Complements or Substitutes?
Labor Market Effects of Foreign Inputs in Developing Economies

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September 12th 2024
Trade and Uneven Development Conference

Outline of the talk

Introduction

"*Jobs that should be offered to Brazilians are being delivered on a tray to the Chinese, Koreans, Indians, etc ..*"

(Association of Capital Goods Producers, cited in Pavcnik [2017]).

- Competition from low-wage countries decrease employment in developed countries

  Autor et al. [2013, 2014], Pierce and Schott [2016]

- Liberalization in developing countries negatively affect employment and salaries:
  - Imperfect labor mobility Dix-Carneiro and Kovak [2017], Pavcnik [2017]

- No net job loses because of labor reallocation

  Bloom et al. [2019]

- Labor market effects of competition and input shocks in developing economies:
  - Cobb-Douglass production functions

    Caliendo et al. [2019]; Rodriguez-Clare et al. [2022]; Adão et al. [2022]
    - No substitutability channel-labor shares
  - Differences across sectors?
  - Quantitative models vs. data

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We study the effect of trade liberalization on wage inequality

How does the penetration of goods from foreign countries affect labor markets in emerging economies?

- Identify the effects of competition vs. input shocks Adão et al. [2022]

Our contribution:

- Quantitative Model:
  - Extend CDP and allow for different degrees of substitutability in the prod. function
  - Use a FOA to analyze the impact on labor markets under this setting

- Empirics:
  - Exploit exogenous variation from two reforms to estimate labor market effects
  - Use highly detailed administrative data
  - Compute competition and input shocks at the state-sector level
  - Explore heterogeneity by 1-digit sectors

- Mapping the theory to the data
  - Recover the main elasticities from the point estimate and the FOA
  - Run several counterfactuals to understand the welfare and employment effects

Preview of findings

- Extend trade models to allow for substitutability between labor and inputs
  - We use a FOA to analyze the impact of trade costs
  - An increase in trade costs of inputs can lead to an expansion in labor:
    - The effect depends on the substitutability channel
    - In traditional models, the effect is always negative
  - An increase in the trade costs to foreign firms increases employment

- Exogenous variation from two reforms that reduce tariffs in Colombia:
  - The competition shock is negative and the input shock is positive
  - The negative effect of the input shock is driven by the service sector
  - Positive or "zero" effect in the manufacturing and primary sectors
    - Labor and intermediate inputs are substitutes

- The model calibration suggests relevant implications for welfare and employment
  - Bigger differences in the evolution of employment between services and manufacturing
  - Small effects in overall inequality
    - Decrease in inequality within sectors
    - Increase in inequality across sectors
  - Important effects in welfare for manufacturing

Outline of the talk

Model Environment: Consumption and Intermediate Inputs

- I regions (M inside Colombia), S market sectors plus home production
- Cobb-Douglas preferences (α^{ij}) across market sectors. EK assumption within sectors with a trade elasticity $\theta^j > \eta^j - 1$. All income devoted to consumption
- CES production function using labor and intermediate inputs

$$q_t^{nj} = z_t^{nj} A_t^{nj} \left[\zeta^{nj} (I_t^{nj})^{\frac{\sigma^j - 1}{\sigma^j}} + (1 - \zeta^{nj}) (M_t^{nj})^{\frac{\sigma^j - 1}{\sigma^j}} \right]^{\frac{\sigma^j}{\sigma^j - 1}}$$

- Perfect competition with iceberg trade costs $\kappa_t^{nj,ij} \geq 1$; $\kappa_t^{nj,ij} = \tilde{\kappa}_t^{nj,ij}(1 + t^{nj,ij})$

$$P_t^{nj} = \Gamma^{nj} \left(\sum_{i=1}^{N} (x_t^{ij} \kappa_t^{nj,ij})^{-\theta^j} (A_t^{ij})^{\theta^j} \right)^{\frac{-1}{\theta^j}}$$

where $x_t^{ij} = \left(z_t^{nj} A_t^{nj} \right)^{-1} \left[(\zeta^{nj})^{\sigma^j} (w_t^{nj})^{1-\sigma^j} + (1 - \zeta^{nj})^{\sigma^j} (s_t^{nj})^{1-\sigma^j} \right]^{\frac{1}{1-\sigma^j}}$

$s_t^{nj} = \left[\sum_{k=1}^{J} \tilde{\gamma}_{nj,nk}^{\delta^j} (P_t^{nk})^{1-\delta^j} \right]^{\frac{1}{1-\delta^j}}$

- All sectors and final consumers face the same price index in the destination

Market Clearing Conditions in the Static Equilibrium

- Exogenous trade imbalances:

$$X_t^{nj} = \sum_{k=1}^{J} \gamma_t^{nk,nj} \underbrace{\sum_{i=1}^{N} \frac{\pi_t^{ik,nk}}{1+t_t^{ik,nk}} X_t^{ik}}_{Y_t^{nk}\text{: Gross production } nk} + \alpha^{nj} \underbrace{\left(\sum_{k=1}^{J} w_t^{nk} L_t^{nk} + D_t^n + R_t^n \right)}_{\text{Final consumers}}$$

- Equilibrium in sector j, region n, at time t:

$$Y_t^{nj} = \sum_{i=1}^{N} \frac{\pi_t^{ij,nj}}{1+t_t^{ij,nj}} X_t^{ij}, \quad \psi_t^{ij,nj} = \frac{\pi_t^{ij,nj}}{1+t_t^{ij,nj}} \cdot \frac{X_t^{ij}}{Y_t^{nj}}$$

with trade shares $$\pi_t^{nj,ij} = \frac{(x_t^{ij} \kappa_t^{nj,ij})^{-\theta^j} (A_t^{ij})^{\theta^j}}{\sum_{m=1}^{N} (x_t^{mj} \kappa_t^{nj,mj})^{-\theta^j} (A_t^{mj})^{\theta^j}}$$

- Labor market clearing: $w_t^{nj} L_t^{nj} = \phi_t^{nj} Y_t^{nj}$

- Total revenue: $R_t^n = \sum_{i=1}^{N} \sum_{s=1}^{J} t_t^{ns,is} M_t^{ns,is}$

Labor Supply: Dynamic Decisions

- As in CDP and ACM:
  - Agents can move across sectors and regions
    - Only across sectors in the RoW and the US
  - Forward-looking agents (with perfect foresight) move subject to relocation costs
  - In region i, time t, home production yields μ_i and sector s yields $\omega_{i,s,t}$
- Different elasticities across sectors ($\frac{1}{\nu}$) and regions ($\frac{1}{\kappa}$) as in RUV
  - Nested Gumbel for amenity shocks across regions and sectors

$$\mu_t^{nj,nk|n} = \frac{\exp\left(\beta V_{t+1}^{nk} - \tau^{nj,nk}\right)^{1/\nu}}{\sum_{h=0}^{S} \exp\left(\beta V_{t+1}^{nh} - \tau^{nj,nh}\right)^{1/\nu}}$$

$$\mu_t^{nj,i\#} = \frac{\left(\sum_{h=0}^{S} \exp\left(\beta V_{t+1}^{ih} - \tau^{nj,ih}\right)^{1/\nu}\right)^{\nu/\kappa}}{\sum_{m=1}^{I}\left(\sum_{h=0}^{S} \exp\left(\beta V_{t+1}^{mh} - \tau^{nj,mh}\right)^{1/\nu}\right)^{\nu/\kappa}}.$$

- As in CDP: $\omega_t^{nj} \equiv \frac{w_t^{nj}}{P_t^{nj}}$.
- We can solve the model using dynamic hat algebra:
  - The labor share is not constant ϕ_t^{nj}

Effect of a change in trade costs on earnings

First-order approximation

- We are interested in analyzing the impact of a trade shock on earnings:

$$w^{nj} L^{nj} = \underbrace{\phi^{nj}}_{\text{labor share}} \cdot \underbrace{\sum_{i=1}^{N} \frac{\pi^{ij,nj}}{1+t^{ij,nj}} X^{ij}}_{\text{Gross production}}$$

- By a FOA, we get that the change on earnings is:

$$d\ln w^{nj} l^{nj} = \underbrace{(\sigma^j - 1)}_{\text{Substitutability}} \underbrace{\left[(1-\phi^{nj}) \left(\sum_{k=1}^{J} \gamma^{nj,nk} \left(\sum_{i=1}^{N} \pi^{nk,ik} \, d\ln \kappa^{nk,ik} \right) \right) \right]}_{\text{Foreign Input Shock}} \tag{1a}$$

$$- \underbrace{\theta^j \left(\sum_{i=1}^{N} (1-\pi^{ij,nj}) \psi^{ij,nj} \right)}_{\text{Marginal cost effect}} \underbrace{\left[(1-\phi^{nj}) \left(\sum_{k=1}^{J} \gamma^{nj,nk} \left(\sum_{\ell=1}^{N} \pi^{nk,\ell k} \, d\ln \kappa^{nk,\ell k} \right) \right) \right]}_{\text{Foreign Input Shock}} \tag{1b}$$

$$+ \underbrace{\theta^j}_{\text{Trade elasticity}} \underbrace{\left(\sum_{i=1}^{N} \psi^{ij,nj} \sum_{m=1}^{N} \left(\pi^{ij,mj} - \mathbf{I}\{m=n\} \right) d\ln \kappa^{ij,mj} \right)}_{\text{Import Competition Shock}}, \tag{1c}$$

