Firms and Economic Performance: A View From Trade Concentration in Intarnational Markets

Alessandra Bonfiglioli[1] Rosario Crinò[2] Gino Gancia[3]

ASSA 2020 Annual Meeting

[1]Queen Mary University of London and CEPR
[2]Università Cattolica del Sacro Cuore, CEPR and CESifo
[3]Queen Mary University of London, CREi and CEPR

Firms in Global Markets

- we live in a "superstar" economy dominated by giant firms
  - 10% of the world's public companies generate 80% of all profits (*The Economist*, 2016)
  - sales' shares of top firm has increased (e.g., Autor et al., 2017)
  - large firms dominate global markets (e.g., Melitz, 2003, Freund & Pierola, 2015)
- two key questions:
  1. what is the role of firms in explaining countries performance in global markets?
  2. are global markets becoming more or less competitive?
- little systematic evidence due to lack of comparable data
- we use firm-level data on US imports
  - compare firms from *all* countries selling to a single destination

What We Do

- quantify the importance of firms for explaining US imports
  - map countries market shares into firm-level characteristics
    - ★ number of firms
    - ★ average attributes
    - ★ firm heterogeneity: top firms
    - ★ granularity: deviations from a continuous distribution
  - exact decomposition of the margins of trade
    - ★ more general than Redding & Weinstein (2018), Fernandes et al. (2017), Hummels & Klenow (2005), Freund & Pierola (2015), Gaubert & Itskhoki (2018)
- study concentration in US imports
  - top firms dominate national industries
  - but compete more in markets that are increasingly global

Assumptions: CES Demand

- consider a sector i in a given market (US)
  - preferences over varieties in industry i

$$C_i = \left\{ \sum_{\omega \in \Omega_i} \left[\gamma(\omega) c(\omega) \right]^{\frac{\sigma_i - 1}{\sigma_i}} \right\}^{\frac{\sigma_i}{\sigma_i - 1}}, \quad \sigma_i > 1$$

    - ★ Ω_i = available varieties ω in i, consumption $c(\omega)$
    - ★ $\gamma(\omega)$ = demand shifter (quality)

- demand for variety ω

$$p(\omega) c(\omega) = \tilde{\gamma}(\omega)^{\sigma_i - 1} P_i^{\sigma_i} C_i$$

  - $p(\omega)$ = price of variety ω
  - $\tilde{\gamma}(\omega) \equiv \gamma(\omega) / p(\omega)$ = quality-to-price ratio = "appeal"
  - P_i = price index in industry i

Decomposing Market Shares

- take the market share of origin o in industry i, S_{oi}, decompose:
  1. extensive vs intensive margin

$$S_{oi} = \frac{N_{oi} \cdot \bar{r}_{oi}}{N_i \cdot \bar{r}_i}$$

     - ⋆ $N = \#$ of varieties, $\bar{r} =$ average revenue per variety

  2. decompose the intensive margin

$$\bar{r}_{oi} = \overbrace{\mathbb{E}(\tilde{\gamma}_{oi})^{\sigma_i - 1}}^{\text{average appeal}} + \overbrace{\frac{1}{N_{oi}} \sum_{\omega \in \Omega_{oi}} \left[\tilde{\gamma}(\omega)^{\sigma_i - 1} - \mathbb{E}(\tilde{\gamma}_{oi})^{\sigma_i - 1} \right]}^{\text{appeal heterogeneity}}$$

- when $\sigma > 2$ total sales are convex in $\tilde{\gamma} \longrightarrow$ superstar economy
  - sales increase in heterogeneity through reallocations from less to more attractive products

Data

- transaction-level US import data from Piers (IHS Markit)
  - universe of waterborne import transactions of the US in 2002 and 2012
- info on:
  - exporting firm
  - country of origin
  - exported product (6-digit HS)
  - value and quantity of the transaction
- final sample:
  - 1,350,574 firm-product-year observations
  - 366 manufacturing industries
  - 104 exporting countries
  - 83% of average export to the US per origin-sector-year

