Intra- and inter-industry misallocation and comparative advantage

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Job Market Seminar
January 2018

Introduction

- Comparative advantage (CA) is one of the main explanations of bilateral trade flows.
- This paper shows that firm-level factor misallocation (FM) can alter the relative unit costs of producing a good across industries, distorting the "natural" CA of a country.
  - FM: The extent in which the marginal returns of the factors varies across firms.
  - Literature on FM has focused on closed economies: effect on aggregate TFP.

Two types of FM

- In an open economy, FM can shape CA at two levels of aggregation:
  - **Differences in FM within industries:** Larger extent of intra-industry FM $\Rightarrow$ larger TFP losses.
  - **FM between industries:** If firms in an industry exhibit on average larger marginal returns to factors $\Rightarrow$ industry' size is too small and average productivity is too high.
- Examples: East Asian industry policies during post-war period, import substitution schemes in Latin America during 60-70's.

Main questions

1. Are observed patterns of CA related to both types of FM?
2. What are the implications of removing FM for CA taking into account general equilibrium effects?

Outline (I)

1. Are both types of FM related to observed patterns of CA?

- Using Colombian firm-level data, I present evidence on how metrics of FM are related to measures of "revealed comparative advantage" (RCA).
  - Colombian prices at the firm-level makes it possible to obtain direct measures of physical productivity.
  - As a RCA measure, I use the estimates of the exporter-industry fixed effect derived from a gravity equation.
- I find that both types of FM have a quantitative importance similar to the Ricardian and Heckscher-Ohlin determinants.

Outline (II)

2. What are the implications of removing FM for CA taking into account general equilibrium effects?

- I use a general equilibrium model of international trade with endogenous selection of heterogeneous firms and both types of FM, to compute a counterfactual in which FM is removed in Colombia.
- Removing FM allows Colombia to specialize in industries with "natural" CA.
  - Industrial composition substantially changes.
- I decompose the change in the RCA in the contributions of the **extensive** (number of varieties produced) and **intensive** margin (average price).
  - Extensive margin drives the results.

Related literature

1. On FM:

- **Endogenous selection:** Bartelsman et al. (2013), Yang (2017), Adamopoulos et al. (2017).
- **Intra/inter-industry types:** Oberfield (2013), Brandt et al. (2013).
- **Wedge analysis:** Restuccia and Rogerson (2008) and Hsieh and Klenow (2009) (inspired by the business cycle literature).

2. On trade:

- **Trade reforms and intra- and inter-industry factor reallocation:** Bernard et al. (2007), Balistreri (2011).
- **CA measures:** Costinot et al. (2012), Levchenko and Zhang (2015), Hanson et al. (2016), French (2017).
- **Sources of CA:** Beck (2002), Levchenko (2007), Bombardini et al. (2012), Nunn and Trefler (2015).

3. Intersection of 1 and 2:

- **Trade liberalization in an economy with factor distortions:** Ho (2012), Tombe (2015), Święcki (2017).

Contents

RCA measure

- New trade models deliver theoretically grounded gravity equations.
- Gravity structure allows to decompose bilateral log of exports x_{ijs} (i exporter, j importer, s sector) in three terms:

$$lnx_{ijs} = \delta_{is} + \delta_{js} + \delta_{ij} + \varepsilon_{ijs}$$

1. δ_{is}: Exporting country's export capability in s
2. δ_{js}: Importing country's demand for foreign goods in s
3. $\delta_{ij} + \varepsilon_{ijs}$: Bilateral accessibility of destination to exporter (trade costs + other bilateral frictions)

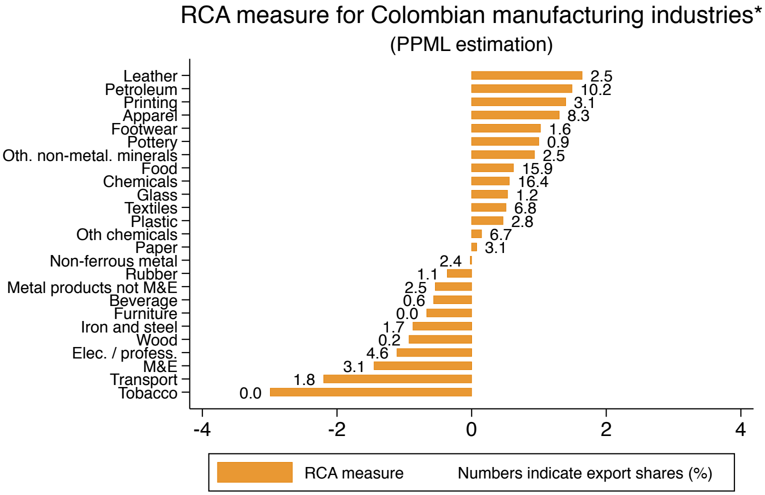
RCA measure

- New trade models deliver theoretically grounded gravity equations.
- Gravity structure allows to decompose bilateral log of exports x_{ijs} (i exporter, j importer, s sector) in three terms:

$$lnx_{ijs} = \delta_{is} + \delta_{js} + \delta_{ij} + \varepsilon_{ijs}$$

  - Let $\hat{\delta}_{is}$ an estimate of δ_{is}. A revealed comparative advantage (RCA) measure is: $RCA_{is} = exp[(\hat{\delta}_{is} - \hat{\delta}_{is'}) - (\hat{\delta}_{i's} - \hat{\delta}_{i's'})]$
    - Same as Costinot et al. (2012) or Hanson et al. (2016).
  - Set of 48 ▸ Countries, 26 ▸ Sectors for 1995, global means for i' and s', as in Hanson et al. (2016). Estimated by Poisson-PML

RCA for Colombia



*Relative to the mean industry and the mean country in the world, for 1995.
Manufacturing exports are 65% of the total exports in Colombia

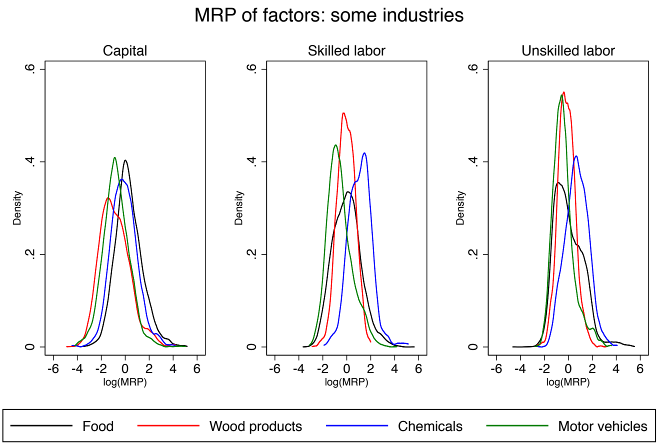
PPML vs Tobit | Export composition

An efficient allocation of resources

- Assume firms are heterogenous in TFP, but all firms in an industry use the factors with the same intensity.
- Under the standard monopolistic competition setting (Dixit-Stiglitz preferences and constant returns to scale production functions), in an efficient allocation:
    1. Marginal revenue products (MRP) of factors are equalized across all firms.
    2. Industry's TFP is a power mean of firm-level *physical* productivities (TFPQ).

MRP distributions

- To visualize MRP, assume Cobb-Douglas technology, no fixed costs.



*MRP: Marginal revenue product.
CD-GO specification, controlling for year FE. Source: Colombian AMS.

Other explanations

Measures of misallocation

- Two possible measures of **intra-industry FM**:
  1. Ratio sectoral TFP to efficient TFP: $A_{is} / A^e_{is} = AEM_{is}$
  2. Dispersion in firm-level *revenue* productivity (TFPR): $\sigma^2_{TFPR_{is}}$
     - Since TFPR (revenues/composite factor) is a geometric average of the factors' MRP. Formulas
- To measure **inter-industry FM**, I compute an appropriate average of factors' MRP in the industries.
  - Sectoral TFPR can be expressed as the geometric average of the inter-industry measures. Importance

1. Introduction
2. Definitions and motivation
   - Revealed comparative advantage (RCA) measure
   - Intra and inter-industry misallocation measures
   - RCA and misallocation
3. Theoretical framework
   - Model
   - Gravity equation
4. Empirical implementation
   - Counterfactual exercise
   - Baseline results

RCA and misallocation: A simple test (I)

- RCA is determined by $\frac{P_{is}}{P_{is'}} / \frac{P_{i's}}{P_{i's'}}$, where P_{is} is the sectoral PPI.
- PPI is simply: $P_{is} = \frac{TFPR_{is}}{A_{is}}$ ▸ Proof
  - Sectoral TFP, A_{is}, is the product of:
    1. Efficient TFP: A^e_{is} (*Ricardian CA*).
    2. Measure 1 of intra-industry FM, AEM_{is}.
  - Sectoral $TFPR_{is}$ is the product of the geometric average of:
    1. Factor prices in the efficient allocation: They depend on factor endowments and factor intensities (*Heckscher-Ohlin CA*) ▸ Formula
    2. Inter-industry FM measures.
- To use the direct measures of TFPQ available in Colombia, I use a two-stage strategy that exploits the variation over time of the Colombian RCA in panel data.

RCA and misallocation: A simple test (II)

1. **1st stage:** Estimate the panel-version of the FE regression:

$$lnX_{ijst} = \delta_{ist} + \delta_{ijt} + \delta_{jst} + \varepsilon_{ijst}$$

where $\hat{\delta}_{ist}$ identifies $dRCA_{ist}$, the change of RCA_{is} from t' to t.

