Exports and Credit Constraints under Incomplete Information: Theory and Evidence from China

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Introduction

- The financial crisis of 2008 raises the question of whether credit constraints faced by exporters played a role in the fall in world trade.
- Empirical findings on this question are divergent: Amiti and Weinstein (2009) and Chor and Manova (2010) vs. Levchenko et. al (2010) and Behrens, Corcos and Mion (2010).
- This paper go back to the theory and ask why credit for exports should be allocated any differently than credit for domestic sales. We emphasize one possible reason, longer time-lag between production and export sales for exports than for domestic sales.
- This reason is built into a model of heterogeneous firms with incomplete information.

- Assumptions: a single bank makes loans of working capital, and has incomplete information about the firms in two respects:
  - Does not know whether a loan is used for domestic or export production: this means we are not modeling "export finance"
  - Does not know the productivity of firms: this means that without loss of generality we can focus on incentive-compatible loan policies
- Goals of the paper:
  - We solve for the incentive-compatible loan policy for the bank, building in the longer time-lag for exporters
  - We estimate a structural equation arising from the model, under which sales revenue is a function of interest payments and other variables, on a dataset of Chinese domestic and exporting firms over 2000 - 2008.

Main Findings

- We obtain robust empirical evidence that exporting firms face more severe credit constraints than purely domestic firms. The credit constraint is more stringent
  - as a firm's export share grows,
  - as the time to ship for exports is lengthened
  - and as there is greater dispersion of firms' productivities reflecting information incompleteness.

The Model

- Monopolistic competition with heterogeneous firms, productivity x
- Consumer has CES utility function and demand system.
- Firms need to cover a fraction δ of total costs, taking loan $M(x')$ and interest payment $I(x')$ schedule as given, and choosing quantity q and claimed productivity x'

Domestic Firm

- Domestic firm maximizes:

$$\max_{x',q_d} \pi_d(x,x') = p_d q_d - (1-\delta)\left(\frac{q_d w}{x} + C_d\right) - \left(M_d(x') + I_d(x')\right), \qquad (1)$$

$$\begin{aligned} \text{s.t. } & \pi_d(x,x) \geq \pi_d(x,x'), \\ & \pi_d(x,x) \geq 0, \\ & M_d(x') \geq \delta\left(\frac{q_d w}{x} + C_d\right), \end{aligned}$$

and also CES demand.

- First constraint is the incentive compatibility condition.
- Second constraint is zero-cutoff-profits
- Third constraint is for the loan

Domestic Firm continued

- The incentive compatibility condition implies locally:

$$\left.\frac{\partial \pi_d(x, x')}{\partial x'}\right|_{x'=x} = 0.$$

- Use the loan constraint to solve for quantity produced, and therefore price and revenue from the CES demand system. The above condition becomes:

$$\left[\Phi_d\left(x, M_d(x)\right) - 1\right] \frac{M_d'(x)}{\delta} = I_d'(x),$$

where

$$\Phi_d\left(x, M_d(x)\right) \equiv \left[p_d\left(\frac{\sigma - 1}{\sigma}\right)\right] / \frac{w}{x},$$

  - Φ_d is the ratio of expected marginal revenue to marginal costs.
  - Without any credit constraint, expected marginal revenue equals marginal cost, so that $\Phi_d = 1$.
  - When firms produce quantity below the optimal level then $\Phi_d > 1$, indicating a credit constraint.

- The intuition of the credit constraints:
  - Suppose that $M_d'(x)$ and $I_d'(x)$ are both positive $\Rightarrow$ the firm *must be* credit constrained, i.e. $\Phi_d > 1$.
  - A firm that is producing at the first-best would have only a *second-order loss* in profits from announcing a slightly smaller productivity x', and producing at a slightly lower level.
  - But the firm would have a *first-order gain* from the reduction in interest payments, with $I_d'(x) > 0$.
  - So a firm at the first-best would always understate its productivity.
  - With increasing loan and interest payment schedules, a credit constraint is therefore needed to ensure incentive compatibility.

