The Effects of Trade Competition on Reallocations, Productivity, and Welfare

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Trade and Reallocations

- Trade induces many different reallocations across firms and products:
  - Selection effects:
    - Which products are sold where (across domestic and export markets)
    - Which firms survive; which firms export (and where)
  - But also competition effects:
    - Conditional on selection (same products sold in a given market) – trade affects the relative market shares of those products
- These reallocations generate (endogenous) productivity changes that are independent of "technology"

Outline

1. Measuring the reallocation effects of trade (and what they imply about the structure of trade models)
2. How big is the effect of reallocations on productivity?
3. Do productivity changes generated by reallocations contribute to aggregate gains from trade?

Measuring Reallocations Within Multi-Product Firms

Measuring the Reallocation Effects of Trade

- It is very hard to measure the reallocation effects across firms at the country/industry level:
  - Shocks that affect trade (institutions, technology, ...) are also likely to affect the distribution of market shares across firms
- Recent theoretical models of multi-product firms highlight how trade induces a similar pattern of reallocations within firms as it does across firms

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- Recent theoretical models of multi-product firms highlight how trade induces a similar pattern of reallocations within firms as it does across firms
- When measuring reallocations within multi-product firms, can:
  - Isolate trade shocks that are exogenous to individual firms – controlling for country/industry effects
  - Control for firm-level technology changes
  - Look at same set of (narrowly defined products) sold by same firm across destinations or time

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- Aside: Multi-product firms dominate world trade

Similar Reallocations Across Firms and Within Multi-Product Firms

Firms

- Stable performance ranking for firms based on performance in any given market (including domestic market) or worldwide sales
- Better performing firms export to more destinations
- Worse performing firms are most likely to exit (overall, or from any given export market)

Products within Firms

- Stable performance ranking across destinations (and for worldwide sales)
- Better performing products are sold in more destinations
- Worse performing products are most likely to be dropped from any given market

▸ Product Ladder Evidence

Prices, Markups, and Pass-Through

Firms

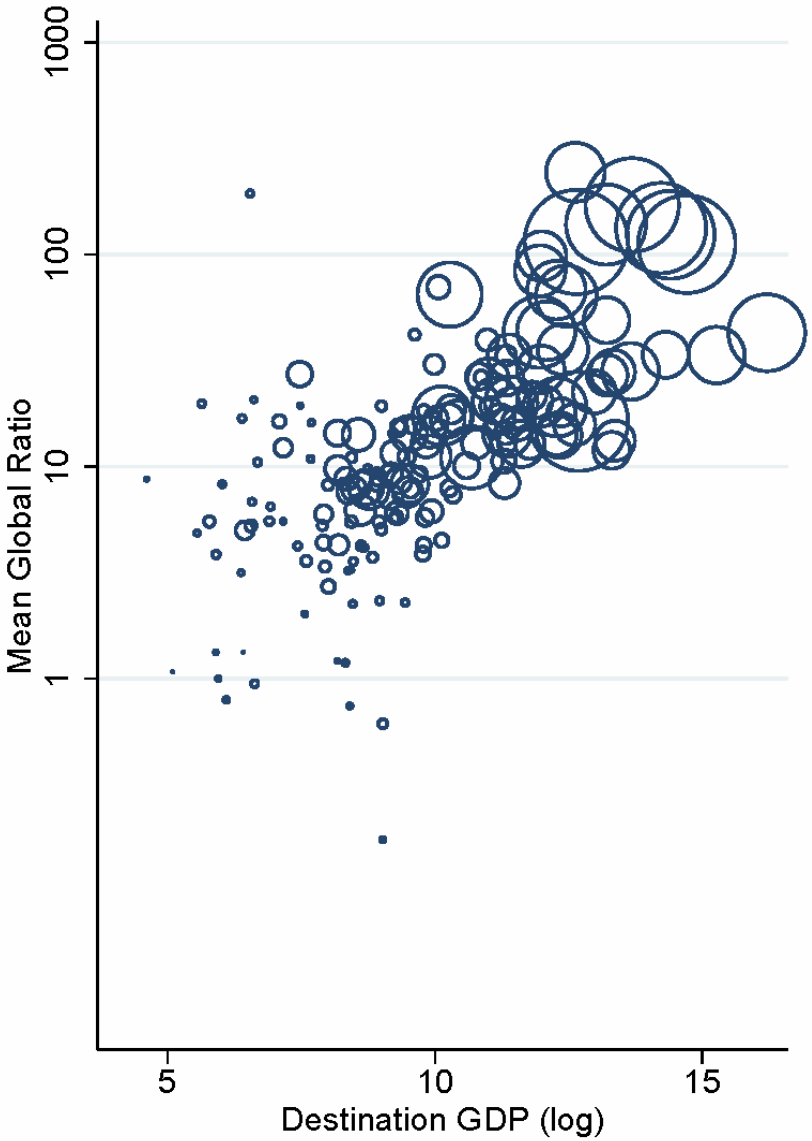
- Larger, better performing firms set higher markups
- Incomplete pass-through of cost shocks to prices
  - 'More' incomplete for larger, better performing firms (Berman et al, 2012)