- $\hat{\delta}_{ist}$ should be related to $\left(\frac{P_{ist}}{P_{is't}} / \frac{P_{ist'}}{P_{is't'}}\right) / \left(\frac{P_{i'st}}{P_{i's't}} / \frac{P_{i'st'}}{P_{i's't'}}\right)$

2. **2nd stage:** Regress $\hat{\delta}_{ist}$ for Colombian industries on the 4 determinants of CA, using for each independent variable v_{ist} the transformation:

$$\tilde{v}_{ist} = \left(\frac{v_{ist}}{v_{is't}} / \frac{v_{ist'}}{v_{is't'}}\right) / \left(\frac{P_{i'st}}{P_{i's't}} / \frac{P_{i'st'}}{P_{i's't'}}\right)$$

- where i' US, t' first year and s' sector with the median number of zeros.

Results

- Both types of FM have a quantitative importance similar to Ricardian and Heckscher-Ohlin determinants.

Second-stage results. First stage: FE by PPML

	(1)	(2)
Measure 1 of intra-industry FM	0.358***	
(AEM_{is})	(0.082)	
Measure 2 of intra-industry FM		-0.145**
$(\sigma^2_{TFPR_{is}})$		(0.060)
Measure of inter-industry FM	-0.351***	-0.241***
	(0.081)	(0.088)
Efficient TFP	0.244**	0.234**
	(0.090)	(0.098)
Factor prices	-0.318***	-0.197**
	(0.066)	(0.076)
Observations	208	208
R-square	0.327	0.266

* $p<0.10$, ** $p<0.05$ and *** $p<0.01$. Dependent variable is $dRCA_{ist}$, the change in the RCA measure with respect to the first period. All independent variables are transformed to be changes with respect to the first period relative to the reference industry, normalized by the corresponding changes in the US PPI. Standardized coefficients and heteroskedastic robust errors.

Model outline

- **Model:** Multi-country, multi-sector and multi-factor Melitz (2003) model (as in Bernard et al., 2007), with dispersion in factor's MRP.
- **Main difference with allocative efficient Melitz**: FM distorts selection in the domestic and exporting markets:
  - There are "zombie" and "shadow" firms (Yang, 2017).

Model description (I)

- **Notation:**
  - m =variety, i =exporting country, j =importing country, s =industry, l =homogenous production factor.
  - N countries, S industries, L primary factors.
  - I omit sector subscripts for firm variables.
- **Demand system**: Upper-level Cobb-Douglas with expenditure shares β_{is}; lower-level CES, elasticity of substitution σ, let $\rho = \frac{\sigma-1}{\sigma}$.
- **Trade costs:** Iceberg trade cost $\tau_{ijs} \geq 1$, with $\tau_{iis} = 1$ and access fixed cost f_{xijs}.
- **Fixed cost of production:** f_{is}. Define $f_{ijs} = f_{xijs}$ if $j \neq i$; $f_{iis} = f_{xiis} + f_{is}$ otherwise.

Model description (II)

- **Firms:** Characterized by a TFPQ a_{im} and a vector of L factor-distortions: $\vec{\theta}_{im} = \{\theta_{i1m}, \theta_{i2m}, ...\theta_{iLm}\}$ drawn from a joint ex-ante distribution $G_{is}(a, \vec{\theta})$.
  - Technology to produce q_{im} units of m is Cobb-Douglas, using factors z_{ilm} with intensities α_{ls}.
  - For the firms with $\vec{\theta}_{im} = 0$, factor price of l is w_{il}.
  - Cost to sell in country j :

$$c_{ijm}(q_{ijm}) = \omega_{is}\Theta_{im}(\frac{\tau_{ijs}q_{ijm}}{a_{im}} + f_{ijs})$$

with: $\Theta_{im} = \prod_{l}^{L}(1+\theta_{ilm})^{\alpha_{ls}}$ and $\omega_{is} = \prod_{l}^{L} w_{il}{}^{\alpha_{ls}}$

- MRP of factor l: $(1+\theta_{ilm})\frac{w_{il}}{\rho}$ and TFPR: $\Theta_{im}\frac{\omega_{is}}{\rho}$.

Model description (III)

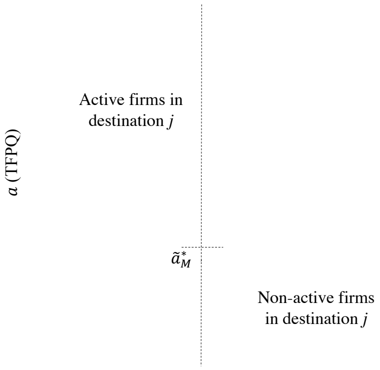
- **Entry/exit:** Exogenous probability of exit δ_{is}, entry cost f_{is}^{e}.
- **Inter-industry misallocation:** Define $(1+\bar{\theta}_{ls}) = (\sum_{m}^{M_s} \frac{1}{(1+\theta_{lm})} \frac{c_{im}}{C_{is}})^{-1}$, with $c_{im} = \sum_{j}^{N} c_{ijm}$ and $C_{is} = \sum_{m}^{S} c_{im}$.
  - $(1+\bar{\theta}_{ls})$ is an "inter-industry wedge": It affects factors that are use for production.
- **Competitive equilibrium:** Defined by free entry, aggregate stability, zero profit, factor market clearing and trade balanced conditions.

Equilibrium

Effects of FM on selection

- In the standard Melitz model, there is a productivity cutoff for each i, j, s given by the zero profit (ZP) condition: $\pi_{ijs}(\widetilde{a}_{ijs}) = 0$

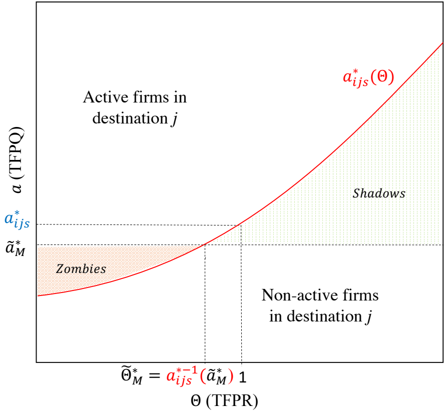
Productivity cutoff ($\widetilde{a}_M$) of country i in sector s for destination j



Effects of FM on selection

- With FM, ZP condition is: $\pi_{ijs}\left(a^*_{ijs}(\Theta), \Theta\right) = 0$. Define $a^*_{ijs} \equiv a^*_{ijs}(1)$, then: $a^*_{ijs}(\Theta) = a^*_{ijs}\Theta^{\frac{1}{\rho}}$

Cutoff frontier $a^*_{ijs}(\Theta)$ of country i in sector s for destination j



Evidence on the effects of FM on selection: exporters

- Factor misallocation affects the selection of exporters.

LPM of being a exporter explained by TFPQ and TFPR for Colombia

	(1)	(2)	(3)	(4)
TFPR	0.043***	-0.178***	-0.139***	-0.141***
	(0.004)	(0.005)	(0.007)	(0.007)
TFPQ		0.177***	0.148***	0.150***
		(0.004)	(0.005)	(0.005)
Demand shock		0.093***	0.080***	0.080***
		(0.001)	(0.002)	(0.002)
Year FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Firm controls			Yes	Yes
Location FE				Yes
N	47692	47692	39969	39904
R^2	0.058	0.219	0.233	0.235

* p<0.10, ** p<0.05 and *** p<0.01. Dependent variable: probability of being a exporter. All independent variables are in deviations over industry means. Firm controls: Size, age and lagged capital. Heteroskedastic robust errors.
Source: EAM Colombia, 1982-1991.

Probit | Domestic

Assumptions

- For tractability, consider:

A1.Pareto distribution

$$\forall a_i > \bar{a},\ \ G^{a}_{is}(a) = 1 - (\tfrac{\bar{a}_{is}}{a})^{\kappa};\ \ \kappa > \sigma - 1;$$

A2.Ex-ante independence

$$G_{is} = G_{is}(a, \vec{\theta}) = G^{a}_{is}(a)\, G^{\theta}_{is}(\vec{\theta})$$

Results under A1 and A2

1. The total inter-industry wedge is:

$$v_{ils} = \frac{1}{(1+\bar{\theta}_{ils})}(1-\frac{\rho}{\kappa}) + \frac{\rho}{\kappa}$$

   and we can express: $w_{il} Z_{ils} = \alpha_{ls} v_{ils} R_{is}$

2. We can write:

$$log(\frac{X_{ijs} X_{i'js'}}{X_{ijs'} X_{i'js}}) = log[\underbrace{\frac{\varrho_{is}\varrho_{i's'}}{\varrho_{is'}\varrho_{i's}} \frac{\Gamma_{is}\Gamma_{i's'}}{\Gamma_{is'}\Gamma_{i's}} \frac{R_{is} R_{i's'}}{R_{is'} R_{i's}} (\frac{\omega_{is}\omega_{i's'}}{\omega_{is'}\omega_{i's}})^{-\frac{\kappa}{\rho}}}_{Exp \times Ind\ \ FE = RCA}] + B_{ijs}$$

   with $\Gamma_{is} = \int_{\theta_{i1}} \dots \int_{\theta_{iL}} \Theta_i^{1-\frac{\kappa}{\rho}} dG^{\theta}_{is}(\vec{\theta})$ and $\varrho_{is} = \frac{\bar{a}^{\kappa}_{is}}{d_{is} f^{e}_{is}}$