Exporting Firm

- Exporters' decision:

$$\max_{x',q_d,q_e} \pi_e(x,x') = p_d q_d + p_e q_e - (1-\delta)\left(\frac{q_d w}{x} + C_d + \frac{q_e w}{x} + C_e\right) \qquad (2)$$
$$- \left(M_e(x') + I_e(x')\right),$$
$$\text{s.t. } \pi_e(x,x) \geq \pi_e(x,x')$$
$$\pi_e(x,x) \geq \pi_d(x,x)$$
$$M_e(x') \geq \delta\left(\frac{q_d w}{x} + C_d + \frac{q_e w}{x} + C_e\right),$$

  and CES demand for exports.
- The bank is making a single loan $M_e(x')$ and cannot verify whether the loan is used to cover the costs of production for domestic sales or for exports.

Exporting Firm continued

- Exporters' quantity decision:

$$p_d\left(\frac{\sigma-1}{\sigma}\right)=p_e\left(\frac{\sigma-1}{\sigma}\right). \tag{3}$$

For any given loan, the bank will know exactly how production is allocated between the two market. We break up the total loan into the domestic component, $M_e^d(x')$, and the export component, $M_e^e(x')$.

- Exporters' incentive-compatibility condition:

$$\left[\Phi_e^d\left(x, M_e^d(x)\right)-1\right]\frac{M_e^{d\prime}(x)}{\delta}+\left[\Phi_e^e\left(x, M_e^e(x)\right)-1\right]\frac{M_e^{e\prime}(x)}{\delta}=I_e'(x), \tag{4}$$

where,

$$\begin{aligned}\Phi_e^d\left(x, M_e^d(x)\right)&\equiv\left[p_d\left(\frac{\sigma-1}{\sigma}\right)\right]/\frac{w}{x}\\ \Phi_e^e\left(x, M_e^e(x)\right)&\equiv\left[p_e\left(\frac{\sigma-1}{\sigma}\right)\right]/\frac{w}{x}\\ \Phi_e^d\left(x, M_e^d(x)\right)&=\Phi_e^e\left(x, M_e^e(x)\right).\end{aligned} \tag{5}$$

The Bank

- The bank faces an opportunity cost of i – the interest rate – on its loans.
- We assume that the loans for domestic (export) projects are paid back after τ_d (τ_e) periods, and further assume that $\tau_e > \tau_d$, reflecting the longer time-lags involving in the shipping of exports.
- Export loans therefore have a higher opportunity cost for the bank, which is a potential reason to treat exporters and domestic firms differently.

The Bank continued

- Bank's decision:

$$\max_{M,I} \int_{\underline{x}_d}^{\underline{x}_e} (I_d(x) - i\tau_d M_d(x)) f(x)\, dx + \int_{\underline{x}_e}^{\infty} \Big(I_e(x) - i\tau_d M_e^d(x) - i\tau_e M_e^e(x) \Big) f(x)\, dx \tag{6}$$

s. t.

$$[\Phi_d(x, M_d(x)) - 1] \frac{M_d'(x)}{\delta} = I_d'(x), \text{if } x \in [\underline{x}_d, \underline{x}_e)$$

and

$$\left[\Phi_e^d\left(x, M_e^d(x)\right) - 1\right] \frac{M_e^{d\prime}(x)}{\delta} + [\Phi_e^e(x, M_e^e(x)) - 1] \frac{M_e^{e\prime}(x)}{\delta} = I_e'(x), \text{if } x \in [\underline{x}_e, \infty)$$

- First solve optimal control problem, and then solve for optimal $\underline{x}_d$ and $\underline{x}_e$