Products within Firms

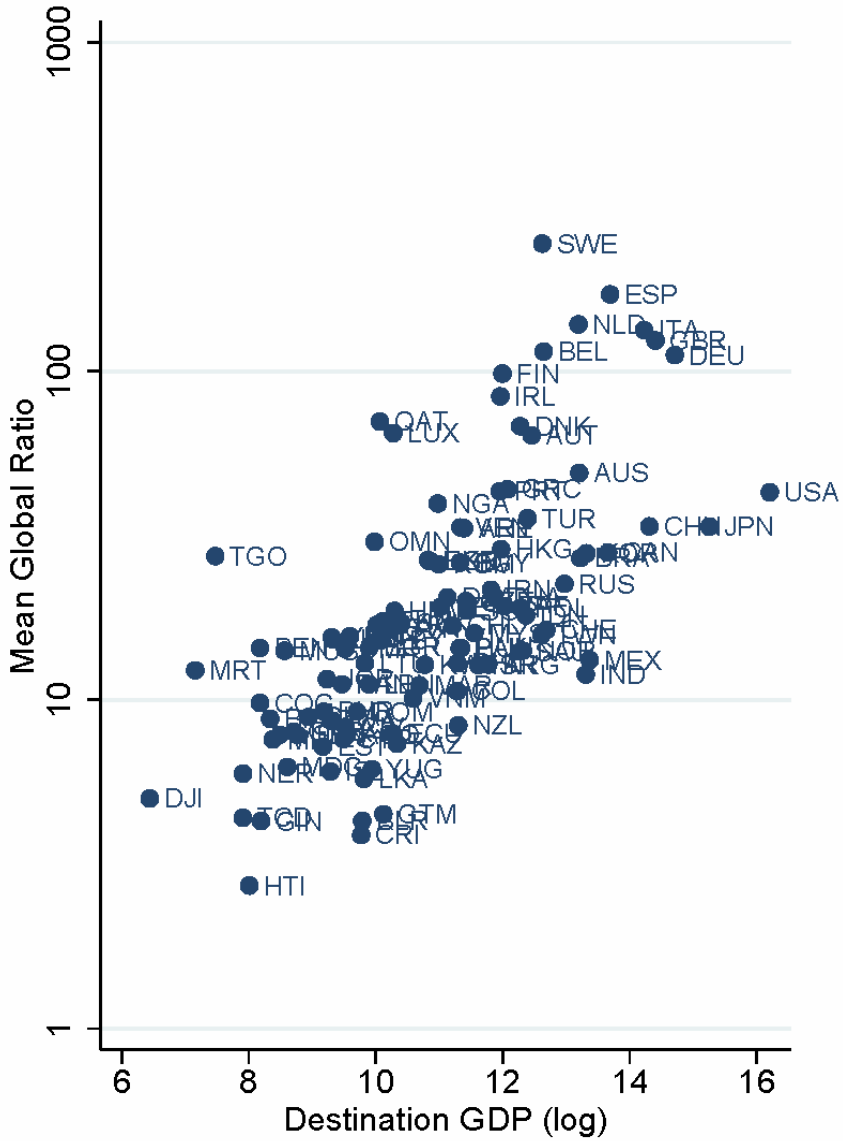
- Similar pattern for multi-product firms:
  - India (Goldberg et al, 2012)
  - Brazil (Chatterjee et al, AEJ EP 2013)
  - China (Li et al, JIE 2015)

Reallocations Across Destinations

Mean Global Sales Ratio and Destination Market Size

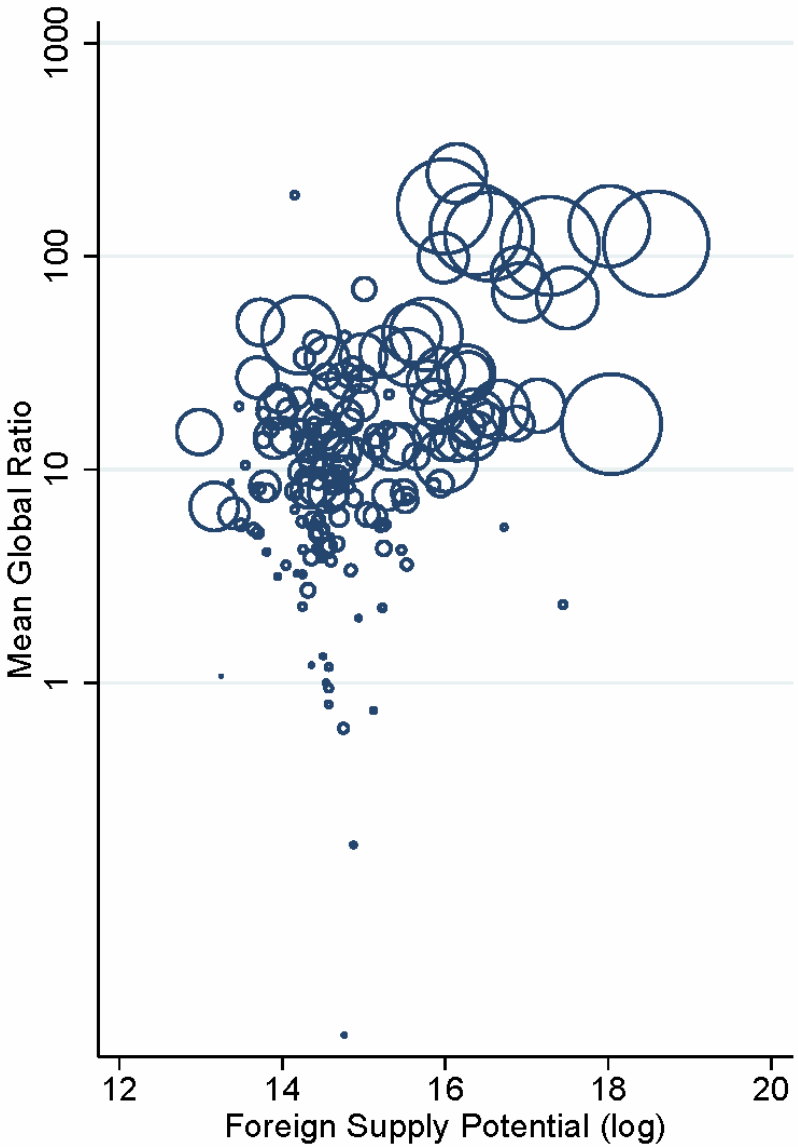


All countries (209)



