

# Trade Exposure and Earnings Inequality

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PRELIMINARY AND INCOMPLETE

# Research Questions

- 1 **Exposure:** Who is exposed to international trade?
- 2 **Incidence:** How do differences in trade exposure affect inequality?

# This Paper

## 1 New data to measure trade exposure in Ecuador:

- ▶ Each individual is a potentially distinct factor of production
- ▶ Both as a *worker* and a *capital owner*
- ▶ *Export exposure (EE)*: share of factor's services that are ultimately exported—in spirit of Leontief's factor content of trade
- ▶ *Import exposure (IE)*: correlation between factor intensity and ultimate import intensity

## 2 New theoretical decomposition of the effect of trade on inequality:

- ▶ *Exports channel*: relative EE  $\Rightarrow$  shift in relative factor demand curve
- ▶ *Imports channel*: foreign factor services may be closer substitutes to some domestic factors  $\Rightarrow$  relative IE causes another shift in relative factor demand

## 3 Factor demand estimation + counterfactuals:

- ▶ Foreign demand shocks and tariff variation as IV
- ▶ In general: own and cross-price elasticities
- ▶ Today: CES benchmark

## Related Literature

- **Factor content of trade:**

- ▶ Measurement: Leontief (1953), Bowen et al (1987), Davis and Weinstein (2001), Johnson and Noguera (2012), Dhyne et al (2020)
- ▶ For inequality counterfactuals: Deardorff and Staiger (1988), Katz and Murphy (1992), Krugman (2000), Leamer (2000), Burstein and Vogel (2011)

- **Examples of exports channel:**

- ▶ High-quality goods are exported and skill-intensive: e.g. Verhoogen (2008)
- ▶ Larger/more productive activities both exported and more skill-intensive: e.g. Yeaple (2005), Matsuyama (2007), Sampson (2014), Burstein and Vogel (2017), Helpman et al (2017), Antras et al (2017)

- **Examples of imports channel:**

- ▶ Relative substitutability: Stolper-Samuelson, etc.
- ▶ Imported intermediates: Feenstra and Hanson (1996), Grossman and Rossi-Hansberg (2008), Burstein et al (2013), Hummels et al (2014)

- **Earnings inequality with individual capitalists:**

- ▶ Piketty et al (2018), Smith et al (2019)

Data

# Administrative Microdata on Firms and Individuals in Ecuador (2008-2015)

- **Corporate income tax filings**
  - ▶ Firm revenues, costs, profits
- **VAT filings: matched firm-to-firm data**
  - ▶ Transactions between all formal firms
- **Customs records**
  - ▶ Transaction-level imports & exports by firm
- **Social security filings: matched employee-employer data**
  - ▶ Income of all formal workers in the economy
- **Civil registrar filings: matched firm-owner data**
  - ▶ Share of each private firm owned by each taxpayer
  - ▶ Publicly listed firms a minor share of economy

## Measuring export exposure (EE)

- Individuals' earnings exposure to exports (direct + indirect):

$$W^X = A(I - B)^{-1}X$$

- Where

- ▶  $B$  is firm-to-firm input share matrix (firm-to-firm VAT data)
- ▶  $A$  is matrix where each row measures an individual's share in the value-added of the firm in each column (employer-employee, capital ownership data)
- ▶  $X$  is vector of firm-level export sales (customs data)

- Let  $W_i$  be individual  $i$ 's earnings. Export exposure (EE) is

$$EE_i \equiv \frac{W_i^X}{W_i}$$

## Measuring import exposure (IE)

- Individuals' earnings exposure to imports (direct + indirect):

$$W^M = \tilde{A}(I - B')^{-1}M$$

- Where

- ▶  $B$  is firm-to-firm input share matrix (firm-to-firm VAT data)
- ▶  $\tilde{A}$  is matrix where each row has indicators for the firm in each column with the individuals' main income source (employer-employee, capital ownership data)
- ▶  $M$  is vector of firm-level import value as a share of total cost (customs data)

- Import exposure (IE) for individual  $i$  is

$$IE_i \equiv W_i^M$$



Who is exposed to international trade?

