

Monetary Economics

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Golosov-Lucas (JPE 2007)

- Menu costs
- Monetary Neutrality
- Selection of firms that change prices (Calvo: random; menu costs: those with extreme $p - p^*$)

Golosov-Lucas (JPE 2007)

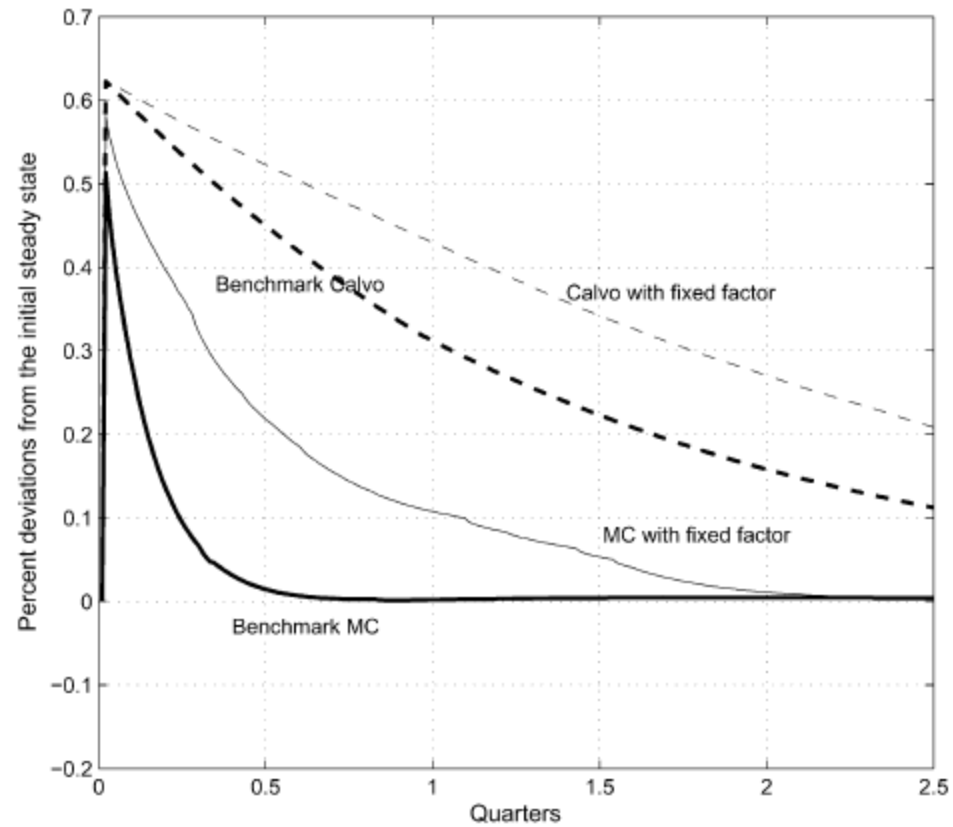


FIG. 5.—Output responses in menu cost and Calvo models

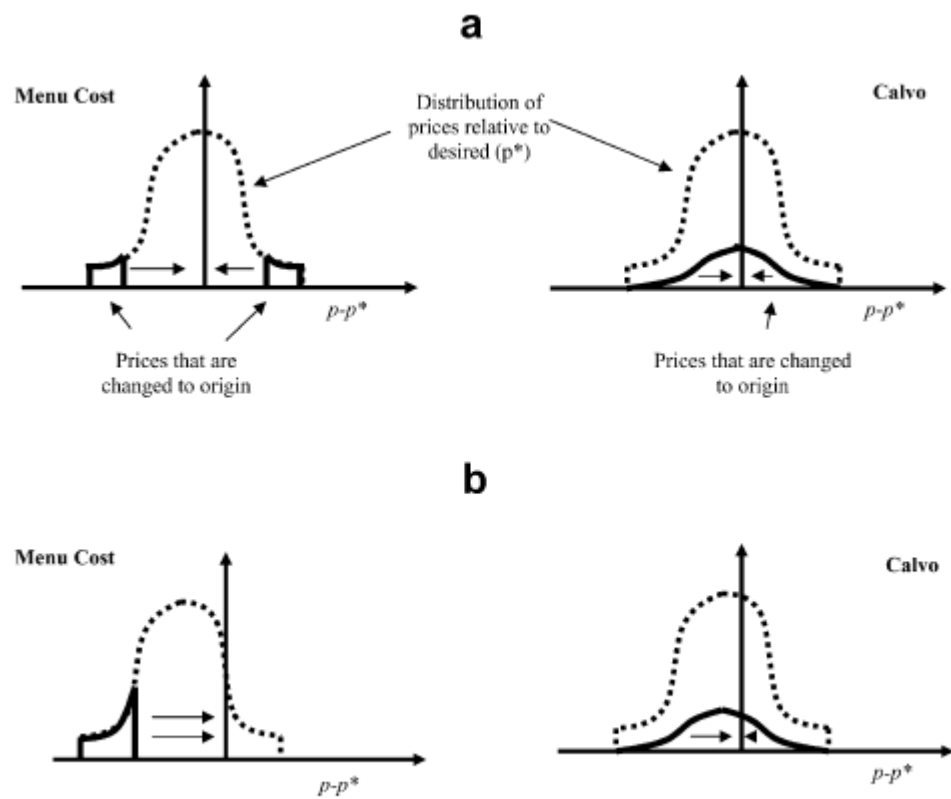


FIG. 6.—Price adjustment in menu cost and Calvo models. *a*, Price adjustment before aggregate shock. *b*, Price adjustment after aggregate shock.

Midrigan (*Econometrica*, forthcoming.)

- Golosov-Lucas:
menu costs model → monetary neutrality
- But it misses two features of the data
 - Many price changes are small (heterogeneity in price changes)
 - Sales represent the majority of price changes (temporary)

Midrigan (*Econometrica*, forthcoming.)

- Data: scanner price data from Dominick's
- available online at
<http://research.chicagogsb.edu/marketing/databases/index.aspx>
- Separate between regular prices and sales