- Assuming Pareto distribution of productivity, solution to the optimal control problem is:

$$\Phi_d\left(x, M_d(x)\right) = \overline{\Phi}_d \equiv (1 + i\delta\tau_d)\left(1 - \frac{\sigma - 1}{\sigma\theta}\right)^{-1}, \tag{7}$$

$$\Phi_e^d\left(x, M_e^d(x)\right) = \Phi_e^e\left(x, M_e^e(x)\right) = \overline{\Phi}_e \equiv \left[1 + i\delta\left(\tau_d\eta_d + \tau_e\eta_e\right)\right]\left(1 - \frac{\sigma - 1}{\sigma\theta}\right)^{-1}.$$

where η_d and η_e are the shares of demand coming from the domestic and foreign markets as:

$$\eta_d = \frac{YP^{\sigma-1}}{YP^{\sigma-1} + Y^* P^{*\sigma-1}} \text{ and } \eta_e = \frac{Y^* P^{*\sigma-1}}{YP^{\sigma-1} + Y^* P^{*\sigma-1}}.$$

Results

- (a) credit constraint applies even if $i = 0$ (like in earlier intuition);
- (b) exporters face a tighter credit constraint in domestic market than domestic firms, $\overline{\Phi}_e > \overline{\Phi}_d$ when $\tau_e > \tau_d$ and $i > 0$ (opportunity cost to bank);
- (c) exporters face the same credit constraint in export market and domestic market, since $\Phi_e^d = \Phi_e^e = \overline{\Phi}_e$

Cutoff Productivities

- The bank will optimally choose the initial interest payment for a domestic firm to determine $\underline{x}_d$ via the zero-cutoff-profit condition $\pi_d(\underline{x}_d, \underline{x}_d) = 0$
- Likewise the initial interest payment for the cutoff exporter is chosen to determine $\underline{x}_e$ via $\pi_d(\underline{x}_e, \underline{x}_e) = \pi_e(\underline{x}_e, \underline{x}_e)$
- The solution for the cutoff firms are:

$$\frac{M_d(\underline{x}_d)}{\delta} = \sigma C_d,$$
$$\frac{M_e(\underline{x}_e)}{\delta} = (\Delta(\sigma - 1) + 1) C_e + C_d,$$

where

$$\Delta \equiv \left(\frac{1 + i\delta\tau_e}{1 + i\delta(\tau_d \eta_d + \tau_e \eta)} \right) \left(1 - \left(\frac{1 + i\delta(\tau_d \eta_d + \tau_e \eta_e)}{1 + i\delta\tau_d} \right)^{\sigma - 1} \eta_d \right)^{-1},$$
$$\Theta \equiv \frac{i\delta(\tau_e - \tau_d)}{(1 - \frac{\sigma - 1}{\sigma\theta})} (\eta_d C_e - \eta_e C_d).$$

Cutoff Productivities continued

- The credit constraints have impacts on the extensive margin:
  - σC_d is the total cost of the credit unconstrained production for the cutoff producer in Melitz (2003). Here, since there are credit constraints so $\overline{\Phi}_d > 1$, the cutoff productivity $\underline{x}_d$ is *higher* than the cutoff productivity in Melitz (2003).
  - When $i = 0$ so that $\Delta = 1/\eta_e$, then $\frac{M_e(\underline{x}_e)}{\delta}$ is the export costs of production for the cutoff exporter in Melitz (2003). Likewise, since $\overline{\Phi}_e > 1$, the cutoff exporter $\underline{x}_e$ is also higher than that in Melitz (2003).

- We derive a linear relationship between interest payments and revenue of the firm

$$r_{jt}(x) = \beta_0 C + \beta_1 I_{jt}(x) + g_1(\eta_e) I_{jt}(x) + g_2(\eta_e) C + g_3(\eta_e) i \mathbf{1}_{\{x_{jt} \geq \underline{x}_e\}}, \tag{8}$$

where

$$I(x) = \begin{cases} I_d(x) & \text{if } x \in [\underline{x}_d, \underline{x}_e] \\ I_e(x) & \text{if } x \in [\underline{x}_e, \infty] \end{cases}, \quad r(x) = \begin{cases} p_d q_d & \text{if } x \in [\underline{x}_d, \underline{x}_e] \\ p_d q_d + p_e q_e & \text{if } x \in [\underline{x}_e, \infty] \end{cases}$$

and $\mathbf{1}_{\{x_{jt} \geq \underline{x}_e\}}$ is an indicator variable which takes one for $x_{jt} \geq \underline{x}_e$ and zero otherwise;

$$C = \begin{cases} C_d & \text{if } x \in [\underline{x}_d, \underline{x}_e] \\ C_d + C_e & \text{if } x \in [\underline{x}_e, \infty] \end{cases}$$

