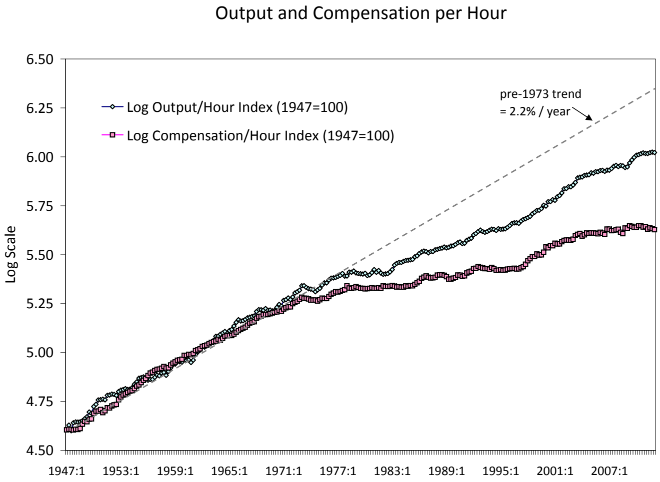
Trade and Competition in Product and Labor Markets

Roman D. Zarate
UC Berkeley

November 5th 2018

Productivity and Wages



Source: D. Card's lecture 7 (250A) based on Fleck, Glaser and Sprague (2011)

Labor Market Power

THE WALL STREET JOURNAL.

OPINION | COMMENTARY

Why Aren't Americans Getting Raises? Blame the Monopsony

Instead of bidding up wages, firms collude to keep pay low and enforce noncompete clauses.

PHOTO: GETTY IMAGES

By **JASON FURMAN** and **ALAN B. KRUEGER**
Nov. 3, 2016 7:33 p.m. ET

Pat Cason-Merenda had worked as a registered nurse at the Detroit Medical Center for four years, unaware that she was being underpaid. That changed when a class-action

"Ignoring the existence of employer market power could lead to incorrect conclusions on the driving force behind changes in wage inequality" (Manning, 2003)

Measuring the elasticity of LS to the firm *"turns out to be substantively important for understanding the sources for wage inequality"* (Card et al., 2016)

Trade Literature

- The trade literature has studied what are the pro-competitive effects of trade in product markets:
  - Melitz & Ottaviano (2008), Edmond et al. (2015), De Loecker et al. (2016), Arkolakis et al. (2018)
- The trade literature hasn't studied yet labor market power responses due to trade
- Labor markets in trade models:
  - Perfectly competitive labor markets
  - Search models with constant bargaining parameters: Verhoogen (2008), Helpman et al. (2010; 2017), Sampson (2014)

Research project

- How does market power in goods and labor react to the trade liberalization in Colombia?
  - Quantitative model assuming oligopolies and oligopsonies
  - Take the data to the model

- The goal of the project is to study implications of market power responses on:
  - Aggregate gains due to resource misallocation
  - Distributional Implications:
    - Pass-through rates between firms, workers and consumers
    - Real income inequality across groups (for the future)

- The main mechanisms are changes in product or labor market shares.
  - Trade costs $\rightarrow$ Product market shares $\rightarrow$ Demand elasticities $\rightarrow$ markups
  - Trade costs $\rightarrow$ Labor market shares $\rightarrow$ Labor supply elasticities $\rightarrow$ markdowns

This presentation

1. Introduction
2. Evidence of Oligopsonies
3. Closed Economy Model
4. Small Open Economy Model
5. Estimation of the main parameters of the model
6. Trade Liberalization
7. Next Steps
8. Simulations

“Evidence” of Oligopsonies

Data: Colombia's Encuesta Anual Manufacturera

- Plant-level data from the Encuesta Anual Manufacturera (EAM) in Colombia spanning the period 2002 to 2014.
  - It is a census of manufacturing plants with 10 or more workers
  - It provides information on products, inputs, employment, and earnings
  - There are approx 5000-6000 plants each year producing 4,000 distinct eight-digit product codes.
- Data from 1970 to 2014 linked to shipments customs data.
  - I'm building a panel from 1982 to 1998.
- Manufacturing represents from 20% to 25% of total employment in Colombia.

Labor market concentration

- A local labor market is defined as a 4-digit-cz-year cell or 4 digit-cz-year cell
- Herfindahl Hirshman indexes:

$$HHI_s = \sum_{i=1}^{n(s)} s_{i(s)}^2$$

- I use this measure to test if there is "evidence" of oligopsonies
- Wages are lower in more concentrated labor markets
- This result is consistent with recent evidence in the labor literature:

  Autor et al. (2016), Azar et al. (2017), Benmelech et al. (2018), Abel et al. (2018).

Labor Market Concentration: Summary Stats

Table: Summary Stats - HHI Map

HHI	Mean	Sd	Min	Max	Obs
4 digit-cz-year cell	0.383	0.222	0.014	0.979	6627
3 digit-cz-year cell	0.352	0.229	0.012	0.979	4562
2 digit-cz-year cell	0.294	0.238	0.012	0.962	2441
cz-year cell	0.128	0.175	0.001	0.661	200

Note: This table reports summary statistics of Herfindahl Hirshman indexes across labor markets. A labor market is defined as a 4 digit-cz-year cell, 3 digit-cz-year cell or 2 digit-cz-year cell following Benmelech et al. (2018).

