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

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November 2010

Motivation

- What is the role of banks in amplifying economic fluctuations?
  - ▶ Do banks propagate international financial shocks?
  - ▶ Do shocks to banks have real economic effects?

- Subprime crisis opened this debate in international trade
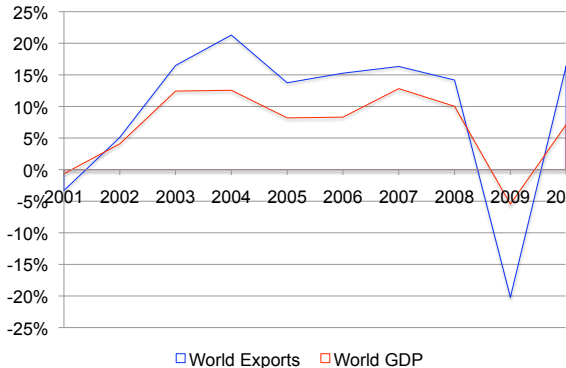
Motivation

- 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?
  - ▶ International trade is intensive in external finance
    - → More working capital, letters of credit, longer period to maturity
  - ▶ Data allows to control for changes in demand
   - → Detailed information on product and destination

This Paper

- Setting: Peru during the 2008 financial crisis
  - ▶ Sharp exports decline
  - ▶ Small Open Economy
  - ▶ Not directly affected by U.S. real estate market
  - ▶ Data: matched customs and credit registry at the firm level

- Margins of Trade
  - ▶ Intensive margin: amount of exports for firm-product-destination flows active before and after the credit shock
  - ▶ Continuation margin: number of firms that continue exporting a product-destination market
  - ▶ Entry margin: number of firms that start exporting a new product-destination market

Peru Monthly Exports (log)
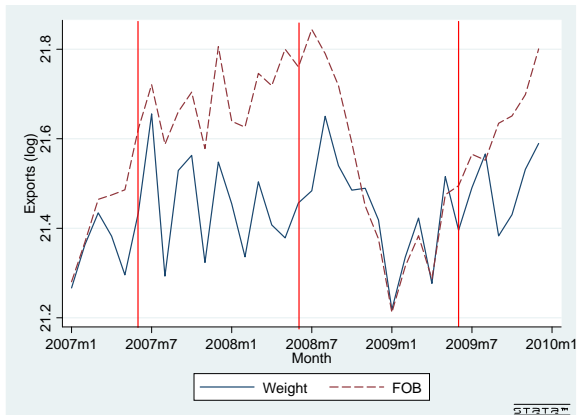
This Paper

- Empirical Challenge:

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

- Our Approach:
  - Bank A: large share of foreign-currency liabilities
  - Bank B: low share of foreign-currency liabilities
  - One firm borrows from A, another one borrows from B

  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 U.S. economic conditions equally affect both firms
  $\rightarrow$ Changes in price of cotton equally affect both firms

- Credit supply by banks with above average dollar liabilities drops 17%

- Firms cannot perfectly substitute banks in the short term

- Export elasticity to credit
  (% change in 1 year export flow for every 1% change in credit stock)

  ▶ Intensive margin: 0.23
    large export flows are more elastic to credit shocks

  ▶ Continuation margin: 0.28
    small export flows are more elastic to credit shocks

  ▶ Entry margin: inconclusive

Outline

- Empirical Strategy

- Data

- Results
  - ▶ Transmission of bank balance sheet shocks to firms
  - ▶ Effect of credit on export margins

- Conclusion

Empirical Strategy

- Identification problem

$$X_{ipdt} = X(H_{ipdt}, C_{it})$$

$$C_{it} = C(H_{ipdt}, S_{it})$$

  ▶ We are interested in $\eta = \frac{\partial X}{\partial C} \frac{C}{X}$
  ▶ Demand (or productivity) factors, H_{ipdt}, affect exports and credit demand

- Solution
  ▶ Instrument for C_{it} with credit supply shifter, S_{it}: shock to the balance sheet of firm i's lender
  ▶ Control for demand at product-destination-time level

$$\ln(X_{ipdt}) = \eta \cdot \ln(C_{it}) + \delta_{ipd} + \alpha_{pdt} + \epsilon_{ipdt}$$

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

- How international financial crisis affects domestic banks' balance sheet?
  - ▶ Capital flow reversal
  - ▶ Depreciation of Peruvian currency
 - → Negative balance sheet shock to banks with foreign liabilities
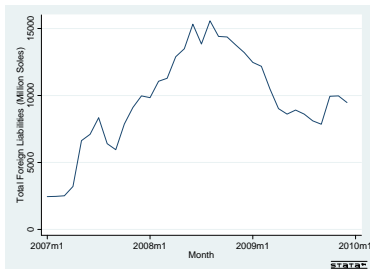
(a) Banking Sector Foreign Liabilities   (b) Exchange Rate
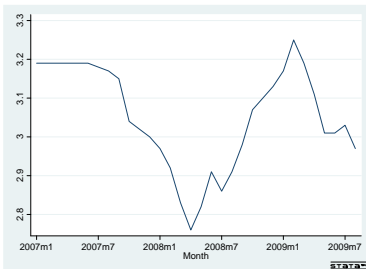
Empirical Strategy – Instrumental Variable