   1. Further, RCA can be decomposed in its 3 determinants: i) Average TFP; ii) factor prices; iii) number of varieties. Decomposition Simulation

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Counterfactual exercise

- I perform the counterfactual exercise of removing both types of factor misallocation in Colombia.
  - For solving the model I use the exact hat algebra approach of Deckle *et al.* (2008).
  - Set of 48 Countries, 25 Sectors for 1995
  - GO production function with 3 primary factors (capital, skilled and unskilled labor) and materials.
  - Parameters: $\kappa = 4.6$ and $\sigma = 3.5$.
- Wedges are measured assuming log-normal joint distribution to link ex-post to ex-ante parameters, and taking into account measurement error in both revenues and inputs (following Bils et al., 2017). Wedges

Solving the model with exact hat algebra

- Denote $\tilde{Z}_{ils}$ the share of factor l ($\tilde{Z}_{ils} \equiv \frac{Z_{ils}}{\bar{Z}_{il}}$) and π_{ijs} trade shares.
- For any x in the initial equilibrium denote x' its counterfactual value and $\hat{x} \equiv \frac{x'}{x}$. Under A1 and A2 we have:

$$
\begin{aligned}
\hat{w}_{il} &= \sum_s^S \tilde{Z}_{ils} \hat{R}_{is} \hat{v}_{ils} \\
R_{is}\hat{R}_{is} &= \sum_j^N \pi'_{ijs} \beta_{js} \left(\sum_s^S R_{js}\hat{R}_{js} - D_j \hat{D}_j\right) \\
\pi'_{ijs} &= \frac{\pi_{ijs} \left(\prod_l^L \hat{w}_{il}^{\frac{-\kappa\alpha_{ls}}{\rho}}\right) \hat{\Gamma}_{is} \hat{R}_{is}}{\sum_k^N \pi_{kjs} \left(\prod_l^L \hat{w}_{kl}^{\frac{-\kappa\alpha_{ls}}{\rho}}\right) \hat{\Gamma}_{ks} \hat{R}_{ks}}
\end{aligned}
$$

Solving the model with exact hat algebra

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\end{aligned}
$$

Objective: derive the impact of removing misallocation (through $\hat{v}_{ils}$ and $\hat{\Gamma}_{is}$) on $\hat{R}_{is}$ and $\hat{w}_{il}$.

Solving the model with exact hat algebra

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\end{aligned}$$

Required info: observable π_{ijs}, $\tilde{Z}_{ils}$ R_{is}, D_i, coefficients α_{ls}, β_{is}; assumptions on $\hat{D}_j$ and parameters κ and σ.

Welfare

- Once $\hat{R}_{is}$ and $\hat{w}_{il}$ are obtained, it is straightforward to compute changes in aggregate expenditure and trade shares: $\hat{E}_i$ and $\hat{\pi}_{ijs}$.
- The cost of each type of misallocation in terms of welfare, measured as total real expenditure, can be computed from:

$$\frac{\hat{E}_i}{\hat{P}_i^d} = \prod_s^S \left[\hat{E}_i^{\frac{1}{\kappa} - \frac{1}{\rho}} \left(\frac{\hat{\pi}_{iis}}{\hat{R}_{is} \hat{\Gamma}_{is}} \right)^{\frac{1}{\kappa}} \prod_l^L \hat{w}_{il}^{\frac{\alpha_{ls}}{\rho}} \right]^{-\beta_s}$$

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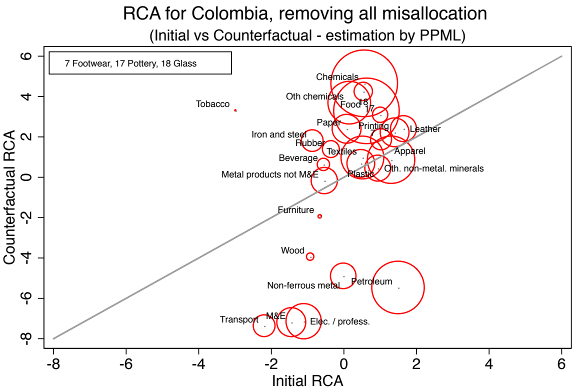
Aggregate results

	Change in each variable after removing factor misallocation in Colombia					
Variable	Revenue	Value added	Exports	Exports /GDP*	RCA s.d.*	Welfare
Counterfactual	$\hat{R}_{Col}$	$\hat{GDP}_{Col}$	$\hat{X}_{Col}$	$\Delta(\frac{X}{GDP})_{Col}$	$\Delta\sigma_{RCA_{Col}}$	$\frac{\hat{E}_{Col}}{\hat{P}_{Col}}$
Baseline results						
Both types	1.54	2.22	4.78	0.18	2.60	1.75
Only intra-industry	1.41	1.92	3.59	0.13	1.95	1.56
Only inter-industry	1.04	1.09	1.57	0.07	1.69	1.08

Note: Each cell shows the proportional change in each variable between the counterfactual equilibrium and the actual data. For variables marked by *, the simple difference in the measure is displayed.

Counterfactual RCA - Removing both types (I)

- The efficient allocation involves much more specialization, and a substantial change in industrial composition (4 industries disappear).



Note: Marker' sizes represent export shares in the actual data

Revenue shares

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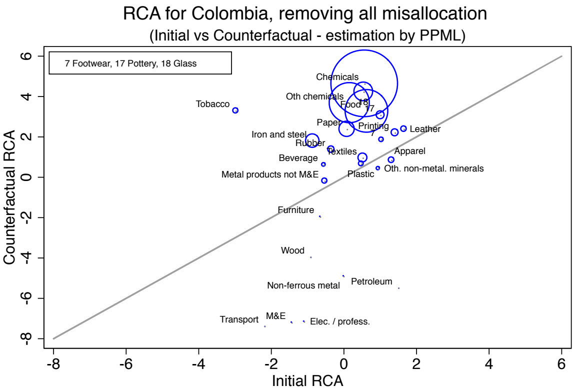
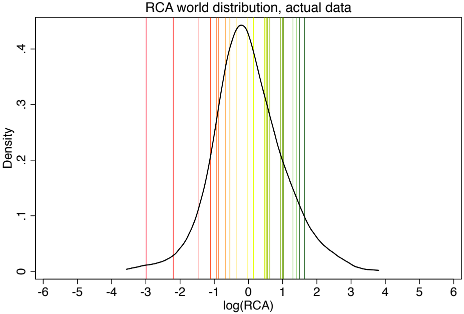


Note: Marker' sizes represent export shares in the counterfactual data

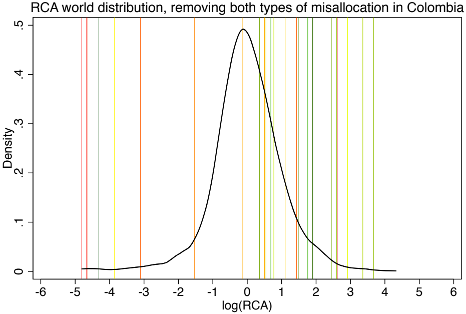
Revenue shares

Counterfactual RCA - Removing both types (II)

- The change in industrial composition is due to the increase in the dispersion of RCA.



Note: Each line represents the position of a Colombian industry in the RCA world distribution



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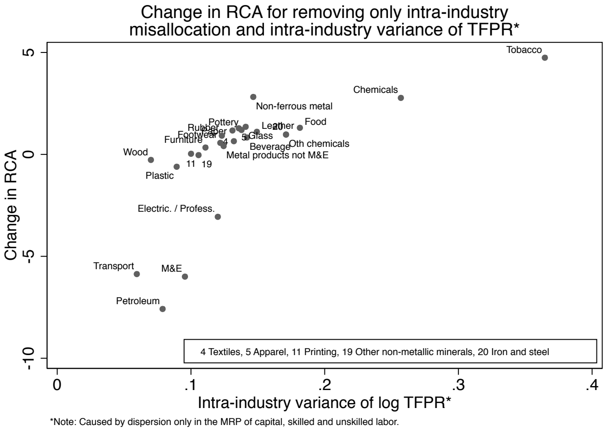
Changes in RCA by type of misallocation

- The magnitude of the change in RCA due to removing each type of misallocation is explained by the extent of each misallocation:



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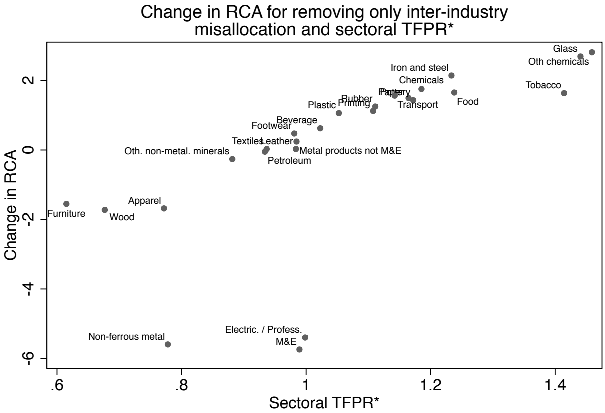
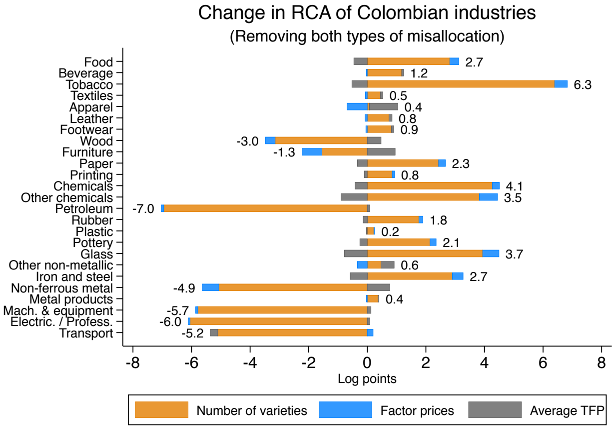


*Note: Computed using only capital, skilled and unskilled labor as inputs.

