Dissecting the Effect of Credit Supply on Trade: Evidence from Matched Credit-Export Data

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Motivation

- What is the role of banks in amplifying economic fluctuations?
  - In the debate since Great Depression

    Friedman and Schwartz (1963), Bernanke (1983),....
  - Do banks propagate international financial shocks?

    IMF (2009), Cetorelli and Goldberg (2010), Schnabl (2010)
  - Do shocks to banks have real outcome effects?

    Peek and Rosengren (2000), Ashcraft (2005), Kalemli-Ozcan et al (2010)

- 2008 crisis opened this debate in international trade
  - Exports fell 23% in 2009 (WTO)

    Amiti and Weinstein (2009), Bricongne et al (2009), Iacovone and Zavacka (2009), Chor and Manova (2010), Antras and Foley (2011)

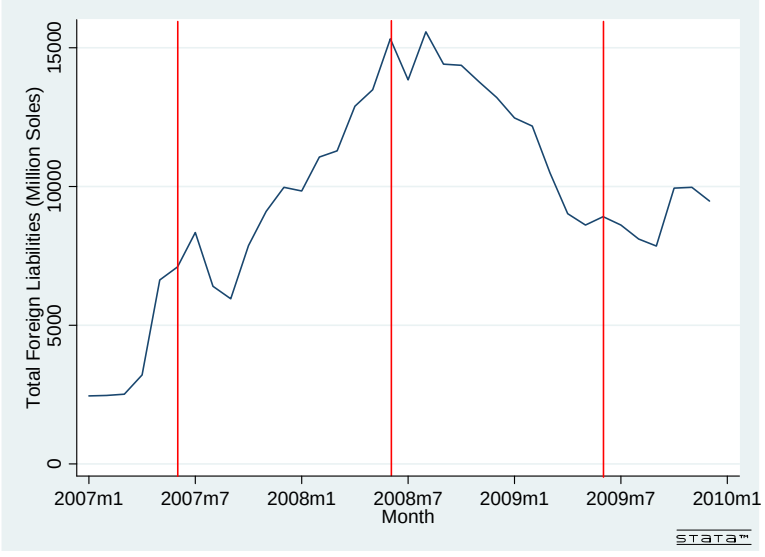
Motivation

- When do shocks to banks affect real activity?
  - Banks cannot offset shock with other sources of funding
    - → Negative shock to banks' balance sheet implies drop in lending
  - Firms cannot substitute banks in the short term
    - → Drop in overall credit supply to the firm
  - Firms need external finance in the short term
    - → Increase cost of working capital and/or investment

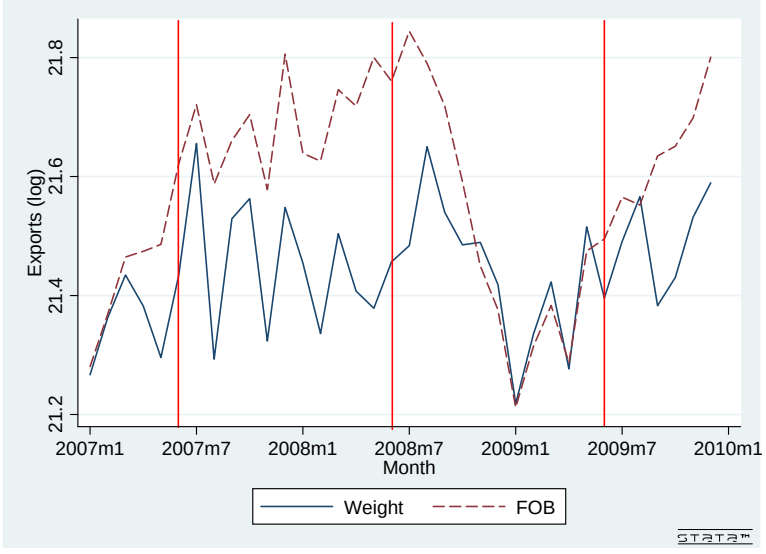
- Why focus on trade?
  - Interesting in itself
  - Data allow to control for changes in demand
    - → Detailed information on product and destination

