Specialization in Bank Lending: Evidence from Exporting Firms

Daniel Paravisini (LSE), Veronica Rappoport (LSE), and Philipp Schnabl (NYU)

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Conventional Wisdom in (Academic) Banking

- Do banks develop expertise and lending advantages?

- Relationship Lending: firm-specific informational advantage
  Rajan (1992), Stein (2002)

  ▶ Outside relationship lending, banks are presumed perfectly substitutable sources of debt

  ▶ Outside relationship lending, banks are presumed to diversify portfolio of corporate loans

- What if banks specialize in funding projects in specific markets/sectors?

  ▶ Isolated bank failures may have real effects

  ▶ Multiple banks in a location may coexist with market power

  ▶ Assessment of bank risk needs to consider exposure to the market of expertise

  ▶ Rationale for multiple banking relationships for complex firms

Empirical Setting

- **In this paper: Specialization in Export Markets**
  - ▶ Recent important advances in effect of credit on export performance
    Manova (...), Amiti-Weinstein (2011), Chaney (2005), Paravisini et al (2014), ...
  - ▶ Bank input in exports goes beyond mere funding
  - ▶ Capabilities embedded in "credit" are inputs of production and export

- Methodological reasons for working with exports
  - ▶ Key: allows measuring the firm's output in every market and the bank's lending to firms in different markets
  - ▶ Empirically: allows us to account for firm-specific, country-specific, and bank-specific shocks

- Data: Peru during period 1994–2010
  - ▶ Customs data: exports from each firm to every country
  - ▶ Credit registry: amount of credit from each bank to each exporter
  - ▶ Observations: bank-firm-year (mean debt) and firm-country-year (sum of exports)

Specialization in Lending: An Example

- Consider two large international banks in the data, and two countries

Bank Exposure to Country of Export Destination in 2010

	Country of Export Destination	
	China	Switzerland
Weight in Total Peruvian Exports	0.182	0.093
Weight in bank's exporter portfolio		
Santander (Spain)	0.301	0.000
CitiBank (U.S.)	0.117	0.343

→ Does specialization predict firms' market-specific credit demand?

- Revealed preference argument:
  - ▶ Test whether firms increase (start) borrowing from Santander when increase (start) exports to China.
  - ▶ Controlling for any bank-wide supply shock and firm-wide demand shock

- Specialization
  - ▶ Every bank is a persistent outlier in at least one country

- Lending advantages
  - ▶ Firms that expand exports to a country increase debt 79% more from banks that are specialized in the country
  - ▶ Credit supply shocks disproportionately affect the activity in which the bank specializes
  - ▶ Macro shocks to a given country disproportionately affect banks specialized in that market

- Characterization of Lending Advantage
  - ▶ Consistent with local learning...but different from Relationship Lending
  - ▶ Not related to domestic or international network of brunches/subsidiaries

Outline

- Simple Framework

- Data

- Specialization Patterns

- Identifying Lending Advantages
  - Correlation between Exports and Credit
  - Destination-Specific Export Demand Shock
  - Bank-Specific Credit Supply Shock

- Narrowing Down Sources of Lending Advantage

- A firm is a collection of activities $j \in J_i$:

  ▶ Each firm i uses credit from banks $b = 1, ..., B$ to finance $j \in J_i$:

  $$q_{ij}\left(\{L_{ib}^j\}_{b=1}^B\right) = \left[\sum_{b=1}^B \gamma_{jb}^{\frac{1}{\rho}}\left(L_{ib}^j\right)^{\frac{\rho-1}{\rho}}\right]^{\frac{\rho}{\rho-1}}$$

    - γ_{jb} is the productivity of bank b in credit specific to market j
    - $\rho \geq 0$ is the elasticity of substitution between credit from different banks

- Banks

  ▶ Each bank b is characterized by the price of lending r_b and a vector of activity-specific productivity $\gamma_b = [\gamma_{1b}, ..., \gamma_{Jb}]$

  ▶ r_b may reflect the bank's cost of capital or overall diversification

  ▶ γ_{jb} may reflect and activity-specific screening/monitoring advantage, or a service associated with activity j