Disentangling the impacts: extensive and intensive margin

- The contribution of the extensive margin (number of varieties produced) in the adjustment of the RCA is the most important.



Intra Inter

Robustness checks and additional exercises

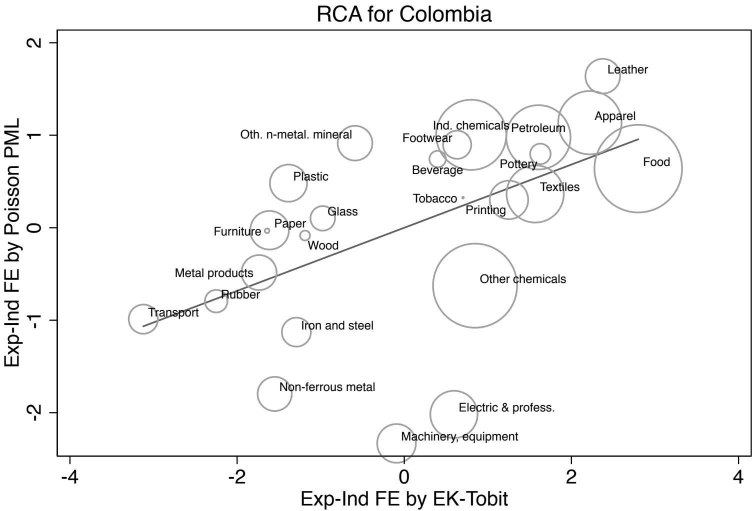
- Gradual reforms ▸ Gradual
- Changes in κ and σ ▸ Parameters
- One sector vs. multiples industries ▸ OneSector
- Closed vs. open economy ▸ Autarky

Conclusions

- Resource misallocation at the firm level can distort "natural" CA.
- Models of FM in closed economies omit a series of general equilibrium adjustments that take place when removing FM in open economies.
  - This paper offers a framework to compute RCA under a country's frictionless factor markets, considering the whole set of general equilibrium effects in an open economy..
- Removing FM both at the intra and the inter-industry level not only boosts aggregate productivity, but also allows the country to specialize in industries with "true" comparative advantage.

Thank you!

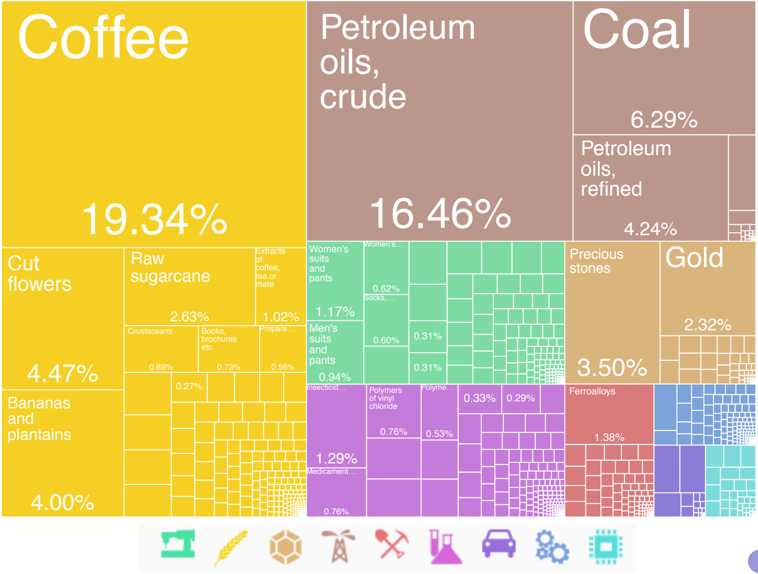
RCA for Colombia: PPML vs. EK's (2001) Tobit



*Markers' sizes represent export shares, and the line the best linear fitting

Return

Composition of Colombian exports in 1995 ($10.2B)



Return

Alternative explanations of variation in MRP

Source	Variable	Contribution*	Countries	Paper
Adjustment costs	σ^2_{MRPK}	1%	China, Colombia, Mexico	David and Venkateswaran (2017)
Uncertainty about TFP		7%		
Variable markups		5%	China	
Heterogeneity in technology		17%		
Heterogeneity in workers ability	σ^2_{MRPL}	9%	Denmark	Bagger et al. (2014)
Additive measurement error in revenues and inputs	σ^2_{TFPR}	45%	India	Bils et al. (2017)

*Average contribution if the number of countries is greater than 1.

Return

Definitions to evaluate the extent of misallocation

- Assume:
  - Monop. competition, CES demand (markup $\frac{1}{\rho}$), no fixed costs.
  - Variety m in industry s is produced with CD technology and L factors: $q_m = a_m \prod_l^L z_{lm}^{\alpha_{ls}}$

Physical productivity (TFPQ)

$$TFPQ_m \equiv \frac{q_m}{\prod_l^L z_{lm}^{\alpha_{ls}}} = a_m$$

Revenue productivity (TFPR)

$$TFPR_m \equiv \frac{p_m q_m}{\prod_l^L z_{lm}^{\alpha_{ls}}} = \frac{1}{\rho} \prod_l^L \left(\frac{w_l}{\alpha_{ls}}\right)^{\alpha_{ls}}$$

- $\sigma^2_{TFPR,s} = \vec{\alpha}_s' V_s \vec{\alpha}_s$ where $\vec{\alpha}_s$ is a L-vector of factor intensities α_{ls} and V_s is the var-cov matrix of factor's marginal revenue products (MRP_{lm}) within s.
- Without fixed costs, $MRP_{lm} \propto \frac{p_m q_m}{z_{lm}}$. Return

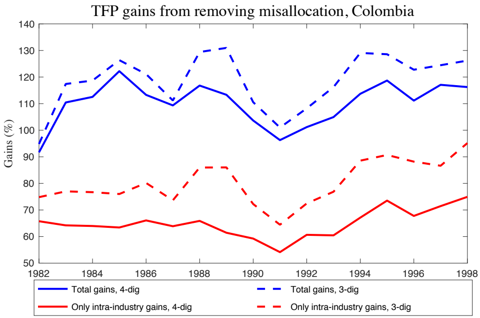
Intra and inter-industry misallocation

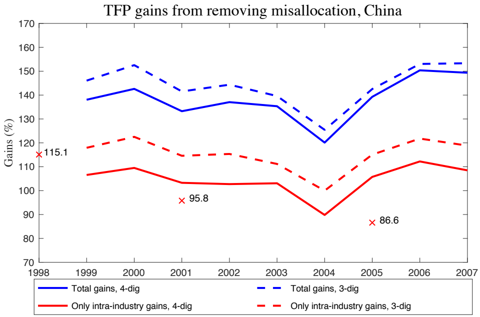
- To measure inter-industry misallocation, the appropriate average is the harmonic weighted average (HWA), with weights given by firms' revenue shares.
  - Sector-level TFPR can be expressed as a geometric average of the HWA of the MRP.
- In a closed-economy with fixed mass of firms (HK), both types of misallocation play a role:
  - In Colombia inter-industry type contributes up to 35% of the total gains in TFP (30% in China), computed at the 4-dig industry level. Graph
  - Inter-industry misallocation also explains TFP gaps across countries. Graph

Return

TFP gains, closed economy (HK)

- For Colombia and China, the inter-industry type contributes up to 35% and 30% of the total gains, respectively. ▸ Formulas ▸ CES case





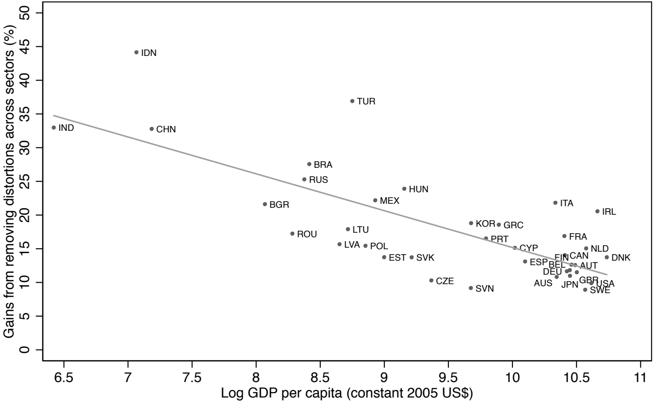
Source: AMS, Colombia

× correspond to the values in HK (2009). Source: ASIP, China

▸ Return

Inter-industry misallocation and income per capita.

- Inter-industry misallocation is also related with the TFP gaps across countries.



Note: Averages 1994-2007. Data source: WIOD (Timmer et al., 2015), World Bank Development indicators.