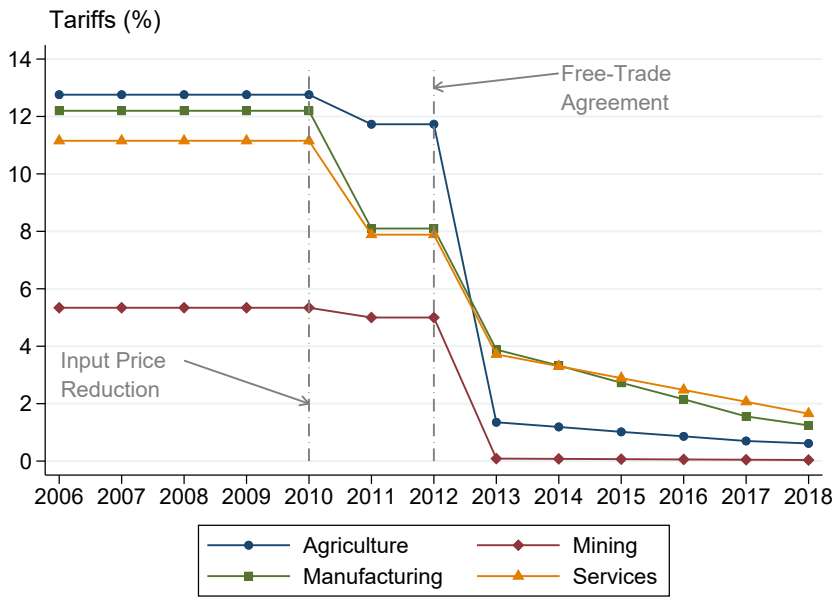
Outline of the talk

Colombian Tariff Reductions

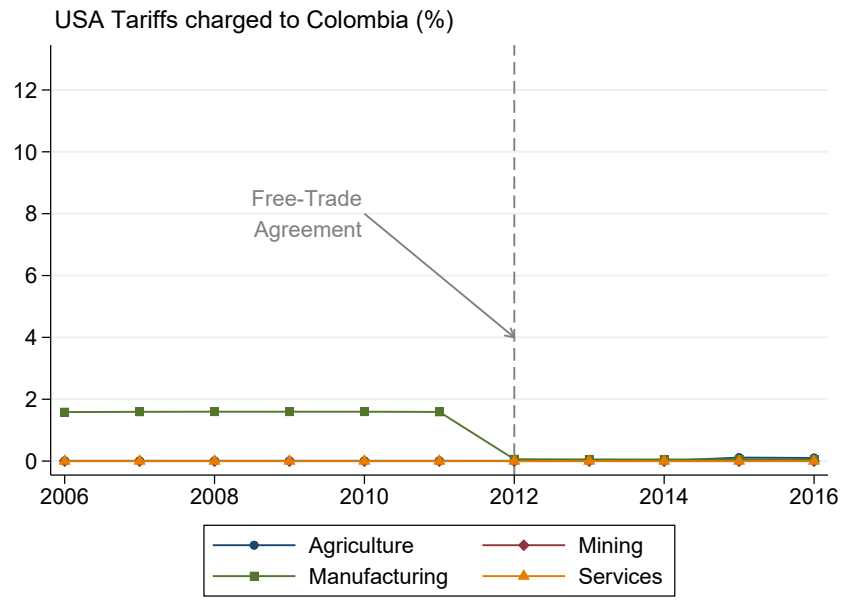
- The United States is Colombia's biggest trade partner (30%-50% of imports).
- The Colombian government had interest in increasing international trade.
- Two tariff decreases:
  1. Unilateral tariff decrease in 2010 (decree 4114):
     - ⋆ Applied to all countries;
     - ⋆ Decreased tariffs on mainly manufactured inputs.
  2. Free-trade Agreement in 2012 (decree 730):
     - ⋆ Applied only to United States.
     - ⋆ Mainly manufacturing products.
     - ⋆ Progressive decrease in some agricultural goods.
- Neither affected Colombian exports.

Tariffs Charged by Colombia and the U.S.

Colombian Tariffs



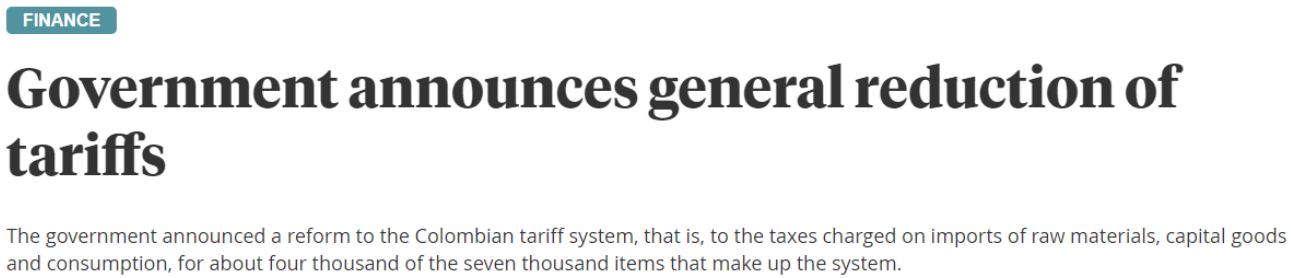
U.S Tariffs



Trade Evolution | Other Countries | Products

The tariff decreases were unanticipated

- Unilateral tariff decrease in 2010:
  - There was a change of the Government in 2010
  - The decrease was a response to changes in the exchange rate
  - Colombian firms were losing participation in international markets



FINANCE

Government announces general reduction of tariffs

The government announced a reform to the Colombian tariff system, that is, to the taxes charged on imports of raw materials, capital goods and consumption, for about four thousand of the seven thousand items that make up the system.

- Free trade agreement with the US:
  - The Free Trade Agreement was signed in 2006
  - Human right violations and the safety of Colombian labor leaders
    - Big concern in the US congress
  - In October 2011, the agreement was finally approved by the congress

U.S. Elections.

Obama again objects to FTA with Colombia

In his last televised duel, McCain criticized the Democratic candidate for not supporting the free trade agreement with Colombia. Three weeks before the election, Obama leads the polls. By Juan Carlos Iragorri, Semana correspondent in the United States.

15/10/2008

Multiple Sources of Data

1. Matched employer-employee monthly earnings records;
   - Longitudinal records
   - Reporting issues in initial edition (2008) $\Rightarrow$ matching estimator
   - Formal employees (60% of workers)
   - Build transition matrices at the state and 2-digit sector level

2. Colombian household surveys

3. Colombian trade at the state-year-industry level

4. Tariff Decrees: 4589 of 2006; 4114 of 2010; and 730 of 2012

5. Records of imports by firm

6. Regional Input-Output matrices from the Colombian Central Bank

- Estimating data sets from 2008-2018:
  - Year-industry (4-digit): N= 4,576 (416×11)
  - Year-industry (4-digit)-geolevel 1: N $\approx$ 50,000 ($416 \times 11 \times 20$)

Outline of the talk

We build a competition and input Shocks

Exposure measures to the liberalization

1. Competition Shock:

$$\tilde{\tau}_{jt} = \ln \tau_{jt} - \ln \tau_{j,2010}$$

2. Input Shock:

$$\tilde{q}_{jst} = \sum_k w_{jsk}^{2008} \tilde{\tau}_{kt},$$

$$\text{where } w_{jsk}^{2008} = \frac{X_{jsk}^{2008}}{\sum_k X_{jsk}^{2008}}$$

- $j \equiv$ industry,
- $k \equiv$ input,
- $s \equiv$ state,
- $X_{jsk}^{2008} \equiv$ Sector-state js's imports of inputs k,
- $w_{jsk}^{2008} \equiv$ Share of input k imported by js,
- $\tilde{q}_{jst} \equiv$ Weighted decrease in the tariffs of imported inputs.

