Thai Inflation Dynamics: A View from Micro CPI Data

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Motivation

► A better understanding of individual price setting behavior is important towards:

   ► Differentiating among alternative microfoundations of price setting

   ► Understanding the nature of shocks that drive aggregate price changes

   ► Designing the appropriate monetary policy response to shocks

This paper

Exploits micro price data to help further our understanding about inflation dynamics in *Thailand*.

Our focus:

► <u>Patterns of price adjustment</u> (frequency, direction, size, dispersion and synchronicity of price changes)

► <u>Drivers of heterogenous price movements</u> based on a dynamic factor analysis (Reis and Watson, 2010)

Related Literature

Patterns of price adjustment based on micro CPI data

► <u>USA</u>: Bils and Klenow (2004), Klenow and Krysvtov (2008), Nakamura and Steinsson (2008), Nakamura et al. (2018)

► <u>Euro Area</u>: Baudry et al. (2004), Aucremanne and Dhyne (2004), Altissimo et al. (2006), Fabiani et al. (2006), Dhyne et al. (2005)

► <u>Japan</u>: Saita et al. (2006)

► <u>Mexico</u>: Gagnon (2006)

► <u>Brazil</u>: Gouvea (2007)

► <u>Chile</u>: Medina et al. (2007)

Factor analysis of inflation

► Stock and Watson (1989), Boivin et al. (2009), Ciccarelli and Mojon (2010), Reis and Watson (2010), Forbes et al. (2017)

Data Overview

Description of Dataset

Number of Items	53,785
Number of Products	8,317
Number of Entry Level Items	445
Number of Provinces	77
Sample Period	2002M1-2017M12

Actual and Constructed CPI Inflation

Coverage of the Consumer Price Index

Category	Dataset Coverage (ELI Count)	Actual Share (ELI count)
Food & Non-Alcoholic Beverages	33.48 (175)	33.48 (175)
Apparel & Footware	3.03 (53)	3.06 (54)
Housing & Furnishing	8.73 (61)	24.14 (62)
Medical &Personal Care	6.54 (63)	6.54 (63)
Transportation & Communication	25.53 (47)	25.54 (49)
Recreation & Education	5.81 (42)	6.03 (43)
Tobacco & Alcoholic Beverages	1.20 (4)	1.20 (4)
Total	84.33 (445)	100 (450)

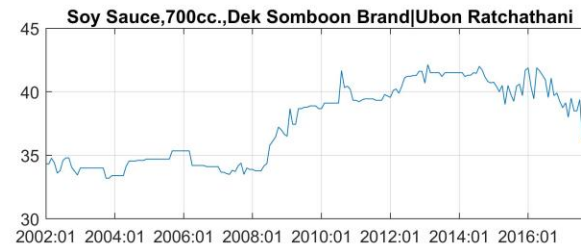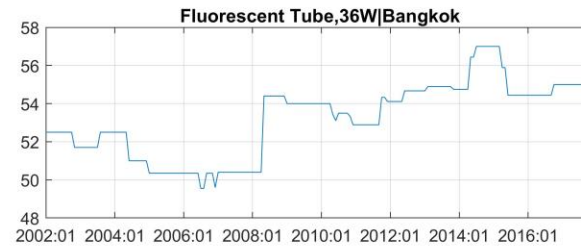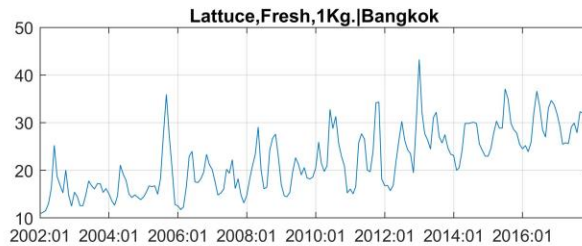| Economic Sector	Dataset Coverage (ELI Count)	Actual Share (ELI count)
Core	57.42 (307)	73.09 (312)
Service	9.63 (80)	25.26 (83)
Total	84.33 (445)	100 (450)