Simple Framework to Motivate the Empirical Exercise

- Cost minimization problem:

$$\min_{\{L_{ib}^j\}_{j,b}} \sum_{b=1}^{B} r_b \, L_{ib} \quad s.t. \quad q_{ji}\left(\{L_{ib}^j\}_{b=1}^B\right) = \overline{q}_{ji} \quad \forall j \in J_i$$

$$L_{ib} = \sum_{j \in J_i} L_{ib}^j \quad \forall b$$

- If homogeneous goods and competitive export market
  - ▶ Firm-bank (observable) outstanding debt:

$$L_{ib} = \left(\frac{1}{r_b}\right)^\rho \sum_{j \in J_i} X_{ji} \, \gamma_{jb}$$

  where $X_{ji} = q_{ji} p_{ji}$ is (observable) value of exports of firm i in market j

  - ▶ If $\rho = \infty$, firms borrow from the bank that offers lowest r_b
  - ▶ If $\rho < \infty$, firms have multiple banking relationships
  - ▶ r_b influences bank size, measured in overall lending

Simple Framework to Motivate the Empirical Exercise

- Consider two banks b, b' that have same productivity parameters for all activities, with the exception of sectors j and j' for which $\gamma_{bj} = \gamma_{b'j'} > \gamma_{bj'} = \gamma_{b'j}$. Then:

  1. The share of lending associated to exports to j is higher for bank with advantage in market j.

  $$S_{bj} \equiv \frac{\sum_{i=1}^{I} L_{ib} X_{ij}}{\sum_{k=1}^{J} \sum_{i=1}^{I} L_{ib} X_{ik}} \qquad \rightarrow \qquad S_{bj} > S_{b'j}$$

  2. The elasticity of credit to exports to j is higher for bank with advantage in market j.

  $$\varepsilon_{jb} \equiv \frac{\partial \ln L_{ib}}{\partial \ln X_{ij}} \geq 0 \qquad \rightarrow \qquad \varepsilon_{bj} > \varepsilon_{b'j}.$$

$\rightarrow$ The first result justifies our measures of specialization, and the second is the basis for our revealed preference test

Data

- Credit registry
  - Monthly panel loan level data on credit in the domestic banking sector

- Customs
  - Web crawler to download each individual export document
  - Data on export volume, price, destination, detailed product characteristics
  - Validation: our data accounts for 99.98% of the aggregate exports reported by the tax authorities

- Sample characteristics
  - Period: 1994-2010
  - Observations: bank-firm-year (mean debt) and firm-country-year (sum of exports)
  - Firm subsample: Only exporting firms
  - Bank subsample: 33 banks, unbalanced due to entry/exit/M&A (exclude savings and loans)
  - Country subsample: top 22 export destination markets GRAPH

Banks' Lending Shares by Country

- Define bank b's lending share to country c at time t S_{bct} as:

$$S_{bct} \equiv \frac{\sum_{i=1}^{I} L_{bit} X_{ict}}{\sum_{c=1}^{C} \sum_{i=1}^{I} L_{bit} X_{ict}}$$

  or bank-b borrowers' exports to country c, weighted by their debt in bank-b, as a share of bank-b borrowers' total exports

- We are interested in $S_{bct} - \overline{S}_{ct}$: difference between the bank's share of lending associated to a given country and the average across banks

  ▶ Captures departures from the overall Peruvian pattern of exports

  ▶ Specialization as exposure based on stock of debt

- Bank exposure distribution by market is extremely heterogeneous and right-skewed