Countries with more than 250 exporters (112)

Mean Global Sales Ratio and Foreign Supply Potential



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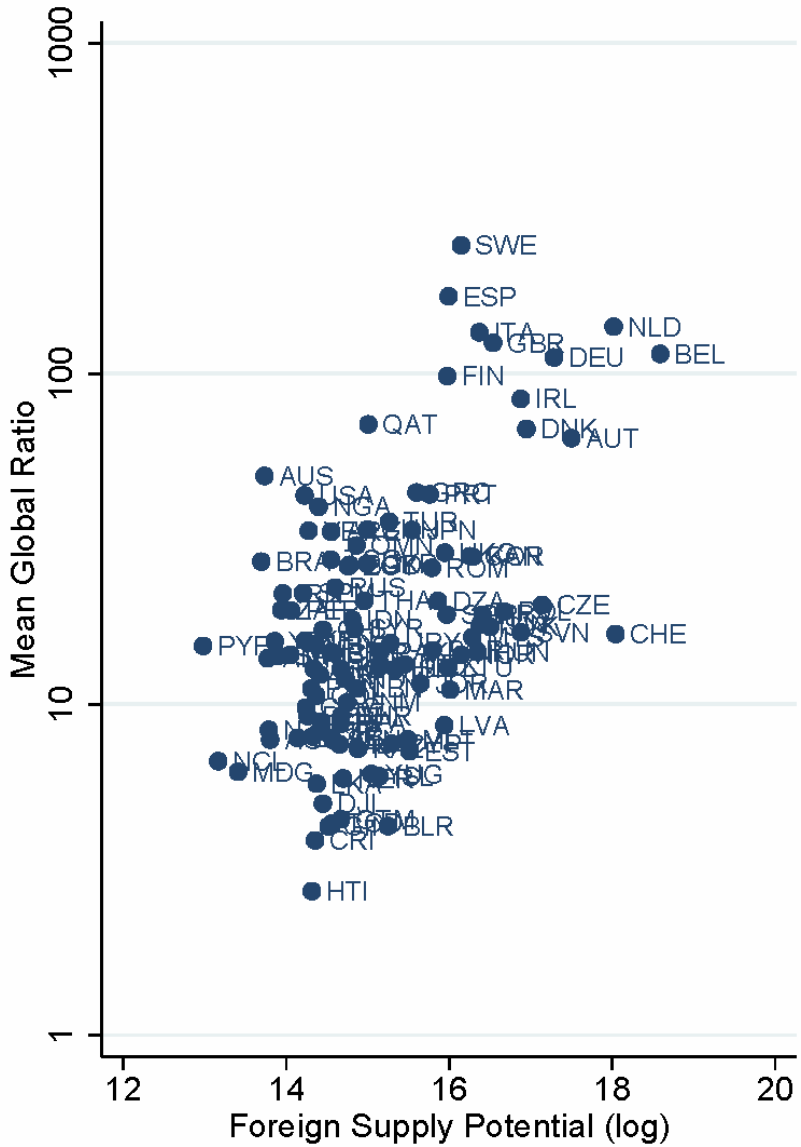

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Reallocations Over Time

Reallocations Over Time: Measuring Trade Shocks

- Changes in the destination markets over time also induce similar pattern of reallocations
- For all firms exporting to destination d, can measure change in
  - $\log GDP_{d,t}$
  - Total imports into d (in ISIC I) excluding French exports: $\log M^I_{d,t}$
  - Both capture demand shocks for French exporters to d (trade-induced for the case of $\log M^I_{d,t}$)
- ... but we can also construct a firm i-specific measure of the trade-induced demand shock:

$$\text{shock}^I_{i,d,t} \equiv \overline{\log M^s_{d,t}} \quad \forall \text{ products } s \in I \text{ exported by firm } i \text{ to } d \text{ in } t_0$$

$\longrightarrow$ Shocks in first differences: $\tilde{\Delta} GDP_{d,t}$, $\tilde{\Delta} M^I_{d,t}$, $\overline{\tilde{\Delta} M^s_{d,t}}$

- All 3 trade shocks strongly predict response of firm i's exports in destination d along both extensive and extensive margins

Impact of Trade Shocks on Reallocations Over Time

Destination-level over time:

- Trade shock strongly predicts increased skewness of firm's product mix
- Theoretical connection with preferences satisfying previous evidence on markups and pass-through

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Aggregating up to firm-level:

- Use (lagged) firm-destination export shares
- Trade shock strongly predicts increased skewness of firm's global product mix (global exports and total production)

Effects of Trade-Induced Reallocations on Productivity

New Data and Productivity

- Merge trade data with production data (comprehensive annual census)
  - Adds firm level variables (by year) for input and output use
- Measure productivity as deflated value-added per worker