Robustness checks | Return

Decomposition of the PPI (P_{is})

- Wedge analysis is used to characterize the variation in MRP_{lm}.
  - Each firm is characterized by a vector of wedges, $\vec{\theta}_m = \{\theta_{lm}, \ldots \theta_{Lm}\}$ where $MRP_{lm} = \frac{1}{\rho} w_l (1 + \theta_{lm})$
  - TFPR at the firm level is: $\frac{1}{\rho} \prod_l^L (1 + \theta_{ilm})^{\alpha_{ls}} \left(\frac{w_{il}}{\alpha_{ls}}\right)^{\alpha_{ls}}$
  - HWA of factor-l wedges for firms in s, $(1 + \overline{\theta}_{ls})$, are the industry-analogue of firm-level wedges.
- Let Y_{is} sector output and R_{is} sectoral revenue. Then:

$$P_{is} = \frac{P_{is} Y_{is}}{Y_{is}} = \frac{R_{is}}{A_{is} \prod_l^L Z_{ils}^{\alpha_{ls}}} = \frac{TFPR_{is}}{A_{is}^e AEM_{is}} = \frac{\prod_l^L (1 + \bar{\theta}_{ils})^{\alpha_{ls}} \left(\frac{w_{il}}{\alpha_{ls}}\right)^{\alpha_{ls}}}{\rho A_{is}^e AEM_{is}}$$

where A_{is}^e is the allocative efficient TFP and $AEM_{is} \equiv A_{is} / A_{is}^e$ a measure of intra-industry misallocation. Return

Factor prices in the efficient allocation

- Using FOC of the CD demand across sectors, it is possible to derive the solution for relative factor prices in the efficient closed economy:

$$\frac{w_l}{w_k} = \frac{\bar{Z}_k \sum_s \alpha_{ls} \beta_s}{\bar{Z}_l \sum_s \alpha_{ks} \beta_s}$$

  where $\bar{Z}_l$ is the total endowment of factor l and β_s the CD expenditure shares β_{is}.

- This relation is satisfied using as price for factor l:

$$w_l = \frac{\rho R}{\bar{Z}_l} \sum_s \alpha_{ls} \beta_s$$

  which is the price that ensures the HWA of HWA of firm-level wedges for factor l is equal to 1. Return

TFP gains - formulas

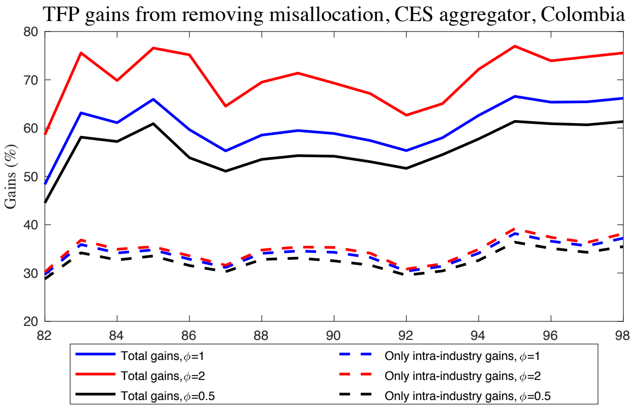
Denote TFPR ψ_{ms} and MRP ξ_{lms}. Let $\bar{\psi}_s$, $\bar{\xi}_{ls}$ the corresponding HWA.

1. TFP in sector s: $A_s^{\sigma-1} = \frac{1}{M_s}\sum_m^{M_s}(a_{ms}\bar{\psi}_s/\psi_{ms})^{\sigma-1}$
2. Efficient TFP in sector s: $\widetilde{A}_s^{\sigma-1} = \frac{1}{M_s}\sum_m^{M_s} a_{ms}^{\sigma-1}$
3. Gains from removing intra-industry misallocation in sector s:
$$Gains_s^{intra} = 100\left(\frac{\widetilde{A}_s}{A_s} - 1\right) = 100\left(\left(\sum_m^{M_s}\left(\frac{a_{ms}\bar{\psi}_s}{\widetilde{A}_s\psi_{ms}}\right)^{\sigma-1}\right)^{\frac{1}{1-\sigma}} - 1\right)$$
4. Total gains from removing intra-industry misallocation:
$$Gains^{intra} = 100\left(\prod_s^S\left(\frac{\widetilde{A}_s}{A_s}\right)^{\beta_s} - 1\right)$$
5. Total gains from removing inter-industry misallocation:
$$Gains^{inter} = 100\left(\prod_s^S\prod_l^L\frac{\widetilde{Z}_{ls}{}^{\alpha_{ls}\beta_s}}{Z_{ls}{}^{\alpha_{ls}\beta_s}} - 1\right) = 100\left(\prod_s^S\prod_l^l\left[\frac{\sum_s^S(\alpha_{ls}\beta_s/\bar{\xi}_{ls})}{(\sum_s^S\alpha_{ls}\beta_s)/\bar{\xi}_{ls}}\right]^{\alpha_{ls}\beta_s} - 1\right)$$
6. Total gains from removing intra and inter-industry misallocation:
$$Gains = 100\left(\frac{\widetilde{Y}}{Y} - 1\right) = 100\left[\left(\frac{Gains^{inter}}{100} + 1\right)\left(\frac{Gains^{intra}}{100} + 1\right) - 1\right]$$

Return

TFP gains - CES across sectors

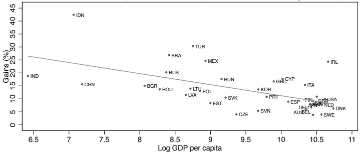
- Assume a two-tier CES demand, with upper-level $Y^{\varphi} = \sum_{s}^{S} \beta_s {Y_s}^{\varphi}$, where $\varphi = \frac{\phi - 1}{\phi}$



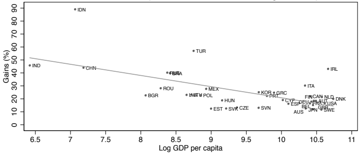
Return

Inter-industry misallocation and income: robustness

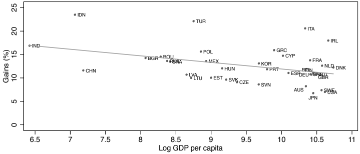
All WIOD sectors, GO spec., own country's cost shares, homogenous inputs



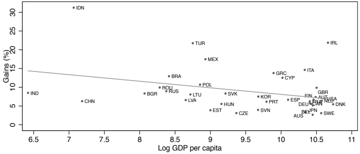
All WIOD sectors, VA spec., US cost shares, homogenous inputs



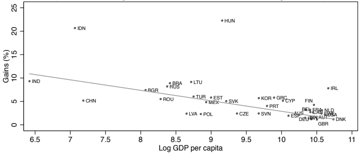
All WIOD sectors, GO spec., US cost shares, heterogenous inputs



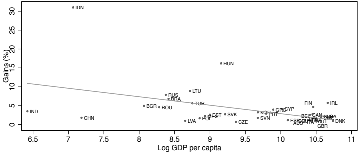
All WIOD sectors, GO spec., own country's cost shares, heterogenous inputs



Only manufacturing, GO spec., US cost shares, homogenous inputs



Only manufacturing, GO spec., own country's cost shares, homogenous inputs



Return

Evidence on the effects of FM on selection: domestic firms

- Factor misallocation also affects the selection of domestic firms

LPM of exit explained by TFPQ and TFPR for Colombia

	(1)	(2)	(3)	(4)
TFPR	-0.026***	0.047***	0.057***	0.057***
	(0.003)	(0.003)	(0.004)	(0.004)
TFPQ		-0.061***	-0.068***	-0.067***
		(0.002)	(0.003)	(0.003)
Demand shock		-0.028***	-0.032***	-0.032***
		(0.001)	(0.001)	(0.001)
Year FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Firm controls			Yes	Yes
Location FE				Yes
N	71880	71880	62619	60394
R^2	0.017	0.044	0.046	0.046

* p<0.10, ** p<0.05 and *** p<0.01. Dependent variable: probability of exit. All independent variables are in deviations over industry means. Firm controls: Size, age and lagged capital. Heteroskedastic robust errors.
Source: EAM Colombia, 1982-1998

Return

Evidence on the effects of FM on selection: exporters (probit)

Probit: exit explained by TFPQ and TFPR for Colombia

	(1)	(2)	(3)	(4)
TFPR	0.219***	-1.019***	-0.997***	-1.010***
	(0.018)	(0.034)	(0.039)	(0.040)
TFPQ		0.983***	0.973***	0.991***
		(0.025)	(0.029)	(0.029)
Demand shock		0.520***	0.517***	0.524***
		(0.007)	(0.009)	(0.009)
Year FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Firm controls			Yes	Yes
Location FE				Yes
N	47692	47692	39969	39904

* $p<0.10$, ** $p<0.05$ and *** $p<0.01$. Dependent variable: probability of exit. All independent variables are in deviations over industry means. Firm controls: Size, age and lagged capital. Heteroskedastic robust errors.
Source: EAM Colombia, 1982-1998.

Return

Aggregation definitions

- To define the competitive equilibrium, we need first the following definitions of aggregates:

Industry-destination aggregates

- Mass of firms selling to j: M_{ijs}
- Bilateral exports:

$X_{ijs} = \sum_{m}^{M_{ijs}} p_{ijm} q_{ijm}$

- Expenditure in access cost:

$\mathfrak{F}_{ijs} = \sum_{m}^{M_{ijs}} \omega_{is} \Theta_{im} f_{ijs}$

- Total cost of exporting to j:

$C_{ijs} = \rho X_{ijs} + \mathfrak{F}_{ijs}$.