Wages and Labor Market Concentration

- Following Benmelech et al. (2018) I study the relationship between wages and labor market concentration in Colombia by running:

$$\ln w_{it} = \beta_0 + \beta_1 HHI_{cj(i,t-1)} + \beta_2 \ln a_{it} + \delta_{jt} + \mu_{f(i)} + \epsilon_{it} \quad (1)$$

  - i plant index, f firm index, j industry index, c city.

- The main hypothesis is that $\beta_1 < 0$

Wages and Labor market Concentration

Table: Wages and Labor Market concentration 3 Digit 2 Digit

	Commuting Zone-ISIC 4 digit					
	(1)	(2)	(3)	(4)	(5)	(6)
	ln w	ln w	ln w	ln w	ln w	ln w
HHI t-1	-0.027***	-0.010**	-0.012**	-0.030***	-0.009**	-0.042**
	(0.005)	(0.005)	(0.005)	(0.006)	(0.004)	(0.017)
ln va	0.222***	0.059***	0.059***	0.221***	0.054***	0.031***
	(0.006)	(0.003)	(0.005)	(0.006)	(0.003)	(0.015)
Obs	63286	62590	62590	63281	62582	3631
R2	0.45	0.87	0.87	0.46	0.88	0.87
Year FE	Yes	Yes	Yes	-	-	-
Industry FE	Yes	-	Yes	-	-	-
Industry-Year FE	-	-	-	Yes	Yes	Yes
Firm FE	-	Yes	Yes	-	Yes	-
Firm-Year FE	-	-	-	-	-	Yes

Note: This table reports the results for the relationship between wages and labor market concentration measured by a Herfindahl index at the 4 digit Isic-cz-year level. The coefficient is standarized using the standard deviation of the HHI. Clustered standard errors at the cz level are reported in parentheses. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$.

Closed Economy Model

Production: Final Good

- Perfectly competitive firms produce a homogeneous final consumption good Y using inputs $y(s)$ from a continuum of sectors

$$Y = \left(\int_0^1 y(s)^{\frac{\theta-1}{\theta}} ds \right)^{\frac{\theta}{\theta-1}}$$

- $\theta > 1$: Elasticity of substitution across sectors.

- Each sector consists of a finite and exogenous number of intermediate producers $n(s)$.

Production: Intermediate Iputs

- In sector s, output is produced using $n(s)$ exogenous firms by a CES production function

$$y(s) = \left[\sum_{i=1}^{n(s)} y_{i(s)}^{\frac{\gamma-1}{\gamma}} \right]^{\frac{\gamma}{\gamma-1}}$$

- $\gamma > \theta$ is the elasticity of substitution across varieties within the same sector.

Market structure-Goods

- Production function is $y_{i(s)} = a_{i(s)} l_{i(s)}$
  - $a_{i(s)}$ Firm's productivity
  - $l_{i(s)}$ Units of labor hired

- Intermediate producers are heterogeneous in their productivity level a_i.

$$G_a(a) = 1 - (a_{min}/a)^{\phi} \qquad a > a_{min} > 0; \phi > 1$$

- Production involves a fixed cost of $f_d > 0$ units of labor.

- As in Atkenson & Burstein (2008), and EMX, firms behave as oligopolies and compete Cournot.

Product Demand Elasticity

- Let's assume that firms compete in quantities:

$$|\epsilon_{i(s)}| = \left(\frac{(1-\lambda_{i(s)})}{\gamma} + \frac{\lambda_{i(s)}}{\theta} \right)^{-1}$$

where

$$\lambda_{i(s)} \equiv \frac{p_{i(s)}^{1-\gamma}}{\sum_{i=1}^{n(s)} p_{i(s)}^{1-\gamma}} = \frac{p_{i(s)}^{1-\gamma}}{p(s)^{1-\gamma}}$$

  - $\lambda_{i(s)}$: Product market share of firm i in sector s.

- The demand elasticity is a weighted harmonic average between θ and γ.

- Larger firms exert more market power Bertrand

Assumptions - Labor Supply - Roy model

- Roy model across sectors and across firms within sectors.

- Workers receive labor supply shocks for firms and sectors as in:
  Lagakos & Waugh (2013), Hsieh et al. (2015), and Galle et al. (2017)

- Workers make two sequential decisions:
  - Sector
  - Firm within sector

- Labor supply shocks at the sector level are drawn from a Frechet distribution with dispersion parameter $\kappa > 1$ and level parameters $A(s)$

$$\nu(s) = \epsilon(s)/\Gamma\left(1 - 1/\kappa\right)$$

- Labor supply shocks at the firm level are drawn from a Frechet distribution with dispersion parameter $\beta > \kappa$ and level parameters $A_{i(s)}$

$$\nu_{i(s)} = \epsilon_{i(s)}/\Gamma\left(1 - 1/\beta\right)$$

Labor Supply: Nested Frechet

- The probability of working at firm i in sector s is:

$$s^L_{i(s)} \equiv \underbrace{\left(\frac{A_{i(s)} w^{\beta}_{i(s)}}{\sum_{j=1}^{n(s)} A_{j(s)} w^{\beta}_{j(s)}}\right)}_{\text{Prob of working at firm i in sector s}} \underbrace{\left(\frac{n(s)^{\frac{-\kappa}{\beta}} A(s) w(s)^{\kappa}}{\int_0^1 n(k)^{\frac{-\kappa}{\beta}} A(k) w(k)^{\kappa} dk}\right)}_{\text{Prob of working at sector s}}$$

  where

  - $W(s) \equiv \left(\sum_{i=1}^{n(s)} A_{i(s)} w^{\beta}_{i(s)}\right)^{\frac{1}{\beta}}$
  - $w(s) \equiv \left(\sum_{i=1}^{n(s)} \frac{A_{i(s)} w^{\beta}_{i(s)}}{n(s)}\right)^{\frac{1}{\beta}}$
  - $W \equiv \left(\int_0^1 n(s)^{\frac{-\kappa}{\beta}} A(s) w(s)^{\kappa} ds\right)^{\frac{1}{\kappa}} = 1$