Aside on TFP^Q versus TFP^R:

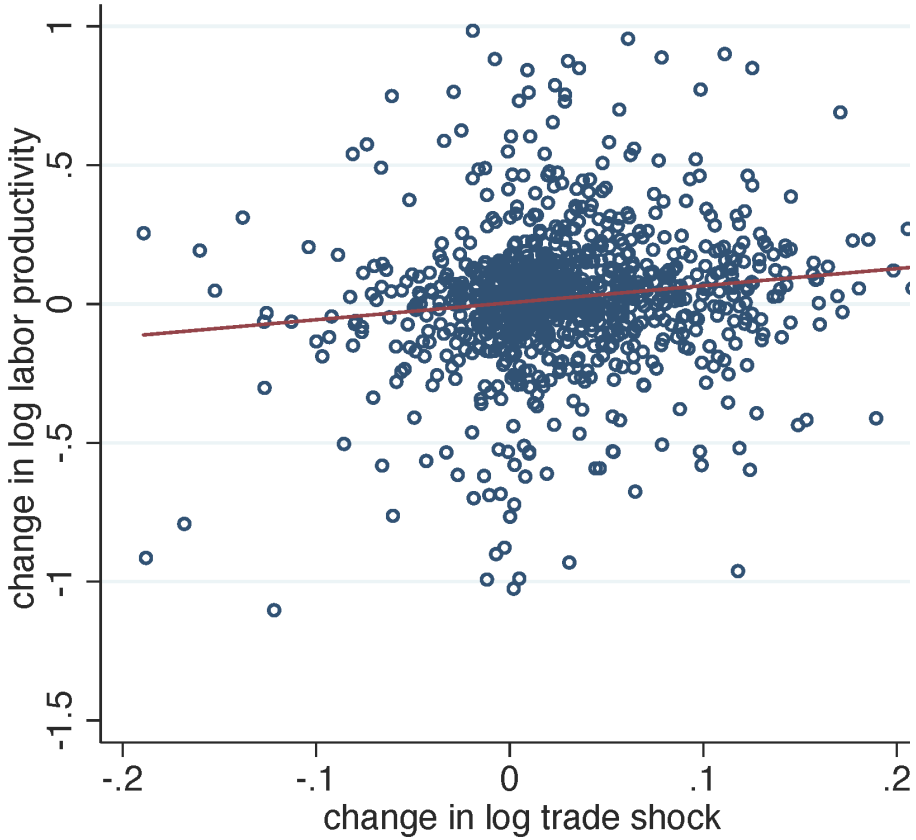
- Firm/product level:

$$TFP_i^Q = \frac{Y_i / P_i}{L_i} \qquad TFP_i^R = \frac{Y_i / \tilde{P}_S}{L_i}$$

- Sector/aggregate level:

$$TFP_S^Q = \frac{Y_S / \tilde{P}_S}{L_S} = \sum_{i \in S} \frac{L_i}{L_S} TFP_i^R$$

Impact of Demand Shocks on Firm Productivity: Largest French Exporters



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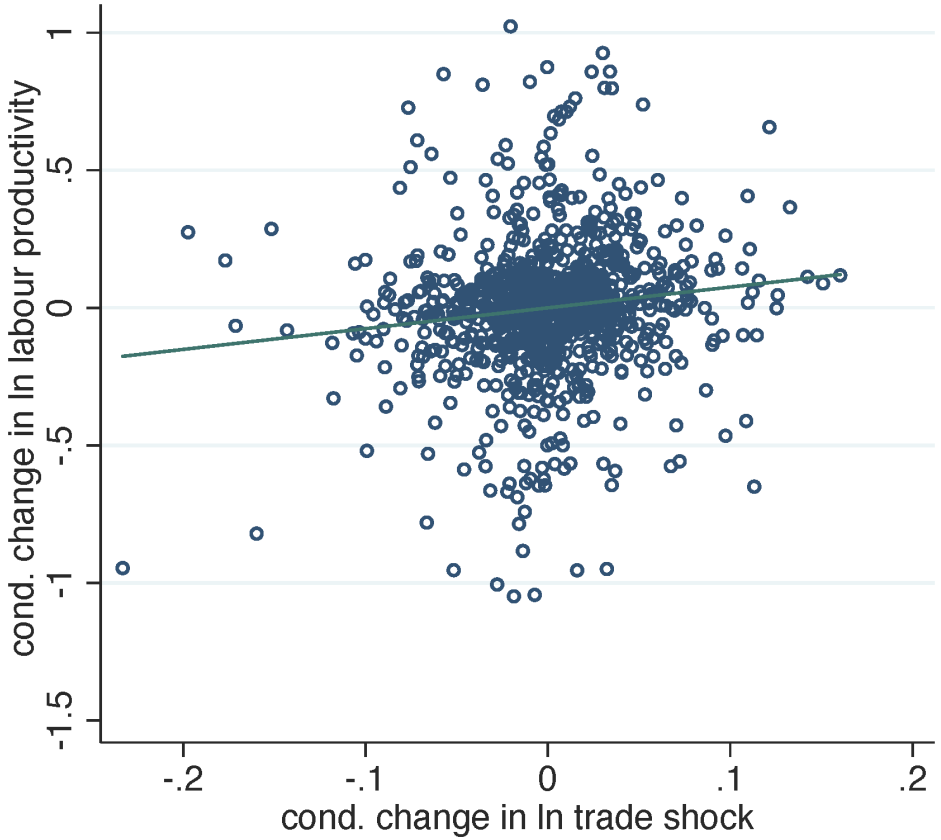
sample: 168 firms representing 50% of French exports in 1996
standard errors clustered by firm



