

# On What State Do Prices Depend?

## Answers from Ecuador

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# Motivation

- An important challenge for macroeconomics is to understand the reasons that retail prices change infrequently
- The role of inflation is an important motive for price adjustment
- **But inflation cannot be the only story:** A growing literature documents large cross-sectional variations in the frequencies and sizes of price adjustment. This literature focuses on idiosyncratic shocks to explain these patterns:
  - Dotsey, King, and Wolman (1999): menu costs
  - Golosov and Lucas (2007): micro-productivity shocks
- **Our “structural” explanation:**

the cost structure underline these patterns

# This Paper

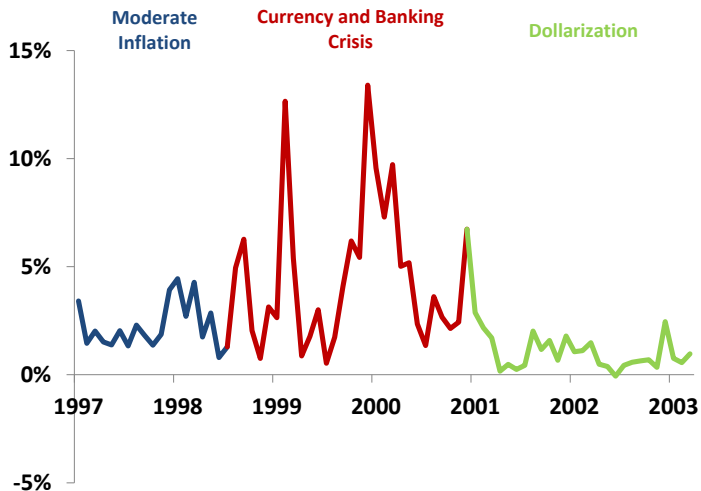
- The goal of this paper is to expand the states upon which firms' price adjustment decisions depend
- We develop a menu cost model of pricing with a *heterogeneous* distribution margin across firms
- **The distribution margins:**
  - capture real frictions associated with intermediating trade between manufacturers and final consumers
  - are important for the average consumer good:  $\sim 50\%$  of the retail price
- Consequently, firms with different cost structures will change prices by different amounts and at different frequencies despite facing a common menu cost of price adjustment

## Ecuador as a Case Study

- We apply our model to Ecuador to take advantage of a rich database of monthly retail prices of 223 goods and services from 1997 to 2003
- Recent Ecuadorian history also provides macroeconomic sources of variations of inflation and exchange rate
- We assume that retail firms purchase manufacturing goods in competitive global markets and employ workers to sell the goods in retail outlets
- Novel dimension here is that the cost share of traded inputs varies across categories
- **We show that this is an important structural component to account for the cross-sectional variations in pricing behavior**

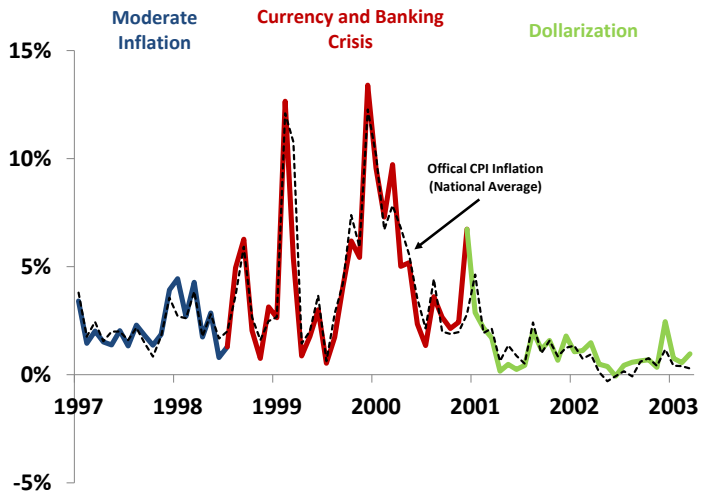
# Ecuador CPI Inflation Rate by Era

## 3 Regimes



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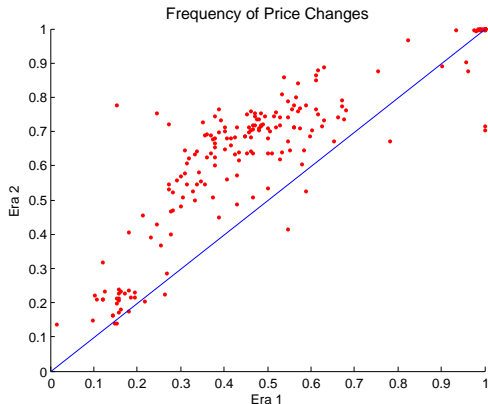