Figure 1: Example of algorithm

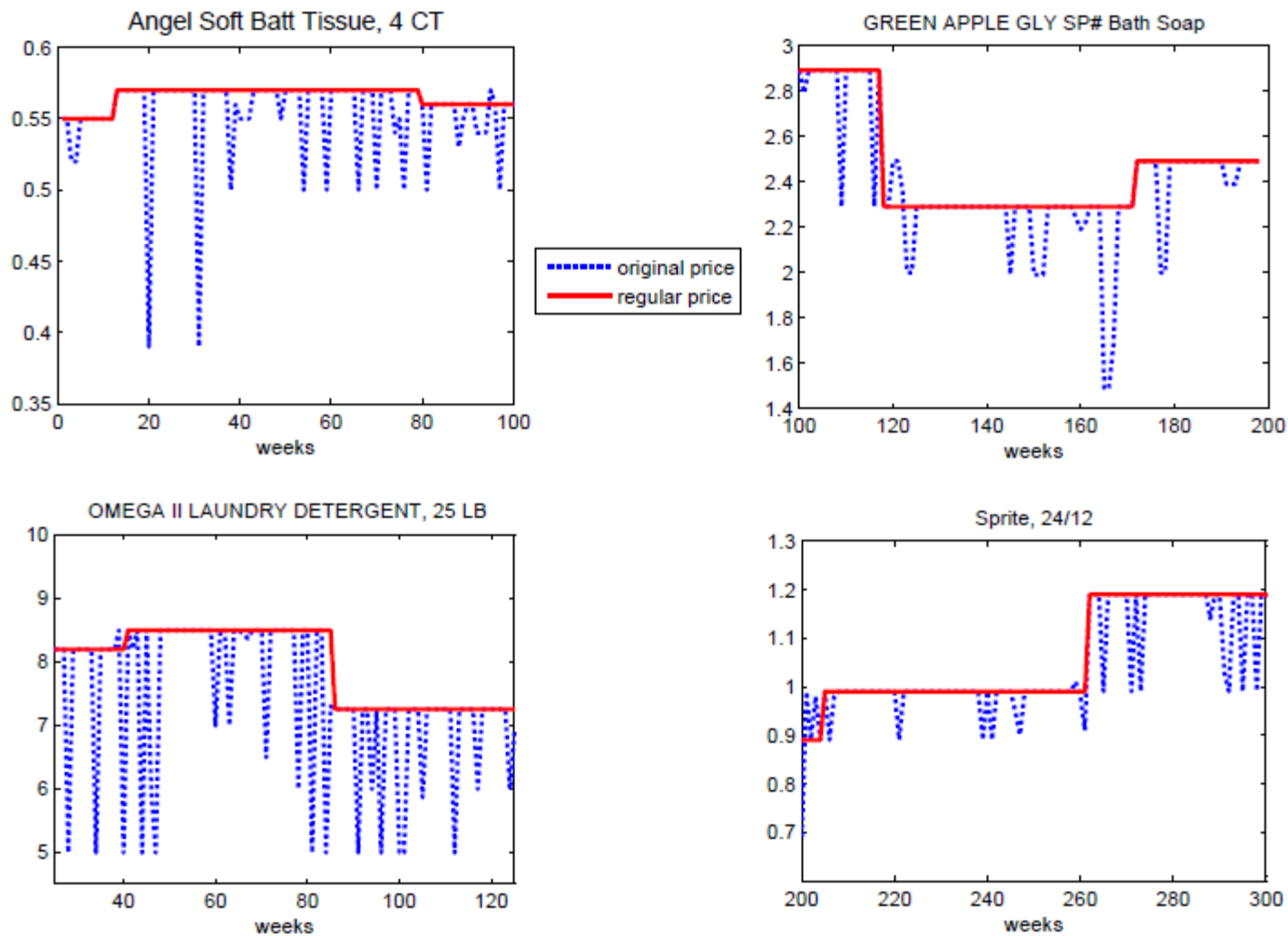
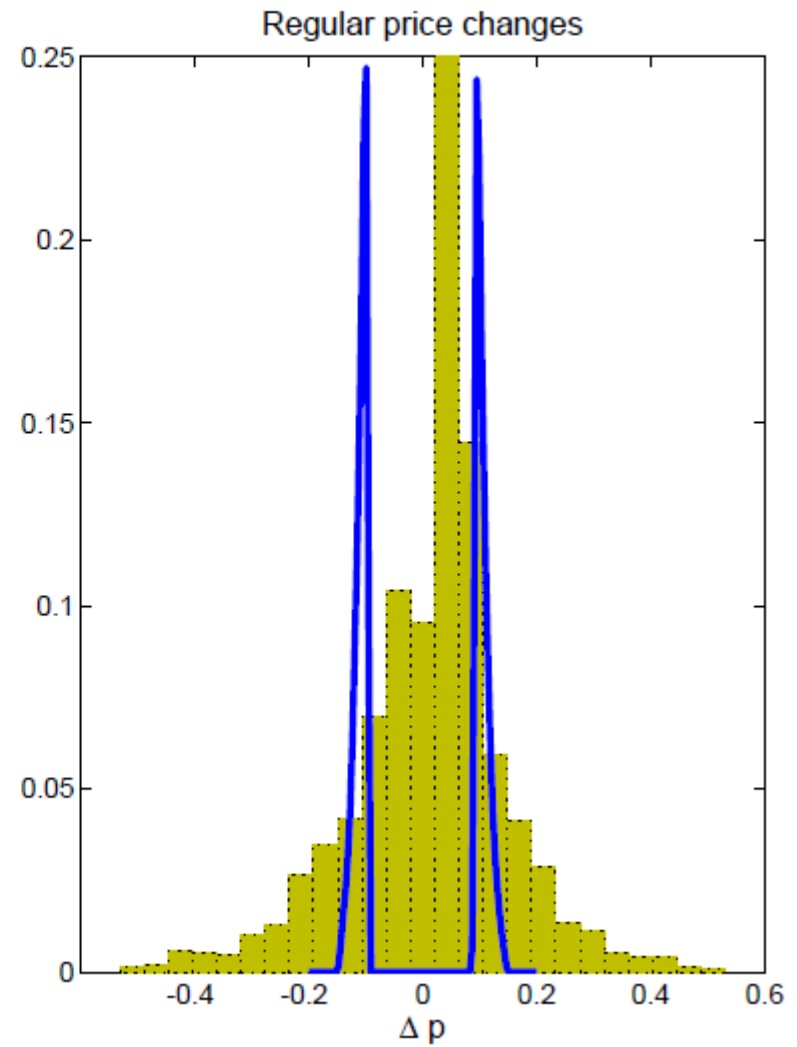
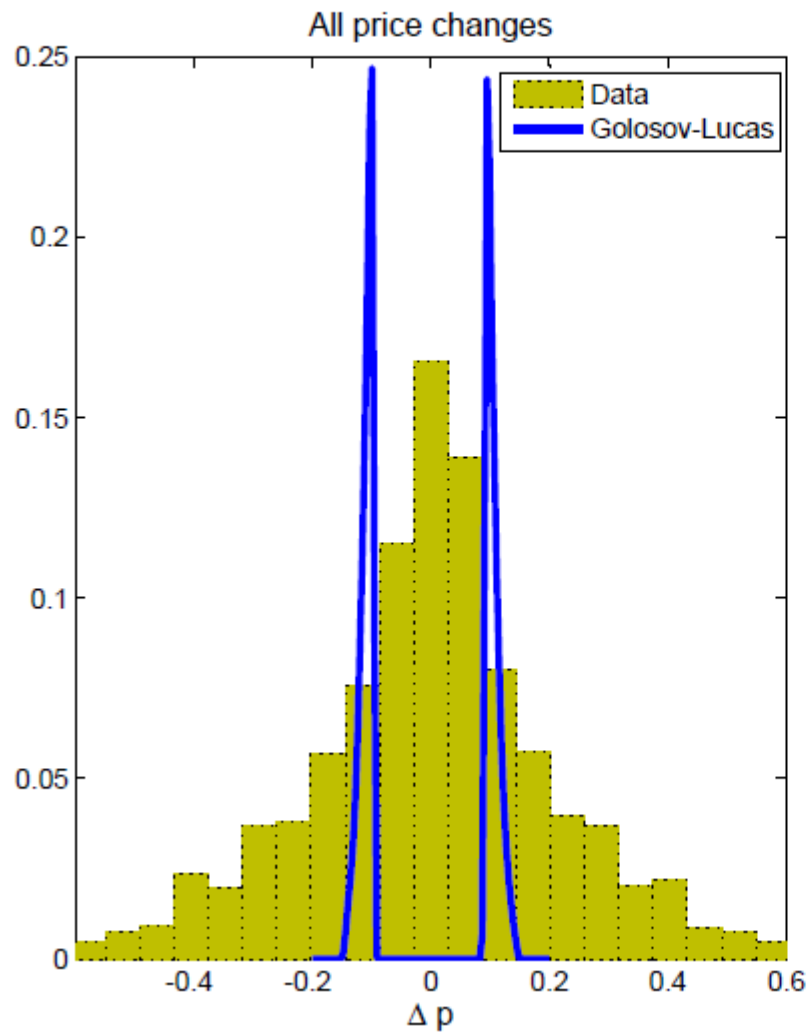


Figure 2: Distribution of non-zeros price changes: Dominick's vs. Golosov-Lucas model



- What incentive do retailers have to change their prices temporarily?
- What incentive do they have to change prices by a small amount?

- Build a menu cost model
- Firm sells multiple goods and faces a single cost of changing all prices.
- Two prices: regular and posted price
- E.g., regular chosen by headquarters, posted by sales people

- Real Effects of Money?

From Kehoe & Midrigan (2010)