	$S_{bct} - \overline{S}_{ct}$				
	Std. Dev.	Min	Median	Max	Skewness
	(1)	(2)	(3)	(4)	(5)
BR	0.0281	-0.0504	-0.0050	0.1765	2.02
CA	0.0444	-0.0561	-0.0072	0.4388	4.69
CH	0.0842	-0.0827	-0.0084	0.5919	4.65
CL	0.1550	-0.1344	-0.0340	0.9145	3.98
CN	0.1211	-0.2515	-0.0137	0.6579	1.00
CO	0.0674	-0.0675	-0.0096	0.9051	9.21
ES	0.0643	-0.0652	-0.0062	0.9348	10.62
FR	0.0257	-0.0257	-0.0046	0.2343	5.12
GB	0.0400	-0.0598	-0.0063	0.3577	3.04
IT	0.0255	-0.0351	-0.0034	0.3379	7.70
JP	0.0619	-0.1017	-0.0010	0.6686	5.45
KR	0.0227	-0.0371	-0.0038	0.2119	3.79
US	0.1721	-0.2812	-0.0372	0.8457	1.65
Overall	0.0708	-0.2812	-0.0050	0.9348	5.48

Specialization Measure

- Definition 1 (Specialization)

  A bank is specialized in the corresponding country, during the corresponding year, if it is an outlier in the country-year distribution of debt shares.

  $O(S_{bct}) = 1$, if S_{bct} is above the 75-th percentile plus 1.5 interquartile ranges of the distribution of $\{S_{bct}\}$ across banks for a given country-year.
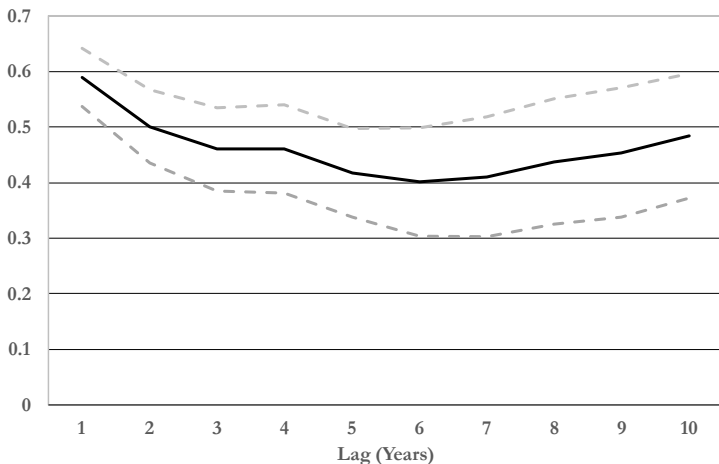
  - Same outlier definition used in the standard box-and-whisker plot GRAPH '

  - In a normal distribution it corresponds to the 99-th percentile

- Correlation between being specialized in a country at t and $t - \tau$

$$Corr(O(S_{bct}), O(S_{bct-\tau})) \qquad \tau = 1, ...10$$

- Does specialization, measured based on *stock* of loans, signal advantage in lending to firms that export to that country?

$$L_{bit} = L(L_{bt}^S, L_{it}^D, \mathcal{L}_{bit})$$

1. Test whether the covariance between $\mathcal{L}_{bit}$ and X_{cit} is higher for banks specialized in market c
   - Most robust specification: Absorbs for all unobserved firm-specific and bank-specific shocks

2. Test whether shocks to export demand X_{cit}^D disproportionately affect $\mathcal{L}_{bit}$ for banks specialized in market c
   - Assumption: Credit supply is uncorrelated with country-shocks after absorbing bank-time FE

3. Test whether effect change in L_{bt}^S on X_{cit}^S is higher if destination c is of bank's set of specialization
   - Assumption: Export demand is uncorrelated with shocks to banks, after absorbing product-country-time FE

1. Baseline Specification

$$L_{bit} = L(L_{bt}^S, L_{it}^D, \mathcal{L}_{bit})$$

- Test whether the covariance between $\mathcal{L}_{bit}$ and X_{it}^c is higher for banks specialized in market c

$$\ln L_{bit} \quad = \quad \alpha_{bi}^c + \alpha_{it}' + \alpha_{bt}'' + \beta_1 \ln X_{it}^c + \beta_2 \, \mathcal{S}_{ibt}^c + \beta \, \mathcal{S}_{ibt}^c \times \ln X_{it}^c + \epsilon_{ibt}^c$$

- $\mathcal{S}_{ibt}^c$: Rolling window of 3 years. Leaving firm i out of the computation.