## Trade exposure and income across individuals

$$\ln W_i = \beta_E EE_i + \beta_I IE_i + u_i$$

(1)	
$\beta_E$	-0.014*** (0.0037)
$\beta_I$	1.208*** (0.0062)
$R^2$	0.022

*Note.* Sample of 1,673,693 individuals. Robust standard errors in parentheses. \*\*\*  $p < 0.01$

- $\beta_E < 0$ : Higher export exposure for individuals with lower income
- $\beta_I > 0$ : Higher import exposure for individuals with higher income
- Low  $R^2$ : trade exposure explain small fraction of income inequality

## Firm-to-firm links attenuate relationship

$$\ln W_i = \beta_E EE_i + \beta_I IE_i + u_i$$

	(1)	(2)
$\beta_E$	-0.014*** (0.0037)	-0.049*** (0.0046)
$\beta_I$	1.208*** (0.0062)	1.618*** (0.0084)
$R^2$	0.022	0.022
Exposure computed with		
Firm trade	Yes	Yes
Firm-to-firm links	Yes	No

Note. Sample of 1,673,693 individuals. Robust standard errors in parentheses. \*\*\*  $p < 0.01$

- Adding firm-to-firm links reduce both coefficients  $\Rightarrow$  Indirect firm-to-firm links make trade exposure more even across individuals.

## Observables account for most of export exposure

$$\ln W_i = \beta_E EE_i + \beta_I IE_i + Z_i \gamma + u_i$$

- $Z_i$ : 1,320 dummies for industry-province-education triples

	(1)	(2)
$\beta_E$	-0.014*** (0.0037)	0.006 (0.0047)
$\beta_I$	1.208*** (0.0062)	1.209*** (0.0072)
$R^2$	0.022	0.073
	All	Within

Note. Sample of 1,673,693 individuals. Robust standard errors in parentheses. \*\*\*  $p < 0.01$

- Weaker correlation between income and export exposure across firms in each industry-education-province
- Similar relation with import exposure within industry-education-province

## Observables account for most of export exposure

$$\widehat{\ln W}_i = \beta_E \widehat{EE}_i + \beta_I \widehat{IE}_i + u_i$$

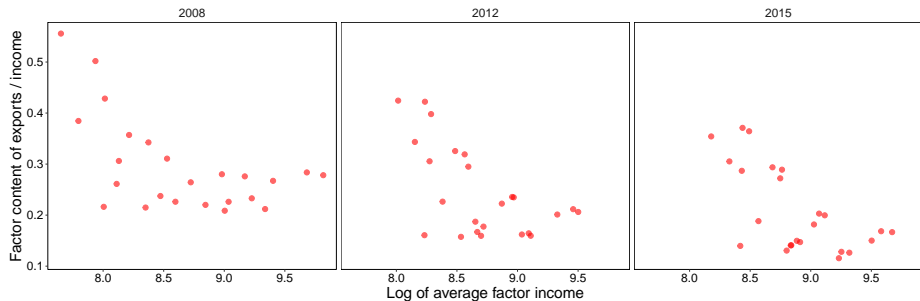
- “ $\widehat{\phantom{x}}$ ” denotes predicted variable obtained from regression on 1,320 dummies for industry-province-education triples in  $Z_i$

	(1)	(2)
$\beta_E$	-0.014*** (0.0037)	-0.044*** (0.0014)
$\beta_I$	1.208*** (0.0062)	1.213*** (0.0028)
$R^2$	0.022	0.102
	All	Between

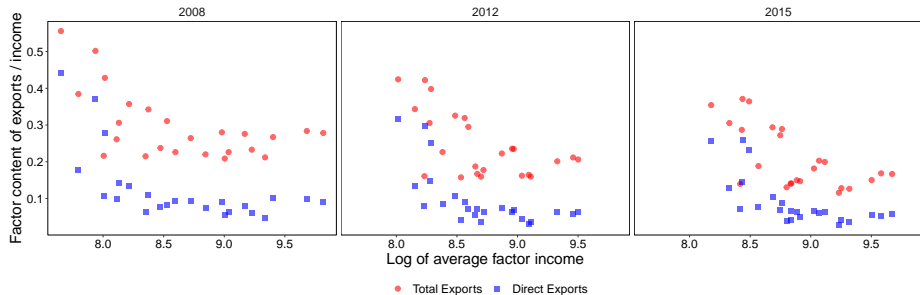
Note. Sample of 1,673,693 individuals. Robust standard errors in parentheses. \*\*\*  $p < 0.01$

- Stronger relation between income and export exposure across industry-province-education triples