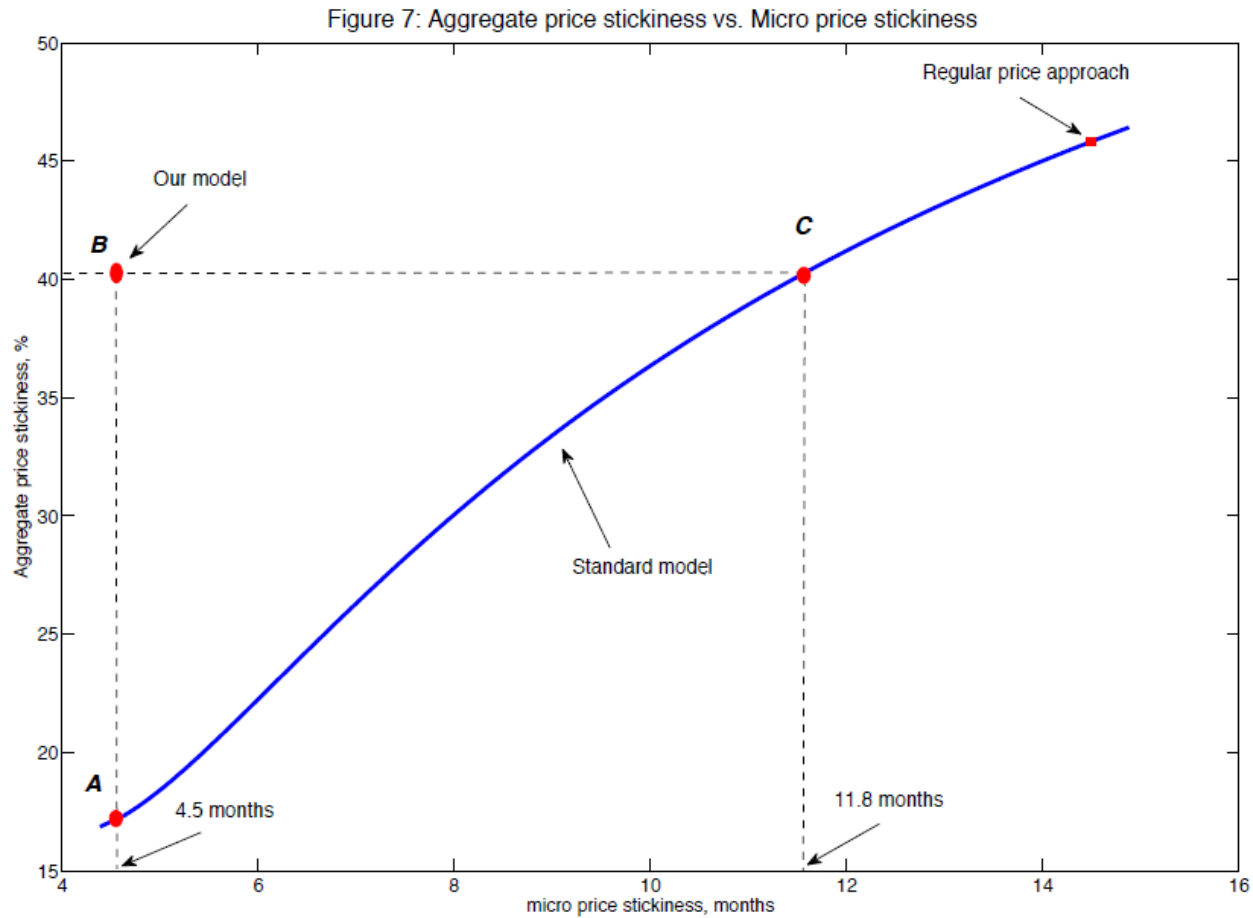


Figure 8: Impulse responses in our model and in the standard model with 11.8-month stickiness

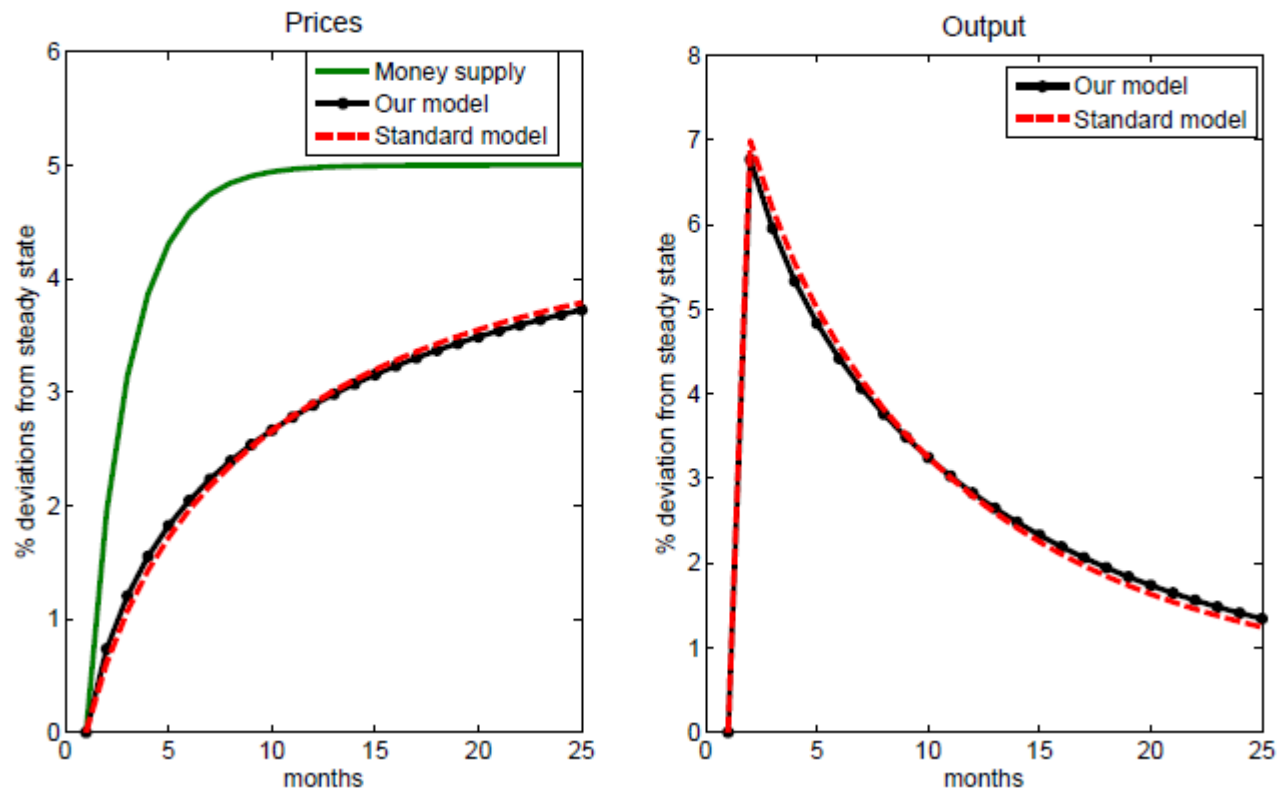
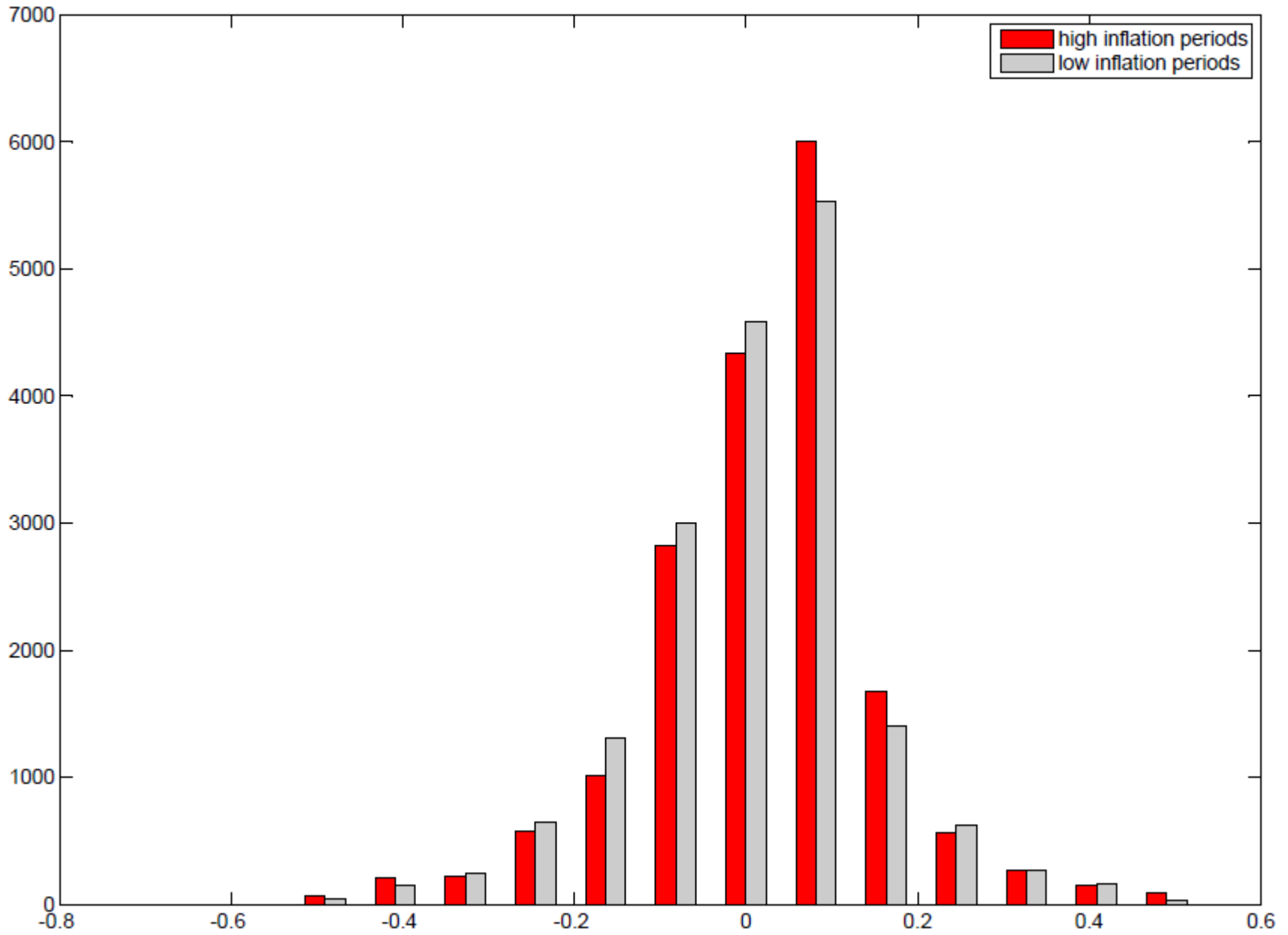


Figure 5: Distribution of (regular) price changes in high and low inflation periods



Nakamura & Steinsson (QJE 2008)

- “FIVE FACTS ABOUT PRICES: A REEVALUATION OF MENU COST MODELS”
- Bureau of Labor Statistics (BLS) micro data on CPI and PPI
- Five Facts