$$\mathcal{S}_{ibt}^c = \frac{1}{3} \sum_{\tau = t-3}^{t} O(S_{-ibct})$$

- Stacked country-bank-firm-year specification
  - ▶ Clustered at the bank level: L_{bit} repeated as many times as i's export destinations

1. Baseline Results

- Correlation between exports and credit is 79% larger if lending bank is specialized in country of destination

  ▶ Strategy is robust to any source of variation of credit or exports

  ▶ But without identifying source of shock, the coefficient is of difficult economic interpretation

Dep. Variable	Intensive Margin $\ln(L_{ibt})$
$\mathcal{S}_{ibt}^c \times \ln(X_{it}^c)$	0.019***
	(0.006)
$\ln(X_{it}^c)$	0.024***
	(0.006)
$\mathcal{S}_{ibt}^c$	0.000
	(0.030)
Observations	334,432
$R^2 adj$	0.31

firm-time, bank-time, firm-bank FEs

Alternative Specifications

② Look at the differential elasticity of credit to export demand shocks

- ▶ The bank-advantage uncovered here is related to destination factors
- ▶ But export flows do not only depend on destination-specific factors
- ▶ Isolate an export demand shock driven by destination factors

→ Why is this important? To assess bank stress due to isolated events

③ Look at the differential effect of a pure credit supply shock

- ▶ Use setting in Paravisini et al. (2015) allowing for specialized banks
- ▶ Same data, focus on the 2008 financial crisis
- ▶ Use shock to availability of bank foreign funding as source of variation in bank credit supply
- ▶ Use saturated regressions to measure effect of credit supply on real export

→ Why is this important? To assess economic impact of isolated bank shocks

2. Elasticity of Credit to Export Demand Shock

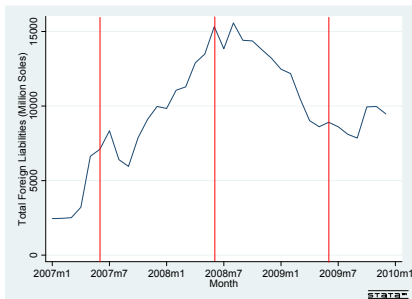- Instrument X_{it}^c with shocks to destination: GDP_t^c and RER_t^c

$$\ln L_{bit} = \alpha_{bi}^c + \alpha_{it}' + \alpha_{bt}'' + \beta_1 \ln X_{it}^c + \beta_2 \, \mathcal{S}_{ibt}^c + \beta \, \mathcal{S}_{ibt}^c \times \ln X_{it}^c + \epsilon_{ibt}^c$$

- Qualitatively same results, but point estimates are 7 to 14 $\times$ OLS
  - ▶ Consistent with 10% of export variation being destination-specific variation

Dep. Variable	$\ln(X_{it}^c)$	$\ln(L_{ibt})$	
		OLS	IV
$\Delta GDPGrowth_t^c$	0.0104***		
	(0.003)		
$\Delta \ln(RER_t^c)$	0.504***		
	(0.028)		
$\mathcal{S}_{ibt}^c \times \ln(X_{it}^c)$		0.019***	0.120**
		(0.006)	(0.059)
$\ln(X_{it}^c)$		0.024***	0.339**
		(0.006)	(0.173)
Observations	334,432	334,432	334,432

3. Elasticity of Exports to Credit Supply Shock

- Use bank exposure to crisis 08-09 as instrument for credit supply shock
- 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

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

(a) Banking Sector Foreign Liabilities   (b) Foreign Liabilities

3. Elasticity of Exports to Credit Supply Shock

- Compare exports (same product, same destination) by firms with different shares of credit received from *exposed* banks (e.g. cotton T-shirts to Germany)

$$\ln X_{ipct} = \alpha_{ipc} + \alpha_{pct} + \beta \sum_b \omega_{ib} Exposed_b \times Post_t + \epsilon_{ipct}$$

X_{ipct} :   volume of exports of product p by firm i to country c at time t

$\omega_{ib} \equiv L_{ib} / \sum_b L_{ib}$:   share of firm-i's credit from bank-b (in 2006)