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CounterFactual Bottom Line: Aggregate Effects of Trade Shocks on Productivitv

Industry	prod.	trade shock	% high exp.intens.	% mfg. emp.
Wearing Apparel	3.38	5.21	27.36	2.26
Wood	3.37	6.34	20.36	1.7
Tobacco	3.22	43.6	.48	.16
Printing and publishing	2.81	8.48	5.36	3.31
Radio, television and communication	1.8	4.94	59.77	4.31
Leather and footwear	1.79	3.59	26.86	1.21
Textiles	1.69	1.99	33.04	3.29
Motor vehicles, trailers and semi-trailers	1.62	9.8	52.39	7.82
Machinery	1.32	5.54	45.4	9.12
Manufacturing nec	1.19	5.94	22.72	3.56
Pulp and paper	1.18	3.67	30.62	2.82
Chemicals	1.15	6.58	40.55	9.63
Fabricated metal	.94	7.04	17.41	8.81
Medical, precision and optical instruments	.85	5.84	46.82	3.53
Rubber and plastics	.8	5.75	36.97	7.18
Electrical machinery	.73	5.83	53.12	5.17
Basic metals	.7	6.27	58.91	4.06
Food and beverages	.66	6.2	14.12	11.88
Other transport equipment	.65	7.25	69.14	4.3
Office machinery	.64	3.7	42.55	1.09
Other Non-Metallic Mineral	.46	3.89	35.52	3.86
Coke, ref. petr. and nuclear fuel	-.18	5.12	25.54	.93
Total mfg	1.17	6.2	36.66	100

Do productivity changes generated by reallocations contribute to aggregate gains from trade?

Endogenous Productivity Changes and Aggregate Gains From Trade

- Theoretical comparative static experiment: change the degree of firm heterogeneity holding all other structural parameters constant
- Compare a heterogeneous firm model to a homogeneous firm model special case with a degenerate productivity distribution
  - Calibrate to an initial autarky equilibrium or open economy equilibrium with same aggregate statistics
  - Initial welfare is the same in the two models
  - ... But welfare is strictly higher in the heterogeneous firm model for all other values of trade costs $\longrightarrow$ endogenous productivity effect

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- Holds for general productivity distributions under firm heterogeneity