1. Frequency of Price Changes

- 9-12% per month (20% if including sales)
- It implies a price duration between 8 and 11 months
- This is consistent with typical Calvo estimates
- Previous work (Bils & Klenow) found lower duration (4 months)

TABLE I
FREQUENCY OF PRICE CHANGE IN THE CPI

	Median frequency		Median implied duration		Mean frequency		Mean implied duration	
	1988–1997 (%)	1998–2005 (%)	1988–1997 (months)	1998–2005 (months)	1988–1997 (%)	1998–2005 (%)	1988–1997 (months)	1998–2005 (months)
A. Including sales								
Excluding substitutions	20.3	19.4	4.4	4.6	23.9	26.5	8.3	9.0
Including substitutions	21.7	20.5	4.1	4.4	25.2	27.7	7.5	7.7
B. Excluding sales and substitutions								
Contiguous observations	11.1	8.7	8.5	11.0	18.7	21.1	11.6	13.0
Carry regular price forward during sales and stockouts	11.2	9.0	8.4	10.6	18.6	20.9	11.0	12.3
Estimate frequency of price change during sales	11.5	9.6	8.2	9.9	19.0	21.3	11.2	12.5
Estimate frequency of price change during sales and stockouts	11.9	9.9	7.9	9.6	18.9	21.5	10.8	11.7
C. Excluding sales, including substitutions								
Contiguous observations	12.7	10.9	7.4	8.7	20.4	22.8	9.3	9.8
Carry regular price forward during sales and stockouts	12.3	10.6	7.6	8.9	19.7	22.0	9.6	10.4
Estimate frequency of price change during sales	12.8	11.3	7.3	8.3	20.8	22.8	9.2	9.8
Estimate frequency of price change during sales and stockouts	13.0	11.8	7.2	8.0	20.7	23.1	9.0	9.3

Notes. All frequencies are reported in percent per month. Implied durations are reported in months. “Median frequency” denotes the weighted median frequency of price change. It is calculated by first calculating the mean frequency of price change for each ELI and then taking a weighted median across ELIs within the major group using CPI expenditure weights. The “Median implied duration” is equal to $-1/\ln(1 - f)$, where f is the median frequency of price change. “Mean frequency” denotes the weighted mean frequency of price change. “Mean implied duration” denotes the weighted implied duration of price change. It is calculated by first calculating the implied duration for each ELI as $-1/\ln(1 - f)$, where f is the frequency of price change for a particular ELI, and then taking a weighted mean across ELI’s using CPI expenditure weights.

TABLE VIII
ABSOLUTE SIZE OF PRICE CHANGES

Major group	Weight	Regular prices			Sales			All prices
		Median change	Median increase	Median decrease	Median change	Median ratio	Frac. price ch.	Median change
Processed food	8.2	13.2	11.5	17.6	33.1	2.6	57.9	26.5
Unprocessed food	5.9	14.2	13.9	15.0	35.1	2.5	37.9	27.1
Household furnishings	5.0	8.7	8.0	9.8	28.0	2.8	66.8	20.8
Apparel	6.5	11.5	10.0	13.3	37.1	3.1	87.1	30.2
Transportation goods	8.3	6.1	5.9	6.2	14.1	0.9	8.0	6.1
Recreation goods	3.6	10.1	8.7	12.0	32.9	3.1	49.1	18.9
Other goods	5.4	7.3	7.2	9.2	26.5	2.9	32.6	10.0
Utilities	5.3	6.3	6.2	6.4	12.6	1.6	0.0	6.3
Vehicle fuel	5.1	6.4	6.8	5.9	11.7	1.8	0.0	6.4
Travel	5.5	21.6	20.9	22.4	29.3	1.4	1.5	21.9
Services (excl. travel)	38.5	7.1	6.5	9.5	29.5	2.9	3.1	7.3
All sectors	100.0	8.5	7.3	10.5	29.5	2.6	21.5	10.7

Notes. The sample period is 1998–2005. “Regular prices” denotes prices excluding sales. “Weight” denotes the CPI expenditure weight of the major group. “Median change,” “Median increase,” and “Median decrease” refer to the weighted median absolute size of log price changes, increases, and decreases, respectively. The median absolute size of log price changes is calculated by first calculating the mean absolute size of log price changes for each ELI and then taking a weighted median across ELIs using CPI expenditure weights. Other median statistics are calculated in an analogous manner. “Median ratio” denotes the weighted median ratio of the mean absolute size of log price changes due to sales to the absolute size of log regular price changes within ELIs. For each ELI the mean size of sales is calculated for all price changes at the beginning and end of sales. “Frac. price ch.” denotes the mean fraction of price changes that are due to sales. The sector weights add up to 97.4% because used cars are not included in any sector.

2. 1/3 of price changes are price decreases

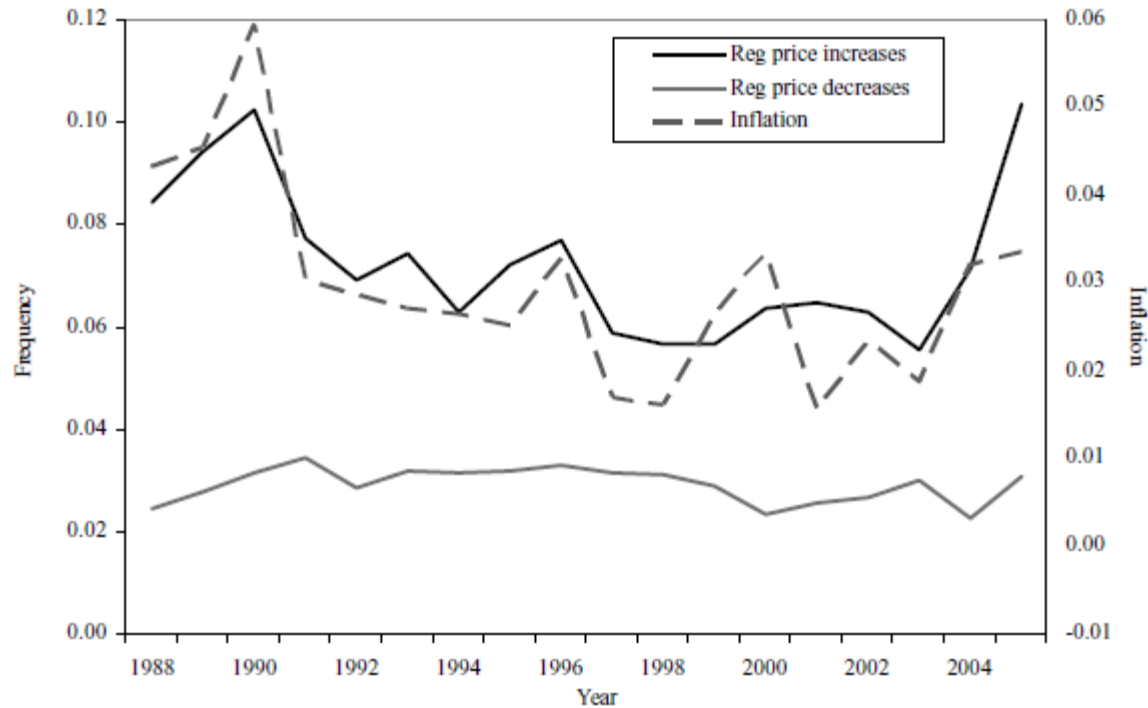


FIGURE II

Inflation and the Frequency of Regular Price Change for Consumer Prices

Note. The figure plots the annual evolution of the weighted median frequency of regular price increases and decreases along with the CPI inflation rate.

3. Frequency of price increases covaries with inflation

- Frequency of price decreases and size of changes do not covary

TABLE X
REGRESSIONS OF FREQUENCY AND SIZE OF CONSUMER PRICE CHANGES ON INFLATION

Dependent variable	Regular prices		Prices	
	1988–1997	1998–2005	1988–1997	1998–2005
Consumer price ELI level:				
Frequency of price increase	0.96*	0.56*	0.77*	0.70*
	(0.09)	(0.26)	(0.10)	(0.22)
Frequency of price decrease	-0.22*	-0.36*	-0.22	-0.41
	(0.10)	(0.08)	(0.13)	(0.13)
Size of price increase	0.17	-0.48	-0.06	-0.58
	(0.18)	(0.45)	(0.09)	(0.40)
Size of price decrease	-0.11	-0.43	0.08	0.24
	(0.37)	(0.24)	(0.24)	(0.14)
Frequency of price change	0.74*	0.37	0.56*	0.41
	(0.18)	(0.43)	(0.21)	(0.34)
Size of price change	0.52*	0.49	0.17	0.59
	(0.12)	(0.35)	(0.10)	(0.56)

Notes. The table reports the results of regressions of the mean frequency and absolute size of log price increases and decreases at the ELI level on the aggregate CPI inflation rate (log change over twelve months). For example, the number in the table in the first row of numbers and first column of numbers (i.e., 0.96) refers to the regression coefficient on CPI inflation in a regression where the dependent variable is the frequency of regular price increases in 1988–1997. Each observation is for a particular ELI in a particular year. All regressions include ELI-level fixed effects and ELI-level time trends. Standard errors are in parentheses. The standard errors are cluster-robust standard errors calculated according to the method described by Arellano (1987), where the standard errors are clustered by year. *Significant at 5% level.