# Price Facts

Cross-sectional distribution of frequencies is preserved across eras

The correlation of price changes frequencies across goods is strongly positive

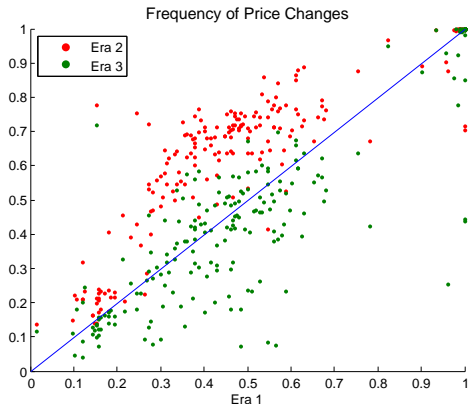




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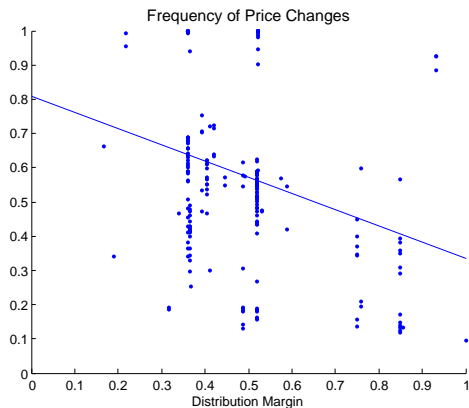
The correlation of price changes frequencies across goods is strongly positive



# Price Facts

Distribution margin affects the frequency of price change

Traded goods are more likely to reprice in all three eras.



## Price adjustment depends on the cost structure

- The fact that the cross-sectional distribution of frequencies is preserved across eras is consistent with the idea of a structural relationship
- There is some factor specific to an individual good that induces more/less frequent price adjustments which has little to do with the inflation regime
- **A vital structural relationship is the cost structure**
- In our model, there are no productivity shocks, but the variation in the import price serves a similar purpose: **it shifts the firm's cost function**
- An important difference is that our production function exhibits diminishing marginal productivity to each factor and a constant return in total

## Our Partial Equilibrium Model

- A continuum of firms belongs to a sector that combines labor (retail services) and wholesale good purchases on world markets to produce a differentiated final good:

$$y_t(i) = \ell_t(i)^{\alpha_i} m_t(i)^{(1-\alpha_i)}$$

- Firms decide on the extensive (timing) and the intensive (size) of price adjustment to maximize expected discounted value of profits
- Flow profits in real terms equal:

$$\pi_t(i) = p_t(i)y_t(i) - w_t \ell_t(i) - p_t^m m_t(i) - \chi w_t l_t(i).$$

- Following Nakamura and Steinsson (2006), we assume that the real wage is constant and therefore indexed to the inflation rate

# Our Partial Equilibrium Model

- Consumers have CES preferences over final goods:

$$y_t(i) = y \left( \frac{p_t(i)}{p_t} \right)^{-\theta}$$

- Finally, we assume 2 stochastic processes:

1. Money growth rate/price level evolution:

$$\log p_t = \mu_r + \log p_{t-1} + \eta_t$$

2. Import prices/exchange rate evolution:

$$\log p_t^m = \mu_r + \log p_t^m + \nu_t$$

where  $\eta_t \sim N(0, \sigma_\eta^2)$  and  $\nu_t \sim N(0, \sigma_\nu^2)$

- In making pricing decisions, the firm takes the aggregate price level, the real wage, and the import price as given

# Calibration

## Stochastic processes parameters

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	<b>Full Sample</b> 1997:01-2003:04	<b>Moderate Inflation</b> 1997:01-1998:04	<b>Currency Crisis</b> 1998:08-2000:12	<b>Dollarization</b> 2001:01-2003:04
<b>Monthly inflation rate</b>	2.7%	2.2%	4.7%	1.2%
<b>variance of inflation, <math>\sigma_{\eta}</math></b>	2.7%	0.8%	3.3%	1.0%
<b>variance of log-change in the trade-weighted real exchange rate, <math>\sigma_v</math></b>	0.2%	0.1%	0.4%	0.1%

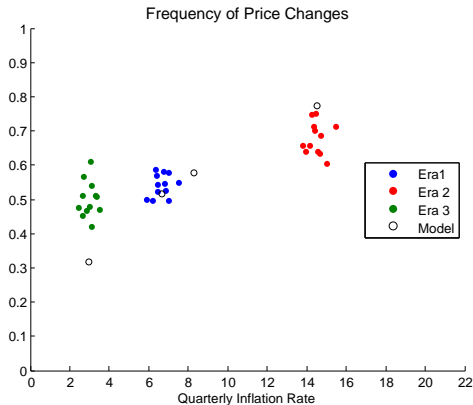
## Structural parameters

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<b>27 sectorial distribution shares, <math>\alpha_i</math></b>	Haircuts	0.85
(taken from U.S. NIPA data)	Gasoline	0.19
	Median	0.52
<b>Menu Cost (as % of labor income)</b>		0.70%
<b>Mean frequency of price adjustments</b>		0.60
<b>Agg. labor income spent on price adjustments</b>		0.42%