- HWA of exporter wedges:

$(1 + \bar{\theta}_{ijls})$

Industry aggregates

- Mass of entrants: H_{is}
- Gross output: $R_{is} = \sum_{j}^{N} X_{ijs}$
- Expen. in fixed costs: $\mathfrak{F}_{is} = \sum_{j}^{N} \mathfrak{F}_{ijs}$
- Total cost: $C_{is} = \sum_{j}^{N} C_{ijs}$
- Factor l allocated to entry: Z^{e}_{ils}
- Factor l to produce and delivery:

$Z^{o}_{ils} \equiv \sum_{m}^{M_{ijs}} z_{ilm}$

- HWA of firm wedges: $(1 + \bar{\theta}_{ils})$

Return

Equilibrium conditions

- **Free entry:** $\forall\ i, s$:

$$\sum_{j}^{N}\sum_{m}^{M_{ijs}} \pi_{ijm} = \omega_{is} f_{is}^{e} H_{is}$$

- **Aggregate stability:** $\forall\ i, j, s$:

$$\delta_{is} M_{ijs} = \left[1 - G_{is}\left(a_{ijs}^{*}(\Theta), \Theta\right)\right] H_{is}$$

- **Factor market clearing:** Let $\bar{Z}_{il}$ factor l endowment.$\forall\ i, l$:

$$\bar{Z}_{il} = \sum_{s}^{S} Z_{ils} = \sum_{s}^{S} Z_{ils}^{o} + Z_{ils}^{e} = \sum_{s}^{S} \frac{\alpha_{ls} C_{is}}{w_{il}(1+\bar{\theta}_{ils})} + \frac{\alpha_{ls}\omega_{is} f_{is}^{e} H_{is}}{w_{il}}$$

- **Balance trade condition:** $\forall\ i$:

$$R_i = E_i + D_i$$

where $R_i = \sum_{s}^{S} R_{is}$, $E_i = \sum_{s}^{S} E_{is}$ and D_i is the country's trade balance. Global trade balance requires: $\sum_{i}^{N} D_i = 0$. Return

Simulation

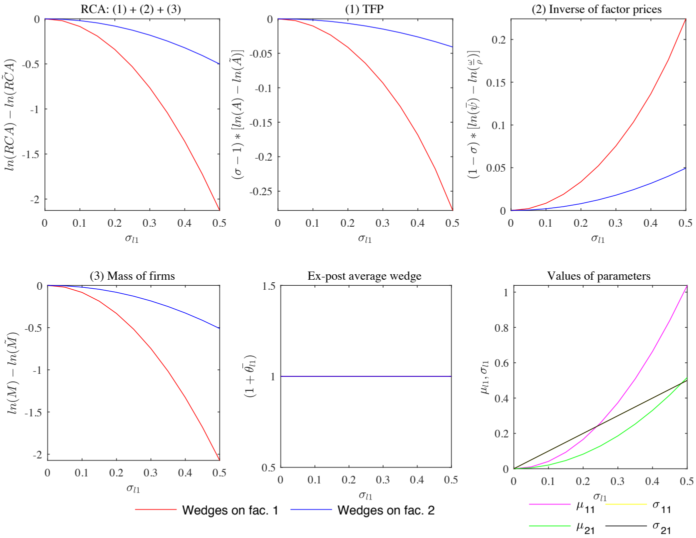
- Assume a simple 2x2x2 world:
  - Sector 1 is factor 1-intensive, and country 1 is relatively abundant in factor 1.
  - Trade/fixed costs and $\bar{a}_{is}$,κ,δ_{is} do not vary across sectors.
- Misallocation:
  - Country 1 in sector 1 faces misallocation.
  - $\theta_{1lm} \sim logN(\mu_{1l1}, \sigma^2_{1l1})$ and zero covariances. With A1 and A2, we obtain:

$$ln(1 + \bar{\theta}_{1l1}) = \mu_{1l1} + [(1 - \frac{k}{\rho})\alpha_{l1} - \frac{1}{2}]\sigma^2_{1l1}$$

Parameters

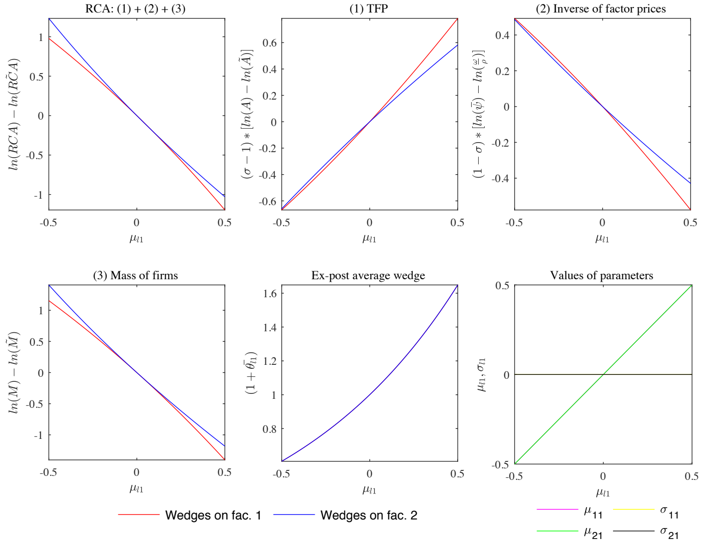
GE effects of intra-industry misallocation

Effects of intra-industry misallocation on RCA of sector 1 of country 1



GE effects of inter-industry misallocation

Effects of inter-industry misallocation on RCA of sector 1 of country 1



Decomposition of Exp-Ind FE

From gravity:

$$ln\frac{X_{ijs}X_{i'js'}}{X_{ijs'}X_{i'js}} = ln(\frac{M_{ijs}M_{i'js'}}{M_{ijs'}M_{i'js}}) + ln(\frac{\bar{\psi}_{ijs}\bar{\psi}_{i'js'}}{\bar{\psi}_{ijs'}\bar{\psi}_{i'js}})^{1-\sigma} + ln(\frac{A_{ijs}A_{i'js'}}{A_{ijs'}A_{i'js}})^{\sigma-1} + ln(\frac{\tau_{ijs}\tau_{i'js'}}{\tau_{ijs'}\tau_{i'js}})^{1-\sigma}$$

Under A1 and A2, from the stability condition: $M_{ijs} = \frac{H_{is}\Upsilon_{is}}{\delta_{is}}(\frac{\bar{a}_{is}}{a^*_{ijs}})^{\kappa}$ with $\Upsilon_{is} = \int_{\theta_{i1}} ... \int_{\theta_{iL}} \Theta_i^{-\frac{k}{\rho}} dG^{\theta}_{is}(\vec{\theta})$. After some algebra, the RHS is:

$$=log[\frac{\varrho_{is}\varrho_{i's'}}{\varrho_{is'}\varrho_{i's}}\frac{R_{is}R_{i's'}}{R_{is'}R_{i's}}\frac{\Upsilon_{is}\Upsilon_{i's'}}{\Upsilon_{is'}\Upsilon_{i's}}(\frac{\omega_{is}}{\omega_{is'}}\frac{\omega_{i's'}}{\omega_{i's}})^{-\frac{\kappa}{\rho}-1}] + log[\frac{\omega_{is}\omega_{i's'}\bar{\Theta}_{is}\bar{\Theta}_{i's'}}{\omega_{is'}\omega_{i's}\bar{\Theta}_{is'}\bar{\Theta}_{i's'}}]^{1-\sigma}$$
$$+ log[(\frac{\bar{\Theta}_{is}\bar{\Theta}_{i's'}}{\bar{\Theta}_{is'}\bar{\Theta}_{i's'}})^{\sigma-1}(\frac{\omega_{is}}{\omega_{is'}}\frac{\omega_{i's'}}{\omega_{i's}})^{\sigma}\frac{\Gamma_{is}\Gamma_{i's'}}{\Gamma_{is'}\Gamma_{i's}}\frac{\Upsilon_{is'}\Upsilon_{i's}}{\Upsilon_{is}\Upsilon_{i's'}}] + B_{ijs}$$

i.e., the decomposition of the RCA in number of varieties (**extensive margin**) and factor returns + average TFP (**intensive margin**) Return

Measuring wedges

- Assume a log-normal joint distribution for wedges. Thus:

$$ln(1+\bar{\theta}_{ils}) = \mu_{ils} + \frac{1}{2}[(\vec{\alpha_s})' V_{is}\vec{\alpha_s} - (\vec{\alpha_{ls}})' V_{is}\vec{\alpha_{ls}}]$$

  where $\vec{\alpha_s}$ and $\vec{\alpha_{ls}}$ are functions of factor intensities, κ and σ.
- I need estimates of V_{is} (var-cov of MRP within industries) and observed measures of $(1+\bar{\theta}_{ils})$ to recover μ_{ils}.
- I use Bils et al. (2017, BKR) method to measure dispersion in MRP under measurement error in both revenues and inputs.
  - Additive error analogous to (heterogenous) overhead costs.
  - Main idea: Estimate a "compression factor" λ to correct observed dispersion on TFPR (σ^2_{TFPR}) as a measure of dispersion in MRP ($\lambda = \frac{\sigma^2_{\Theta}}{\sigma^2_{TFPR}}$) using panel data. BKR method
  - For Colombia, : $\hat{\lambda} = 0.88$ (0.05). BKR results