We estimate the impact of the liberalization on earnings

Two-way fixed effects and event study specification

We compare industries-states facing different tariffs declines:

$$\ln y_{jst} = \beta^c \tilde{\tau}_{jt} + \beta^i \tilde{q}_{jst} + \gamma X_{js} \cdot \mu_t + \mu_{js} + \mu_{st} + u_{jst}.$$

And estimate using an event study:

$$y_{jst} = \sum_{t \neq 2010} \beta_t^c \left[T_j^c \times 1(\text{year=t}) \right] + \sum_{t \neq 2010} \beta_t^i \left[T_j^i \times 1(\text{year=t}) \right] + \mu_{js} + \mu_{st} + \varepsilon_{jst}.$$

- $y_{jst} \equiv$ log outcome in year t
- $\mu_{js} \equiv$ Industry-state FE
- $\mu_{st} \equiv$ State-year FE
- $T_j^c \equiv$ Difference of tariffs between 2018 and 2010
- $T_j^i \equiv$ Input shock between 2018 and 2010

Tariff Reduction on Imports

Table: Impact of Tariff Reductions on Imports

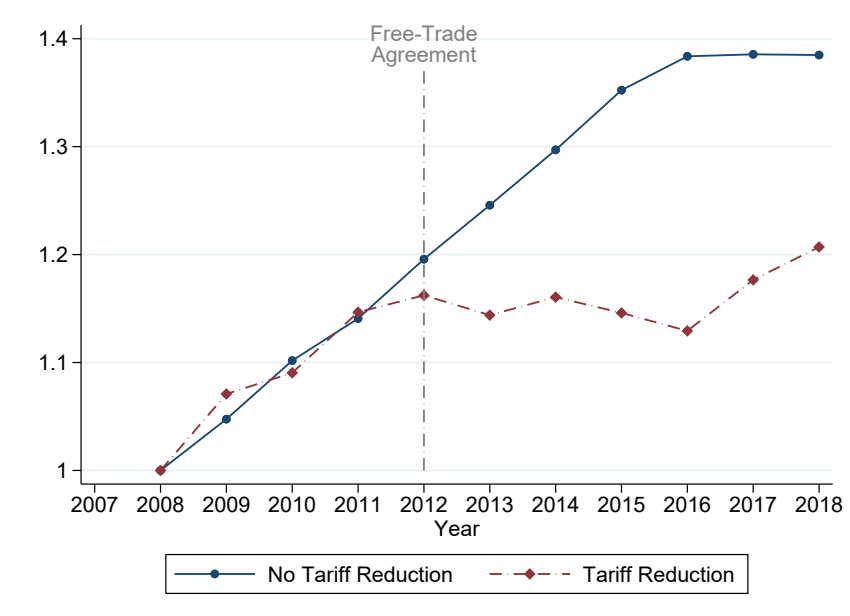
	Log(Total Imports)		U.S. Imports (%)		Non-U.S. Imports (%)	
	(1)	(2)	(3)	(4)	(5)	(6)
A) All Imports						
Comp. Shock	-1.415***		-0.994***		0.280***	
	(0.208)		(0.205)		(0.066)	
Comp. Shock$_{t\in\{2010,2012\}}$		-1.346***		-0.620***		0.217**
		(0.280)		(0.238)		(0.092)
Comp. Shock$_{t\in\{2013,2018\}}$		-1.425***		-1.068***		0.288***
		(0.226)		(0.228)		(0.070)
Observations	69987	69987	79956	79956	79956	79956
B) Imported Inputs						
Comp. Shock	-1.428***		-0.848***		0.303***	
	(0.205)		(0.203)		(0.060)	
Comp. Shock$_{t\in\{2010,2012\}}$		-1.456***		-0.482**		0.210**
		(0.263)		(0.229)		(0.082)
Comp. Shock$_{t\in\{2013,2018\}}$		-1.424***		-0.929***		0.315***
		(0.223)		(0.229)		(0.065)
Observations	67125	67125	71496	71496	71496	71496
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table presents the results of estimating our main specification using imports as an outcome at the product level (10-digits). Standard errors clustered at the product level. *** p<0.01, ** p<0.05, * p<0.1

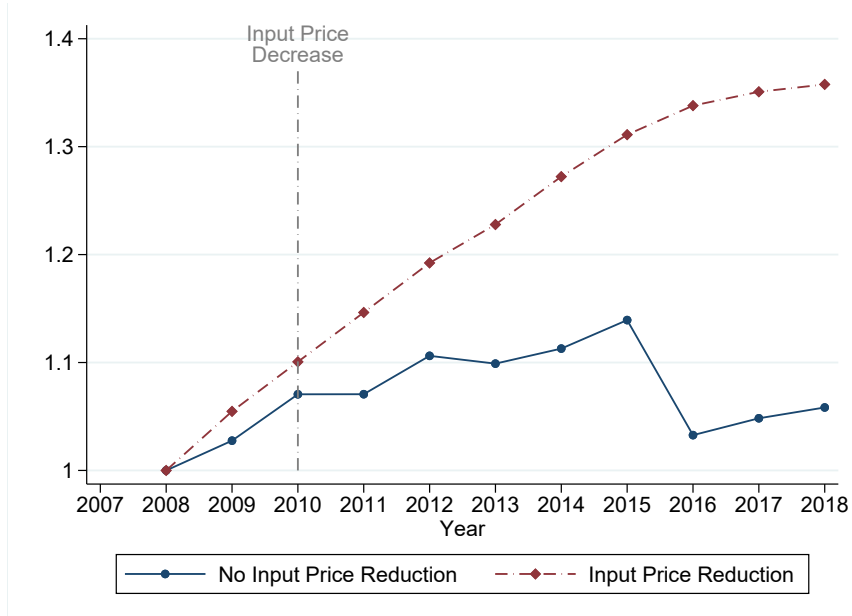
Evolution of earnings by sectors that experience tariff declines

Competition and Input Shock

Figure: Evolution of labor earnings: sectors that changed tariffs vs. other sectors



(a) Competition shock



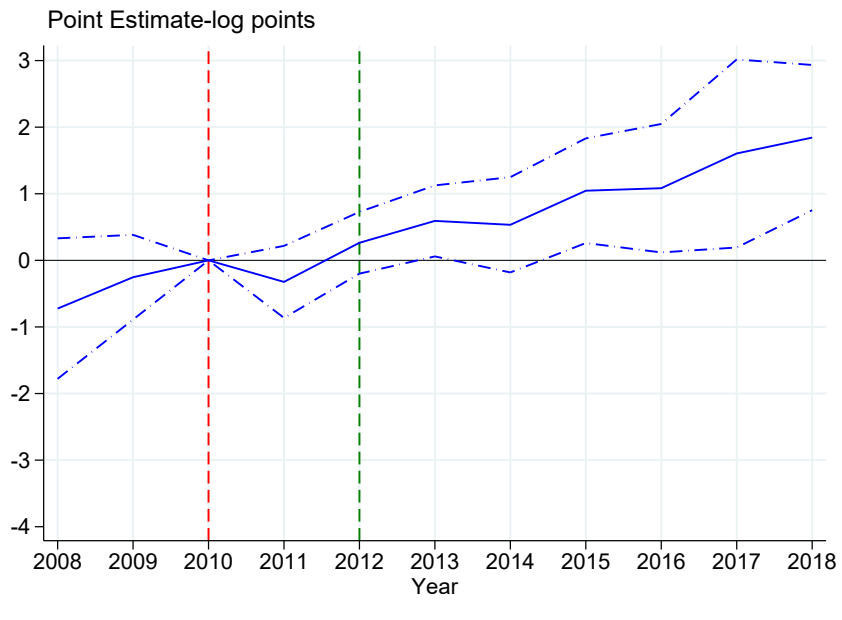
(b) Input shock

Notes: These figures present the evolution of overall employment with respect to 2008. Panel a presents separate results by industries that did and did not reduce tariffs. Panel b presents separate results by industries that did and did not reduce the price of inputs. The graphs use household survey data from 2008 to 2018, and divide by the value of the variable in 2008

The effect of the trade liberalization on earnings

Event study specification

Figure: Event study specification: effect of the tariff shock on labor earnings



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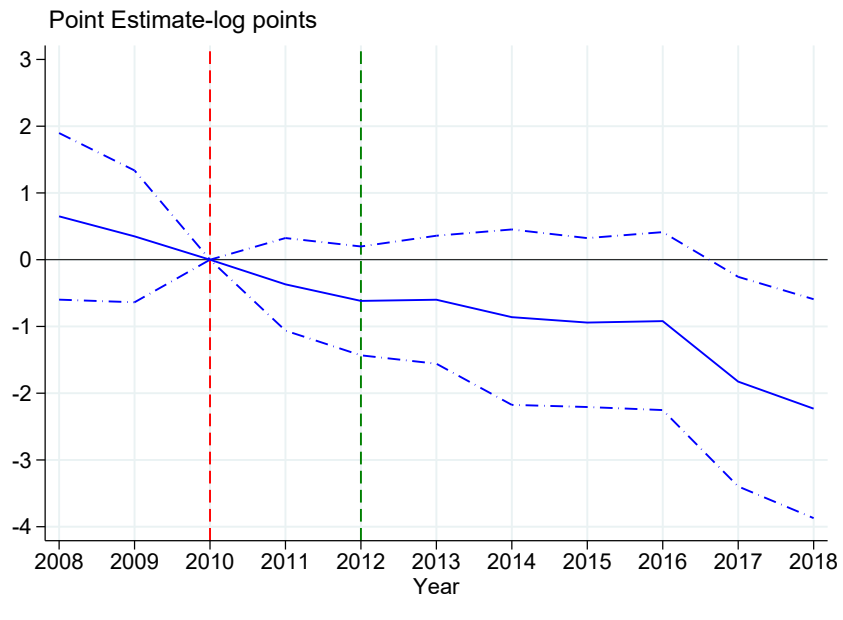

(b) Input shock

Notes: These figures present the point estimates of the event study specification with the 95% confidence interval. Panel a presents the results for the competition shock, and panel b for the input shock. We use household survey data from 2008 to 2018 at the state-industry level.