- How domestic banks transmit the shock to firms?
  - ▶ Heterogeneous dependence on foreign liabilities before the crisis
  - ▶ Disproportionately drop in lending by banks with high share of foreign liabilities
  - → *Affected* banks: share of foreign liabilities above mean (10%)
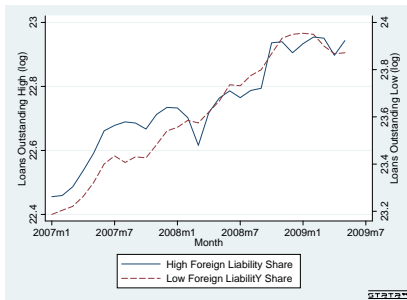
Bank	For.Liabilities/Assets
(top 10)	2007-S2
HSBC	0.177
Mibanco	0.168
Continental	0.122
Citibank	0.103
Interamericano	0.075
Financiero	0.073
Credito	0.062
Wiese	0.060
Interbank	0.055
Santander	0.022

(c) Outstanding Loans   (d) Foreign Liabilities

$$\ln(X_{ipdt}) = \eta \cdot \ln(C_{it}) + \delta_{ipd} + \alpha_{pdt} + \epsilon_{ipdt}$$

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

t={Pre, Post}	:	12 months before and after July 2008
F_i	:	1 if firm i borrows more than 50% from *affected* banks
$Post_t$	:	1 if $t = Post$

- Identification assumption 1: F_{it} correlated with credit supply

- Identification assumption 2: exclusion restriction

$$E[(F_i \cdot Post_t) \cdot \epsilon_{ipdt} | \delta_{ipd}, \alpha_{pdt}] = 0$$

  ▶ Cross-firm variation in exports of the same product to the same destination is independent of bank affiliation, after accounting for all time invariant heterogeneity

Data

- Bank Balance Sheets

- Credit Registry
  - Firm-bank-month panel
  - Outstanding debt every firm with evert domestic bank

- Customs Data (SUNAT)
  - Web crawler: download every export document since 1995
  - Product (11 digits), destination, volume, value, prices

- Unit of information
  - Matched customs-credit registry data at firm level
  - Firm-product-destination export flow (4 and 6 digits HS)
  - Collapsed into two periods of 12 months before and after July 2008 (Pre and Post)

Data – Descriptive Statistics of Banks

	High Foreign Exposure (N = 4)			Low Foreign Exposure (N = 9)		
	mean	sd	p50	mean	sd	p50
Assets (M Soles)	7,599	11,451	2,382	8,661	13,630	2,260
Loans (M Soles)	5,127	7,724	1,687	4,949	7,352	1,521
Deposits (M Soles)	5,043	8,045	1,309	6,336	10,078	1,396
Foreign Financing (M Soles)	1,059	1,520	362	637	1,109	155
Loans/Assets	0.659	0.126	0.660	0.661	0.103	0.673
Deposits/Assets	0.573	0.082	0.543	0.665	0.158	0.733
Foreign Financing/Assets	0.196	0.135	0.175	0.050	0.034	0.065

Data – Descriptive Statistics of Firms

	Borrows > 50% from Affected Banks					
	Yes (N = 1,471)			No (N=3,503)		
	mean	sd	p50	mean	sd	p50
Debt (1,000 Soles)	5,917	33,608	337	2,586	14,205	1
Exports (1,000 Soles)	12,789	117,039	288	10,883	183,836	57
Exports (1,000 Kg)	6,004	43,503	39	12,316	304,919	8
# destinations	3.6	5.3	2.0	2.5	4.1	1.0
Distance (km)	6,000	8,771	3,448	5,946	6,591	4,725
# products (4-digit)	4.6	7.2	2.0	4.7	8.6	2.0
# Product-Destinations	8.9	16.3	3.0	7.6	19.3	2.0
Frac. debt exposed bank	0.910	0.149	1.000	0.036	0.109	0.000

Result I – Role of Banks in Spread of Financial Crisis

- Challenge: disentangle drop in credit supply from firm reduction in demand
- Solution: within-firm estimation procedure in Khwaja and Mian (2008)

$$\ln(C_{ibPost}) - \ln(C_{ibPre}) = \alpha_i + \gamma \cdot FD_b + \epsilon_{ib}$$

C_{ibt}	:	firm i's total outstanding credit with bank b at time t
FD_b	:	1 if bank b has more than 10% foreign liabilities (in 2006)

Dependent Variable:	$\Delta \ln C_{ib}$		
	All firms	Small ($< median X$)	Large ($> median X$)
FD_b	-0.168***	-0.194***	-0.136***
	(0.046)	(0.049)	(0.049)
Firm FE	yes	yes	yes
Observations	10,336	6,349	3,987
# banks	42	41	33
# firms	5157	3490	1667

- Banks with high share of foreign liabilities cut lending when Peru capital flows reversed