# EE by Labor Factor Group



# EE by Labor Factor Group: Direct vs Total

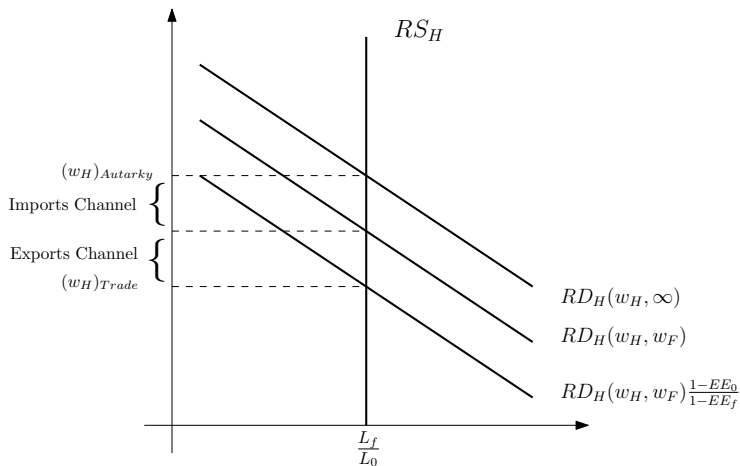


NB: "total EE" corresponds to  $A(I - B)^{-1}X$ ; "direct EE" corresponds to  $AX/W$

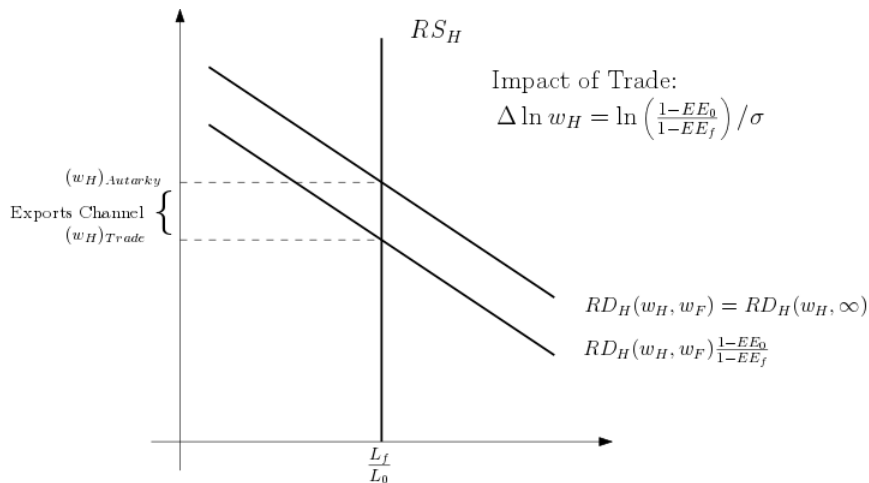
# How Do Differences in Trade Exposure Affect Inequality?



# The Simple Economics of Trade and Inequality: Decomposition into Exports and Imports Channels



## A Simple Benchmark (For Now): CES Factor Demand



Under CES factor demand (e.g. Antras, de Gotari and Itskhoki, 2017), import channel is zero since  $w_F$  doesn't affect relative domestic factor demand

# CES Factor Demand Estimation

- Estimating equation (for inverse factor demand function):

$$\Delta \log w_{f,t} = -\frac{1}{\sigma} \Delta \log(1 - EE_{f,t}) + \alpha_t + \varepsilon_{f,t} \quad \forall f \in L$$

- Requires IV. Use shift-share:

$$\Delta Z_{f,t} = \sum_i EE_{f,2008}(i) \Delta \log M_t^{US}(i)$$

- Where:

- ▶  $\Delta \log M_t^{US}(k)$ : US import growth in agriculture & mining product  $k$
- ▶  $EE_{f,2008}(k)$ : EE by factor  $f$  in product  $k$  (in 2008)

## IV Estimates

$$\Delta \log w_{f,t} = \beta \Delta \log(1 - EE_{f,t}) + \alpha_t + \varepsilon_{f,t}$$

Dep. Var.:	$\Delta \log w_{f,t}$	
	OLS	IV
	(1)	(2)
$\Delta \log(1 - EE_{f,t})$	1.75* (0.96)	-2.23** (1.07)
First-stage F-stat		39.2