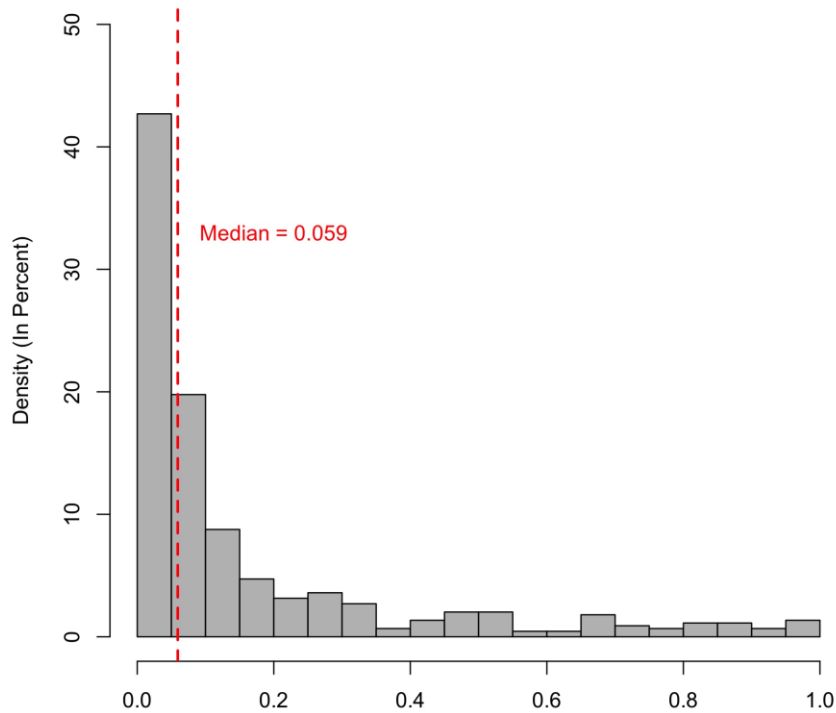Source: Ministry of Commerce, Author's calculation

Data Overview

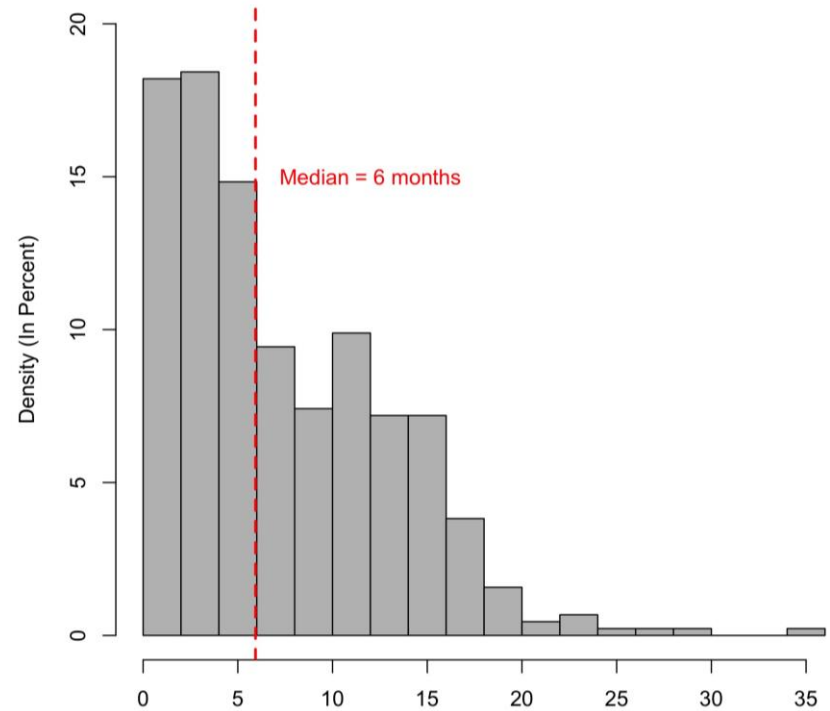**Examples of price trajectories for individual items**
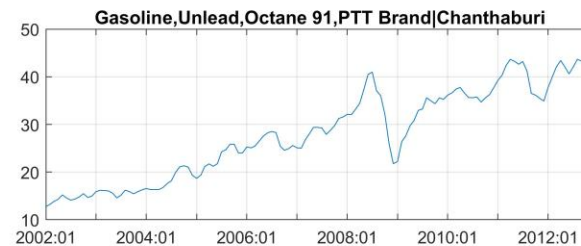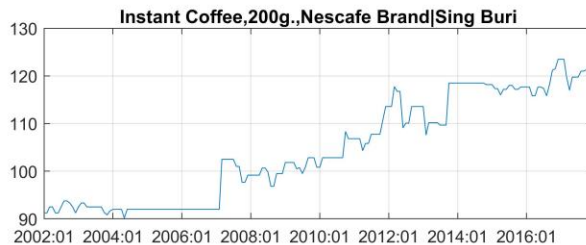
Source: Ministry of Commerce, Author's calculation

Frequency and Duration of Price Changes

Distribution of the frequency of price changes

Distribution of the duration of price changes

Note: Plotted are the frequency and empirical duration of price changes at the ELI level (unweighted) based on the median population-weighted product.