Extra Slides

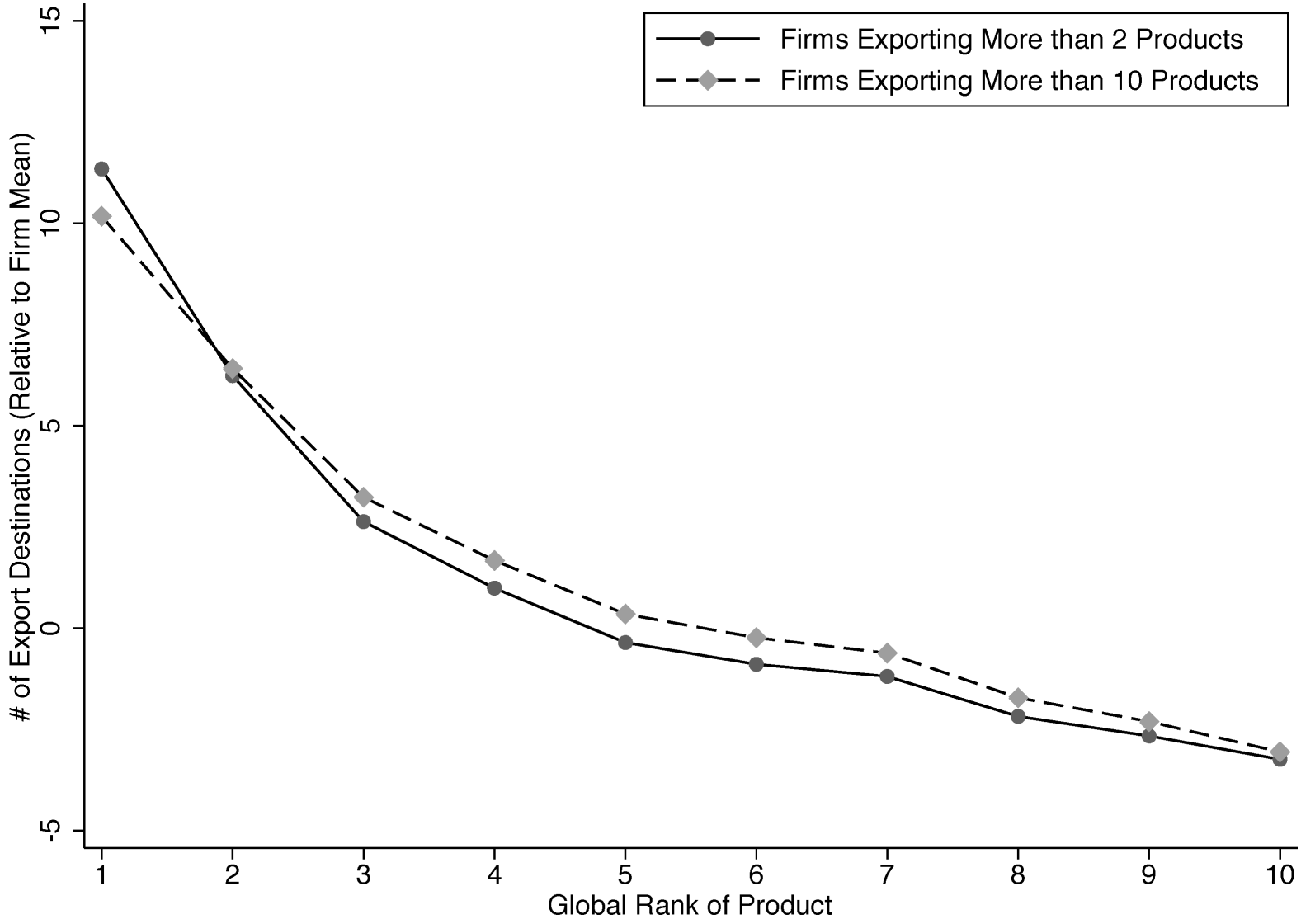
Evidence on Within-Firm Product Ladders

Correlations Between Local and Global Rankings

Table 1: Spearman Correlations Between Global and Local Rankings

Firms exporting at least: to # countries	# products				
	1	2	5	10	50
1	67.93%	67.78%	67.27%	66.26%	59.39%
2	67.82%	67.74%	67.28%	66.28%	59.39%
5	67.55%	67.51%	67.2%	66.3%	59.43%
10	67.02%	67%	66.82%	66.12%	59.46%
50	61.66%	61.66%	61.64%	61.53%	58.05%

Global Ranking and Selection Into the Local Ranking



Back

Reallocations Over Time: Measuring Trade Shocks

- Changes in the destination markets over time also induce similar pattern of reallocations
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  - log $GDP_{d,t}$
  - Total imports into d (in ISIC I) excluding French exports: log $M^I_{d,t}$
  - Both capture demand shocks for French exporters to d (trade-induced for the case of log $M^I_{d,t}$)

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- For all of these demand shocks $X_t = GDP_{d,t}, M^I_{d,t}, M^s_{d,t}$, we compute the first difference as the Davis-Haltiwanger growth rate:

$$\tilde{\Delta} X_t \equiv (X_t - X_{t-1}) \,/\, (.5X_t + .5X_{t-1}) \,.$$

$\longrightarrow$ Shocks in first differences: $\tilde{\Delta} GDP_{d,t}$, $\tilde{\Delta} M^I_{d,t}$, $\overline{\tilde{\Delta} M^s_{d,t}}$

Impact of Trade Shocks on Intensive and Extensive Margins of Firm Export

Dependent Variable	Δ log Exports per Product			Δ log # Products Exported		
$\tilde{\Delta}$ GDP Shock	0.486^a			0.147^a		
	(0.046)			(0.016)		
$\tilde{\Delta}$ Trade Shock		0.273^a			0.075^a	
		(0.009)			(0.004)	
$\tilde{\Delta}$ Trade Shock - ISIC			0.038^a			0.014^a
			(0.005)			(0.002)
Observations	396740	402522	402522	396740	402522	402522

Standard errors in parentheses: $^c < 0.1$, $^b < 0.05$, $^a < 0.01$

Skewness of Product Mix

Dependent Variable	$T^I_{i,d,t}$		$\Delta T^I_{i,d,t}$
Specification	FE	FD	FD-FE
GDP Shock	0.076^a		
	(0.016)		
Trade Shock	0.047^a		
	(0.005)		
Trade Shock - ISIC	0.002^a		
	(0.000)		
$\tilde{\Delta}$ GDP Shock		0.067^a	0.068^a
		(0.012)	(0.016)
$\tilde{\Delta}$ Trade Shock		0.036^a	0.032^a
		(0.005)	(0.006)
$\tilde{\Delta}$ Trade Shock - ISIC		0.006^a	0.004
		(0.002)	(0.003)
Observations	474506	396740	396740

Standard errors in parentheses: $^c < 0.1$, $^b < 0.05$, $^a < 0.01$

Aggregating up to Firm Level

- Aggregate destination-level trade shock to the firm-level:

$$\text{shock}_{i,t} = \sum_d s_{d,t-1} \cdot \text{shock}_{i,d,t} \quad \text{and} \quad \tilde{\Delta}\text{shock}_{i,t} = \sum_d s_{d,t-1} \cdot \tilde{\Delta}\text{shock}_{i,d,t}$$

- This aggregation only includes shocks for export market (but not for domestic market)
- Since cannot measure exogenous shocks for domestic market, adjust shock to reflect export intensity
  (In other words, adjust market shares s_d to reflect sales in domestic market)

$$\text{shock}_{i,t} \times \text{export intensity}_{i,t=0} \quad \text{and} \quad \tilde{\Delta}\text{shock}_{i,t} \times \text{export intensity}_{i,t-1}$$

Note: Use $t = 0$ for levels and $t - 1$ for first difference

Skewness of Global Product Mix

	T_{it}	ΔT_{it}		exp. intens$_{it}$	Δ exp. intens$_{it}$	
	FE	FD	FD-FE	FE	FD	FD-FE
ln GDP shock	0.037^a			0.004^a		
	(0.003)			(0.001)		
ln trade shock	0.018^a			0.002^b		
	(0.003)			(0.001)		
ln trade shock - isic	-0.000			0.001^a		
	(0.001)			(0.000)		
Δ GDP shock		0.117^a	0.105^a		0.032^a	0.035^a
		(0.031)	(0.038)		(0.010)	(0.012)
Δ trade shock		0.054^a	0.048^a		0.019^a	0.016^a
		(0.011)	(0.013)		(0.003)	(0.004)
Δ trade shock - isic		-0.003	-0.009		0.002	0.000
		(0.005)	(0.007)		(0.002)	(0.002)
Observations	118052	118052	118052	110728	107433	107433