# Median Price Adjustment Frequency by Regime

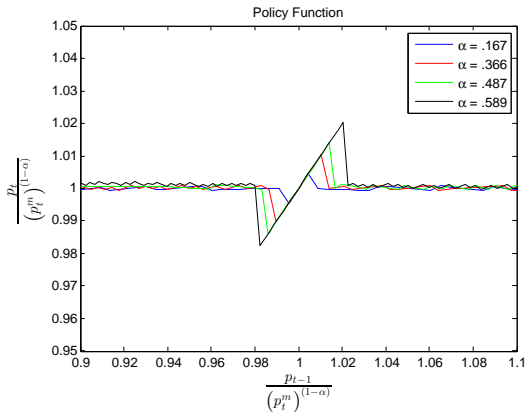
Our model fits the median price adjustment frequency across regime



# Decision Rule

Firm's inaction band depends on the distribution margin

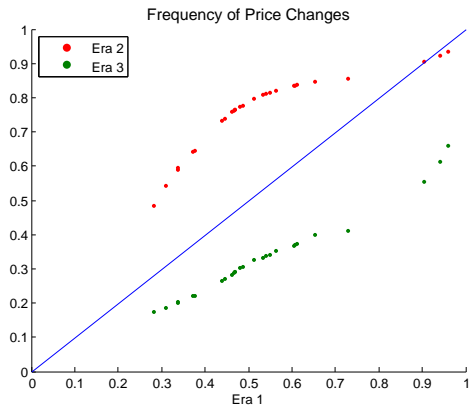
Profits become less sensitive to the import price as the labor share rises





# Frequency of Price Adjustments by Sector and Regime

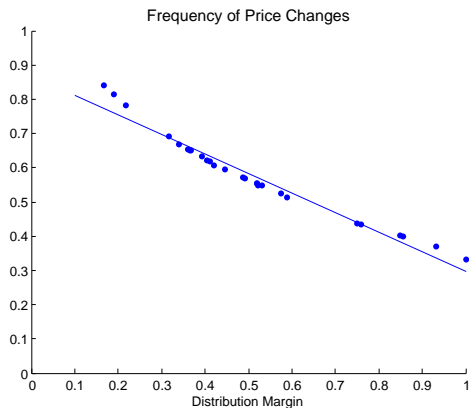
Our model accounts for the heterogeneity of price adjustments frequencies when the only heterogeneity that exists is in distribution margins



The order of price adjustment frequencies is preserved across eras

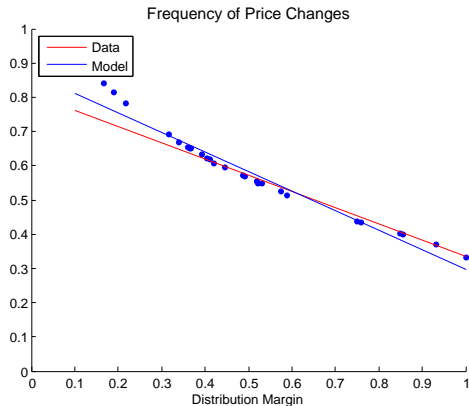
# Frequency of Price Adjustments by Sector and Regime

Our model accurately accounts for the change in frequency across distribution margin.  
Traded goods are more likely to reprice in all three eras.



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## Conclusion

- We develop a menu cost model of pricing with a *heterogenous* distribution margin across firms to account for the large cross-sectional variations in the frequencies and sizes of price adjustment
- Our preliminary work indicates that our menu cost model has the structure necessary to account for these pricing patterns across regimes and across goods
- Future work: General equilibrium version and reconcile micro-data on unit value of imports with retail goods.

# Price Facts

First state: Price adjustment depends on inflation

	<b>Full Sample</b> <small>1997:01-2003:04</small>	<b>Moderate Inflation</b> <small>1997:01-1998:04</small>	<b>Currency Crisis</b> <small>1998:08-2000:12</small>	<b>Dollarization</b> <small>2001:01-2003:04</small>
<b>Monthly inflation rate</b>	<b>2.7%</b>	<b>2.2%</b>	<b>4.5%</b>	<b>1.2%</b>
<b>Frequency of price changes</b>	<b>57.7%</b>	<b>54.1%</b>	<b>67.8%</b>	<b>50.0%</b>
Positive price changes	43.2%	42.8%	54.7%	31.8%
Negative price changes	14.4%	11.3%	13.1%	18.2%
<b>Absolute size of price changes</b>	<b>7.1%</b>	<b>5.9%</b>	<b>9.8%</b>	<b>3.9%</b>

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