Frequency and Duration of Price Changes

Category	Mean Freq (% per month)	Implied Mean Duration (months)	Mean Duration (months)
Food & Non-Alcoholic Beverages	0.23	3.91	5.37
Apparel & Footware	0.03	29.37	13.42
Housing & Furnishing	0.13	7.37	6.37
Medical & Personal Care	0.07	13.03	8.68
Transportation & Communication	0.29	2.86	7.14
Recreation & Education	0.04	22.88	8.33
Tobacco & Alcoholic Beverages	0.11	8.70	7.15
Total CPI	**0.20**	**4.40**	**6.79**

Sector	Mean Freq (% per month)	Implied Mean Duration (months)	Mean Duration (months)
Core	0.06	15.13	8.81
Non-core	0.50	1.44	2.47
Service	0.04	22.76	10.30
Non-Service	0.22	3.94	6.33
Total CPI	**0.20**	**4.40**	**6.79**

Note: Mean frequency denotes the average frequency of price changes at the ELI level weighted by their corresponding 2011 expenditure share weights. Implied duration is equal to $-1/\ln(1-f)$ where f is the mean frequency of price change. Mean duration is the average length of price spells for the ELI weighted by their corresponding 2011 expenditure share weights.
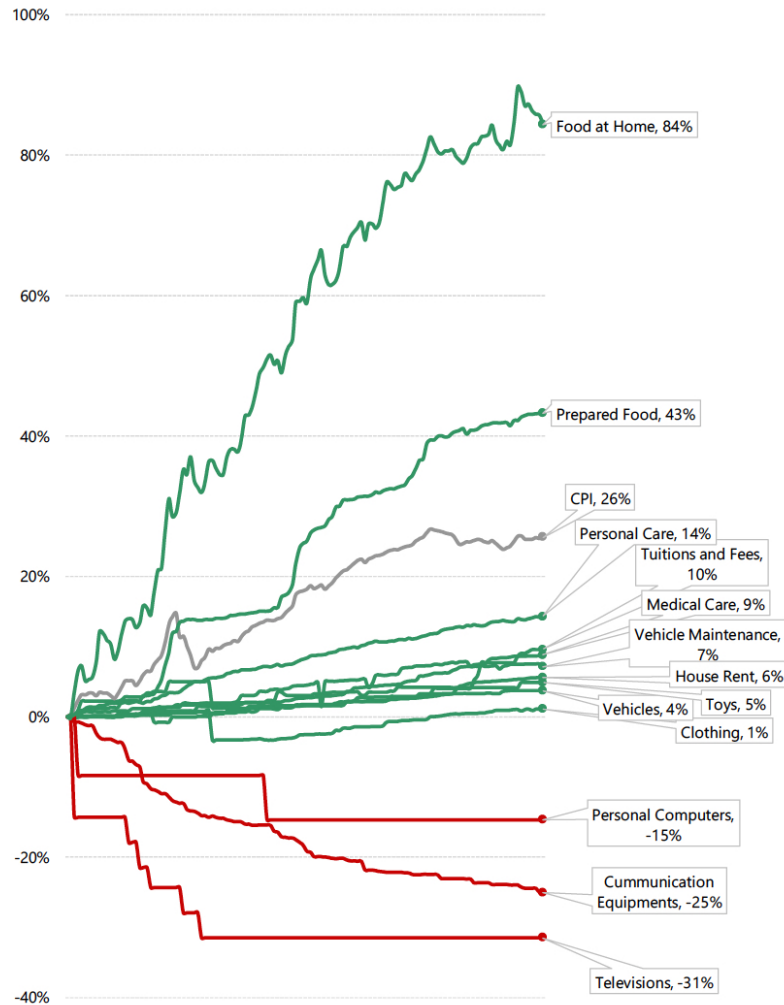
International Comparison

Country	Mean Frequencies
USA	0.26-0.36
UK	0.19
France	0.19
Germany	0.11
Italy	0.10
Japan	0.23
Chile	0.46
Brazil	0.37
Mexico	0.29

Source: Klenow and Malin (2010)