	$\Delta \ln X_{ic}$	
$\sum_b \omega_{ib} \; Exposed_b \times Post_t$	-0.193***	
	(0.063)	
$\sum_b \omega_{ib} \; Exposed_b \; (\mathcal{S}_{bc} = 0) \times Post_t$		-0.165***
		(0.061)
$\sum_b \omega_{ib} \; Exposed_b \; (\mathcal{S}_{bc} > 0) \times Post_t$		-0.220**
		(0.086)
Obs	14,208	14,208
R^2 adj	0.438	0.438

- Is this lending advantage similar to *Relationship Lending*?
  - ▶ Advantage extends beyond firm-specific knowledge. It is market-wide.
  - ▶ Advantage does not diminish with size
  - ▶ Advantage transferred to the bigger organization after M&A

- Why is this important?
  - ▶ Traditional argument against consolidation of banking system or global banks

- Is this Export-Market Expertise related with Global Banks?
  - ▶ Not explained by home country advantage network of affiliates
  - ▶ Not explained by *current* domestic geographic presence

Different from Relationship Lending: Not firm-specific

- Advantage is not firm-specific but market-specific
  - ▶ Relationship lending: firm-specific advantages is private information derived from ongoing lending relationship
  - ▶ Test: focus on firms with no previous relationship with the bank (extensive margin)

- Prob of starting relationship with bank b after start exporting to c:

$$(L_{bit} > 0 | L_{bit-1} = 0) = \alpha_b^c + \alpha_{it}' + \alpha_{bt}'' + \beta_1 (X_{it-1}^c > 0 | X_{it-2}^c = 0) + \beta_2 \, \mathcal{S}_{ibt}^c$$
$$+ \beta \, \mathcal{S}_{ibt}^c \times (X_{it-1}^c > 0 | X_{it-2}^c = 0) + \epsilon_{ibt}^c$$

- Prob of starting exporting to c after start borrowing from bank b:

$$(X_{it}^c > 0 | X_{it-1}^c = 0) = \alpha_b^c + \alpha_{it}' + \alpha_{bt}'' + \beta_1 (L_{ibt-1} > 0 | L_{ibt-2} = 0) + \beta_2 \, \mathcal{S}_{ibt}^c$$
$$+ \beta \, \mathcal{S}_{ibt}^c \times (L_{ibt-1} > 0 | L_{ibt-2} = 0) + \epsilon_{ibt}^c$$

- Prob start borrowing from b the year after entry country-c is 6.9X larger if b specialized in c than if b not specialized in c.
- Prob enter country-c 3.8X larger the year after first borrowing from bank specialized in c.

Dep. Variable	$(L_{ibt} > 0 \mid L_{ibt-1} = 0)$ (×100)	$(X_{it}^c > 0 \mid X_{it-1}^c = 0)$ (×100)
$\mathcal{S}_{ibt}^c \times (X_{it-1}^c > 0 \mid X_{it-2}^c = 0)$	0.400***	
	(0.065)	
$(X_{it-1}^c > 0 \mid X_{it-2}^c = 0)$	0.058***	
	(0.006)	
$\mathcal{S}_{ibt}^c \times (L_{ibt-1} > 0 \mid L_{ibt-2} = 0)$		2.578***
		(0.155)
$(L_{ibt-1} > 0 \mid L_{ibt-2} = 0)$		-0.006
		(0.005)
$\mathcal{S}_{ibt}^c$	-0.003**	-0.190***
	(0.002)	(0.015)
Observations	145,599,237	145,869,772
$R^2 adj$	0.28	0.26

- Characterization is different from relationship lending
  - ▶ No correlation in the cross section or time series with local size
  - ▶ Banks become more specialized when acquired by foreign banks]

Dep. Variable	$\mathcal{S}_{bct}$	
	between	within
$ln(Size_{bt})$	-0.006	0.004
	(0.006)	(0.004)
$Foreign_{bt}$	-0.021**	0.017***
	(0.010)	(0.002)
Bank FE	No	Yes
Country FE	Yes	Yes
Year FE	Yes	Yes
Observations	7,560	7,560
R-squared	0.49	0.51