Structural Estimation

- to implement the decomposition we need σ_i and $\tilde{\gamma}(\omega)$
- we use 4 estimates of elasticities of substitution:
  - Reverse-Weighting estimator (Redding & Weinstein, 2016) $\longrightarrow$ σ_i^{RW}
  - identify σ_i from dispersion of sales $\longrightarrow$ $\sigma_i^{reg.base.}$; $\sigma_i^{reg.contr.}$
  - estimates from Broda & Weinstein (2006) $\longrightarrow$ σ_i^{BW}
- mean & median σ_i well above 2
- then, calibrate $\tilde{\gamma}(\omega)$ to match observed sales
  - from sales:

$$\ln r(\omega) = \overbrace{\sigma_i \ln P_i + \ln C_i}^{\text{fixed effect, } \alpha_i} + \overbrace{(\sigma_i - 1) \ln \tilde{\gamma}(\omega)}^{\text{Residual}}$$

Decomposing US Imports: Results

- market shares: extensive vs intensive margin
  - separately regress $(\ln N_{oi} - \ln N_i)$ and $(\ln \bar{r}_{oi} - \ln \bar{r}_i)$ on $\ln S_{oi}$
- intensive margin: average vs heterogeneity
  - regress $\mathbb{E}(\tilde{\gamma}_{oi})^{\sigma_i - 1}$ and $\sum_{\omega \in \Omega_{oi}} \left[\frac{\tilde{\gamma}(\omega)^{\sigma_i - 1} - \mathbb{E}(\tilde{\gamma}_{oi})^{\sigma_i - 1}}{N_{oi}} \right]$ on $\bar{r}_{oi}$

Table 4 - Decomposition of Countries' Market Shares

	reg. base.	*reg. contr.*	*RW*	*BW*
	(1)	(2)	(3)	(4)
a) First step - Decomposition of market shares				
N. of varieties	0.502***	0.502***	0.499***	0.505***
	[0.003]	[0.003]	[0.003]	[0.003]
Average revenue per variety	0.498***	0.498***	0.501***	0.495***
	[0.003]	[0.003]	[0.003]	[0.003]
b) Second step - Decomposition of average revenue per variety				
Average quality-to-price ratio	0.487***	0.480***	0.481***	0.492***
	[0.075]	[0.106]	[0.114]	[0.118]
Heterogeneity in quality-to-price ratios	0.513***	0.520***	0.519***	0.508***
	[0.075]	[0.106]	[0.114]	[0.118]
Obs.	24754	24754	17660	23622

Heterogeneity, Superstars and Granularity

- is heterogeneity driven by superstar firms?
  - on average, top firm in each country accounts for 25% of exports to the US
- but are superstar firms "exceptional"?
  - *define* "granularity" as exceptional deviations from a continuous distribution
  - identify it from the data and quantify its role
- assume quality-to-price ratio $\tilde{\gamma}$ is log-normal
  - then, market share of country o *relative to* country x

$$\ln \frac{S_{oi}}{S_{xi}} = \left[\mathbb{E}\left(\ln r_{oi}\right) - \mathbb{E}\left(\ln r_{xi}\right)\right] + \frac{\mathbb{V}\left(\ln r_{oi}\right) - \mathbb{V}\left(\ln r_{xi}\right)}{2} + \ln \frac{N_{oi}}{N_{xi}} + g_{oxi}$$

    - ★ where g_{oxi} "granular" residual: 0 if LLN applies
- we quantify g_{oxi} and ask if it captures superstars

The Contribution of Granularity and Superstars

Table 6 - Decomposition of Countries' Market Shares under Log Normality

	Difference in av. log sales	Difference in var. of log sales	Difference in log n. of varieties	Residual
	(1)	(2)	(3)	(4)
	a) Baseline			
Log relative market share	0.236***	0.228***	0.487***	0.048***
	[0.000]	[0.001]	[0.000]	[0.000]
Obs.	1078915	1078915	1078915	1078915