Parameters for the simulation

Parameter	Description	Value
α_{ls}	Factor intensities	$\begin{bmatrix} 0.7 & 0.3 \\ 0.3 & 0.7 \end{bmatrix}$
β_{is}	Expenditure shares	$0.5 \; \forall \; i, s$
σ	Varieties' elasticity of substitution	3.8
κ	Pareto's shape parameter	4.58
$\bar{Z}_{il}$	Factor endowments	$\begin{bmatrix} 100 & 90 \\ 90 & 100 \end{bmatrix}$
$\bar{a}_{is}$	Pareto's location parameter	$1 \; \forall \; i, s$
δ_{is}	Exogenous probability of exit	$0.025 \; \forall \; i, s$
f_{is}^{e}	Fixed entry cost	$2 \; \forall \; i, s$
f_{ijs}	Fixed trade cost	$2 \; \forall \; i, j, s$
τ_{ijs}	Iceberg trade cost	Free trade: $1 \; \forall \; i, j, s$ Costly trade: $2 \; \forall \; s \wedge i \neq j$; $1 \; \forall \; s \wedge i = j$
σ_{l1}	Log-normal shape par. in sector 1	For figure 1: $[0, 0.5] \; \forall \; l$ For figure 2: $0 \; \forall \; l$
μ_{l1}	Log-normal location par. sector 1	For figure 1: $(\frac{1}{2} - (1 - \frac{\kappa}{\rho})\alpha_{l1})\sigma_{l1}^{2} \; \forall \; l$ For figure 2: $[-0.5, 0.5] \; \forall \; l$

Return

Sectors in the empirical exercise

No.	Sector	Sector Description	ISIC Rev. 2
1	Food	Food manufacturing	311-312
2	Beverage	Beverage industries	313
3	Tobacco	Tobacco manufactures	314
4	Textiles	Manufacture of textiles	321
5	Apparel	Wearing apparel, except footwear	322
6	Leather	Leather and products of leather and footwear	323
7	Footwear	Footwear, except vulcanized or moulded rubber or plastic footwear	324
8	Wood	Wood and products of wood and cork, except furniture	331
9	Furniture	Furniture and fixtures, except primarily of metal	332
10	Paper	Paper and paper products	341
11	Printing	Printing, publishing and allied industries	342
12	Chemicals	Industrial chemicals	351
13	Other chemicals	Other chemicals (paints, medicines, soaps, cosmetics)	352
14	Petroleum	Petroleum refineries, products of petroleum and coal	353-354
15	Rubber	Rubber products	355
16	Plastic	Plastic products	356
17	Pottery	Pottery, china and earthenware	361
18	Glass	Glass and glass products	362
19	Other non-metallic	Other non-metallic mineral products (clay, cement)	369
20	Iron and steel	Iron and steel basic industries	371
21	Non-ferrous metal	Non-ferrous metal basic industries	372
22	Metal products	Fabricated metal products, except machinery and equipment	381
23	Machinery, equipment	Machinery and equipment except electrical	382
24	Electrical	Electrical machinery apparatus, appliances and supplies	383
25	Transport	Transport equipment	384
26	Profess., scientific	Professional and scientific, and measuring and controlling equipment	385

Return 1 Return 2

Sample of countries

OECD Country (I)	Code	OECD Country (II)	Code	Non-OECD Country	Code
Australia	AUS	Korea	KOR	Argentina	ARG
Austria	AUT	Mexico	MEX	Brazil	BRA
Belgium	BEL	Netherlands	NLD	China	CHN
Canada	CAN	New Zealand	NZL	Colombia	COL
Chile	CHL	Norway	NOR	Ecuador	ECU
Denmark	DNK	Poland	POL	Hong Kong	HKG
Finland	FIN	Portugal	PRT	India	IND
France	FRA	Czech Republic	CZE	Indonesia	IDN
Germany	DEU	Spain	ESP	Malaysia	MYS
Greece	GRC	Sweden	SWE	Philippines	PHL
Hungary	HUN	Switzerland	CHE	Rest of the World	ROW
Ireland	IRL	Turkey	TUR	Romania	ROU
Israel	ISR	United Kingdom	GBR	Russia	RUS
Italy	ITA	United States	USA	Saudi Arabia	SAU
Japan	JPN			Singapore	SGP
				South Africa	ZAF
				Thailand	THA
				Taiwan	TWN
				Venezuela	VEN

Return 1 Return 2

Values used in the counterfactual

Sector	Number of firms (in 1995)	Factor intensities (GO specification)			HWA of firm-level wedges				Intra-industry variances of log-wedges			Intra-industry covariances of log-wedges		
		α_k	α_s	α_u	$(1+\bar{\theta}_k)$	$(1+\bar{\theta}_s)$	$(1+\bar{\theta}_u)$	$\bar{\Theta}$	σ_k^2	σ_s^2	σ_u^2	σ_{ks}	σ_{ku}	σ_{su}
Food	1435	0.31	0.06	0.09	1.90	1.01	1.14	1.15	1.32	1.34	1.48	0.23	0.23	1.06
Beverage	142	0.36	0.06	0.06	1.05	0.98	1.14	1.33	1.06	0.89	0.89	0.00	-0.08	0.58
Tobacco	9	0.73	0.02	0.04	1.67	1.64	0.39	1.28	0.70	1.63	2.13	0.37	-0.45	1.24
Textiles	465	0.22	0.08	0.18	0.81	1.08	0.88	1.02	1.57	0.83	0.81	-0.07	0.10	0.51
Apparel	944	0.23	0.10	0.17	1.25	0.40	0.26	0.72	1.46	0.75	0.71	0.12	0.18	0.34
Leather	118	0.32	0.12	0.16	1.38	1.00	0.47	0.73	1.06	0.87	0.55	-0.02	-0.07	0.55
Footwear	254	0.21	0.12	0.20	1.51	1.00	0.59	0.97	1.29	0.77	0.54	0.10	0.14	0.40
Wood	196	0.13	0.07	0.18	0.25	0.37	0.48	0.51	1.67	0.53	0.43	0.31	0.18	0.34
Furniture	270	0.18	0.11	0.25	0.70	0.27	0.32	0.50	1.70	0.48	0.47	0.14	0.01	0.24
Paper	170	0.21	0.09	0.18	0.64	2.40	2.62	1.17	1.19	1.01	1.39	0.07	-0.04	0.86
Printing	434	0.23	0.15	0.26	1.02	0.83	1.62	1.02	0.87	0.59	0.59	-0.06	-0.10	0.23
Chemicals	177	0.37	0.07	0.08	1.23	1.96	1.77	1.08	1.72	0.95	0.92	0.14	-0.07	0.65
Other chemicals	356	0.36	0.12	0.09	2.50	1.13	1.49	1.53	1.20	0.84	1.00	-0.08	-0.13	0.59
Petroleum	46	0.15	0.02	0.02	0.65	0.98	0.86	1.28	2.66	1.49	1.93	1.08	1.28	1.57
Rubber	93	0.20	0.12	0.22	0.63	2.01	1.64	1.05	0.80	0.71	0.57	0.24	0.24	0.39
Plastic	428	0.10	0.08	0.28	0.38	0.95	1.74	1.04	1.00	0.74	0.71	-0.01	-0.05	0.47
Pottery	13	0.27	0.13	0.30	1.16	1.19	1.38	1.11	0.23	0.58	0.91	-0.08	-0.11	0.70
Glass	82	0.26	0.29	0.12	0.91	4.59	0.70	1.38	1.14	0.63	0.57	-0.17	0.02	0.39
Other non-metallic	365	0.21	0.07	0.14	0.46	1.36	1.11	1.05	1.50	0.85	1.08	0.03	-0.01	0.76
Iron and steel	86	0.18	0.10	0.21	0.50	2.74	3.01	1.28	1.17	1.38	1.72	-0.19	-0.15	1.37
Non-ferrous metal	42	0.18	0.10	0.27	0.38	0.56	0.94	0.39	0.53	0.96	1.49	-0.17	-0.48	1.09
Metal products	664	0.21	0.12	0.17	1.09	1.20	0.72	0.99	1.51	0.69	0.66	0.11	0.09	0.47
Mach. & equipment	374	0.25	0.11	0.09	1.50	0.83	0.36	1.04	1.14	0.51	0.56	0.02	0.14	0.34
Electric. / Profess.	276	0.19	0.02	0.08	1.00	1.27	0.74	1.01	1.10	0.70	0.73	0.06	0.07	0.50
Transport	274	0.24	0.15	0.13	2.23	0.45	0.91	1.20	1.11	0.57	0.87	0.23	0.27	0.46
One-sector	7713	0.24	0.09	0.13	1.00	1.00	1.00	1.00	1.33	1.23	1.01	0.09	0.09	0.74

Return

BKR (2017) method

- Define measured revenues and inputs as: $\hat{R}_m = R_m + f_m$ and $\hat{I}_m = I_m + g_m$. Denote Δ log difference and $\blacktriangle$ abs difference. Under reasonable assumptions, BKR (2017) find that the elasticity of $\Delta\hat{R}$ with respect to $\Delta\hat{I}$, $\beta = \frac{\sigma_{\Delta\hat{R},\Delta\hat{I}}}{\sigma^2_{\Delta\hat{I}}}$, satisfy:

$$E\{\beta \mid ln(TFPR_m)\} = (1 - \frac{\Omega_\Theta}{\sigma} - \Omega_{f'})[1 - (1-\lambda)ln(TFPR)]$$

where $\lambda = \frac{\sigma^2_{ln\Theta}}{\sigma^2_{TFPR}}$, our measure of interest, and $\Omega_\Theta = \frac{\sigma_{\Delta\Theta,\Delta I}}{\sigma^2_{\Delta I}}$,$\Omega_{f'} = \frac{\sigma_{\blacktriangle f',\Delta\hat{I}}}{\sigma^2_{\Delta\hat{I}}}$ $\blacktriangle f' = \frac{\blacktriangle f_m}{\hat{I}_m}$.