Standard errors in parentheses: $^c < 0.1$, $^b < 0.05$, $^a < 0.01$

Effects of Trade-Induced Reallocations on Productivity

New Data and Productivity

- Merge trade data with production data (comprehensive annual census)
  - Adds firm level variables (by year) for input and output use
- Measure productivity as deflated value-added per worker

Aside on TFP^Q versus TFP^R:

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- Sector/aggregate level:

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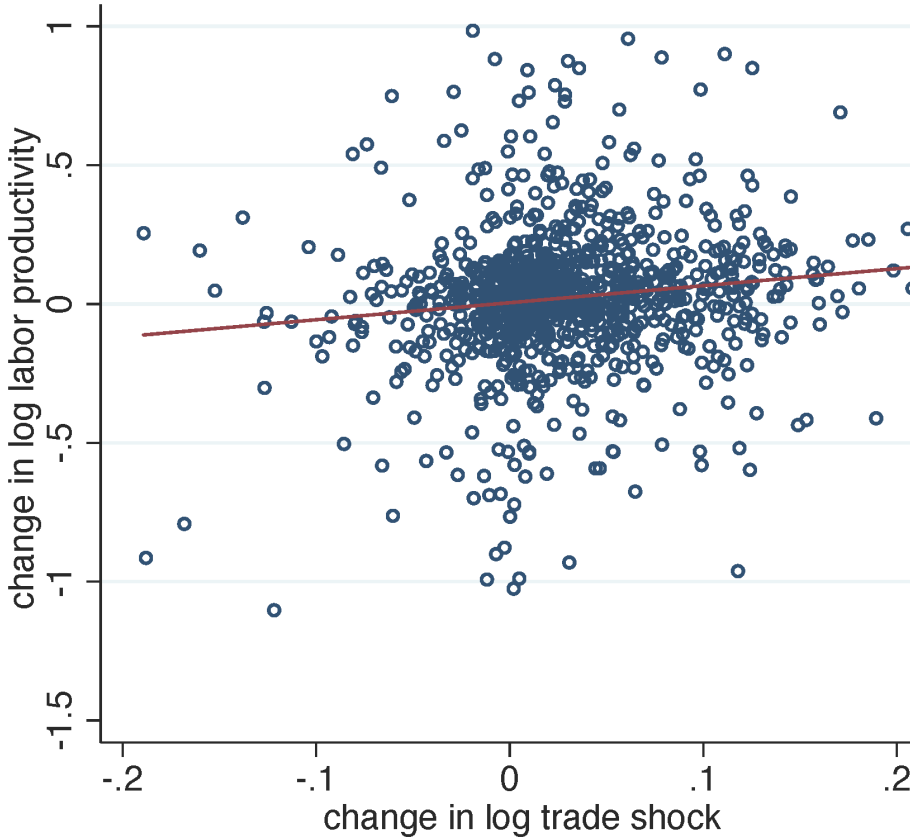
Impact of Demand Shocks on Firm Productivity

Dependent Variable	log prod.	Δ log prod.		log prod.	Δ log prod.	
Specification	FE	FD	FD-FE	FE	FD	FD-FE
log (shock$\times$exp intens)	0.094^a			0.073^a		
	(0.019)			(0.018)		
$\tilde{\Delta}$ (shock$\times$exp intens)		0.134^a	0.116^a		0.108^a	0.096^a
		(0.024)	(0.028)		(0.024)	(0.028)
log K/L				0.228^a		
				(0.007)		
log raw materials				0.091^a		
				(0.004)		
Δ log K/L					0.327^a	0.358^a
					(0.008)	(0.009)
Δ log raw materials					0.100^a	0.093^a
					(0.004)	(0.004)
Observations	213877	188328	188328	201627	174931	174931