- the "granular" residual explains $< 5\%$

Table 7 - Decomposition of Countries' Market Shares under Log Normality: The Role of Superstar Firms

	Difference in av. log sales	Difference in var. of log sales	Difference in log n. of varieties	Residual
	(1)	(2)	(3)	(4)
	a) Excluding superstar firms (sales above triplet average by at least 2 std. dev.)			
Log relative market share	0.272***	0.215***	0.527***	-0.014***
	[0.000]	[0.001]	[0.000]	[0.001]
Obs.	1078909	1078909	1078909	1078909

- it falls to zero if superstars are removed

Additional Results

1. firm heterogeneity
   - correlates positively with market size
     - ★ higher dispersion in countries richer, larger and closer to the US
2. firm heterogeneity is important for welfare:
   - bottom vs top 25% heterogeneity origin $\longrightarrow$ real consumption up by 20-32%
3. firm heterogeneity driven mostly by "quality"
   - variation in prices explains little of variation in appeal
     - ★ similar to Hottman, Redding & Weinstein (2016)

Concentration: Foreign vs National Firms

- is the US market becoming more or less competitive?
  - rise of superstars among national firms
  - vs more intense global competition
- changes in concentration, 2002-2012, by industry and origins
  - a) concentration among foreign firms from one country: $\sim$
  - b) concentration among foreign firms from all countries: $\downarrow$
  - c) concentration among domestic firms: $\uparrow$

Table 1 - Descriptive Statistics on Concentration Measures

	Mean (2012)	Std. Dev. (2012)	Change (02-12)	% of Cases with Rise of Concentration
a) PIERS: Statistics by country-industry pair				
Share of sales by top-4 firms	0.79	0.21	-0.01	0.47
Herfindahl index	0.46	0.29	0.01	0.50
b) PIERS: Statistics by industry				
Share of sales by top-4 firms	0.37	0.23	-0.08	0.34
Herfindahl index	0.09	0.13	-0.03	0.32
c) COMPUSTAT: Statistics by industry				
Share of sales by top-4 firms	0.88	0.15	0.05	0.70
Herfindahl index	0.55	0.30	0.13	0.73

Notes. Industries are defined at the 4-digit level of the Standard Industrial Classification (SIC).

Decomposing Top4 Shares

- decompose changes in market share of top4 firms

$$\Delta \ln s_{top} = -\Delta \ln n^f + \Delta \ln n^p_{top} - \Delta \ln n^p + \Delta \ln \frac{\bar{r}_{top}}{\bar{r}}$$

  - n^f = number of firms, n^p = number of products per firm
  - $\bar{r}$ = average sales per product