Different from Relationship Lending: Doesn't Diminish with Size

Dep. Variable	$\ln(L_{ibt})$	
$\mathcal{S}_{ibt}^{c} \times \ln(X_{it}^{c})$	0.019**	0.019**
	(0.007)	(0.008)
$\ln(X_{it}^{c})$	0.031***	0.015***
	(0.006)	(0.005)
$\mathcal{S}_{ibt}^{c}$	-0.003	-0.027
	(0.030)	(0.032)
$\mathcal{S}_{ibt}^{c} \times \ln(X_{it}^{c}) \times SmallBank_{b}$	-0.010	
	(0.028)	
$\ln(X_{it}^{c}) \times SmallBank_{b}$	-0.028*	
	(0.015)	
$\mathcal{S}_{ibt}^{c} \times SmallBank_{b}$	0.018	
	(0.011)	
$\mathcal{S}_{ibt}^{c} \times \ln(X_{it}^{c}) \times LargeFirm_{it}$		-0.004
		(0.014)
$\ln(X_{it}^{c}) \times LargeFirm_{it}$		0.024***
		(0.005)
$\mathcal{S}_{ibt}^{c} \times LargeFirm_{it}$		0.055***
		(0.011)

Different from Relationship Lending: Preserved after M&A

- Merger events, 3 year before/after windows (all FE $\times$ merger dummy)
- Advantage on pre-merger specialization market increase after mergers
  - ▶ Same result if use specialization set of the target bank only

Dep. Variable	$\ln(L_{ibt})$	
$\mathcal{S}^{j}_{bPreMerger} \times \ln(X^{j}_{it})$	0.014***	0.012**
	(0.004)	(0.004)
$\ln(X^{j}_{it})$	0.011***	0.014***
	(0.003)	(0.003)
$\mathcal{S}^{j}_{bPreMerger} \times \ln(X^{j}_{it}) \times Merger_{bt}$		0.023*
		(0.013)
$\ln(X^{j}_{it}) \times Merger_{bt}$		-0.024***
		(0.009)
$\mathcal{S}^{j}_{bPreMerger} \times Merger_{bt}$		0.045***
		(0.015)
Observations	586,097	586,097
R-squared	0.29	0.29

- Portfolio exposure is correlated with country of ownership and its characteristics
- Not correlated with the subsidiary network location

Dep. Variable	S_{bj}
$CountryOwnership_{bj}$	0.095***
	(0.018)
$DistanceToHeadquarters_{bj}$	0.005*
	(0.003)
$CommonLanguage_{bj}$	0.027***
	(0.009)
$CountrySubsidiary_{bj}$	-0.002
	(0.008)
Bank FE	Yes
Country FE	Yes
Year FE	Yes
Observations	7,560
$R^2 adj$	0.51

- Multinational bank characteristics cannot explain lending advantage

Dep. Variable	$\ln(L_{ibt})$	
$S_{ibt}^c \times \ln(X_{it}^c)$	0.021**	
	(0.008)	
$CountryOwnership_b^c \times \ln(X_{it}^c)$	-0.028	-0.031
	(0.024)	(0.022)
$\ln(DistancetoHeadquarters_b^c) \times \ln(X_{it}^c)$	-0.004	-0.002
	(0.006)	(0.006)
$CommonLanguage_b^c \times \ln(X_{it}^c)$	0.008	0.007
	(0.007)	(0.006)
$CountrySubsidiary_b^c \times \ln(X_{it}^c)$	0.012	0.016
	(0.010)	(0.010)
$\ln(X_{it}^c)$	0.050	0.042
	(0.056)	(0.052)
S_{ibt}^c	0.000	
	(0.030)	
Observations	334,432	366,721
$R^2 adj$	0.31	0.31

## What is the Source of Comparative Advantage?

- Physical ability?
  - ▶ No evidence of connection with country of origin
  - ▶ No evidence of foreign-bank advantage
  - ▶ No significant differences in domestic location of branches