Directional Price Changes

Percentage Change in Price Levels by Category
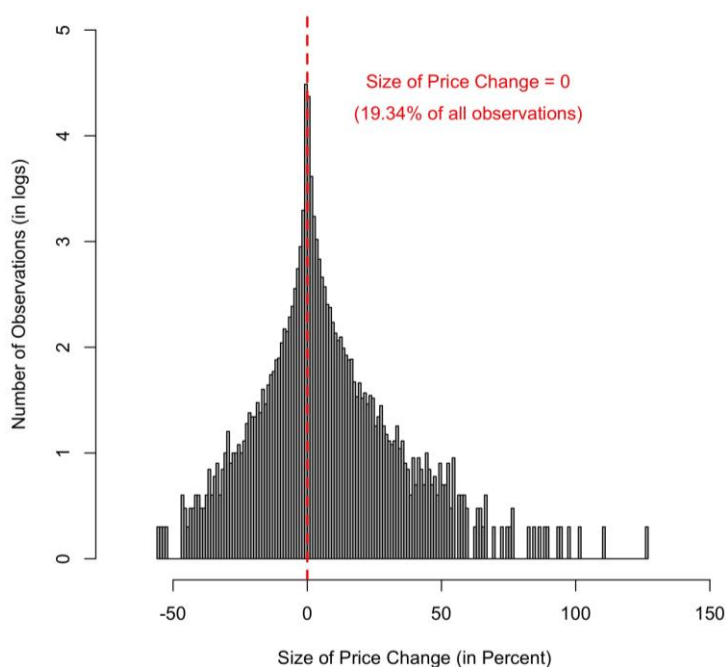

Source: CEIC, Author's calculation

Directional Price Changes

Category	Mean Duration Increase (months)	Mean Duration Decrease (months)	Fraction Increase (pc.)
Food & Non-Alcoholic Beverages	7.94	13.38	57.28
Apparel & Footware	18.08	18.85	66.66
Housing & Furnishing	8.69	10.90	56.55
Medical & Personal Care	11.28	13.94	59.32
Transportation & Communication	10.59	10.26	52.79
Recreation & Education	11.59	10.58	64.28
Tobacco & Alcoholic Beverages	10.68	17.26	82.22
Total CPI	**9.73**	**12.29**	**56.41**

Sector	Mean Duration Increase (months)	Mean Duration Decrease (months)	Fraction Increase (pc.)
Core	11.74	15.10	66.66
Non-core	3.76	4.63	56.42
Service	13.48	15.69	70.00
Non-Service	8.64	11.23	56.01
Total CPI	**9.73**	**12.29**	**56.41**

Note: Mean duration increases (decreases) are based on calculating the average length of price spells between increases (decreases) for each ELI based on the median population-weighted product, then aggregating up by 2011 expenditure share weights. Fraction increase is the fraction of mean frequency increases over the sum of mean frequency price changes.

Size of Price Changes

Distribution of Size of Price Changes

Size of Price Change = 0
(19.34% of all observations)

Source: Ministry of Commerce, Author's calculation

Category	Price Increase (p.c.)	Price Decrease (p.c.)
Food & Non-Alcoholic Beverages	6.84	5.66
Apparel & Footware	14.11	14.14
Housing & Furnishing	16.42	12.87
Medical & Personal Care	10.80	7.91
Transportation & Communication	16.02	8.31
Recreation & Education	29.78	20.47
Tobacco & Alcoholic Beverages	4.96	1.97
Total	**10.37**	**7.74**

Sector	Price Increase (p.c.)	Price Decrease (p.c.)
Core	14.03	10.05
Non-core	5.35	4.57
Service	32.95	16.55
Non-service	8.84	7.14
Total	**10.37**	**7.74**

Note: Reported are the average size of price increases and decreases for each ELI based on the median population-weighted product, then aggregating up by 2011 expenditure weights.

Fraction versus Size of Price Changes

$$\pi_t = fr_t \times dp_t = fr_t^+ dp_t^+ - fr_t^- dp_t^-$$

CPI Inflation and Absolute Size vs. Fraction of Price Changes

Variables	Mean (%)	Stdev (%)	Correlation with π_t
π_t	0.105	0.452	
fr_t	13.976	3.020	0.102
dp_t	0.749	3.259	0.976
fr_t^+	7.908	3.377	0.547
fr_t^-	6.066	2.957	-0.520
dp_t^+	4.538	3.067	0.570
dp_t^-	4.237	3.591	-0.544

Takeaways so far

► **Prices change infrequenty in Thailand**

  ► Average duration is 4-7 months

  ► Large differences across product categories, economic sectors, and across time.