- β determines the labor supply elasticity across firms within sectors
- κ determines the labor supply elasticity across sectors

Labor Supply

- Labor supply units to the firm are given by:

$$l_{i(s)} \equiv \tilde{L} W(s)^{\kappa-\beta} A_{i(s)} w_{i(s)}^{\beta-1}$$

- Aggregate labor supply units at the sector level are:

$$l(s) \equiv \left(\sum_{i=1}^{n(s)} l_{i(s)}^{\frac{\beta}{\beta-1}} \right)^{\frac{\beta-1}{\beta}}$$

- Labor supply units at the aggregate level that are used in production are:

$$\tilde{L} \equiv \left(\int_0^1 l(s)^{\frac{\kappa}{\kappa-1}} ds \right)^{\frac{\kappa-1}{\kappa}}$$

Residual Labor Supply Elasticity

- Let's assume that firms compete in labor units:

$$\eta_{i(s)} = \left(\frac{(1 - \pi_{i(s)})}{\beta - 1} + \frac{\pi_{i(s)}}{\kappa - 1} \right)^{-1}$$

where

$$\pi_{i(s)} \equiv \frac{A_{i(s)} w_{i(s)}^{\beta}}{\sum_{i=1}^{n(s)} A_{i(s)} w_{i(s)}^{\beta}} = \frac{A_{i(s)} w_{i(s)}^{\beta}}{W(s)^{\beta}}$$

  - $\pi_{i(s)}$: Labor market share of firm i in sector s.

- The labor supply elasticity is a weighted harmonic average between κ and β.

- Larger firms exert more labor market power Bertrand

Firm's maximization problem

- The problem of firm i consists to choose prices and wages to maximize profits:

$$\Pi_{i(s)} \equiv p_{i(s)} y_{i(s)} - w_{i(s)} l_{i(s)} - f_d$$

- Solving the firm's maximization problem we get the following FOC:

$$p_{i(s)} = \underbrace{\left(\frac{\epsilon_{i(s)}}{\epsilon_{i(s)} - 1} \right)}_{MU_{i(s)}} \cdot \underbrace{\left(\frac{\eta_{i(s)} + 1}{\eta_{i(s)}} \right)}_{1/MD_{i(s)}} \frac{w_{i(s)}}{a_{i(s)}}$$

where:

  - $\epsilon_{i(s)}$ is the residual product demand elasticity faced by each firm.
  - $\eta_{i(s)}$ is the residual labor supply elasticity faced by each firm.

Equilibrium

- The equilibrium consists to find a vector of wages that solves the following system of equations for all firms in all sectors s:

$$LD_{i(s)} \equiv \underbrace{YP^{\theta}p(s)^{\gamma-\theta}}_{D(s)} \cdot \left[a_{i(s)}^{\gamma-1}\left(\frac{MD_{i(s)}}{MU_{i(s)}}\right)^{\gamma} w_{i(s)}^{-\gamma}\right]$$

$$LS_{i(s)} \equiv \underbrace{\tilde{L}W(s)^{\kappa-\beta}}_{E(s)} \cdot \left[A_{i(s)} w_{i(s)}^{\beta-1}\right]$$

$$ELD \equiv LD_{i(s)} - LS_{i(s)} = 0$$

- This problem is well behaved

General Equilibrium

- A firm operates in the market if the following condition is satisfied:

$$p_{i(s)}y_{i(s)} - w_{i(s)}l_{i(s)} \geq f_d$$

- Let's define $\phi_{i(s)}$ as a dummy variable that takes the value of 1 if the firm decides to operate.

- Labor market clears:

$$\underbrace{\tilde{L}}_{\text{Labor used in production}} + \underbrace{\int_0^1 \sum_{i=1}^{n(s)} \phi_{i(s)} f_d ds}_{\text{Labor used for FCs}} = \bar{L}$$

Resource Misallocation

Resource Misallocation

- Let's define TFP at the sector and aggregate level as

$$TFP(s) \equiv \frac{y(s)}{l(s)}$$

$$TFP \equiv \frac{Y}{\tilde{L}}$$

- where:
  - $l(s)$ is the labor employed in sector s on production.
  - $\tilde{L}$ total labor employed in the production of final output.

- We can derive a similar expression for TFP as Hsieh & Klenow (2009).