This Paper

- Setting: Peru during the 2008 financial crisis



(a) Peruvian Bank Foreign Liabilities



(b) Peruvian Exports

- Peruvian banks not directly affected by U.S. real estate value
- Banks with foreign liabilities adversely affected by capital flow reversals
- Data: customs data matched with credit registry at the firm level

This Paper

- Empirical Challenge:

  How to distinguish the effect of credit supply on exports from changes in credit in response to factors also affecting exports?

- Our Approach:
  - Bank A: large share of foreign liabilities
  - Bank B: low share of foreign liabilities
  - One firm borrows from A, another one borrows from B
  - What if shocks to banks and exports are not orthogonal?

  Compare exports of men's cotton overcoats to US by the two firms

$\rightarrow$ Changes in demand for overcoats equally affect both firms

$\rightarrow$ Changes in US economy (e.g. credit by importers) equally affect both firms

$\rightarrow$ Changes in price of cotton equally affect both firms

Preview of the Results

- Banks are global players and transmit international shocks
  - 1pp higher share of foreign liabilities resulted in 2.3% drop in credit supply
- Elasticity of exports to credit shocks
  - Intensive margin reacts credit by adjusting frequency of shipments
  - Exit margin reacts to credit
  - Inconclusive on entry margin
  - How much of drop in exports is due to credit?
    - Back-of-the-envelope calculation: 16%
- Assessment of alternative empirical approaches in this literature
  - Comparisons based on firm aggregates without market information
  - Cross-sectoral comparisons ala Rajan and Zingales

Data

- Bank Balance Sheets
- Credit Registry
  - Firm-bank-month panel
  - Outstanding debt every firm with every domestic bank
- Customs Data (SUNAT)
  - Web crawler: download every export document since 1993
  - Product (11 digits), destination, volume, value, price, shipment
  - US$ 20,252 Millions FOB in 2009 (57% manufactures)

Mining and derivatives	61.0
Oil and derivatives	10.8
Agriculture	9.2
Fishing and derivatives	8.3
Textile	5.7
Metallurgy	3.2
Other	5.0

(c) Main Sectors (%)

United States	17.0
China	15.3
Switzerland	14.8
Canada	8.6
Japan	5.2
Germany	3.9
Other	35.3

(d) Main Destinations (%)

Data – Definitions

- Intensive and Extensive Margins of Exports

$$X_t - X_{t-1} = \underbrace{\left(X_t^{Cont} - X_{t-1}^{Cont}\right)}_{Intensive\ \ Margin} + \underbrace{\left(X_t^{Entry} - X_{t-1}^{Out}\right)}_{Extensive\ \ Margin}$$

- Firm-product-destination export flows at 4 digits HS
- 2 periods: 12 months before and after July 2008 ($t = \{Pre, Post\}$)

	Value (FOB)		Volume (kg)	
	t=Pre	t=Post	t=Pre	t=Post
Total	10.9%	-22.4%	3.2%	-9.6%
Intensive	10.6%	-15.7%	2.1%	-2.2%
Extensive	0.3%	-6.6%	1.2%	-7.4%
Entry	8.4%	8.2%	8.6%	8.3%
Exit	-8.1%	-14.8%	-7.4%	-15.7%

Empirical Strategy – Instrumental Variable

- How international financial crisis affects domestic banks' balance sheet?
  - Capital flow reversal
  - Heterogeneous dependence on foreign liabilities before the crisis

  → Negative balance sheet shock to banks with foreign liabilities

(e) Banking Sector Foreign Liabilities

Bank (top 10)	For.Liabilities/Assets 2007-S2
HSBC	0.177
Mibanco	0.168
Continental	0.122
Citibank	0.103
Interamericano	0.075
Financiero	0.073
Credito	0.062
Wiese	0.060
Interbank	0.055
Santander	0.022
S&L	0.004