Estimating Equations continued

- The coefficients are obtained from the model as:

$$\beta_0 = -\frac{\sigma}{\sigma - 1}\overline{\Phi}_d < 0, \tag{9}$$
$$\beta_1 = \frac{\sigma}{\sigma - 1}\left(\frac{\overline{\Phi}_d}{\overline{\Phi}_d - 1}\right) > 0,$$

- Fixed costs lower the loan available to cover variable cost $\beta_0 < 0$
- a larger payments are associated with larger revenue $\beta_1 > 0$
- $g_1(\eta_e), g_2(\eta_e), g_3(\eta_e)$ are functions of export share η_e

Estimating Equations continued

- The coefficients are obtained from the model as:

$$g_1(\eta_e) = \frac{\sigma}{\sigma-1}\left(\frac{\overline{\Phi}_e}{\overline{\Phi}_e - 1} - \frac{\overline{\Phi}_d}{\overline{\Phi}_d - 1}\right) \leq 0,$$

$$g_2(\eta_e) = -\frac{\sigma}{\sigma-1}\left(\overline{\Phi}_e - \overline{\Phi}_d\right) \leq 0,$$

$$g_3(\eta_e) = -\frac{\sigma}{\sigma-1}\left(\frac{\overline{\Phi}_e}{\overline{\Phi}_e - 1}\right)\frac{\delta\left(\tau_e - \tau_d\right)}{\left(1 - \frac{\sigma-1}{\sigma\theta}\right)}\left(\eta_d C_e - \eta_e C_d\right).$$

- $g_j(0) = 0$ for $j = 1, 2$, and $g_j(\eta_e) < 0$ for $j = 1, 2, \eta_e > 0$, and $\tau_e > \tau_d$ and interest rate $i > 0$, so that $\overline{\Phi}_e > \overline{\Phi}_d$.
- For exporters, bank payments are positively associated with revenue of $0 < \beta_1 + g_1(\eta_e) < \beta_1$.
- Similarly, $0 > \beta_0 + g_2(\eta_e) > \beta_0$, indicating fixed costs reduce exporter's revenue, but less than β_0.
- So exporters are constrained in what they can earn due to the extra credit constraint that they face via both exporter's bank payments and their fixed costs.
- In addition, exporters face a reduction in revenue from any increase in the interest rate i, as shown by the final term $g_3(\eta_e)$, conditional on the exporting fixed costs or domestic market share being large enough so that $\eta_d C_e - \eta_e C_d > 0$.

Estimating Equations continued

- To estimate the coefficients, we simplify them in the following ways:

$$
\begin{aligned}
g_1(\eta_e) &= -\frac{\sigma}{\sigma-1}\frac{i\delta\eta_e\left(\tau_e-\tau_d\right)}{\left(i\delta(\tau_d\eta_d+\tau_e\eta_e)+\frac{\sigma-1}{\sigma\theta}\right)\left(i\delta\tau_d+\frac{\sigma-1}{\sigma\theta}\right)} \\
&\simeq -\frac{\sigma}{\sigma-1}\frac{1}{\left(i\delta\tau_d+\frac{\sigma-1}{\sigma\theta}\right)}\left(\left(\frac{i\delta\left(\tau_e-\tau_d\right)}{i\delta\tau_d+\frac{\sigma-1}{\sigma\theta}}\right)\eta_e-\left(\frac{i\delta\left(\tau_e-\tau_d\right)}{i\delta\tau_d+\frac{\sigma-1}{\sigma\theta}}\right)^2\eta_e^2\right) \\
&= \beta_2\eta_e+\beta_3\eta_e^2.
\end{aligned}
$$