4. Frequency of price changes is seasonal

- Highest in the 1st quarter, declining over the year

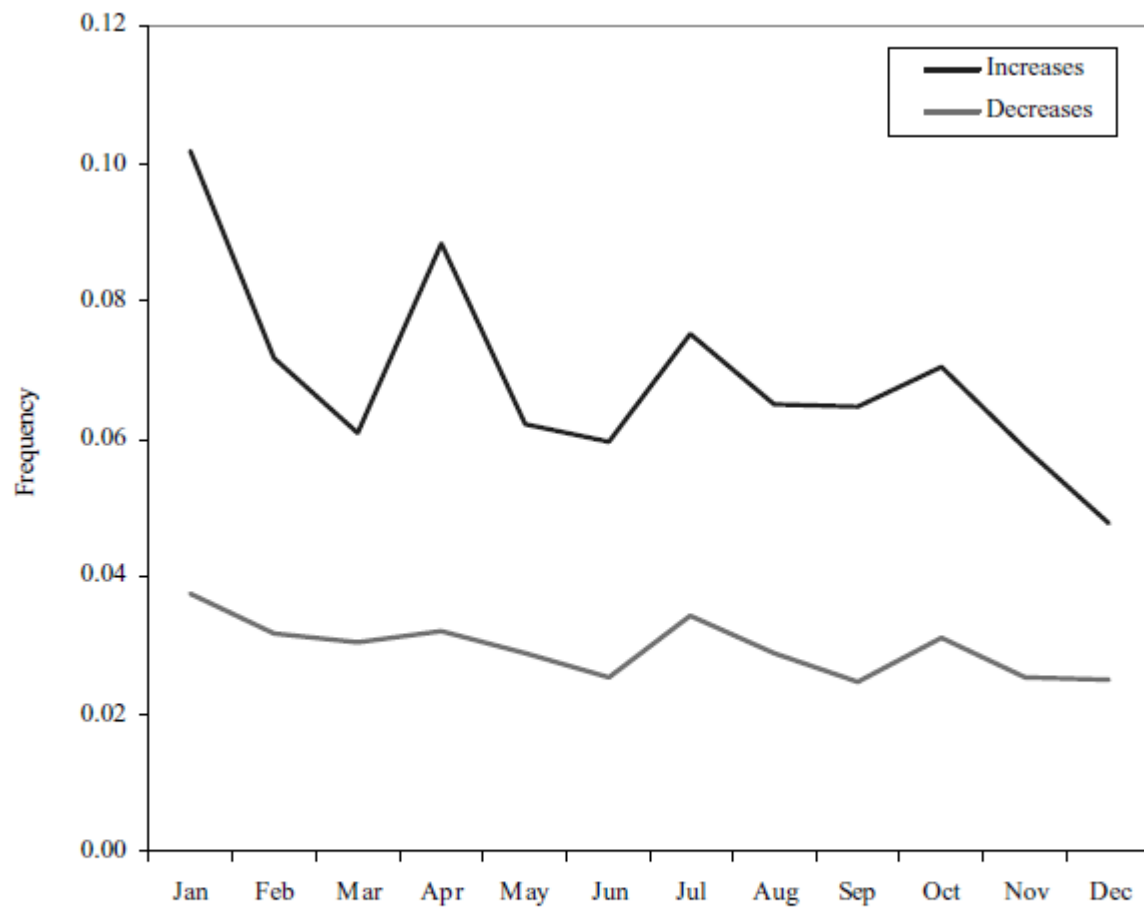


FIGURE V
Frequency of Regular Price Increases and Decreases by Month
for Consumer Prices

Note. The figure plots the weighted median frequency of regular price increase and decrease by month.

5. Hazard function is not upward-sloping

Menu cost model

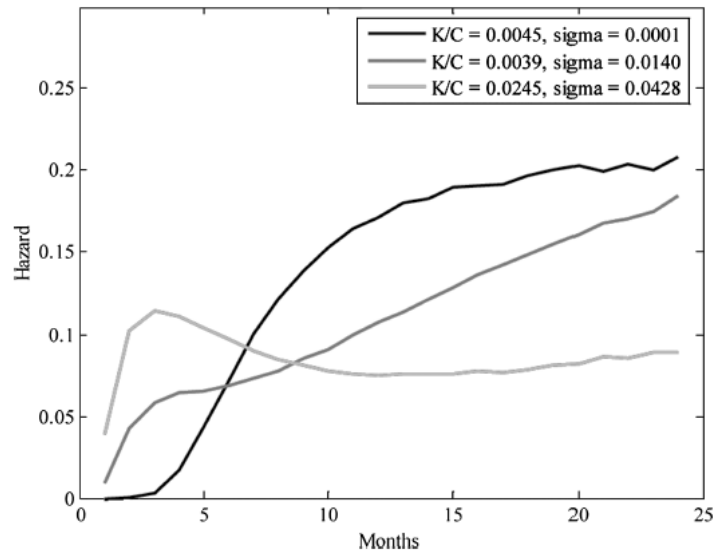
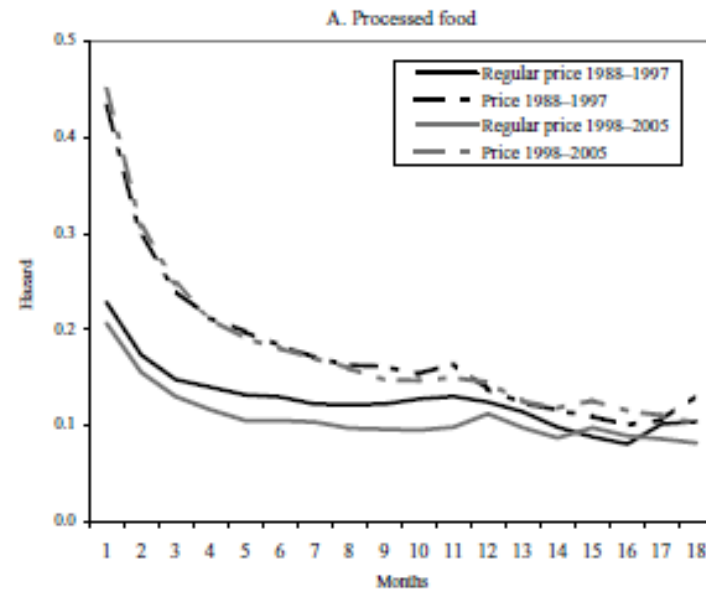


FIGURE VII

Hazard Function in the Menu Cost Model

Notes. Hazard functions with different levels of volatility of the idiosyncratic shock. In all cases $\rho = 0.66$ and the frequency of price change is 8.7%.

Price Data



Eichenbaum-Jaimovich-Rebelo

- Evidence of nominal rigidities in new scanner data set
- Data on prices and costs
- **Reference Prices** (most often quoted price within a quarter)
- Mechanism is different from sticky prices

Eichenbaum-Jaimovich-Rebelo

- Duration?
- Weekly prices change frequently (3 weeks)
- Reference prices are very inertial (1 year)
- What determines duration?

- Prices do not change without a change in costs
- Limited variation in mark-up (always within + or – 10% of its average value)
- When reference prices are changes, the desired markup is re-established

- Evidence is not consistent with main models of price setting (flexible, menu costs, Calvo)