Resource Misallocation

- TFP at the sector level:

$$TFP(s) = \frac{\left[\sum_{i=1}^{n(s)} a_{i(s)}^{\frac{(\gamma-1)\beta}{\gamma+\beta-1}} \left(\frac{MD_{i(s)}}{MU_{i(s)}}\right)^{\frac{(\gamma-1)(\beta-1)}{\gamma+\beta-1}}\right]^{\frac{\gamma}{\gamma-1}}}{\left[\sum_{i}^{n(s)} a_{i(s)}^{\frac{(\gamma-1)\beta}{\gamma+\beta-1}} \left(\frac{MD_{i(s)}}{MU_{i(s)}}\right)^{\frac{\gamma\beta}{\gamma+\beta-1}}\right]^{\frac{\beta-1}{\beta}}}$$

- TFP at the sector and aggregate level is maximized if there is no *markup* or *markdown* dispersion

- The formula replicates HK (2009) when $\beta \to \infty$

- Initial estimates:
  - $\theta = 1.5$, $\gamma = 3.6$
  - $\kappa = 2.5$, $\beta = 7.7$

Log Normal Distribution

- Let's assume that $a_{i(s)}$ and $\left(\frac{MD_{i(s)}}{MU_{i(s)}}\right)$ are log-normally distributed

$$(\ln a_{i(s)}, \ln MD_{i(s)} / MU_{i(s)}) \sim \mathcal{N}(\mu_a, \mu_{MP}, \sigma_a^2, \sigma_{MP}^2, \sigma_{a,MP})$$

- Then, log TFP at the sector level is:

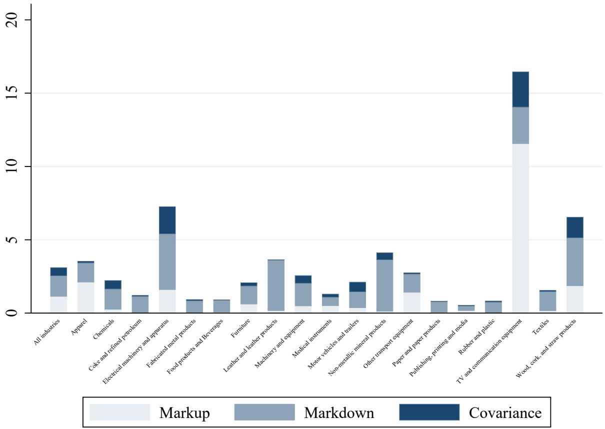
$$\ln TFP(s) = \left(\frac{\gamma+\beta-1}{(\gamma-1)\beta}\right) \ln M + \mu_a + \left(\frac{(\gamma-1)\beta}{2(\gamma+\beta-1)}\right) \sigma_a^2 - \underbrace{\left(\frac{\gamma(\beta-1)}{2(\gamma+\beta-1)}\right) \sigma_{MP}^2}_{\text{MP dispersion is bad}}$$

- For a fixed γ the effect of MP dispersion is lower than for the standard case when $\beta \to \infty$.

Counterfactuals

What are the TFP gains of removing *markup* and *markdown* dispersion?

Figure: TFP Gains



This figure plots the TFP gains of removing market power dispersion for the aggregate economy and by industries.

Pass-through rates

Pass-through rates under constant *market power*

- In a model with constant *markups* and *markdowns* the pass-through rate of productivity shocks to $w/p = 1$.

$$\frac{d \ln w_{i(s)}}{d \ln a_{i(s)}} = \frac{\gamma - 1}{\gamma + \beta - 1}$$

$$\frac{d \ln p_{i(s)}}{d \ln a_{i(s)}} = \frac{-\beta}{\gamma + \beta - 1}$$

- Firms share all their rents with their workers or consumers.

Pass-through rates under variable *market power*

- In a model with variable *markups* and *markdowns* the pass-through rate of productivity shocks to w/p is less than 1.

$$\frac{d \ln w_{i(s)}}{d \ln a_{i(s)}} = \frac{\gamma - 1}{\gamma + \beta - 1} - \frac{\gamma}{\gamma + \beta - 1} \cdot \left(\frac{d \ln MP_{i(s)}}{d \ln a_{i(s)}} \right)$$

$$\frac{d \ln p_{i(s)}}{d \ln a_{i(s)}} = \frac{-\beta}{\gamma + \beta - 1} + \frac{\beta - 1}{\gamma + \beta - 1} \cdot \left(\frac{d \ln MP_{i(s)}}{d \ln a_{i(s)}} \right)$$

- Firms keep part of these rents

- Worker/consumers may got affected differently based on their preferences and where do they work.

Small Open Economy Model

Small Open Economy Model

- Aggregate variables in Foreign are constant:

$$D^*(s) = Y^* P^{*\theta} p(s)^{*\gamma-\theta} \quad E^*(s) = \tilde{L^*}^{\frac{-1}{\kappa-1}} l(s)^{*\frac{1}{\kappa-1}-\frac{1}{\beta-1}}$$

- Domestic firms engage in 3rd degree price discrimination

$$MR(l_{H,i(s)}) = MR(l^*_{H,i(s)}) = MFC\left(l_{H,i(s)} + l^*_{H,i(s)}\right)$$

- Foreign firm solve their maximization problem independently from other markets and markdowns are constant
- Iceberg trade costs take the standard form $\tau_{H,F,s} = \tau \cdot (1 + t_{H,F,s}) > 1$
- There is a fixed cost to export $f_x > f_d$
- Trade balance

Equilibrium

- The equilibrium consists to find the wages that solve the following system of equations:

- Exporter domestic firms:

$$D(s) \cdot \left[\left(\frac{a_{H,i(s)}^{\frac{\gamma-1}{\gamma}}}{MU_{H,i(s)}} \right) l_{H,i(s)}^{\frac{-1}{\gamma}} \right] - E(s) \cdot \left[\left(\frac{l_{H,i(s)} + l^*_{H,i(s)}}{A_{H,i(s)} MD_{H,i(s)}} \right)^{\frac{1}{\beta-1}} \right] \quad (1)$$

$$D(s)^* \cdot \left[\left(\frac{a_{H,i(s)}^{\frac{\gamma-1}{\gamma}}}{\tau_{H,F,s}^{\frac{\gamma-1}{\gamma}} \cdot MU^*_{H,i(s)}} \right) l_{H,i(s)}^{*\frac{-1}{\gamma}} \right] - E(s) \cdot \left[\left(\frac{l_{H,i(s)} + l^*_{H,i(s)}}{A_{H,i(s)} MD_{H,i(s)}} \right)^{\frac{1}{\beta-1}} \right] \quad (2)$$

Equilibrium

- Non-exporter domestic firms

$$D(s) \cdot \left[\left(\frac{a_{H,i(s)}^{\frac{\gamma-1}{\gamma}}}{MU_{H,i(s)}} \right) l_{H,i(s)}^{\frac{-1}{\gamma}} \right] - E(s) \cdot \left[\left(\frac{l_{H,i(s)}}{A_{H,i(s)} MD_{H,i(s)}} \right)^{\frac{1}{\beta-1}} \right] \tag{3}$$

- Foreign firms

$$D(s) \cdot \left[\left(\frac{a_{F,i(s)}^{\frac{\gamma-1}{\gamma}}}{\tau_{F,H,s}^{\frac{\gamma-1}{\gamma}} \cdot MU_{F,i(s)}} \right) l_{F,i(s)}^{\frac{-1}{\gamma}} \right] - E^{*}(s) \cdot \left[\left(\frac{l_{F,i(s)}}{A_{F,i(s)} MD_{F}} \right)^{\frac{1}{\beta-1}} \right] \tag{4}$$

- A domestic firm produces if

$$TR_{H,i(s)} - C_{H,i(s)} > f_d$$

General Equilibrium

- A firm exports if

$$TR^{x}_{H,i(s)} + TR^{*}_{H,i(s)} - C^{x}_{H,i(s)} - f_x > TR_{H,i(s)} - C_{H,i(s)}$$

$$TR_{F,i(s)} - C_{F,i(s)} - f_x > 0$$

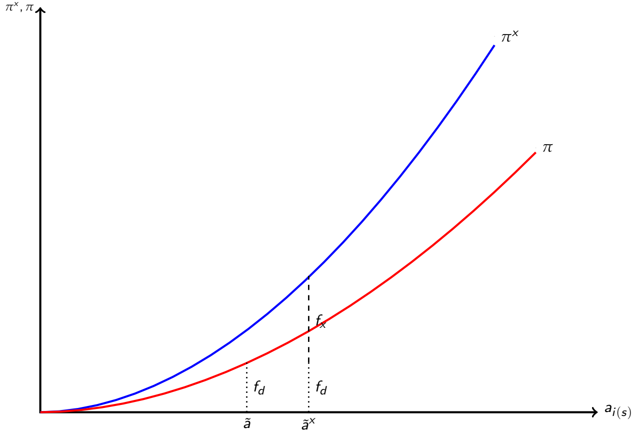
- Labor market clears

$$\tilde{L} + \int_0^1 \sum_{i=1}^{n(s)} \phi_{i(s)} f_d \, ds + \int_0^1 \sum_{i=1}^{n(s)} \phi^{*}_{i(s)} f_x \, ds = \bar{L}$$

- Trade balance

$$\int_0^1 \sum_{i=1}^{n(s)} p^{*}_{H,i(s)} y^{*}_{H,i(s)} \, ds = \int_0^1 \sum_{i=1}^{n(s)} p_{F,i(s)} y_{F,i(s)} \, ds$$

Third-degree price discrimination



Note: This figure shows total profits when domestic firms engage in third-degree price discrimination. The blue line represents profits if firms operate in the two markets, while the red line represents profits if firms only operate in the domestic market. Firms with a productivity above the threshold $\tilde{a}$ produce for the domestic market, and firms with a productivity above the threshold $\tilde{a}^X$ produce for the domestic and foreign market.

Estimation

Firm Labor Supply Elasticity

- From the Roy model, the share of workers that work at firm i within sector s is:

$$\pi_{i(s)} = \frac{A_{i(s)} w_{i(s)}^{\beta}}{\sum_{j=1}^{n(s)} A_{j(s)} w_{j(s)^{\beta}}}$$

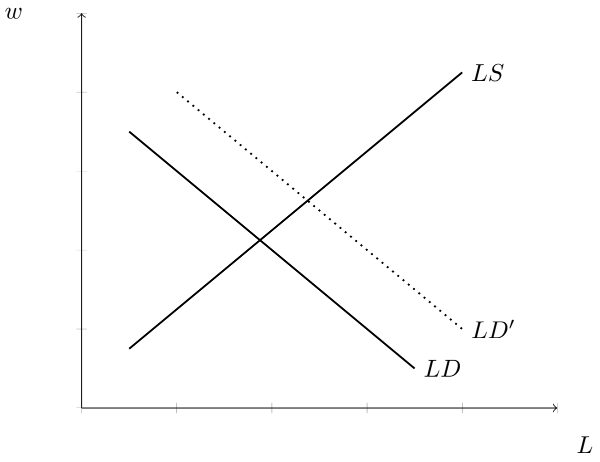
- We can take logs and estimate the following equation:

$$\ln \pi_{i,t} = \beta \ln w_{i,t} + \psi_i + \theta X_{it} + \gamma_{m(i,t)} + e_{it} \qquad (1)$$