- λ can be estimated from:

$$\Delta\hat{R}_m = \phi ln(TFPR_m) + \psi\Delta\hat{I}_m - \psi(1-\lambda)ln(TFPR_m)\Delta\hat{I} + D_s + \epsilon_m$$

Return

BKR (2017) - results

- For Colombia, using GMM and following closely BKR (2017), I obtain:

	$\Delta \hat{R}_m$
ϕ	0.056***
	(0.000)
ψ	0.977***
	(0.139)
λ	0.884***
	(0.018)
Observations	26261

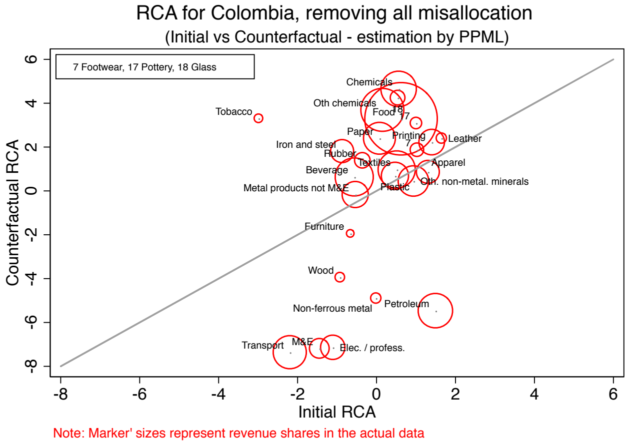
* p<0.10, ** p<0.05 and *** p<0.01.

- BKR estimates: India: $\hat{\lambda} = 0.55$ (0.04), US: $\hat{\lambda} = 0.23$ (0.03).

Return

Results: Counterfactual RCA

- Comparative advantage in the efficient allocation involves much more specialization



Return

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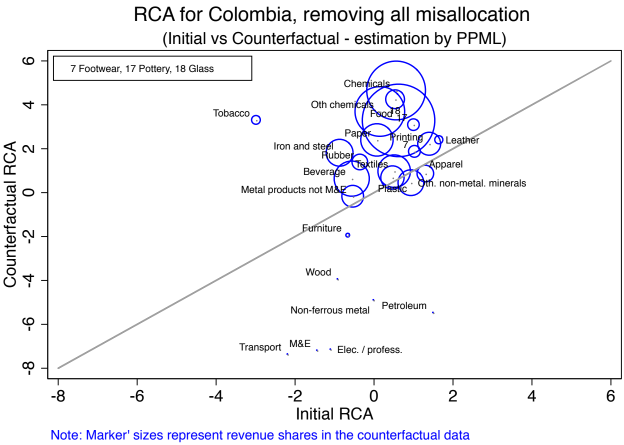
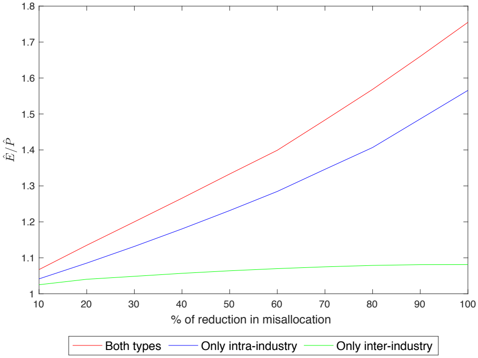


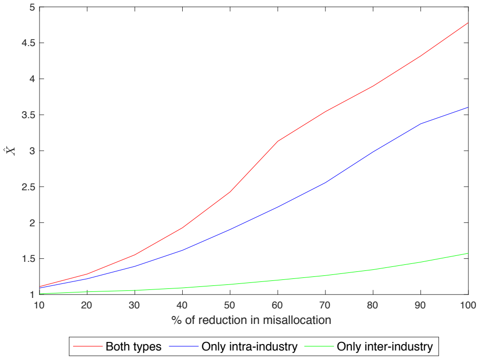
Gradual reforms

- Even the smallest reform, which reduces 10% the extent of both types of FM, has a sizable impact on both welfare and exports (6.7% and 11% respectively)

Panel A: Welfare gains

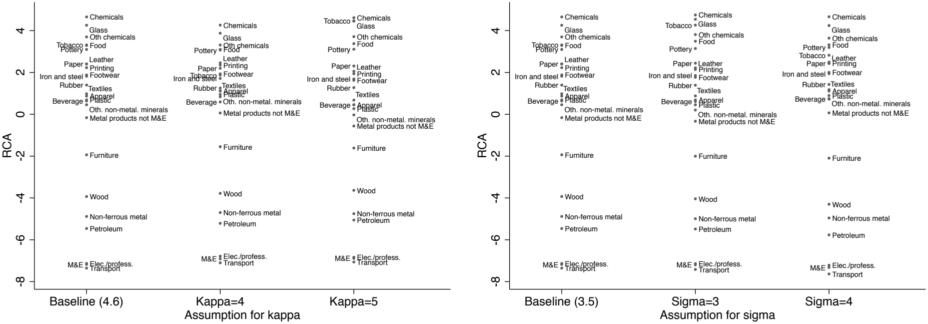


Panel B: Export growth



Return

Counterfactual RCA changing σ and κ



Return

Baseline results and additional exercises

Variable	Revenue	Value added	Exports	Exports /GDP*	RCA s.d.*	Welfare	Welfare - autarky
	Change in each variable after removing factor misallocation in Colombia						
Counterfactual	$\hat{R}_{Col}$	$\hat{GDP}_{Col}$	$\hat{X}_{Col}$	$\Delta(\frac{X}{GDP})_{Col}$	$\Delta\sigma_{RCA_{Col}}$	$\frac{\hat{E}_{Col}}{\hat{P}_{Col}}$	$\left[\frac{\hat{E}_{Col}}{\hat{P}_{Col}}\right]^{closed}$
Baseline results							
Both types	1.54	2.22	4.78	0.18	2.60	1.75	1.85
Only intra-industry	1.41	1.92	3.59	0.13	1.95	1.56	1.72
Only inter-industry	1.04	1.09	1.57	0.07	1.69	1.08	1.07
Robustness: Both types							
Decreasing σ (to 3)	1.59	2.35	5.22	0.19	2.68	1.90	1.99
Increasing σ (to 4)	1.50	2.14	4.51	0.17	2.69	1.67	1.76
Decreasing κ (to 4)	1.44	2.01	4.14	0.16	2.40	1.64	1.75
Increasing κ (to 5)	1.61	2.38	5.36	0.19	2.61	1.84	1.92
One-sector							
Only intra-industry	1.58	2.32	1.43	-0.05	-	1.70	1.87

Note: Each cell shows the proportional change in each variable between the counterfactual equilibrium and the actual data. For variables marked by *, the simple difference in the measure is displayed.

▸ Return

Welfare gains under autarky

- In the closed economy we have $\pi_{iis} = \hat{\pi}_{iis} = 1$ and $\hat{R}_{is} = \hat{E}_{is} = \hat{E}_i$, so the welfare change is:

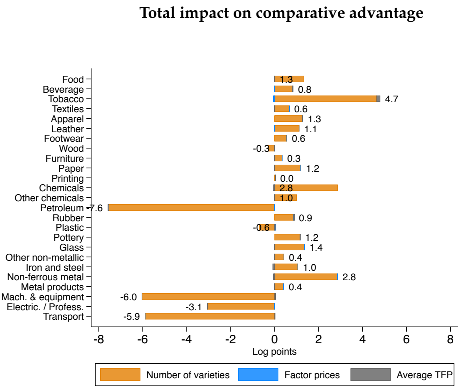
$$\left[\frac{\hat{E}_i}{\hat{P}_i^d}\right]^{closed} = \prod_s \left[\hat{\Gamma}_{is}^{-\frac{1}{\kappa}} \prod_l \left(\sum_s^S \tilde{Z}_{ils} \hat{v}_{ils}\right)^{\frac{\alpha_{ls}}{\rho}}\right]^{-\beta_s}$$

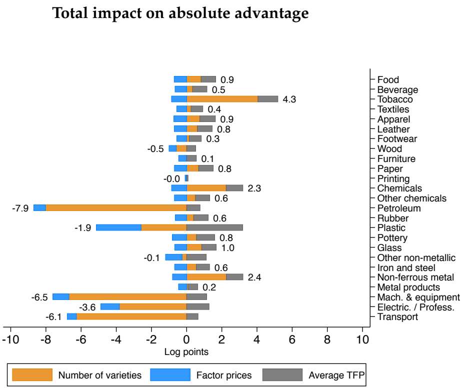
The welfare cost of misallocation in a closed economy can be derived only with measures of misallocation and factor shares in autarky.

Return

Disentangling the impacts: extensive/intensive margin (I)

- For intra-industry misallocation Return





Disentangling the impacts: extensive/intensive margin (II)

- For inter-industry misallocation: ▸ Return