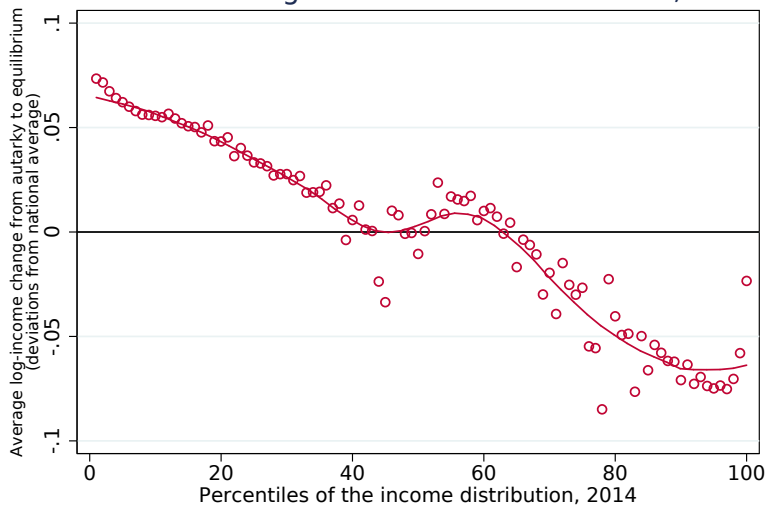
*Note:* Standard errors clustered at the factor level.

- $\beta = -1/\sigma$
- IV estimate implies  $\hat{\sigma} = -\frac{1}{\hat{\beta}} = \frac{1}{2.23} = 0.45$

# How Trade Affects Earnings Inequality

- Now calculate  $\Delta \ln(w_f/w_0) = \frac{1}{\sigma} \ln\left(\frac{1-EE_0}{1-EE_f}\right)$

Distribution of gains from trade in Ecuador, 2014



# Conclusion

# Concluding Remarks

- 1 **Exposure:** Who is exposed to international trade?
  - ▶ New data allows link from trade flows to the individuals (workers and capital owners) who are involved, directly and indirectly.
  - ▶ Export exposure (EE) and import exposure (IE)
  
- 2 **Incidence:** How do differences in trade exposure affect inequality?
  - ▶ Export channel: EE shifts factor demand, effect depends on factor demand elasticity
  - ▶ Import channel: IE shifts factor demand, depends on cross-factor price elasticities
  
- In progress:
  - 1 Incorporate capital ownership
  - 2 Estimate strength of import channel

## Additional Material



Dep. Var.:	$\Delta \log w_{f,t}$			$\Delta \log(1 - EE_{f,t})$
	OLS	2SLS	RF	FS
	(1)	(2)	(3)	(4)
$\Delta \log(1 - EE_{f,t})$	1.75*	-2.23**		
	(0.96)	(1.07)		
Shift-Share IV			0.51**	-0.23***
			(0.22)	(0.04)
F-stat		39.2		

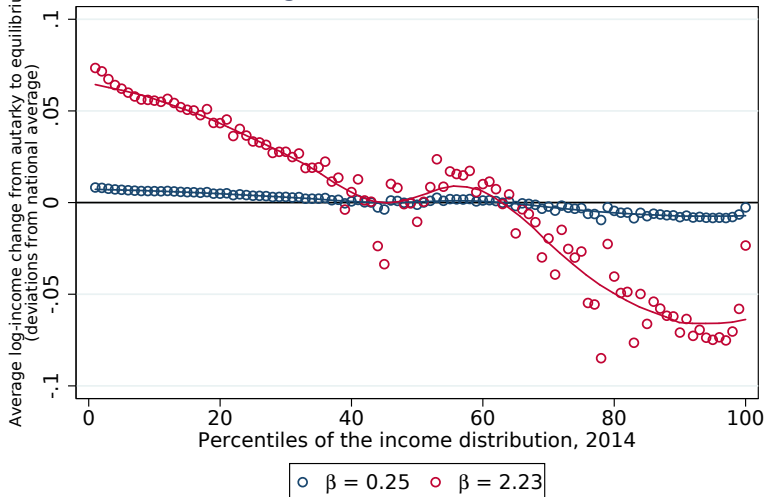
Note: N = 150 (25 factors in 2008-2015). All regressions include time fixed effects and the factor's export share of income in 2008.

▶ Baseline

# Robustness I: Control Set

	Dep. var.: $\Delta \log w_{f,t}$				
	IV (1)	IV (2)	IV (3)	IV (4)	IV (5)
$\Delta \log(1 - EE_{f,t})$	-2.230** (1.068)	-2.491* (1.301)	-2.448 (1.489)	-3.171** (1.568)	-2.801* (1.546)
F-stat	39.19	38.92	35.79	38.87	38.51
<b>Controls</b>					
Time dummies	X	X	X	X	X
Export share in 2008		X	X	X	X
Avg wage in 2008			X		X
Group time trend				X	X

## Distribution of gains from trade in Ecuador, 2014



## Distribution of gains from trade in Ecuador, 2014