Eichenbaum-Jaimovich-Rebelo

Figure 2

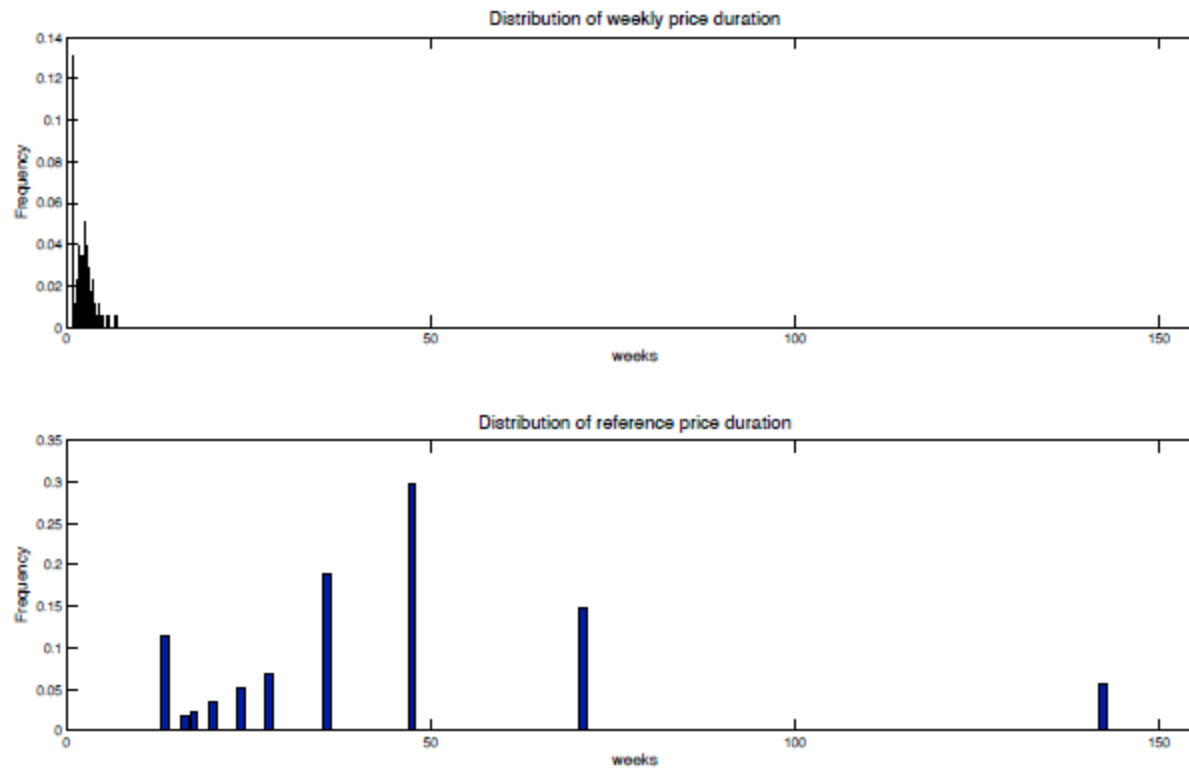


Figure 4

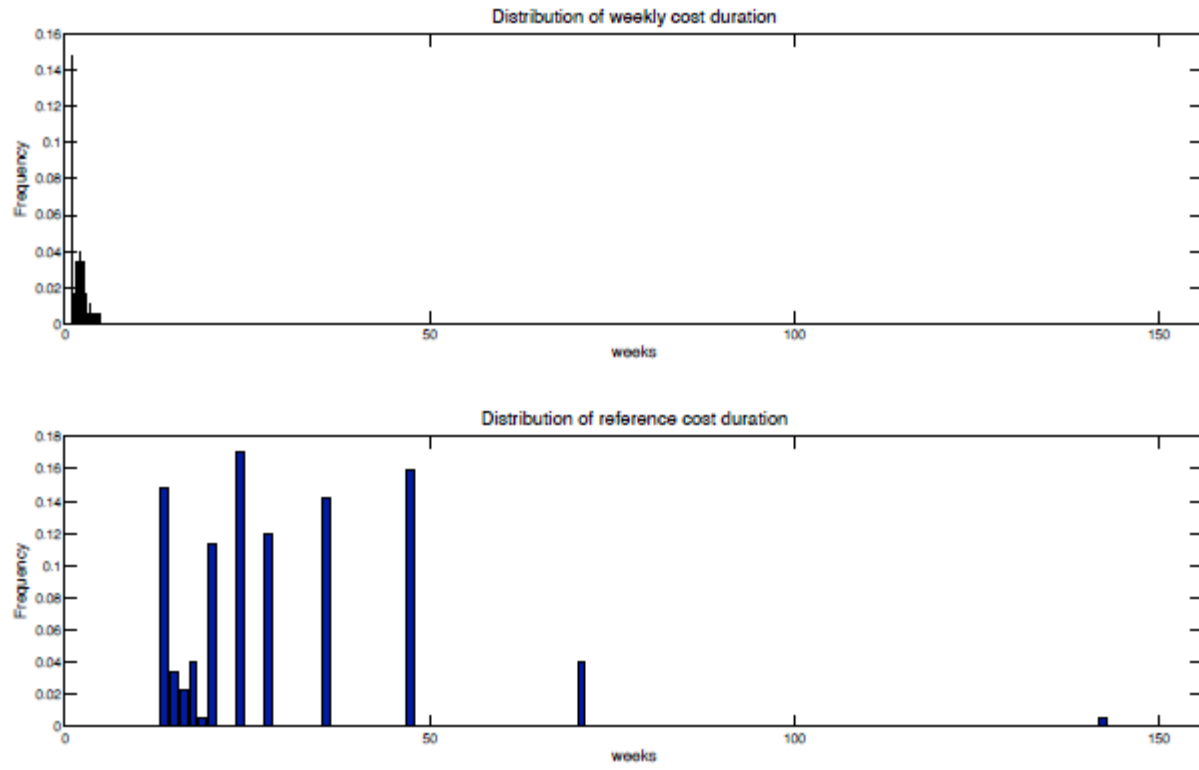


Figure 5

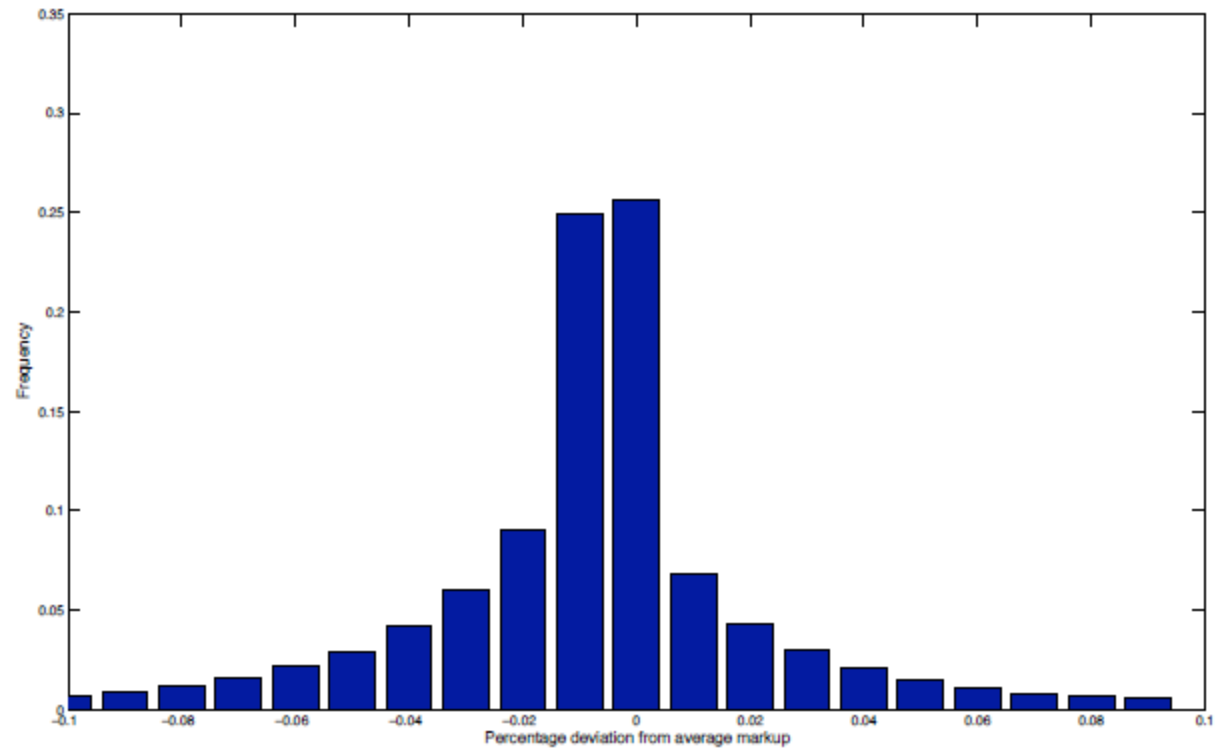
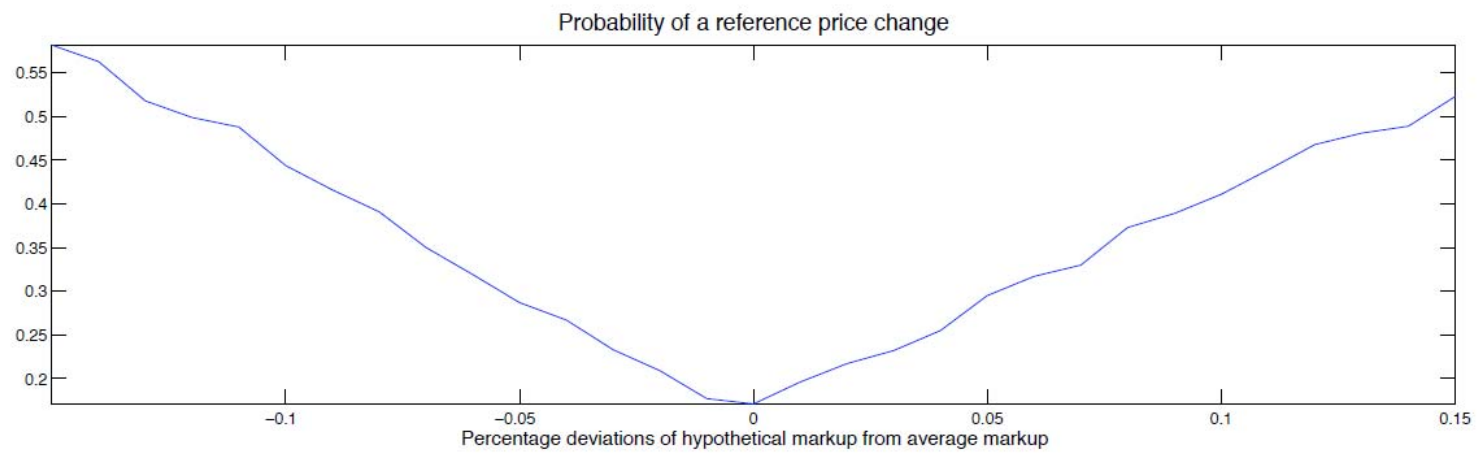


