. Standard errors are clustered at the firm level.

Table B11: Firm-Level Regressions: Comparison of Firm Future Outcomes

VARIABLES	(1) $\ln Y_{t+1}$	(2) $\ln VA_{t+1}$	(3) $\ln K_{t+1}$	(4) $\ln \text{Empl}_{t+1}$
Tariffs Above 75_{t-1}	-0.046*	-0.040	-0.105***	-0.046*
	(0.028)	(0.041)	(0.031)	(0.026)
Tariffs Above 75_{t-1}*Lev Ratio	-0.054	-0.047	-0.172***	-0.077
	(0.054)	(0.078)	(0.059)	(0.051)
ln Age	0.098***	0.106***	0.267***	0.135***
	(0.006)	(0.008)	(0.007)	(0.005)
$\ln \psi$	0.023***	0.051***	0.010***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
TFP	0.367***	0.351***	0.082***	0.172***
	(0.004)	(0.004)	(0.003)	(0.003)
Sector-Year	y	y	y	y
Prov-Year	y	y	y	y
Firm FE	y	y	y	y
Obs.	519,466	519,466	519,466	519,466
R-squared	0.334	0.209	0.126	0.059
Number of nbsid	222,703	222,703	222,703	222,703

$\ln Y_{t+1}$: log revenues at $t+1$.
$\ln VA_{t+1}$: log value added at $t+1$.
$\ln K_{t+1}$: log capital at $t+1$.
$\ln \text{Empl}_{t+1}$: log employment at $t+1$.
Tariffs Above 75_{t-1}: dummy equal to one if firm tariff is above 75 percentile within an industry.
Lev Ratio: average leverage ratio for sector s.
ln Age: log firm age.
$\ln \psi$: profit margin.
TFP: total factor productivity, calculated according to the Wooldrige (2009) extension to the Levinshon-Petrin methodology.
Legend: *** significant at 1%, ** at 5%, * at 10%.
Notes: FE firm-level regressions, 2001-2007. Firm-level tariffs are constructed using export shares in 2000; non-exporters are assigned their industry tariffs. Standard errors are clustered at the firm level.

Table B12: Industry Regressions: Misallocation and Productivity

	(1)	(2)	(3)	(4)
Variables		Avg TFP		
Avg $\lvert\ln \kappa\rvert$	-0.266**		-0.197*	-0.393***
	(0.107)		(0.101)	(0.149)
Avg $\lvert\ln \lambda\rvert$		-0.307**	-0.225	-0.142
		(0.148)	(0.149)	(0.124)
Sd Profit				-0.129
				(0.093)
Sd K				0.547**
				(0.245)
Sd Empl				-0.008
				(0.212)
Year	y	y	y	y
Industry[a] FE	y	y	y	y
Obs.	4,232	4,232	4,232	4,232
R^2	0.813	0.812	0.815	0.838
No. of Industries	425	425	425	425

[a] : 4-digit industry codes.
Avg TFP: within-industry average productivity.
Avg $|ln\lambda|$: average within-sector absolute deviation between firm labor returns and sectoral allocation.
Avg $|ln\kappa|$: average within-sector absolute deviation between firm capital returns and sectoral allocation.
Sd $\ln \psi$: within-sector standard deviation across profit margins.
Sd K: within-sector standard deviation across capital endowments.
sd Empl: within-sector standard deviation across total employment.
Legend: *** significant at 1%, ** at 5%, * at 10%.
Notes: FE industry regressions, 1998-2007. The unit of observation is a sector-year cell; industries are weighted by their average revenue share. Standard errors are clustered at the sector level.