- A market is defined as a cz-industry-year level.
- I use log of intermediate inputs as an instrument

Exclusion Restriction

Figure: TFP shocks to the labor market



Results: Firm Labor supply

Table: Firm Labor supply

	(1)	(2)	(3)	(4)	(5)	(6)
		ISIC 4 digit			ISIC 3 digit	
	OLS	**IV**	**FS**	**OLS**	**IV**	**FS**
Dep variable:	ln share	ln share	ln wage	ln share	ln share	ln wage
ln w	-0.247***	7.233***		-0.247***	7.703***	
	(0.012)	(0.548)		(0.012)	(0.589)	
m			0.043***			0.041***
			(0.003)			(0.003)
Obs	75,169	75,169	75,169	77,447	77,447	77,447
R2	0.977	0.595	0.894	0.973	0.506	0.890
F stat-First stage		190			184	
Market FE	Yes	Yes	Yes	Yes	Yes	Yes
Plant FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table reports the results for the estimation of the main parameters of the model. The labor supply parameter across firms within the same sector denoted β. The first three columns show the results when the market is defined at the 4 digit ISIC level, while columns (3) to (6) show the results when the market is defined at the 3 digit ISIC level. For the instrumental variable, I use *ln* materials as an instrument. Clustered standard errors at the firm level are reported in parentheses. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$.

Industry Labor Supply Elasticity

- Using the structure of the model:

$$\pi(s) = \frac{A(s)w(s)^{\kappa}}{\int_0^1 A(k)w(k)^{\kappa}dk} \qquad \text{where} \qquad w(s) = \left(\frac{1}{n(s)}\sum_{i=1}^{n(s)} w_{i(s)}^{\beta}\right)^{\frac{1}{\beta}}$$

- I construct wage indexes at the cz-sector-year level using the value of β and run:

$$\ln \pi_{st} = \kappa \ln w_{st} + \psi_s + \gamma_{I(s,t)} + \epsilon_{s,t} \qquad (2)$$

  - $\gamma_{I(s,t)}$ is a 2 digit industry-cz-year fixed effect.

- I also use as an instrument the log of total expenditure in intermediate inputs.

Results: Industry Labor supply

Table: Industry Labor supply

	(1)	(2)	(3)	(4)	(5)	(6)
		ISIC 4 digit			ISIC 3 digit	
	OLS	**IV**	**FS**	**OLS**	**IV**	**FS**
Dep variable:	ln share	ln share	ln wage	ln share	ln share	ln wage
ln W	1.402***	2.895***		1.149***	2.655***	
	(0.078)	(0.185)		(0.089)	(0.257)	
m ind			0.169***			0.157***
			(0.018)			(0.118)
Obs	7,505	7,505	7,505	5,110	5,110	5110
R2	0.67	0.56	0.67	0.75	0.64	0.70
F stat-First stage		120			170	
Industry 2d-cz FE	Yes	Yes	Yes	Yes	Yes	Yes
cz-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table reports the results for the estimation of the main parameters of the model. The labor supply parameter across sectors within the same local labor market κ. The first three columns show the results when the market is defined at the 4 digit ISIC level, while columns (3) to (6) show the results when the market is defined at the 3 digit ISIC level. For the instrumental variable, I use the aggregate value of *ln* materials at the industry level as an instrument. Clustered standard errors at the 4 and 3 digit isic-cz cell are reported in parentheses. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$.

Labor supply

- From the previous estimation we get that:
  - $\kappa \in [2.16, 3.22]$
  - $\beta \in [6.16, 8.83]$
- These numbers are in the range of recent estimates of the labor supply elasticity (Kline et al., 2017)
- On average the residual labor supply elasticity is 4.84.
- Galle et al. (2017) finds a value of $\kappa \in [1.50, 2.15]$ for the U.S.

Product Demand Elasticities

Demand Elasticities

- I tried to estimate the demand parameters using market shares
  - The coefficient that I got was positive due to quality issues Kuegler & Verhoogen (2012); Faber (2014)
- From the FOC of the firm's cost minimization problem:

$$\alpha_{i(s)} \equiv \frac{w_{i(s)} l_{i(s)}}{p_{i(s)} y_{i(s)}} = \frac{MD_{i(s)}}{MU_{i(s)}}$$

- We can use the Lerner Index and some algebra manipulation to estimate:

$$\left(\frac{\alpha_{i(s)}}{MD_{i(s)}}\right) = \underbrace{\frac{\gamma - 1}{\gamma}}_{a_0} - \underbrace{\frac{(\gamma - \theta)}{\gamma\theta}}_{a_1} \lambda_{i(s)} + \epsilon_{i(s)} \tag{3}$$

  - where $\lambda_{i(s)}$ is the product market share.