- Acquired capability?
  - ▶ Information from firms in portfolio
  - ▶ Development of services demanded by firms in portfolio
  - ▶ Coordination between bank availability of credit and market-specific demand

- Surely reinforcing mechanisms
  - ▶ Potential initial geographical differences resulted in different capability paths even if those differences are no longer present
  - ▶ Are capabilities related to country or product mix? GO

Conclusions

- Method to measure bank market specialization and lending advantage

- Application to export markets:
  - ▶ Banks have portfolios that diverge sharply from a "market" portfolio, and tend to specialize (persistently) in a few markets
  - ▶ Banks have substantial lending advantage in their markets of specialization
    - Firms use marginal funding from specialized banks to expand output in the country of specialization
    - Start exporting to a country is substantially higher after start borrowing from a specialized bank
  - ▶ Specialization and lending advantage are scalable (do not diminish with size) suggesting that they are not driven by soft information
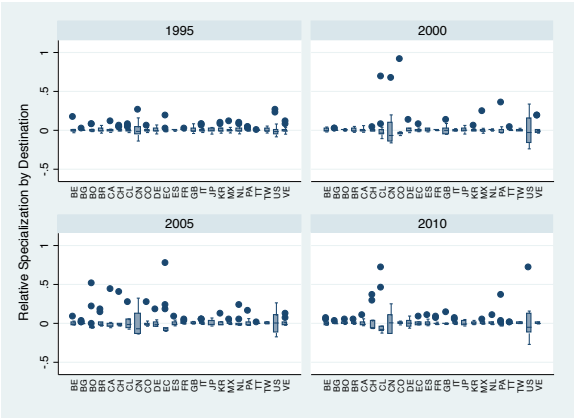 - ▶ Ownership cannot explain the specialization or the comparative advantage patters

Composition of Exports (Value) by Destination
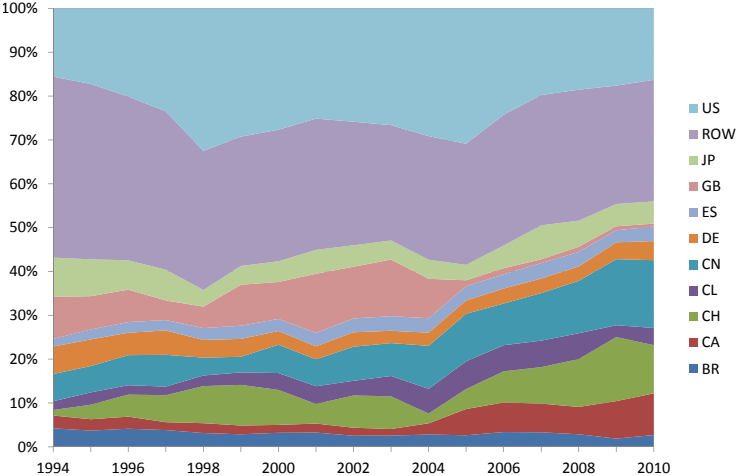
Definition of Outlier: Example

- Outlier: $O(S_{bjt}) = 1$ if S_{bjt} is above the 75-th percentile plus 1.5 IQR of the distribution of $\{S_{bjt}\}$ across banks for a given country-year

▶ In a Normal: 99th percentile

Lending Advantage on Export Products or Destinations?

- In our data 2-digit products and destinations are mapped almost 1-to-1
- We cannot distinguish them, but destination is *statistically* stronger

Dep. Variable	$\ln(L_{ibt})$
$\mathcal{S}^c_{ibt} \times \ln(X^{pc}_{it})$	0.014**
	(0.007)
$\mathcal{S}^p_{ibt} \times \ln(X^{pc}_{it})$	-0.007
	(0.024)
$\ln(X^{pc}_{it})$	0.019***
	(0.005)
$\mathcal{S}^p_{ibt}$	0.205***
	(0.054)
$\mathcal{S}^c_{ibt}$	0.031
	(0.023)
Observations	402,332
R^2 adj	0.29

Firm-year, bank-year, country-product-bank FEs

BACK