- where $\beta_2=-\frac{\sigma}{\sigma-1}\frac{1}{\left(i\delta\tau_d+\frac{\sigma-1}{\sigma\theta}\right)}\left(\frac{i\delta(\tau_e-\tau_d)}{i\delta\tau_d+\frac{\sigma-1}{\sigma\theta}}\right)<0$ and

  $\beta_3=\frac{\sigma}{\sigma-1}\frac{1}{\left(i\delta\tau_d+\frac{\sigma-1}{\sigma\theta}\right)}\left(\frac{i\delta(\tau_e-\tau_d)}{i\delta\tau_d+\frac{\sigma-1}{\sigma\theta}}\right)^2>0.$
- So

$$
g_1(\eta_e)=-\frac{\beta_2^2}{\beta_3}\left(\frac{1}{1-(\beta_2/\beta_3\eta_e)}\right).
$$

Estimating Equations continued

- The property of $g_1(\eta_e) = -\frac{\beta_2^2}{\beta_3}\left(\frac{1}{1-(\beta_2/\beta_3\eta_e)}\right)$:
  - $\beta_2 < 0$ and $\beta_3 > 0$ ensure that $g_1(\eta_e) < 0$ for $\eta_e > 0$.
  - the formular $g_1(\eta_e)$ shows that $|g_1(\eta_e)| < \beta_1$, which ensures there is still a positive relationship between bank payments and revenue for exporters.
  - Provided that $\beta_2 < 0$ and $\beta_3 > 0$, $g_1(\eta_e)$ is decreasing in the export share, which means that exporting firms face more credit constraints if their export share is higher.
  - Using $\eta_e = 1$, $\beta_2 < 0$ and $\beta_3 > 0$, we get $|g_1(1)| < \beta_1$ holds if and only if

$$\beta_2 \in \left(-\frac{1}{2}(\beta_1 + \sqrt{\beta_1^2 + 4\beta_1\beta_3}), 0\right). \tag{10}$$

- Turning to the function g_2,

$$g_2(\eta_e) = -\frac{\sigma}{\sigma-1} i\delta\eta_e(\tau_e - \tau_d)\left(1 - \frac{\sigma-1}{\sigma\theta}\right)^{-1} \tag{11}$$

$$\equiv \beta_4\eta_e, \tag{12}$$

Estimating Equations continued

- The estimation equation is:

$$R_{jt} = \beta_0 + \left(\beta_1 + \beta_2\eta_e + \beta_3\eta_e^2\right) I_{jt}(x) + \beta_4\eta_e + \beta_5\mathbf{1}_{\{x_{jt}\geq \underline{x}_e\}} + \varepsilon_{jt}. \qquad (13)$$

- Instruments:
    - we need variables that are independent of the error ε_{jt}, reflecting all *ex-post* shocks to production.
    - We use the *ex-ante* productivity that is anticipated by firms as the instrument.
    - Using the the technique of Olley and Pakes (1996), we get
        - total factor productivity (TFP) of the firm *inclusive* of the unanticipated, random productivity shocks (what we call TFP1). This is the standard firm-level measure of productivity.
        - TFP of the firms *exclusive* of these unanticipated shocks (what we call TFP2). This makes use of the firm investment decisions to infer the productivity that is anticipated by the firm.
    - By construction, TFP2 is independent of the unanticipated shocks within the error ε_{jt}.

Data

- A Chinese firm-level panel data set which covers more than 160,000 manufacturing firms per year over 2000-2008.
- The dataset covers two types of manufacturing firms:
  - All state-owned enterprises (SOEs) – few and omitted here;
  - Non-SOEs whose annual sales are more than five million *Renminbi* (which is equivalent to around $735,000 under current exchange rate).
- The data set includes many financial variables listed in the main accounting sheets of all these firms.
- Another Chinese transaction-level trade data set for the years 2000-2006, including shipments and export value for each exported good.