Results: Demand Elasticities

Table: Demand Elasticities

	(1)	(2)	(3)	(4)
Dep variable	α/MD	α/MD	$\alpha/\text{MD}\cdot\theta_L$	$\alpha/\text{MD}\cdot\theta_L$
Market Share	-0.288***	-0.469***	-0.315***	-0.472***
	(0.039)	(0.044)	(0.050)	(0.056)
Constant	0.669***	0.673***	0.725***	0.728***
	(0.003)	(0.003)	(0.004)	(0.004)
Sector FE	No	Yes	No	Yes
Obs	67,568	67,568	44,405	44,405
R2	0.51%	8.78%	0.50%	7.22%
Implied γ	3.03	3.03	3.57	3.57
Implied θ	1.64	1.25	1.66	1.33

Note: This table reports the results for the estimation of the demand elasticities after estimating equation 13. In columns 1 and 2, I assume that the output elasticity with respect to labor is 1, while in columns 3 and 4, I estimate an output elasticity by ACF. The last two rows report the estimates of the main parameters of the model. Clustered standard errors at the establishment level are reported in parentheses. *p<0.1, **p<0.05, ***p<0.001.

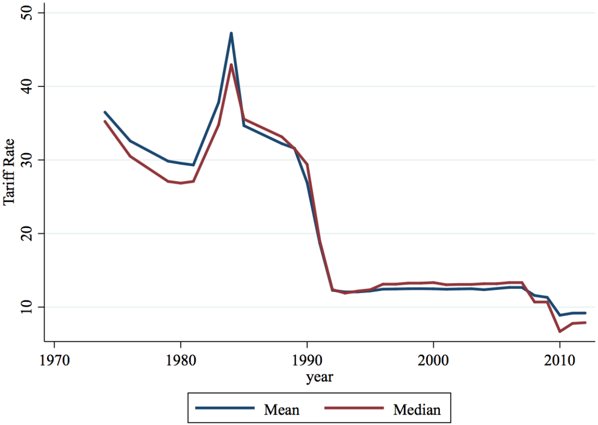
Trade Liberalization

Trade Liberalization

- My main goal is to quantify the effects of the trade liberalization episode in Colombia on market power using the model
- There is a huge decline in tariffs at the early 1990s:
  - On average tariffs decline from 34.5% in 1985 to 12.2% in 1995
- There is variation in the change of tariffs across 4 digit-Isic sectors
  - The 10th percentile for the change in tariffs is -36.83 pp
  - The 90th percentile for the change in tariffs is -7.78 pp
  - The standard deviation for the change in tariffs is 12 pp
- I observe effective tariffs from customs data at the 10 digit product code level

Tariffs over time

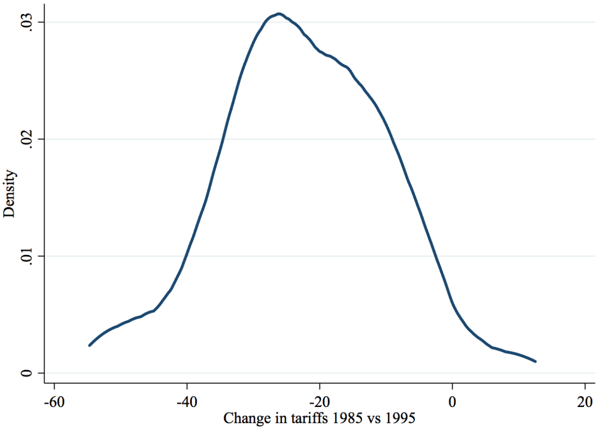
Figure: Colombian Tariffs over time



Note: This figure shows the evolution of Colombian tariffs over time. I report the mean and median at the 4-digit Isic Rev 2 level. There is a huge decline at the early 1990s.

Variation of tariffs across sectors: 1985 vs 1995

Figure: Kdensity change in tariffs 1985 vs 1995



Note: This figure shows a kdensity plot of the change in tariffs between 1985 and 1995. The unit of observation is a 4-digit Isic rev 2 cell.

Next Steps

Next steps and Conclusions

- I built a model to understand market power responses on both sides of the market to different shocks and policies
- Variable markups and markdowns are an important source of resource misallocation
  - Removing *market power* dispersion increases TFP in 3.10%
  - Removing *markups* dispersion increases TFP in 1.14%
  - Removing *markdown* dispersion increases TFP in 1.40%
- Add different groups to the model
  - Expenditure Survey Data in 1985 to build consumer preferences by group
- Production function with high and low skilled labor
- Next semester: Quantify the effects of the trade liberalization using the structure of the model

Closed Economy Simulations

- I simulate a closed economy with:
  - 100 firms in each sector
  - Productivity measures drawn from a Pareto distribution with shape parameter 4 and level parameter 1
  - Different values for the fixed cost
- Effects of variable *markups* and *markdowns* on:
  - TFP
  - Pass-through rates to wages and prices

Results: Simulations

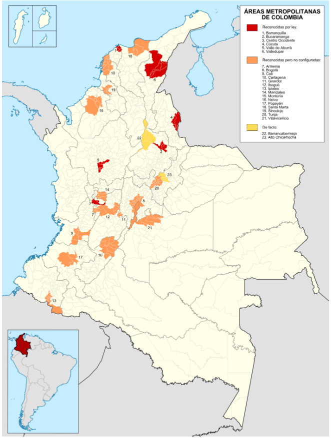
Table: Results: Closed Economy Simulations

	(1) Const. MP	(2) $f_d = 0$	(3) $f_d = 0.001$	(4) $f_d = 0.003$	(5) $f_d = 0.005$
		TFP gains			
Markup	-	1.93%	2.03%	2.19%	2.31%
Markdown	-	0.81%	0.84%	0.88%	0.89%
Covariance	-	0.75%	0.75%	0.73%	0.74%
Market Power	-	3.49%	3.62%	3.80%	3.94%
		Pass-through rates			
Pass-through wages	0.273	0.259	0.245	0.226	0.208
Pass-through prices	-0.727	-0.703	-0.679	-0.645	-0.614
Pass-through real wages	1.00	0.962	0.924	0.871	0.821
$n(s)$	-	100	41	20	13

Note: This table reports the results of the effects of *markups* and *markdowns* on TFP and pass-through rates for different values of the fixed costs after simulating the equilibrium solution with 100 random draws of productivity. Column 1 reports the results for the case in which market power is constant, column 2 when there are no fixed cost, column 3 when the fixed cost is equal to 0.001, column 4 equal to 0.003, and column 5 equal to 0.005. The number of firms that decide to produce are reported in the last row.