Point estimates of the impact of the trade liberalization

Main specification

Table: Input and Competition Shocks on Wage Bill

	OLS			2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
A) All Sectors						
Input Shock	-1.065***	-1.350***	-1.001***	-1.473***	-1.715**	-1.496**
	(0.247)	(0.435)	(0.257)	(0.519)	(0.661)	(0.548)
Comp. Shock	2.788***	2.810***	2.760***	3.260**	3.280**	3.260**
	(0.767)	(0.746)	(0.711)	(1.252)	(1.269)	(1.281)
Observations	53,177	53,177	53,177	53,177	53,177	53,177
State-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FE	Yes			Yes		
Year FE		Yes	Yes		Yes	Yes
Baseline Controls			Yes			Yes

Notes: This table presents the results of estimating our main specification using labor earnings as outcome. Estimations performed in a panel at the industry-state-year level. . Standard errors are two-way clustered at the industry and state level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

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B) By Industry						
Input shock × 1(Agric.)	1.190**	0.972	1.228*	-0.391	-0.524	-0.437
	(0.543)	(0.635)	(0.631)	(1.801)	(2.079)	(1.989)
Input shock × 1(Manuf.)	-0.489	-0.947	-0.659	0.976	0.182	0.286
	(0.445)	(0.622)	(0.564)	(1.429)	(1.907)	(1.590)
Input shock × 1(Serv.)	-1.406***	-1.531**	-1.344**	-1.868***	-1.847***	-1.839***
	(0.430)	(0.650)	(0.488)	(0.510)	(0.566)	(0.509)
Comp. shock × 1(Agric.)	4.272***	4.113***	4.111***	6.359*	6.119	6.263
	(0.539)	(0.452)	(0.474)	(3.675)	(3.784)	(3.765)
Comp. shock × 1(Manuf.)	1.268***	1.492***	1.405***	0.179	0.757	0.651
	(0.435)	(0.482)	(0.484)	(1.054)	(1.305)	(1.161)
Observations	53,177	53,177	53,177	53,177	53,177	53,177
State-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FE	Yes			Yes		
Year FE		Yes	Yes		Yes	Yes
Baseline Controls			Yes			Yes

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Takeaways on the impact of the competition and the input shock

- Negative impact of the input shock and positive impact of the competition shock
  - These results are consistent with the theory
  - Higher competition effect in the primary sector over manufacturing

- The input shock is driven by the service sector
  - Positive or "zero" impact in the primary and manufacturing sector
  - Negative effect in the service sector

- The point estimates suggest:
  - Higher TE in the primary sector over manufacturing?
  - Labor and intermediate inputs: "substitutes" in the primary and manufacturing sectors

Outline of the talk

Linking the Model to the Data:

Use the reduced-form estimates to calibrate model parameters

- We calibrate the model for:
  - 14 sectors + Home production:
    3 primary sectors, 8 mfg. sectors, and 2 service sectors
  - 24 regions in Colombia + the US and the RoW: 26 regions in total
  - We assume that there is only migration within the Colombian states
  - We transform the transition matrix to start in steady state

- We complement the data with:
  - WIOD: tradeflows between the US and the RoW
  - Regional input-output tables

- Recover the trade elasticity by running gravity equations exploiting the FTA:

$$\ln x_t^{n(Col)j,USAj} - \ln x_t^{n(Col)j,RoWj} = \theta[\ln(1 + t_t^{n(Col)j,USAj}) - \ln(1 + t_t^{n(Col)j,RoWj})] + \gamma_{nj} + \gamma_t + \epsilon_{njt}$$

- Recover the key EoS in the prod. function using directly the point estimates:
  - Recover σ^j from the first-order approximation and β^i

Estimation of the Trade Elasticity

Table: Trade Elasticities - Industry

VARIABLES	(1) Aggregate	(2) 1-digit	(3) 2-digit
ln (1+t) x Crop Production			4.158**
			(1.724)
ln (1+t) x Animal Production			-0.857
			(8.366)
ln (1+t) x Forestry			5.582
			(6.994)
ln (1+t) x Fishing			18.982***
			(0.256)
ln (1+t) x Foods and bevarages			4.468***
			(0.789)
ln (1+t) x Tobacco			3.711
			(5.646)
ln (1+t) x Textiles			3.616***
			(1.156)
ln (1+t) x Wearing Apparel			1.742*
			(1.017)
ln (1+t) x Wood			2.297
			(1.790)
ln (1+t) x Petroleum			10.571
			(7.918)
ln (1+t) x Chemicals			2.938***
			(0.895)
ln (1+t) x Metal products			-0.333
			(1.190)
ln (1+t) x Office products			2.280*
			(1.211)
ln (1+t) x Vehicles			1.966
			(1.210)
ln (1+t) x Ag riculture		4.614***	
		(1.639)	
ln (1+t) x Manufacturing		2.992***	
		(0.482)	
ln (1+t)	3.060***		
	(0.476)		
Observations	30,578	30,578	30,578
R-squared	0.777	0.777	0.777

Calibration of the EoS between labor and intermediate inputs

- From the first-order approximation we know that:

Table: Implications of the reduced-form effects

Point estimate	Implication	Labor and intermediate inputs
$\beta^i > 0$	Substitution effect dominates marginal cost effect	Substitutes
$\beta^i = 0$	Substitution effect dominates marginal cost effect	Substitutes
$\beta^i < 0$	Marginal cost dominates and can be complements	?

- Then, using the FOA, the TE, and β^i, we recover σ^j from:

$$\frac{\beta^i}{1-\phi^{nj}} = (\sigma^j - 1) - \theta^j \left(\sum_{i=1}^{N} \psi^{ij,nj} (1 - \pi^{ij,nj}) \right)$$

Model Parameters and Simulation

- We simulate an unanticipated change in 2010 in the evolution of tariffs
  - Weighted average mean of the 10-digit sectors to the 2-digit sectors