Standard errors in parentheses: $^c < 0.1$, $^b < 0.05$, $^a < 0.01$

Impact of Demand Shocks on Firm Productivity: Largest French Exporters



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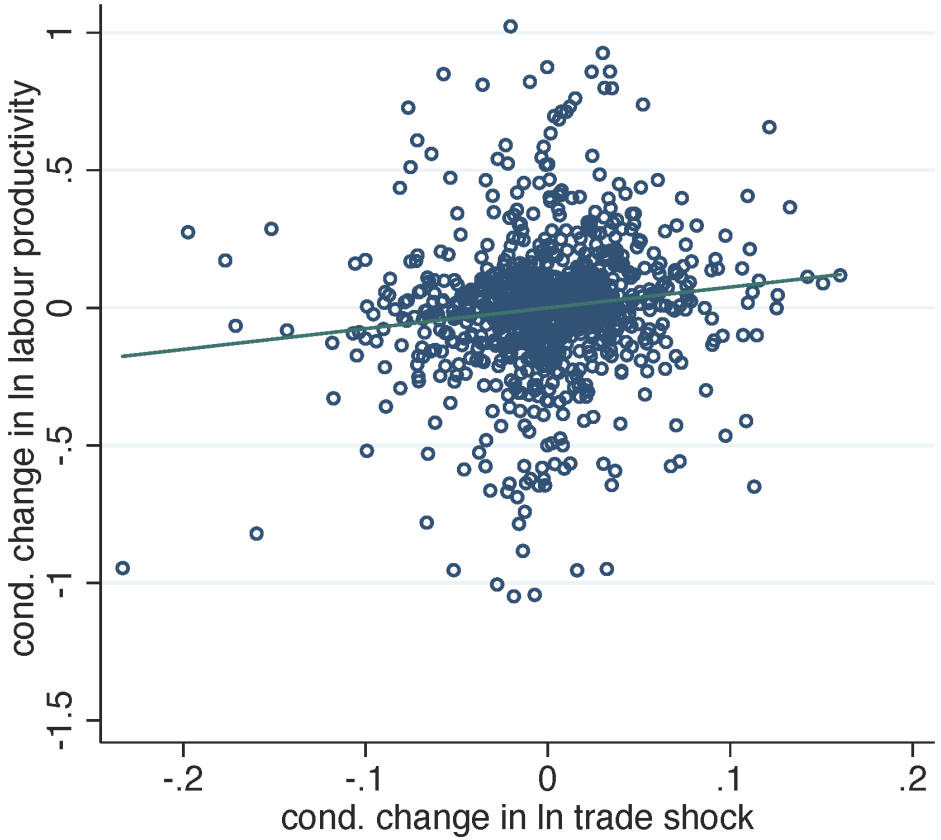

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Robustness – No Reponse of Investment

Dependent Variable	$\ln K/L$	$\Delta \ln K/L$	$\Delta \ln K/L$
Specification	FE	FD	FD-FE
log (trade shock $\times$ export intens.)	-0.018		
	(0.018)		
$\tilde{\Delta}$ (trade shock $\times$ export intens.)		-0.003	-0.005
		(0.017)	(0.020)
Observations	212745	186171	186171

Standard errors in parentheses: $^{c} < 0.1$, $^{b} < 0.05$, $^{a} < 0.01$

Robustness – Returns to Scale

Sample	Employment Increase	Employment Decrease
Dependent Variable	Δ log productivity	Δ log productivity
Specification	FD	FD
$\tilde{\Delta}$ (trade shock $\times$ export intens.)	0.135^{a}	0.156^{a}
	(0.035)	(0.045)
Δ log capital stock per worker	0.288^{a}	0.332^{a}
	(0.012)	(0.013)
Δ log raw materials	0.091^{a}	0.097^{a}
	(0.005)	(0.005)
Observations	69642	65268

Standard errors in parentheses: $^{c} < 0.1$, $^{b} < 0.05$, $^{a} < 0.01$

Robustness – Single Product Firms

Sample	Single Product Firms		
Dependent Variable	log prod.	Δ log prod.	
Specification	FE	FD	FD-FE
log (trade shock $\times$ export intens.)	0.005		
	(0.050)		
log capital stock per worker	0.269^{a}		
	(0.016)		
log raw materials	0.101^{a}		
	(0.010)		
$\tilde{\Delta}$ (trade shock $\times$ export intens.)		-0.021	-0.138^{c}
		(0.062)	(0.079)
Δ log capital stock per worker		0.368^{a}	0.415^{a}
		(0.020)	(0.028)
Δ log raw materials		0.114^{a}	0.090^{a}
		(0.010)	(0.013)
Observations	32870	25330	25330

Robustness – Low/High Export Intensity

Sample	exp. intens. quartile # 1			exp. intens. quartile # 4		
Dependent Variable	log prod.	Δ log prod.		log prod.	Δ log prod.	
Specification	FE	FD	FD-FE	FE	FD	FD-FE
log trade shock	0.009			0.068[a]		
	(0.006)			(0.014)		
log K/L	0.278[a]			0.217[a]		
	(0.022)			(0.015)		
log raw materials	0.070[a]			0.128[a]		
	(0.006)			(0.010)		
$\tilde{\Delta}$ trade shock		0.000	-0.002		0.096[a]	0.100[a]
		(0.007)	(0.009)		(0.017)	(0.021)
Δ log K/L		0.323[a]	0.367[a]		0.325[a]	0.368[a]
		(0.016)	(0.020)		(0.014)	(0.016)
Δ log raw materials		0.070[a]	0.057[a]		0.129[a]	0.123[a]
		(0.006)	(0.006)		(0.008)	(0.010)
Observations	49227	38894	38894	53125	46347	46347

CounterFactual Bottom Line: Aggregate Effects of Trade Shocks on Productivitv

Industry	prod.	trade shock	% high exp.intens.	% mfg. emp.
Wearing Apparel	3.38	5.21	27.36	2.26
Wood	3.37	6.34	20.36	1.7
Tobacco	3.22	43.6	.48	.16
Printing and publishing	2.81	8.48	5.36	3.31
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Pulp and paper	1.18	3.67	30.62	2.82
Chemicals	1.15	6.58	40.55	9.63
Fabricated metal	.94	7.04	17.41	8.81
Medical, precision and optical instruments	.85	5.84	46.82	3.53
Rubber and plastics	.8	5.75	36.97	7.18
Electrical machinery	.73	5.83	53.12	5.17
Basic metals	.7	6.27	58.91	4.06
Food and beverages	.66	6.2	14.12	11.88
Other transport equipment	.65	7.25	69.14	4.3
Office machinery	.64	3.7	42.55	1.09
Other Non-Metallic Mineral	.46	3.89	35.52	3.86
Coke, ref. petr. and nuclear fuel	-.18	5.12	25.54	.93
Total mfg	1.17	6.2	36.66	100