Commuting Zones-Colombia

Figure: Commuting Zones HHI



Note: This figure shows a map of the different commuting zones in Colombia.

Wages and Labor market Concentration

Table: Wages and Labor Market concentration 4 digit

	Commuting Zone-ISIC 3 digit					
	(1)	(2)	(3)	(4)	(5)	(6)
	ln w	ln w	ln w	ln w	ln w	ln w
HHI t-1	-0.033***	-0.016**	-0.017**	-0.034***	-0.014**	-0.038**
	(0.007)	(0.006)	(0.007)	(0.007)	(0.005)	(0.015)
ln va	0.232***	0.059***	0.059***	0.231***	0.054***	0.031**
	(0.007)	(0.003)	(0.003)	(0.007)	(0.003)	(0.014)
Obs	65359	64660	64660	65359	64660	4095
R2	0.43	0.87	0.88	0.44	0.89	0.86
Year FE	Yes	Yes	Yes	-	-	-
Industry FE	Yes	-	Yes	-	-	-
Industry-Year FE	-	-	-	Yes	Yes	Yes
Firm FE	-	Yes	Yes	-	Yes	-
Firm-Year FE	-	-	-	-	-	Yes

Note: This table reports the results for the relationship between wages and labor market concentration measured by a Herfindahl index at the 3 digit Isic-cz-year level. The coefficient is standarized using the standard deviation of the HHI. Clustered standard errors at the cz level are reported in parentheses.$*p < 0.1$, $**p < 0.05$, $***p < 0.01$.

Wages and Labor market Concentration

Table: Wages and Labor Market concentration (4 digit)

	Commuting Zone-ISIC 2 digit					
	(1)	(2)	(3)	(4)	(5)	(6)
	ln w	ln w	ln w	ln w	ln w	ln w
HHI t-1	-0.054***	-0.034***	-0.035***	-0.054***	-0.029***	-0.056***
	(0.008)	(0.009)	(0.009)	(0.008)	(0.008)	(0.014)
ln va	0.243***	0.060***	0.060***	0.241***	0.055***	0.036***
	(0.008)	(0.003)	(0.003)	(0.008)	(0.003)	(0.012)
Obs	66586	66151	66151	66856	66151	4364
R2	0.41	0.87	0.87	0.42	0.88	0.85
Year FE	Yes	Yes	Yes	-	-	-
Industry FE	Yes	-	Yes	-	-	-
Industry-Year FE	-	-	-	Yes	Yes	Yes
Firm FE	-	Yes	Yes	-	Yes	-
Firm-Year FE	-	-	-	-	-	Yes

Note: This table reports the results for the relationship between wages and labor market concentration measured by a Herfindahl index at the 2 digit Isic-cz-year level. The coefficient is standarized using the standard deviation of the HHI. Clustered standard errors at the cz level are reported in parentheses.$*p < 0.1$, $**p < 0.05$, $***p < 0.01$.

Product Demand Elasticity

- If firms compete in prices:

$$|\epsilon_{i(s)}| \equiv \frac{d \ln y_{i(s)}}{d \ln p_{i(s)}} = \gamma - (\gamma - \theta) \frac{d \ln p(s)}{d \ln p_{i(s)}}$$

$$|\epsilon_{i(s)}| = (1 - \lambda_{i(s)})\gamma + \lambda_{i(s)}\theta$$

where

$$\lambda_{i(s)} \equiv \frac{p_{i(s)}^{1-\gamma}}{\sum_{i=1}^{n(s)} p_{i(s)}^{1-\gamma}} = \frac{p_{i(s)}^{1-\gamma}}{p(s)^{1-\gamma}}$$

  - $\lambda_{i(s)}$: Product market share of firm i in sector s.

- The demand elasticity is a weighted average between θ and γ.
- Larger firms exert more market power Cournot

Labor Supply Elasticity

- If firms compete in wages:

$$\eta_{i(s)} \equiv \frac{d \ln l_{i(s)}}{d \ln w_{i(s)}} = (\beta - 1) + ((\kappa - 1) - (\beta - 1)) \frac{d \ln W(s)}{d \ln w_{i(s)}}$$

$$\eta_{i(s)} = (1 - \pi_{i(s)})(\beta - 1) + \pi_{i(s)}(\kappa - 1)$$

where

$$\pi_{i(s)} \equiv \frac{A_{i(s)} w_{i(s)}^{\beta}}{\sum_{i=1}^{n(s)} A_{i(s)} w_{i(s)}^{\beta}} = \frac{A_{i(s)} w_{i(s)}^{\beta}}{W(s)^{\beta}}$$

  - $\pi_{i(s)}$: Labor market share of firm i in sector s.

- The labor elasticity is a weighted average between $\kappa - 1$ and $\beta - 1$.
- Larger firms exert more labor market power Cournot