  → **The impact of a monetary policy shock may be long-lived**

► **Price decreases are common**

  ► Roughly 45% of price changes are price reductions

  → **A higher inflation target may not be needed**

► **Price changes are sizable in both directions and the size of price changes covaries strongly with the rate of inflation**

  ► Size of price increases and decreases average at 10.4% and 7.7%

  ► The fraction of price changes vary systematically with positive and negative inflation movements

  → **Calls for models emphasizing heterogeneity, and those that combine both time and state-dependent pricing elements**
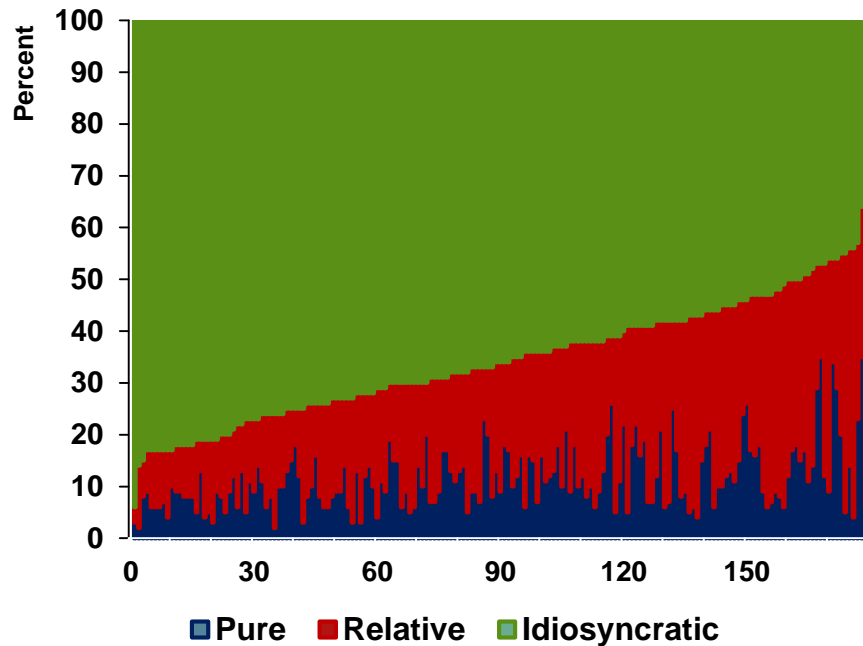
Inflation Decomposition: $\pi_t = \mathbf{1}v_t + \Theta\rho_t + u_t$
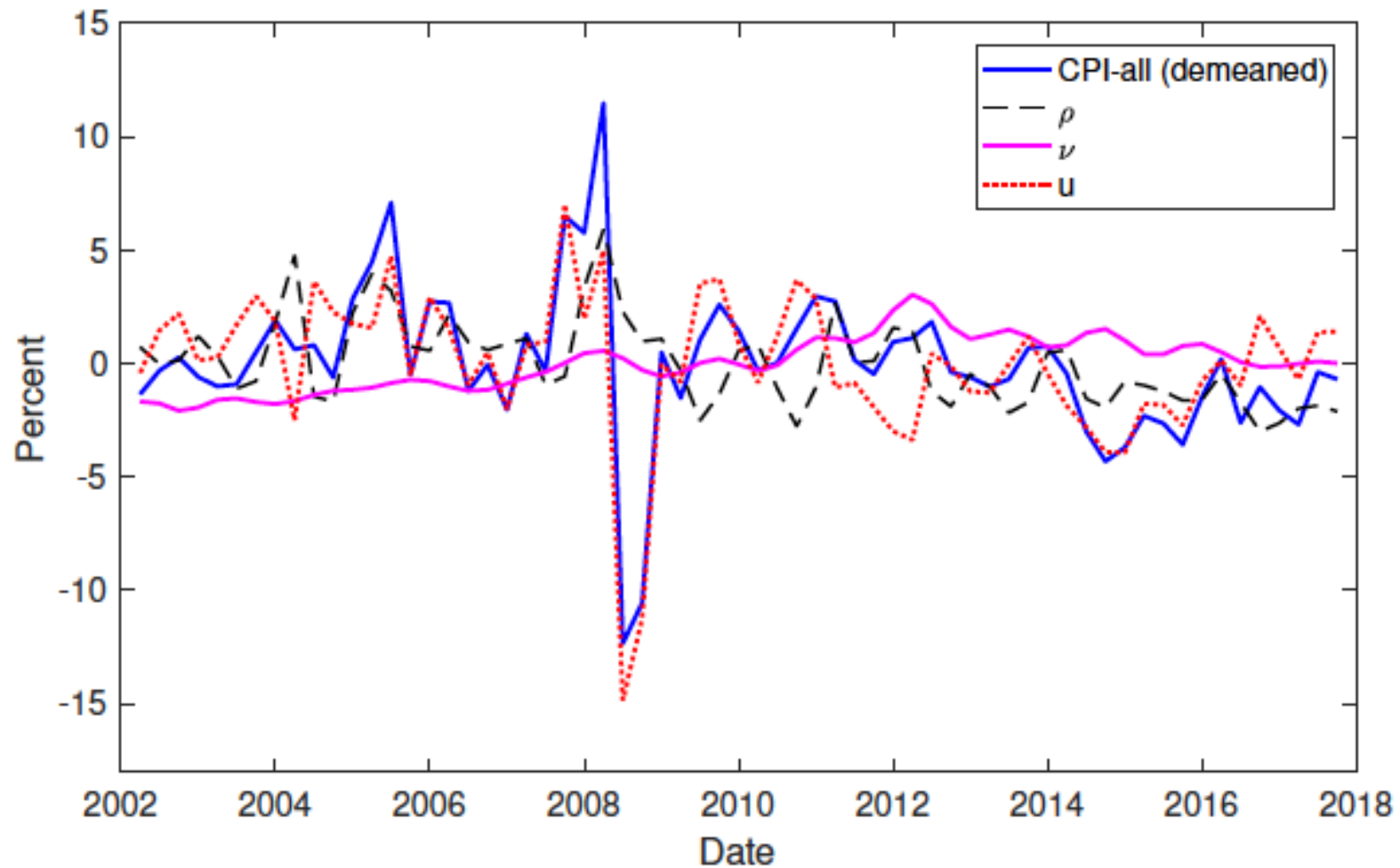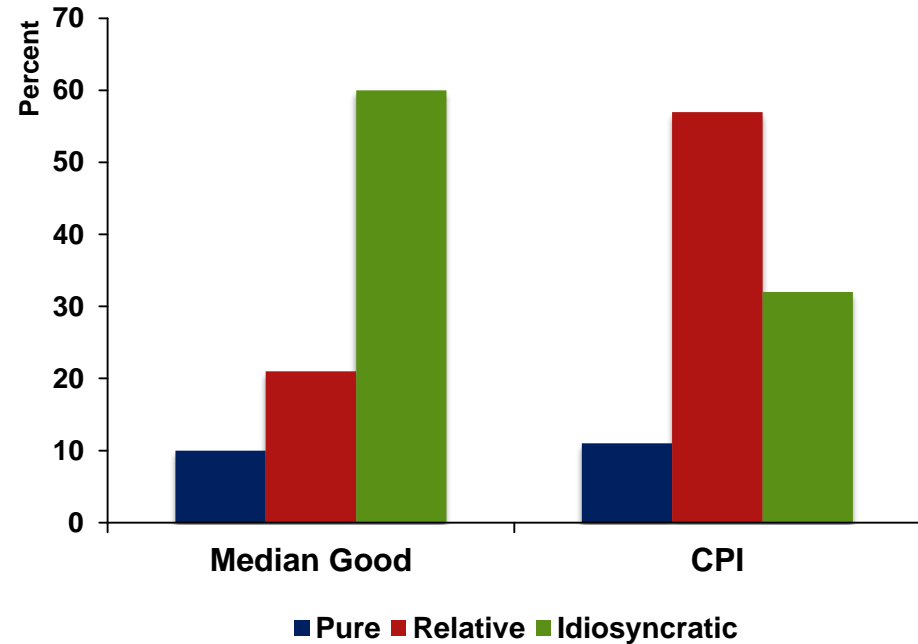
Importance of Inflation Components