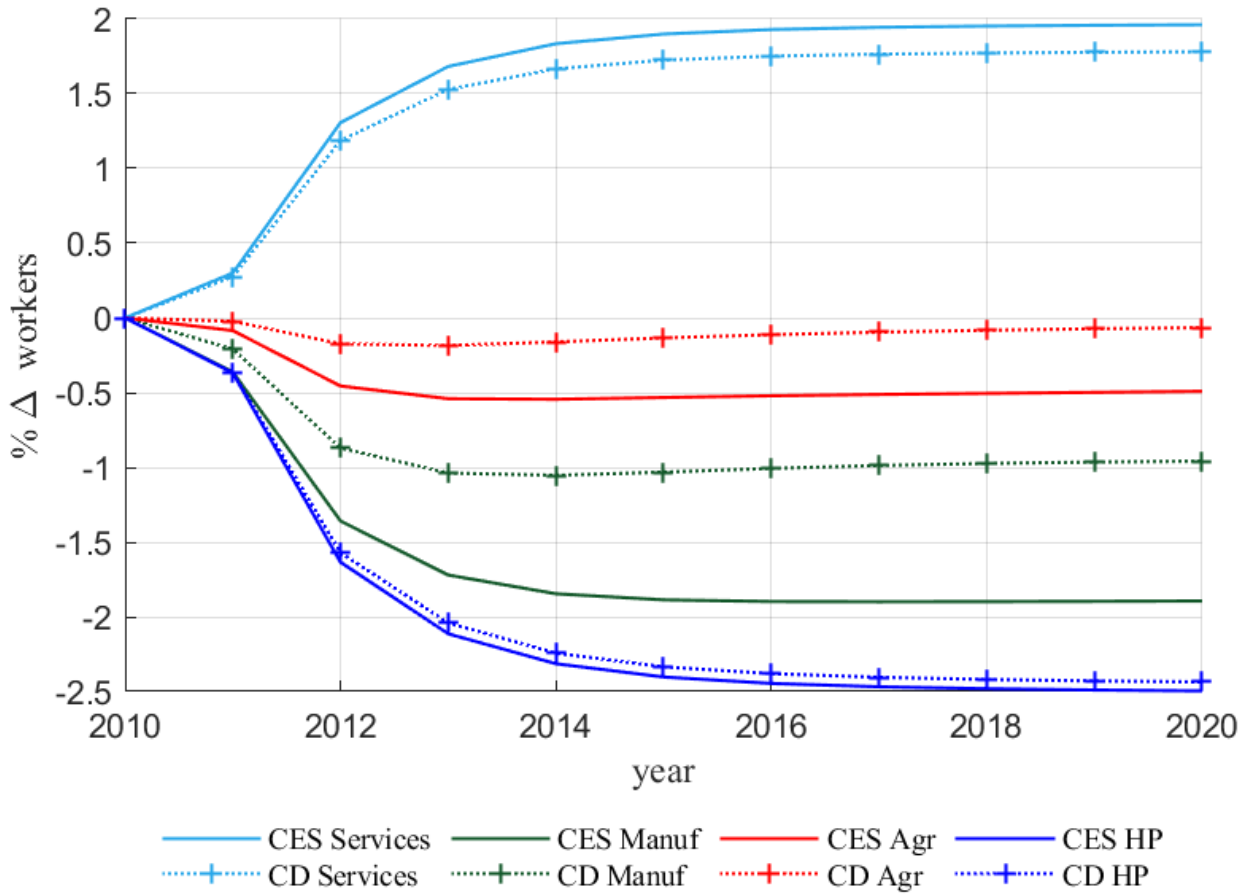
Table: **Parameter values used**

Parameter	Value	Description	Source
σ_L Agriculture	2.5	EoS - labor and intermediate inputs	Calibration
σ_L Manufacturing	2.5	EoS - labor and intermediate inputs	Calibration
σ_L Services	0.2	EoS - labor and intermediate inputs	Calibration
δ	2.0	EoS - intermediate inputs	Peter & Ruane (2023)
κ	12	Inverse moving elasticity - regions	RUV
ν	0.55	Inverse moving elasticity - sectors	RUV
σ	3.0	Average TE	Own Estimation

- Analyze the labor market effects of the reform:
  - Evolution of employment
  - Impacts in the labor share
  - Change in welfare in each cell: NPV of real income + mobility options Welfare

Bigger employment differences with the CES prod. function

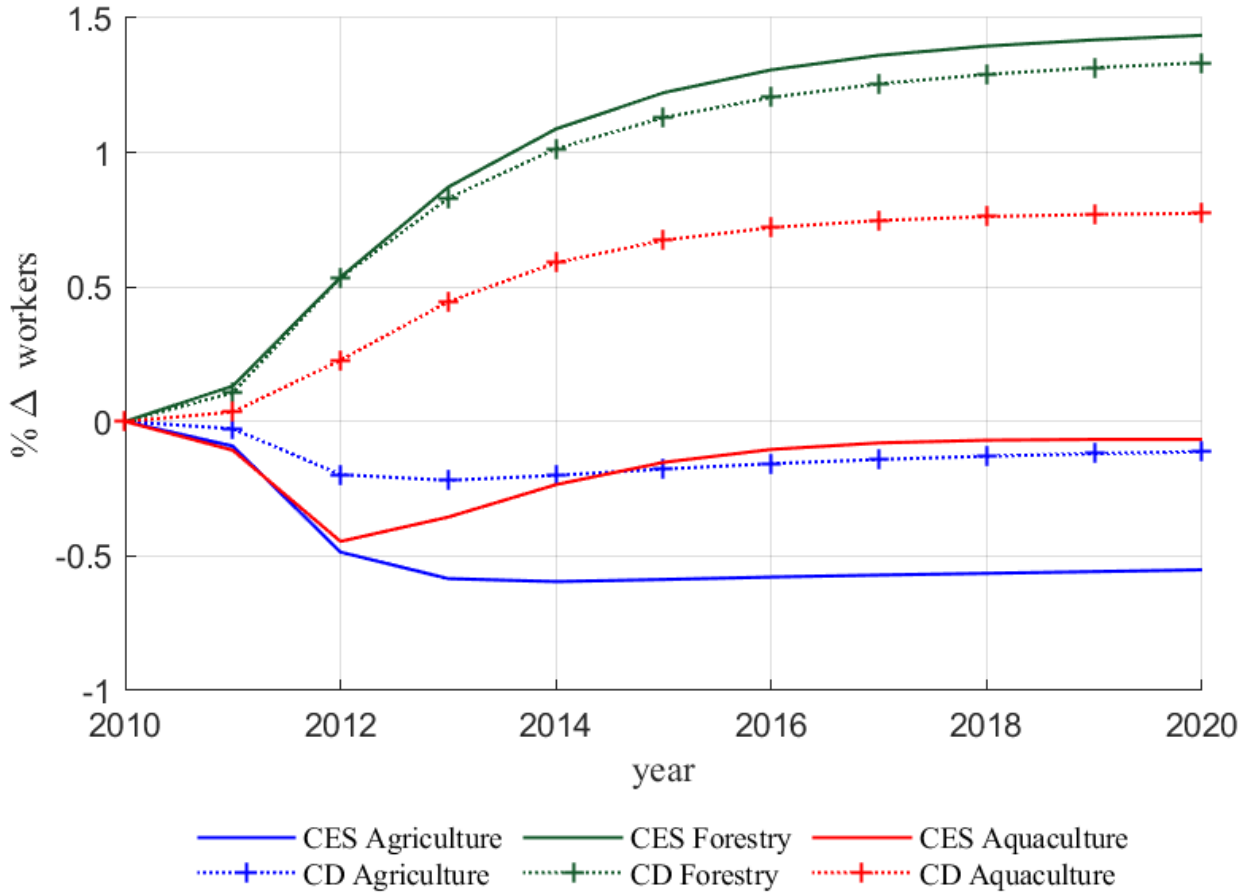
Figure: Results of the Counterfactual-Evolution of Employment



Notes: This figure plots the results of the evolution of employment in the Colombian economy at the 1-digit sector level

Employment effects at the 2-digit sector levels-Primary Sector

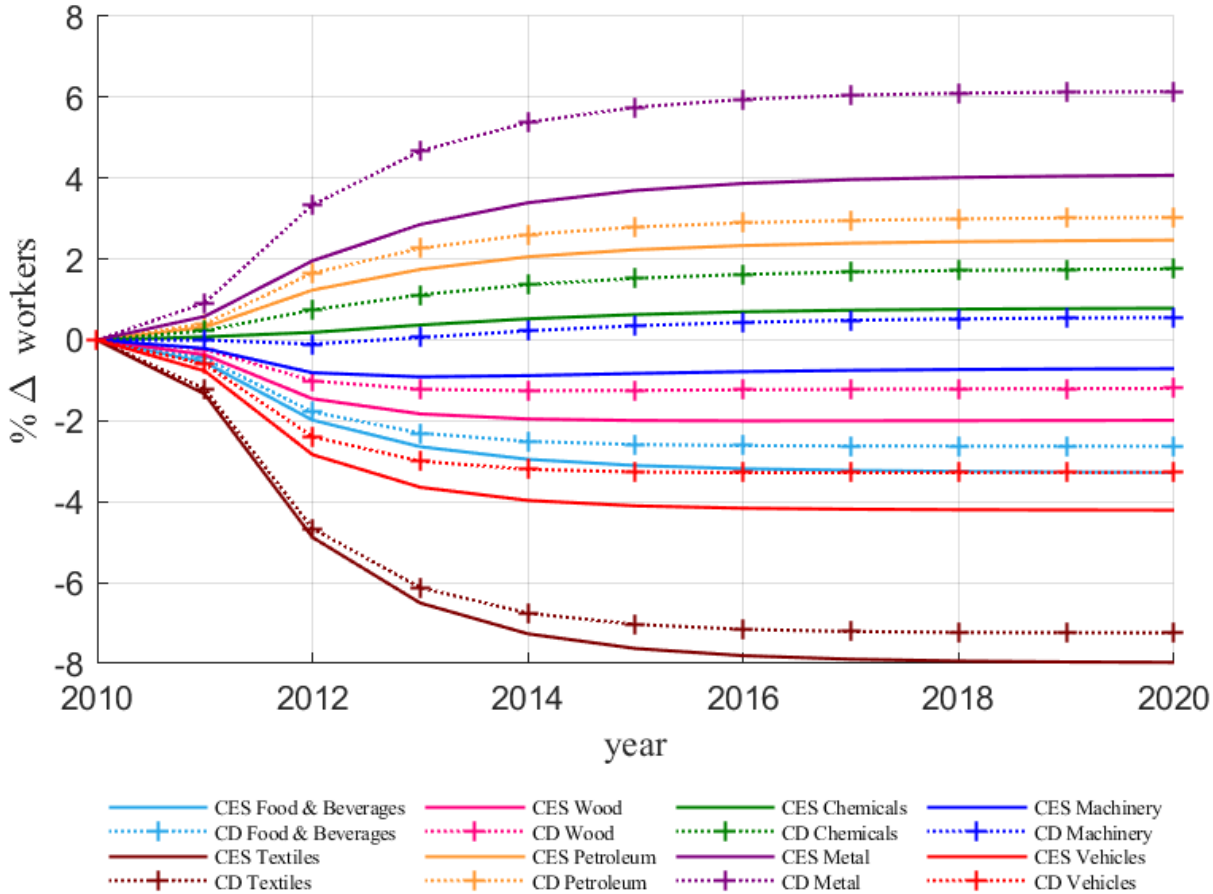
Figure: Results of the Counterfactual-Evolution of Employment