Table 2 - Decomposition of the Share of Sales by the Top-4 Firms

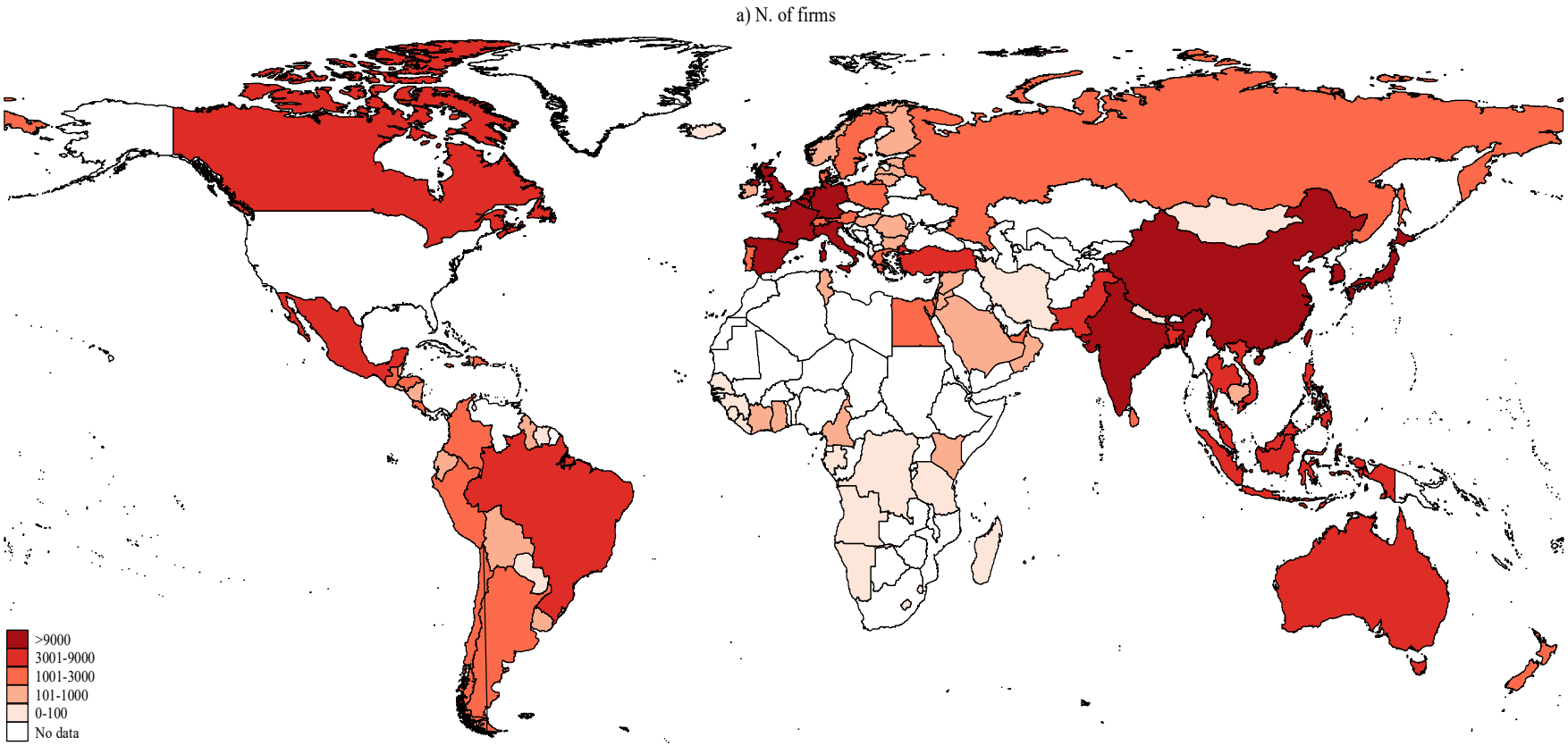
(1)	(2)	(3)	(4)	(5)
$\Delta \ln s_{top}(i,o)$	$-\Delta \ln n^f(i,o)$	$\Delta \ln n^p_{top}(i,o)$	$-\Delta \ln n^p(i,o)$	$\Delta \ln \frac{\bar{r}_{top}(i,o)}{\bar{r}(i,o)}$
				a) Decomposition by Country-Industry Pair
-0.03	-0.27	-0.15	0.07	0.31
				b) Decomposition by Industry
-0.30	-0.75	-0.43	0.10	0.78
				c) Decomposition by Industry (only top-100 Firms)
-0.22	0.00	-0.53	0.22	0.09

- results consistent with trade-driven reallocations:
  - number of firms has increased
  - firms are dropping products, top firms more
  - yet, relative sales per product by top firms has increased

Conclusion

- use US import data to study firms in global markets
- main results:
  - decomposition of countries' market shares
    - ★ extensive/intensive margin: 50%-50%
    - ★ average/heterogeneity: 50%-50%
    - ★ granularity: 5%
  - variation in firm-level heterogeneity is important for explaining sales
    - ★ important implications for quantitative trade models
    - ★ heterogeneity is positively correlated with market size
- top firms compete more in global markets:
  - data consistent with the view that international competition goes hand-in-hand with national concentration
    - ★ Melitz (2003); Bernard, Redding & Schott (2011); Melitz, Mayer & Ottaviano (2014)

Data: Country Coverage



Distribution of Sales and GDP

Figure 3 - Distributions of Log Exports to the United States by Group of Exporting Countries