Figure 8



Realized reference markup as percentage deviation from average markup, conditional on a reference price change

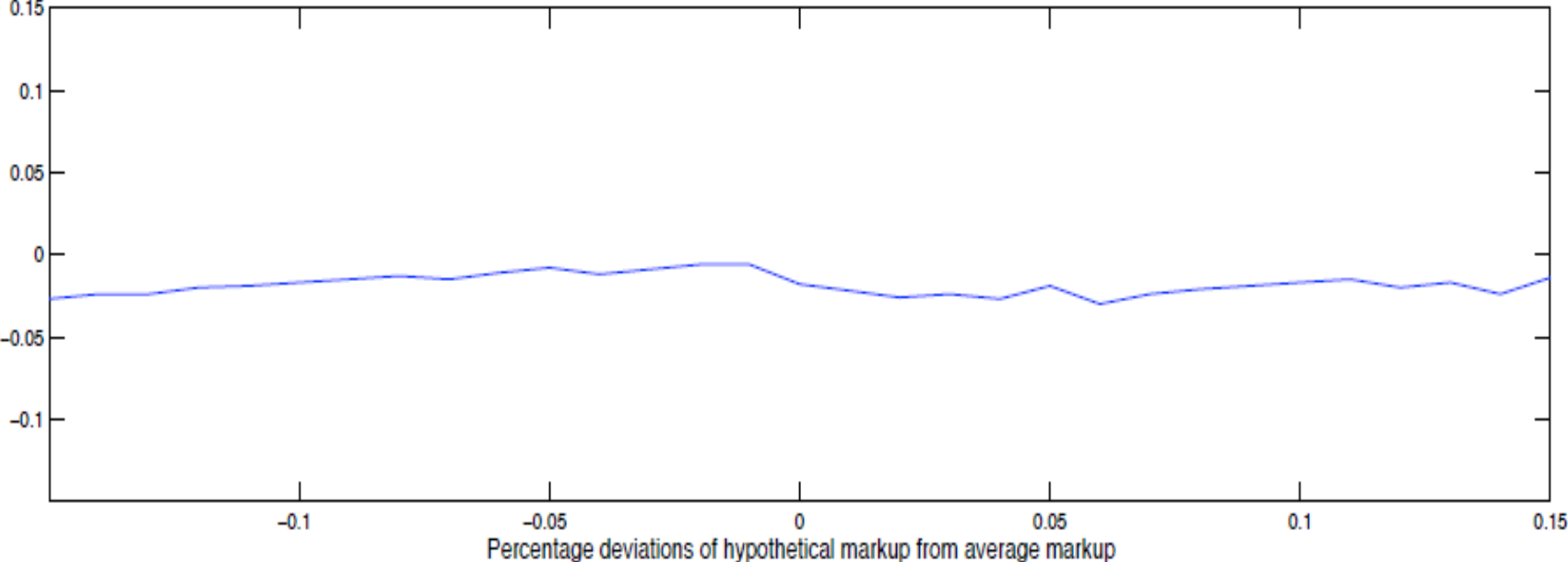


Figure 11

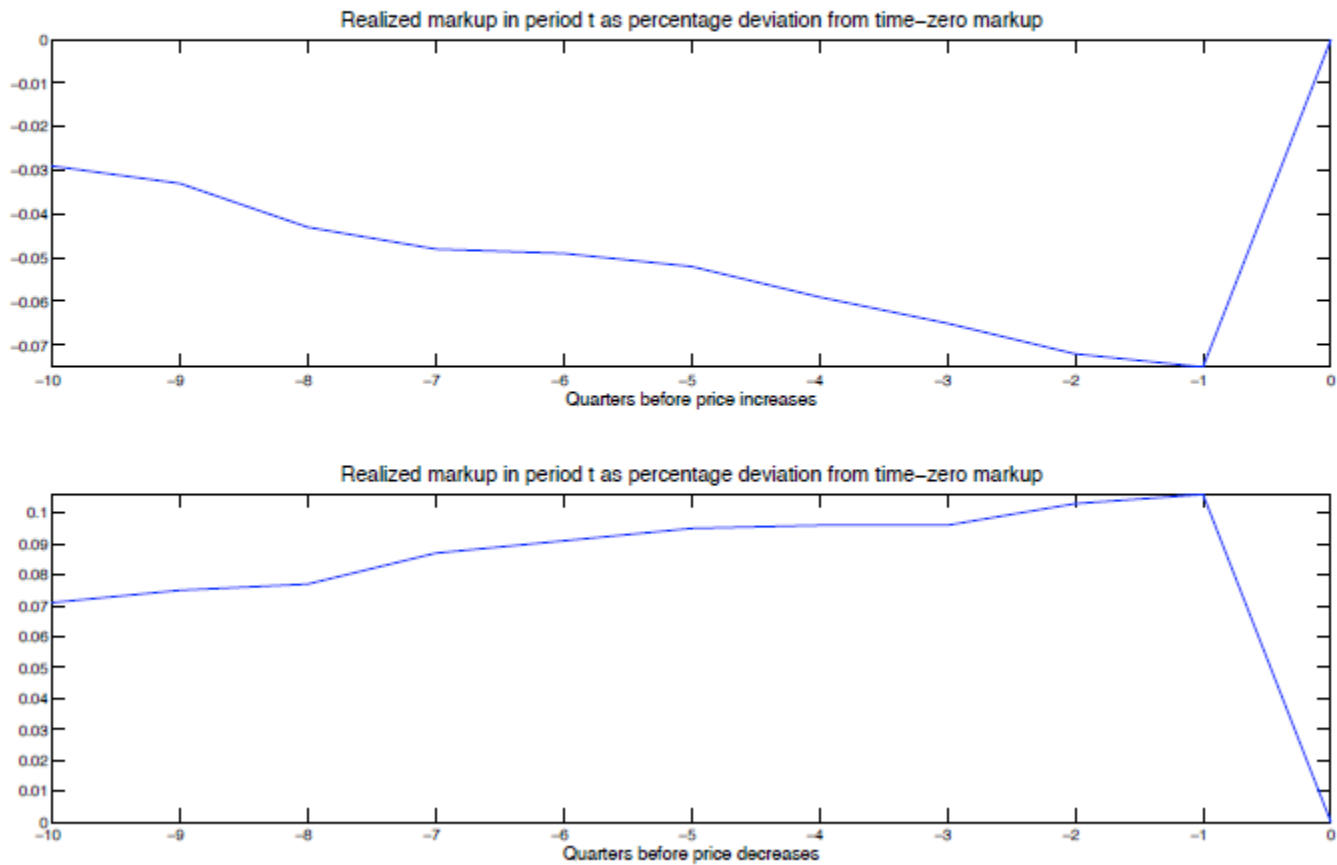
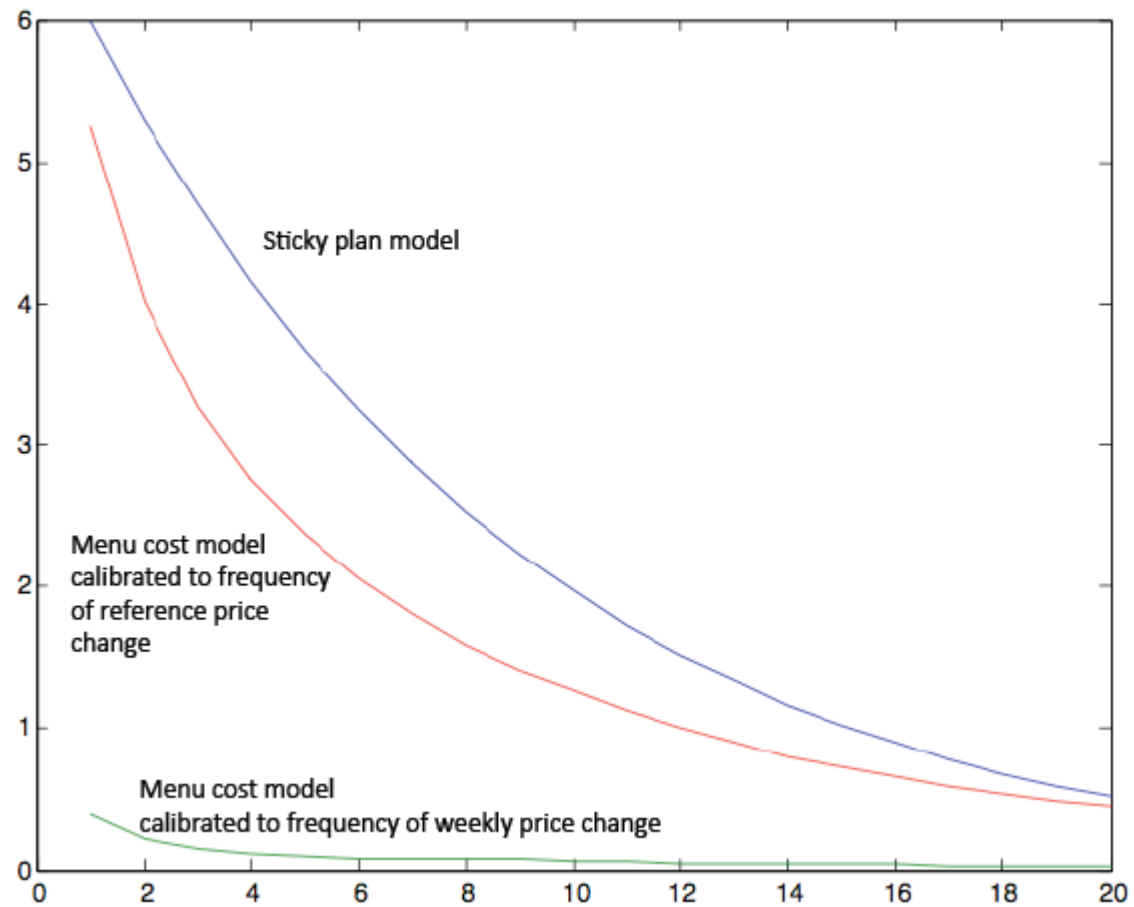