Notes: This figure plots the results of the evolution of employment in the Colombian economy at the 2-digit sector level for the primary sector

Employment effects at the 2-digit sector levels-Manufacturing Sector

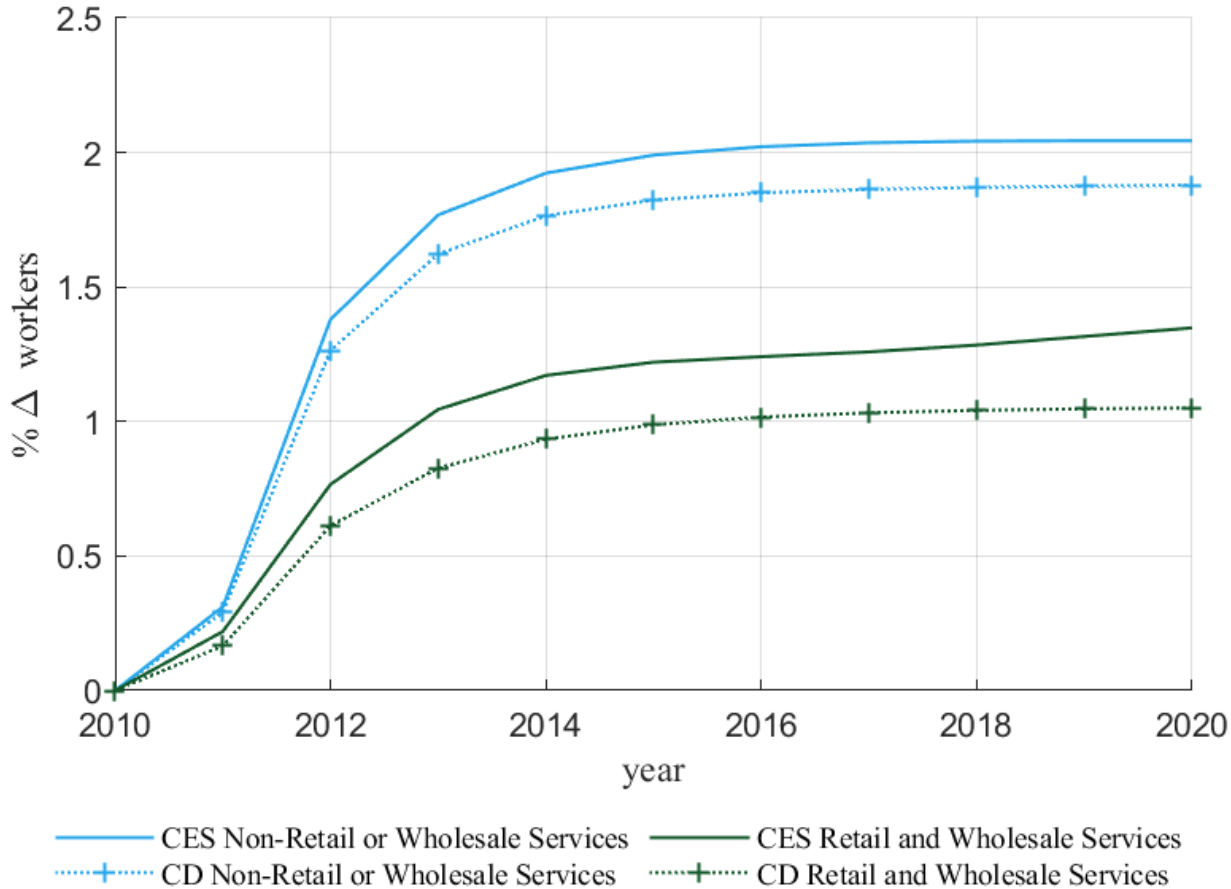
Figure: Results of the Counterfactual-Evolution of Employment



Notes: This figure plots the results of the evolution of employment in the Colombian economy at the 2-digit sector level for the manufacturing sector

Employment effects at the 2-digit sector levels-Service Sector

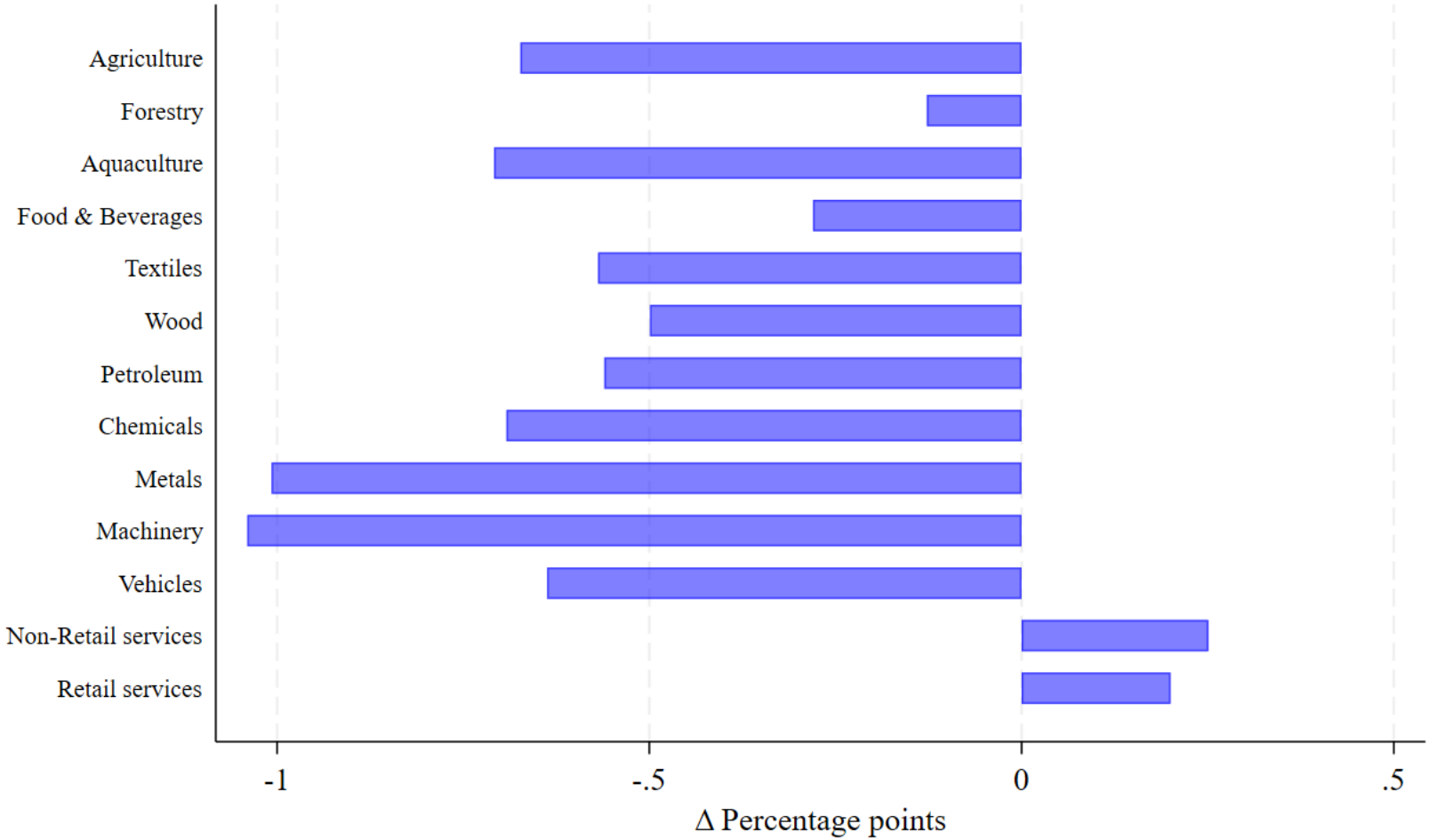
Figure: Results of the Counterfactual-Evolution of Employment



Notes: This figure plots the results of the evolution of employment in the Colombian economy at the 2-digit sector level for the service sector

Impact in the labor share

Figure: Impact in the labor share



Notes: This figure plots the results of the change in the labor share across 2-digit sectors in Colombia