- Credit supply by *exposed* banks dropped 17%, relative to other banks
  - ▸ More pronounced shock to small firms (19.5%) than large firms (13.5%)

- Important to control for changes in firm credit demand
  - ▸ *Overall* credit of firms linked to *exposed* banks dropped 66%, relative to other other firms
  - ▸ Most drop in credit by firms linked to *exposed* banks was demand driven

Exports in Peru

Peru Monthly Exports (log)
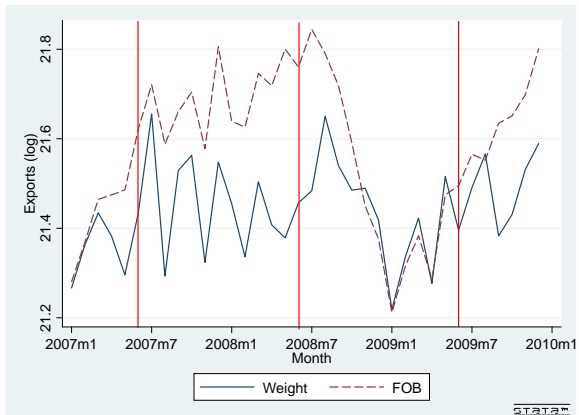
Exports in Peru

- Margins of Trade

$$X_t = X_t^{Cont} + X_t^{Entry}$$

$$X_{t-1} = X_{t-1}^{Cont} + N_{t-1}^{Out}$$

- Change in Exports

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

	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%

Result II – 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:	Change in volume for continuing flows (kg)			
	$\Delta \ln X_{ipd}$			
	OLS		IV	
$\Delta \ln C_i$	0.025	0.227***	0.154*	0.056
	(0.018)	(0.068)	(0.089)	(0.089)
$\Delta \ln C_i \cdot$ Large firms			0.078	
			(0.161)	
$\Delta \ln C_i \cdot$ Large flows				0.271**
				(0.136)
Product-Destination FE	Yes	Yes	Yes	Yes
# Product-Destinations	5,997	5,997	5,997	5,997
Observations	14,209	14,210	14,211	14,212
R^2	0.438			

Result II – Credit Shocks and the Intensive Margin of Trade

- Intensive margin of trade is elastic to credit shocks ($\eta = 0.23$)
  - Elasticity is not related to size of the firm
  - Large export flows are very elastic to credit shocks
  - We interpret η as elasticity to overall finance (not only bank credit)

- What did we learn about cost structure of the firm?
  - Credit supply affects variable cost of exporting
  - Specific to export activity: letter of credit, insurance
  - General to production: cost of working capital

- Crucial to control for demand
  - Counterfactual exercise aggregating exports by firm leads to bias of 65%
  - Largest bias from not controlling for changes by destination

Result III – Credit Shocks and the Extensive Margin of Trade

- Entry: # new firm-product-destination flows (N^E_{Fpdt})

- Continuation: # firm-product-destination flows that continue (N^C_{Fpdt})

- $F = \{1, 0\}$: Group firms in *affected* and *non-affected*

$$ln(N_{FpdPost}) - ln(N_{FpdPre}) = \alpha_{pd} + \nu \cdot \left[ln\left(\sum_{i \in F} C_{iPost}\right) - ln\left(\sum_{i \in F} C_{iPre}\right) \right] + \epsilon_{Fpd}$$

Dependent Variable:	Entry	Continuation		
	$\Delta \ln N^E_{Fpd}$	$\Delta \ln N^C_{Fpd}$		
		Total	Small Flows	Large Flows
$\Delta \ln(\sum_{i \in F} C_i)$	0.232	0.363***	0.409***	0.144*
	(0.185)	(0.095)	(0.138)	(0.083)
Product-Destination FE	Yes	Yes	Yes	Yes
Observations	3,088	4,658	4,595	2,018

- Credit shocks affect the probability of continuing for small export flows
  - ▶ Large export flows are less elastic to credit shocks
  - ▶ Exports are very skewed: small (below median) export flows account for negligible portion of overall exports

- Entry margin not affected by credit shock

- What did we learn about cost structure of the firm?
  - ▶ Consistent with credit supply affecting variable cost of exporting in the presence of fixed costs
  - ▶ Increase in variable cost pushes small export flows out of market
  - ▶ Not compelling evidence for important entry sunk cost

Conclusions

- Shocks to banks have real outcome consequences
  - ▶ Banks transmit shock to related firms
  - ▶ Large export flows: negative credit shock affects quantities exported
  - ▶ Small export flows: negative credit shock triggers exit from export markets
  - → Credit shocks affect variable cost of exporting

- Contribution of Finance to Overall Export Decline in Peru
  - ▶ Share of credit by *exposed* banks: 30.5%
  - ▶ Drop in credit supply by *exposed* banks: 17%
  - ▶ Overall drop in volume exports due to finance: –2.1%

	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%	32%
Extensive	1.2%	-7.4%	-8.6%	8%
Entry	8.6%	8.3%	-0.3%	
Exit	-7.4%	-15.7%	-8.3%	9%