Figure 12: Impulse response to a monetary shock



Gagnon (QJE 2009)

- Price Setting during high and low inflation
- Data set from Mexico CPI
- Inflation goes from 6% to 40% to 5%

Frequency of price changes & Inflation

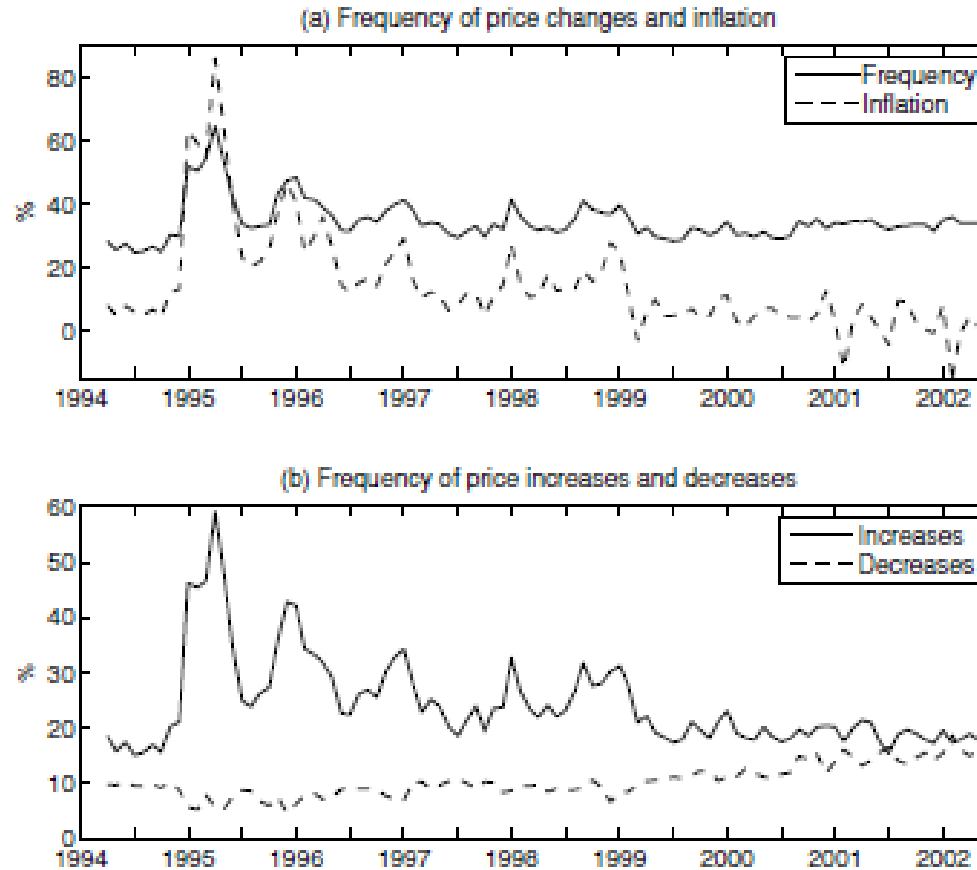


FIGURE III

Monthly Frequency of Price Changes (Nonregulated Goods)

All statistics in the figure, including inflation, are computed using the sample of nonregulated goods.

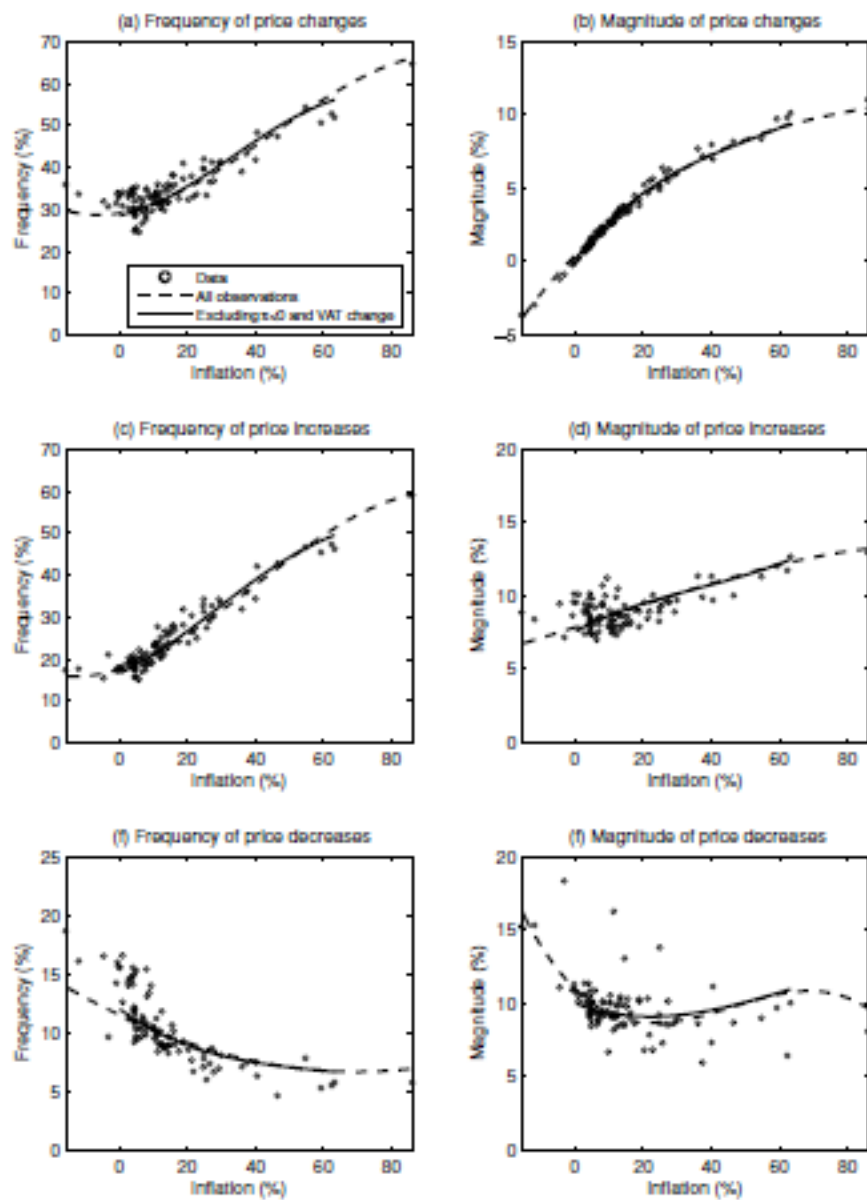


FIGURE IV
Scatterplot of the Monthly Frequency and Average Magnitude of Price Changes
and Inflation (Nonregulated Goods)

ECB Inflation Persistence Network

1. Firms change price once a year
2. Heterogeneity across sectors
3. Price decreases are common
4. Price adjustments are large
5. Frequency is affected by macro conditions
6. Mark-up pricing is common
7. Contracts and strategic interactions are main sources of price stickiness

- What's next?