Fraction of Variability Explained (Goods Level)

Fraction of Variability Explained

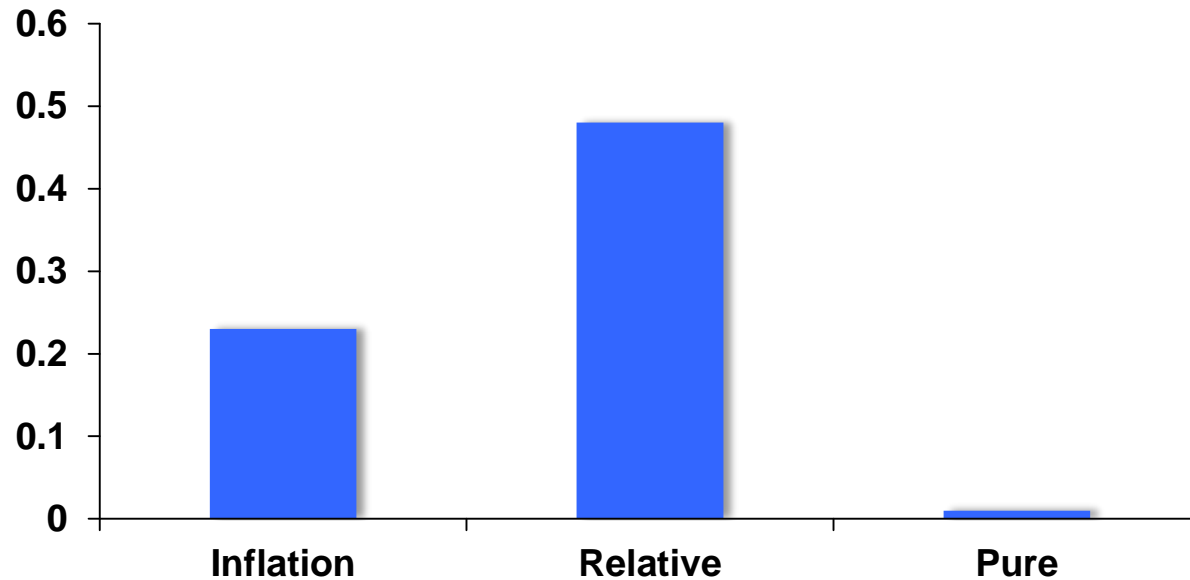Note: Calculated based on the average squared canonical coherence measure at all frequencies