Benchmark estimates

Table: Benchmark Estimates for Chinese and Foreign Firms (2000-2008)

Data Sample	For Chinese-owned firms			Foreign firms
Regressand: Firm's Revenue	OLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)
Interest Payment (β_1)	64.46***	82.44***	84.99***	33.97***
	(31.18)	(32.23)	(32.38)	(3.13)
Interest Payment	-67.55**	-112.3**	-212.5***	242.9*
$\times$ Export Share (β_2)	(-2.43)	(-2.00)	(-3.94)	(1.93)
Interest Payment	165.1***	592.9***	910.2***	390.6
$\times$ Export Share Squared (β_3)	(4.43)	(2.70)	(4.37)	(1.31)
Export Share (β_4)	-12,585***	-60,334***	-64,818***	49,957***
	(-9.15)	(-14.52)	(-11.92)	(2.59)
Export Indicator (β_5)	7,693***	-304.6	-936.4***	-1,922*
	(7.45)	(-1.03)	(-2.59)	(-1.67)
Lower Bound $-\frac{1}{2}(\beta_1 + \sqrt{\beta_1^2 + 4\beta_1\beta_3})$	-140.3	-266.1	-323.8	-133.4
Mean of Fitted Export Share (η_e^m)	0.096	0.095	0.090	0.326
Estimated Value of $g_1(\eta_e^m)$	-5.25	-7.10	-13.80	166.4
90% of Fitted Export Share (η_e^u)	0.462	0.210	0.183	0.501
Estimated Value of $g_1(\eta_e^u)$	-14.65	-11.18	-21.79	626.1
Industry-Specific Fixed Effects	Yes	Yes	Yes	Yes
Year-Specific Fixed Effects	Yes	Yes	Yes	Yes
Hong Kong/Taiwan/Macao Firms Included	Yes	Yes	No	No
Observations	926,534	909,229	812,558	99,886
First-Stage Regressions				
Kleibergen-Paap rk LM χ^2 statistic		367.4†	30.06†	51.05†
Kleibergen-Paap rk Wald F statistic		222.5‡	8.11‡	41.34†
IV1: $TFP2_{it}$		-.409***	-.241***	-2.977***
		(-3.85)	(-4.58)	(-3.51)
		[37.33]	[16.74]	[15.99]

Table 4: The Heckman Two-Step Estimates of Bivariate Selection Model (2000-2008)

	Chinese Firms		Foreign Firms	
Heckman Two-step:	1^{st} Step	2^{nd} Step	1^{st} Step	2^{nd} Step
Regressand:	Export Indicator	Export Share	Export Indicator	Export Share
	(1)	(2)	(3)	(4)
Log of TFP	0.011***		-0.015***	
	(6.66)		(-3.81)	
Export-based EG Index	0.023***	0.023***	0.005	-0.002
	(6.81)	(37.87)	(0.48)	(-0.56)
Tangible Assets Ratio	1.034***	1.067***	1.329***	-0.368***
	(28.06)	(62.35)	(11.52)	(-5.03)
Intangible Assets Indicator	-0.504***	-0.519***	-0.362***	0.112***
	(-101.10)	(-65.85)	(-28.48)	(6.06)
Log of Capital-Labor Ratio	0.007***	-0.006***	-0.005	-0.023***
	(5.62)	(-26.14)	(-1.63)	(-24.51)
Inverse Mills Ratio		1.180***		-0.903***
		(58.02)		(-10.35)