(f) Foreign Liabilities

Empirical Strategy – Instrumental Variable

- Disproportionately drop in lending by banks with high foreign liabilities
- Within-firm estimation to account for firm's changes in credit demand

$$\ln(C_{ibPost}) - \ln(C_{ibPre}) = \alpha_i + \beta \cdot FD_b + \gamma \cdot S\&L_b + \nu_{ib}$$

C_{ibt} : firm i's total outstanding credit with bank b at time t
FD_b : share of foreign debt of bank b
$S\&L_b$: dummy for S&Ls – negligible in private funding

Dependent Variable:	$\Delta \ln C_{ib}$		
	All Debt	US$ Debt	Soles Debt
FD_b	-2.34***	-3.25**	2.85*
	(1.10)	(1.28)	(1.43)
$S\&L_b$	-0.33***	-0.64**	0.12
	(0.12)	(0.25)	(0.20)
Firm FE	yes	yes	yes
Observations	10,334	8,433	6,515
# banks	41	33	39
# firms	5154	4320	3977

Empirical Strategy – Instrumental Variable

$$\begin{aligned} \textit{intensive}: \quad \ln(X_{ipdt}) &= \eta_I \cdot \ln(C_{it}) + \delta_{ipd} + \alpha_{pdt} + \epsilon_{ipdt} \\ \textit{extensive}: \quad E_{ipdt} &= \eta_E \cdot \ln(C_{it}) + \delta_i + \alpha_{pdt} + \epsilon_{ipdt} \end{aligned}$$

- Instrument for $\ln(C_{it})$ with shifter of firm i's credit supply:
  - $F_{it} = (F_i + F_i^2) \cdot Post_t$

t={Pre, Post}	:	12 months before and after July 2008
F_i	:	weighted exposure to banks' foreign liabilities, $\sum_b \omega_{ib} FD_b$
$Post_t$	:	1 if $t = Post$

- Match firm-bank may not be random:
  - Control for factors other than finance that can affect the export flow

δ_{ipd}	:	firm-product-destination time-invariant factors
δ_i	:	firm time-invariant factors for extensive margin
α_{pdt}	:	shocks to the product-destination

i:firm, p:product, d:destination, t:time

Results – Credit Shocks and the Intensive Margin of Trade

$$\ln(X_{ipdPost}) - \ln(X_{ipdPre}) = \alpha_{pd} + \eta \cdot [\ln(C_{iPost}) - \ln(C_{iPre})] + \epsilon_{ipd}$$

Dependent Variable:	$\Delta \ln C_i$	$\Delta \ln X_{ipd}$	
	FS	OLS	IV
F_i	8.33***		
	(3.17)		
F_i^2	-119.98***		
	(24.93)		
$\Delta \ln C_i$		0.026**	0.179**
		(0.010)	(0.071)
Product-Destination FE	Yes	Yes	Yes
Observations	14,208	14,208	14,208

- IV estimate of elasticity is 6 times larger than OLS
  - $\rightarrow$ Supply side factors explain less than half variation in total credit

Results – Credit Shocks and Export Arrangements

$$\ln(Y_{ipdPost}) - \ln(Y_{ipdPre}) = \alpha_{pd} + \eta \cdot [\ln(C_{iPost}) - \ln(C_{iPre})] + \epsilon_{ipd}$$

Dependent Variable:	$\Delta \ln(ShipFreq_{ipd})$	$\Delta \ln(ShipVol_{ipd})$	$\Delta \ln(FracCash_{ipd})$
$\Delta \ln C_i$	0.108***	0.071	-0.033*
	(0.032)	(0.057)	(0.018)
Product-Destination FE	Yes	Yes	Yes
Observations	14,208	14,208	14,208

- Adjustments in intensive margin induced by credit shock exclusively through number of shipments
  - $\rightarrow$ Fixed cost of exporting at the shipment level
- Trade credit partially substitutes for bank credit, but very low elasticity