Components of Inflation and Macro Observables

Observables	All	B-Cycle
Relative inflation		
Food	0.40 (0.12)	0.64 (0.25)
Energy	0.40 (0.12)	0.23 (0.19)
Services	0.55 (0.11)	0.61 (0.17)
Imports	0.29 (0.09)	0.48 (0.23)
Pure inflation		
ΔM1	0.26 (0.06)	0.08 (0.07)
ΔPolicy Rate	0.10 (0.04)	0.02 (0.05)
Term spread	0.09 (0.06)	0.06 (0.08)

Note: Calculated based on the average squared canonical coherence measure at all and business cycle frequencies. Standard error in parentheses.

Components of Inflation and the Real Economy

Correlation between GDP and Inflation Components at Business Cycle Frequencies

Note: Calculated based on the average squared canonical coherence measure at business cycle frequencies.

Takeaways (cont.)

▶ **Large heterogeneity in the pattern of price changes**

▶ **The bulk of overall price movements are relative price changes**

   ▶ Aggregate relative price shocks account for 57 percent of total inflation rate variability and relative price changes can be persistent.

   → **Non-monetary factors may be driving trend inflation**

   → **Central banks may have less control over inflation than we think**

   → **Importance should be given to teasing out the policy relevant part of CPI**

▶ **Underlying drivers of aggregate price movements are related to well-known macroeconomic variables**

▶ **The Phillips curve is still empirically relevant once noisy idiosyncratic price movements are filtered out.**

Appendix

To exclude anomalies, we select only price trajectories that satisfy the following conditions:

▶ The price data must be observed continuously for at least 2 years.

▶ The item must have at least 2 price changes.

▶ The size of price changes must be in the range of -70 to 230 percent.

▶ The item must belong to the CPI basket.

Frequency of Price Increases and Decreases
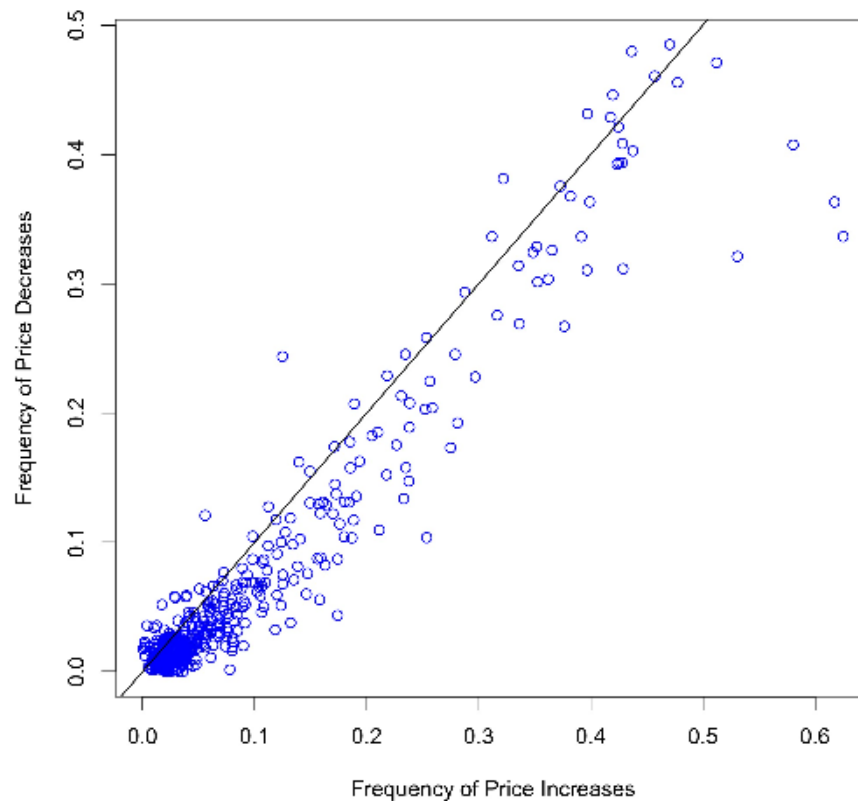
Note: Plotted is the frequency of price increases (decreases) for a particular ELI (unweighted) over the sample period, calculated based on the median population-weighted product