Table 5: 2SLS Estimates by Sea and Non-sea Shipments for Chinese Firms

Data Sample:	All Firms (2000-2008)	Matched Firms (2000-2006) All Matched Firms	Interact with Sea Dummy	Interact with Non-sea Dummy
Regressand: Firm's Revenue	(1)	(2)	(3)	(4)
Interest Payment (β_1)	76.85***	86.31***	85.76***	
	(30.96)	(23.83)	(23.54)	
Interest Payment	-303.8***	-539.7***	-638.1***	-511.5***
× Fitted Export Share (β_2)	(-7.75)	(-10.27)	(-7.89)	(-9.93)
Interest Payment	1,211***	1,457***	2,011***	1,329***
× Fitted Export Share Squared (β_3)	(11.95)	(10.84)	(7.05)	(9.88)
Fitted Export Share (β_4)	-236,380***	-210,621***	-220,669***	-207,623***
	(-8.76)	(-9.30)	(-9.04)	(-9.24)
Export Indicator (β_5)	2,433***	3,552***	3,767***	
	(3.77)	(6.72)	(6.48)	
Tangible Asset Ratio	66,817***	69,260***	69,201***	
	(10.85)	(12.93)	(12.87)	
Tangible Asset Ratio	-18,745*	-12,801	-16,361*	
× Fitted Export Share	(-1.81)	(-1.30)	(-1.67)	
Tangible Asset Ratio	12,287	35,897***	40,034***	
× Fitted Export Share Squared	(0.75)	(2.79)	(3.08)	
Intangible Asset Indicator	-19,240***	-19,886***	-19,785***	
	(-8.82)	(-10.73)	(-10.71)	
Mean of Fitted Export Share (η_e^m)	.090	.114	.135	.094
Estimated Value of $g_1(\eta_e^m)$	-20.61	-41.04	-60.65	-38.90
Year-Specific Fixed Effects	Yes	Yes	Yes	Yes
Industry-Specific Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	812,558	536,100	536,100	

Sectoral Productivity Dispersion

Table 6: 2SLS Estimates with Measures of Sectoral Productivity Dispersion (2000-2008)

Regressand: Firm's Revenue	(1)	(2)	(3)	(4)
Percentile of Sectoral Variance of TFP2	<10%	<25%	[25%, 50%]	>90%
Interest Payment (β_1)	43.05***	42.85***	74.53***	103.8***
	(14.01)	(11.83)	(15.97)	(16.46)
Interest Payment	-100.3***	-156.8***	-523.8***	-1,500***
× Fitted Export Share (β_2)	(-3.65)	(-5.12)	(-6.67)	(-4.22)
Interest Payment	378.6***	493.6***	1,130***	4,395***
× Fitted Export Share Squared (β_3)	(5.81)	(7.21)	(6.74)	(3.14)
Fitted Export Share (β_4)	-176,369***	-307,393***	-327,343***	-888,506***
	(-10.74)	(-10.50)	(-12.79)	(-4.38)
Export Indicator (β_5)	2,313***	4,563***	5,4911***	17,779***
	(7.15)	(7.95)	(7.55)	(4.44)
Tangible Asset Ratio	66,937***	107,471***	91,390***	203,734***
	(16.14)	(12.52)	(12.10)	(5.40)
Tangible Asset Ratio	-88,289***	-100,355***	-13,216	562,492***
× Fitted Export Share	(-10.02)	(-11.03)	(-1.27)	(4.09)
Tangible Asset Ratio	141,985***	193,605***	135,371***	-1,217,340***
× Fitted Export Share Squared	(11.10)	(13.38)	(7.69)	(-4.70)
Intangible Asset Indicator	-18,386***	-31,819***	-29,239***	-70,985***
	(-13.20)	(-11.02)	(-11.82)	(-4.78)
Cutoffs of Sectoral Variance of TFP2	<0.566	<0.670	[0.670, 0.915]	>1.599
Mean of Fitted Export Share (η_e^m)	0.169	0.172	0.101	0.084
Estimated Value of $g_1(\eta_e^m)$	-10.36	-17.54	-43.65	-101.8
Industry-Specific Fixed Effects	Yes	Yes	Yes	Yes
Year-Specific Fixed Effects	Yes	Yes	Yes	Yes
Observations	178,388	235,033	180,551	78,939

Conclusions

- We consider a model of heterogeneous firms needing loans for working capital, provided under incomplete information
- Obtain new results on the need for credit constraints. These are tighter for exporting firms due to the longer time-lag between production and receipt of sales revenue
- Empirical results over 2000-2008 support the tighter credit constraint for exporters