Impact on Welfare-Summary Stats

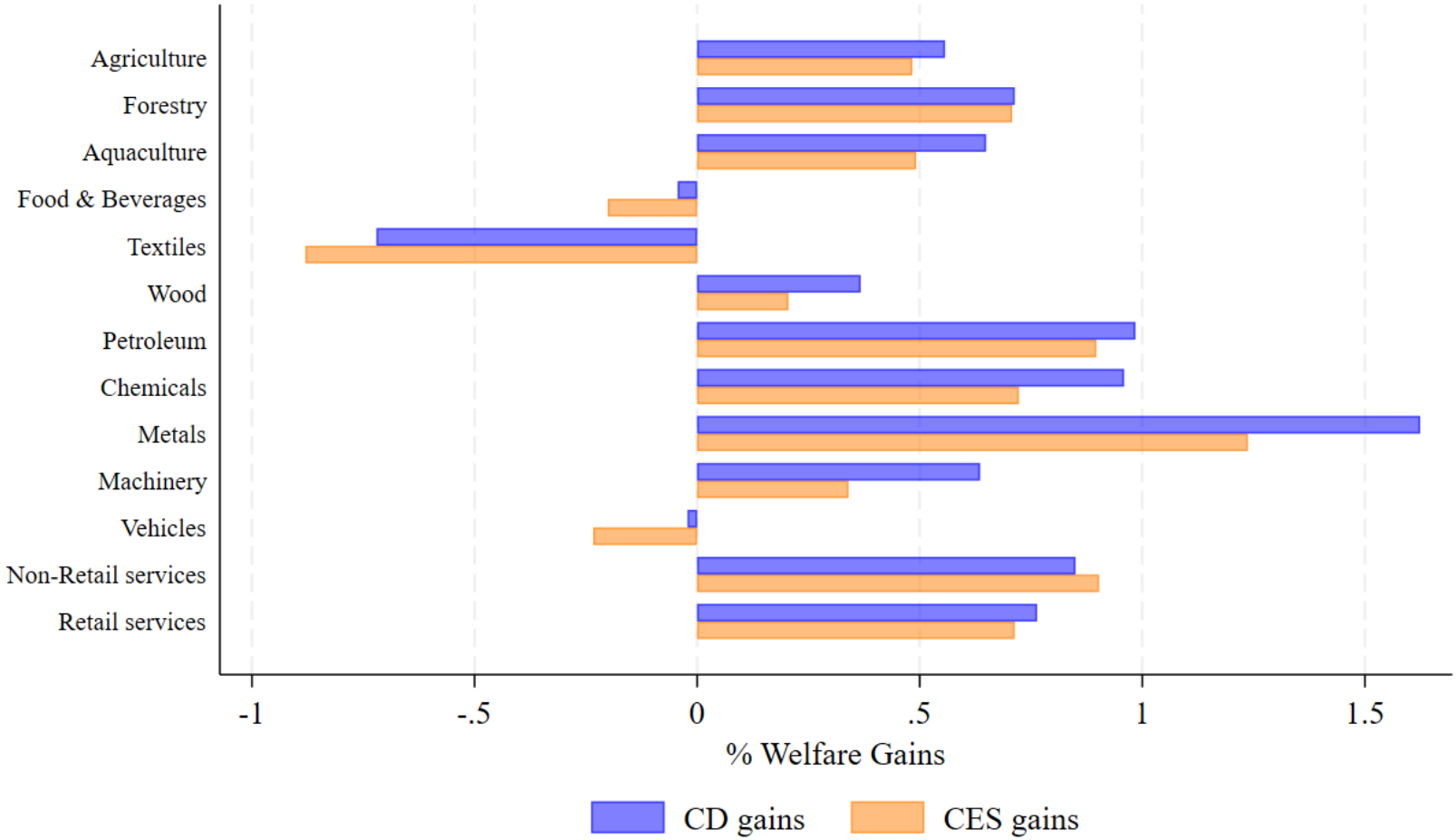
Table: Welfare Gains: Trade Liberalization Shock

	Cobb-Douglas production function				CES production function				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Weighted average:	**Mean**	**sd**	**Min**	**Max**	**Mean**	**sd**	**Min**	**Max**	**Obs**
All industries	0.78	0.35	-1.97	3.61	0.78	0.37	-1.91	2.46	312
Primary sector	0.56	0.45	-0.30	1.95	0.48	0.40	-0.33	1.84	72
Manufacturing	0.37	0.91	-1.98	3.61	0.17	0.80	-1.91	2.46	192
Services	0.84	0.08	0.56	0.96	0.88	0.10	0.50	1.02	48

Note: This table reports the average welfare gains of the trade liberalization episode across industries and states in Colombia.

Impact on Welfare across 2-digit sectors

Figure: Results of the Counterfactual-Welfare weighted average



Notes: This figure plots the results of the change in welfare across 2-digit sectors in Colombia

Outline of the talk

Conclusion

- We exploit the recent trade liberalization episode in Colombia
  - Decrease in the tariffs imposed by Colombia to the US and other countries
  - Negligible decrease for Colombian products in other markets
  - Unanticipated policies

- Import competition and foreign Inputs have opposite effects on employment
  - Bigger competition effect in agriculture than manufacturing
  - Labor and inputs: substitutes in manufacturing and primary sectors

- Extend the dynamic GE model from CDP and ACM:
  - Allowing for different degrees of substitutability in the production function
  - Inputs and labor are:
    - complements in the service sector
    - substitutes in the primary and manufacturing sector

- Implications for the evolution of employment and welfare:
  - Bigger differences in employment
  - Inequality decrease in sectors where labor and inputs are substitutes
  - Losers lose more

Outline of the talk

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Outline of the talk

Trade Between Colombia and the US

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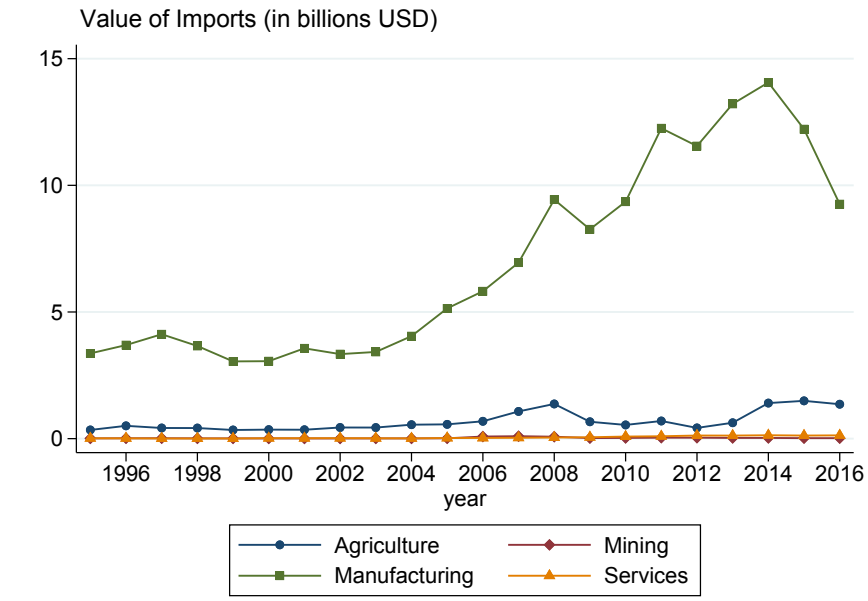
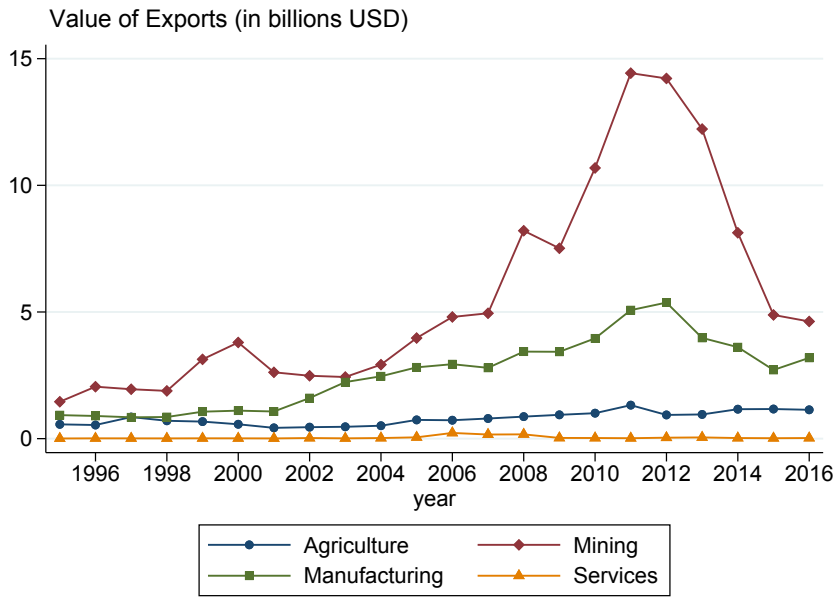
Imports by Industry