Results – Credit Shocks and the Extensive Margin of Trade

- Change in probability of entry/exit an export market induced by a 1% increase in credit supply

$$E_{ipdt} = \eta_E \cdot \ln(C_{it}) + \delta_i + \alpha_{pdt} + \epsilon_{ipdt}$$

  - Entry: E_{ipdt} is 1 if $X_{ipdt} > 0$ conditional on $X_{ipdt-1} = 0$
  - Exit: E_{ipdt} is 1 if $X_{ipdt} = 0$ conditional on $X_{ipdt-1} > 0$
  - δ_i: firm-invariant fixed effect

Dependent Variable:	$Pr(X_{ipdt} = 0 \mid X_{ipdt-1} > 0)$	$Pr(X_{ipdt} > 0 \mid X_{ipdt-1} = 0)$
	Exit	Entry
ln C_i	-0.033*	-0.006
	(0.017)	(0.016)
Prod-Dest-Time FE	Yes	Yes
Observations	62,386	61,909

- No support for important entry sunk cost

Assessment of Alternative Empirical Approaches

- Bank-Firm Selection
  - Replicate without accounting for product-destination shocks
    Amiti and Weinstein (2009), Carvalo et al. (2010), Iyer et al (2010)...

Dependent Variable:	$\Delta \ln X_{ipd}$	
$\Delta \ln C_i$	0.012	0.179**
	(0.067)	(0.071)
Prod-Dest FE	No	Yes

- Banks specialize in markets: Shocks to banks and firms are not orthogonal
  - Firms borrowing from exposed banks specialize in markets less affected by the international crisis.

$\rightarrow$ Caution with inferences based on aggregate data during crises

total exports, total sales, investment, default,...

Assessment of Alternative Empirical Approaches

- Are *High Finance-Dependence* sectors more sensitive to credit shocks?
  - Validity of cross-sectoral comparisons based on Rajan and Zingales

    Bricogne et al (09), Chor and Manova (10), Levchenko et al (10)

Dep Var:	Intensive	Exit	Entry
$\Delta \ln C_i / \ln C_i$	0.145**	-0.032*	-0.008
	(0.070)	(0.018)	(0.017)
$\Delta \ln C_i / \ln C_i \times HighFinDep_p$	-0.109	0.005	0.012***
	(0.082)	(0.004)	(0.004)
Prod-Dest FE	Yes	Yes	Yes

- High Financial Dependence does not predict export sensitivity to credit
  - Only entry is more elastic in high finance-dependence products
  - Entry margin is negligible share of change in exports in a given year

Results – Identification Tests

- Banks may specialize in different products (undistinguishable at 4 HS)
  - Product defined at 6 digits HS
  - Exports measured in value (US$ FOB)
  - Control for export unit price
- Banks may specialize in lending to firms affected through other channels
  - Control for fraction of firm dollar debt, number of products, number of destinations, total exports
  - Pre-existing trends of firms linked to exposed and non-exposed banks (placebo)
- Robustness Tests
  - Alternative IV functional form: dichotomous indicator of exposure
  - Different turning point date: March 2008 (Bearn Stearns)

Conclusions

- Banks participate in global markets and transmit shocks to related parties
  - Drop in credit explained by share of foreign liabilities: 9.6%
- What can we infer about usage of credit by exporter firms?

  → Credit shocks affect variable cost of exporting – working capital
  - Credit affects intensive margin (after entry cost is paid): $\eta = 0.179$

  → Fixed cost of exporting at the product-destination level
  - Credit affects exit margin: $\eta = -0.033$

  → No conclusive evidence on importance of credit on entry margin
- Back of the envelope calculation:

	Annual Export Growth (kg)			
	t=Pre	t=Post	Missing Trade	Finance
Total	3.2%	-9.6%	-12.8%	16%
Intensive	2.1%	-2.2%	-4.3%	39%
Extensive	1.2%	-7.4%	-8.6%	3%