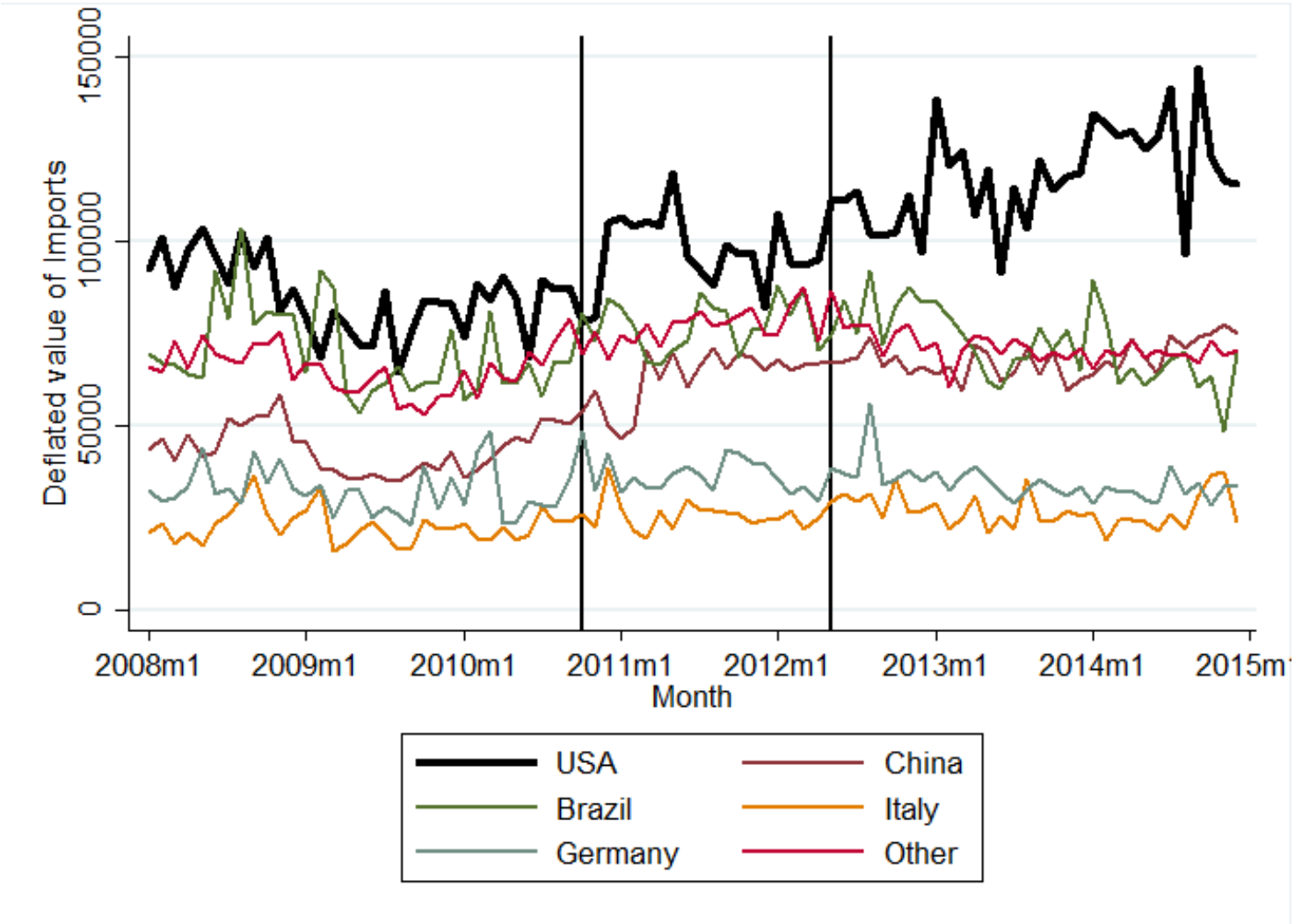


Exports by Industry



- Imports: manufacturing goods.
- Exports: mining goods.

Imports from Other Countries relative to the U.S.



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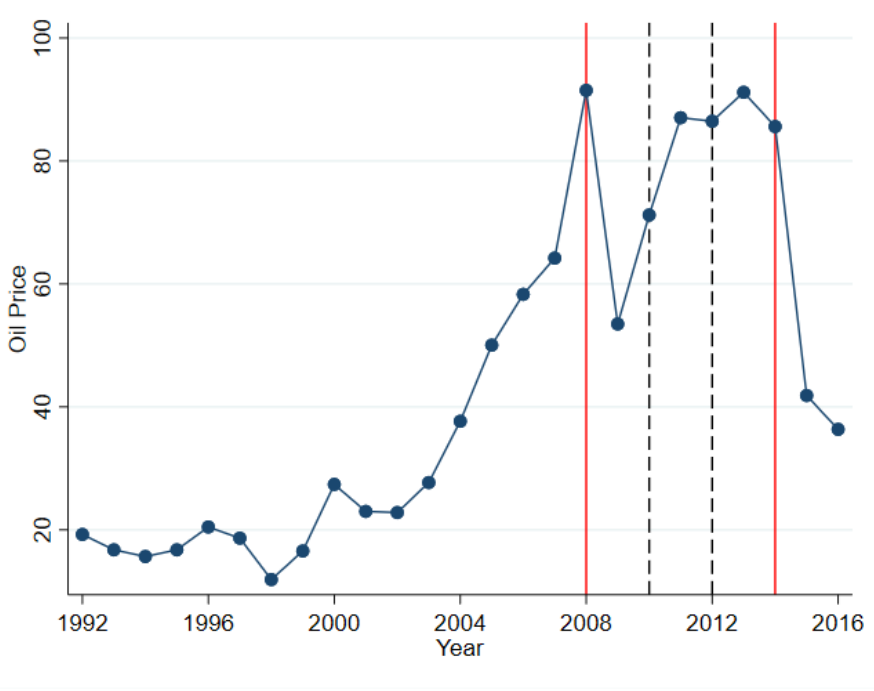
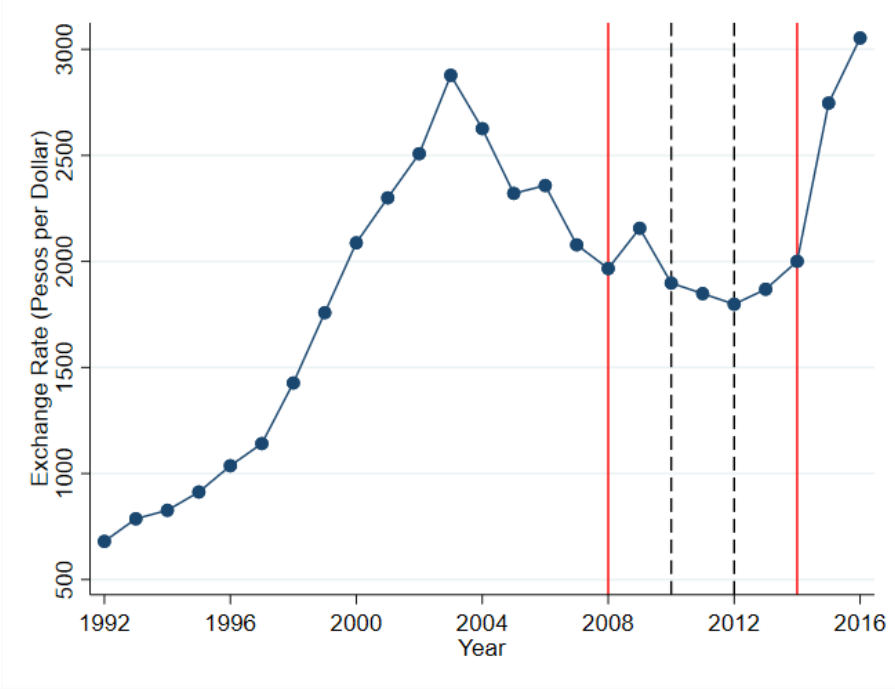
Macroeconomic Environment

Oil Price



Exchange Rate



There are some possible confounders:

1. Exports rely heavily in oil price $\Rightarrow$ we drop mining sector
2. Big peso devaluation after 2015 $\Rightarrow$ we drop 2015-2016

Our results hold when relaxing both constraints.

Back Back Samples

Change in Welfare

- The change in welfare is given by the NPV of real income + mobility options:
  - Change in real income measure: $\omega_{ist} = w_{ist} / P_{it}$
  - Change in the mobility options captured by $\mu_{ii,ss|i,t}$ and $\mu_{ii,s\#,t}$

$$\ln(\zeta_{i,s}) = \sum_{t=1}^{\infty} \beta^t \ln \left(\frac{\hat{\omega}_{i,s,t}}{(\hat{\mu}_{ii,ss|i,t})^{\nu} (\hat{\mu}_{ii,s\#,t})^{\kappa}} \right)$$

- This expression corresponds to the permanent equivalent variation in real income for workers originally employed in region i in sector s

- Without mobility, this expression only corresponds to the present discounted value of changes in real wages

$$\ln(\zeta_{i,s}) = \sum_{t=1}^{\infty} \beta^t \ln (\hat{\omega}_{i,s,t})$$

Model Calibration