CPI Inflation and Absolute Size and Fraction of Size Changes
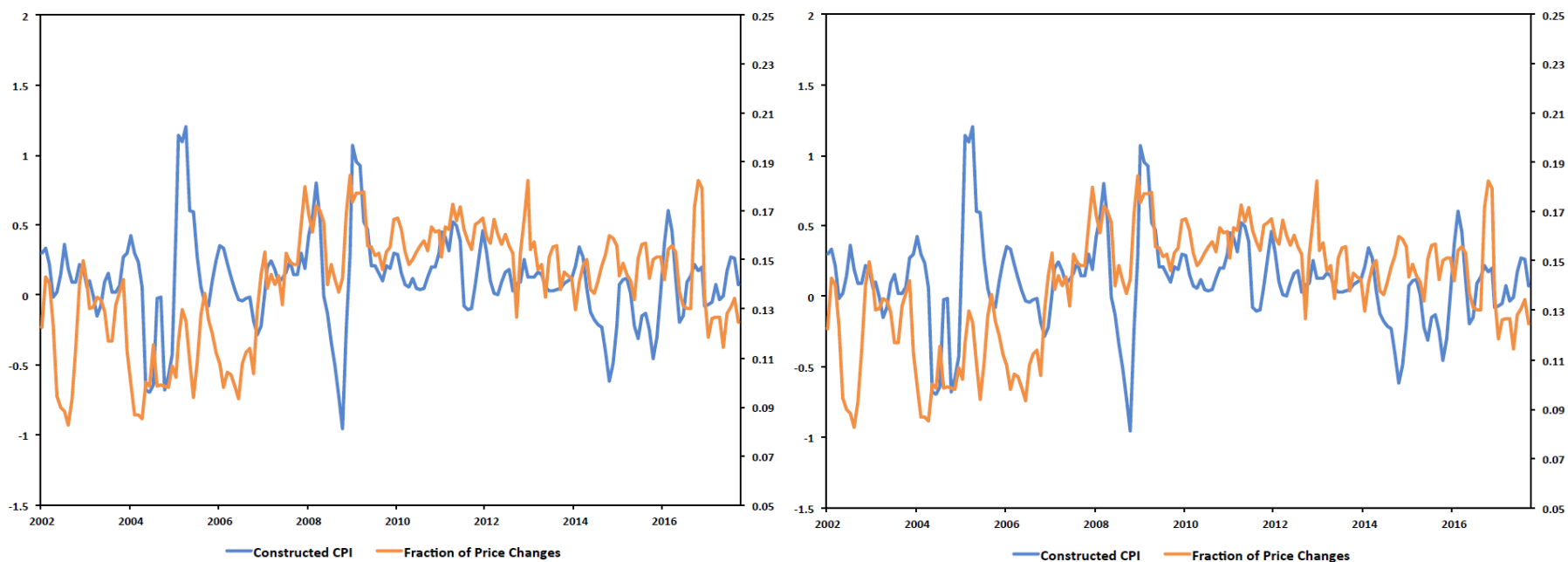
Note: Plotted is the three-month moving average of constructed CPI from our our dataset (left axes in percent) and the absolute size of price changes and fraction of items changing prices in each month (right axes in percent).

Synchronicity and Dispersion of Prices

Category	Number of ELIs	FK Index	Mean CV
Food & Non-Alcoholic Beverages	97	0.43	0.10
Apparel & Footware	13	0.55	0.20
Housing & Furnishing	14	0.59	0.16
Medical & Personal Care	16	0.68	0.05
Transportation & Communication	11	0.87	0.02
Recreation & Education	10	0.66	0.16
Tobacco & Alcoholic Beverages	3	0.66	0.02
Total CPI	164	0.57	0.08
Service	14	0.47	0.26
Non-Service	150	0.57	0.07

Note: FK is the Fisher and Konieczny index and mean CV is the simple mean of the coefficient of variation over time.

$$\boldsymbol{\pi_t} = \boldsymbol{\Lambda F_t} + \boldsymbol{u_t}$$

$$\boldsymbol{\Lambda F_t} = \mathbf{1} a_t + \boldsymbol{\Gamma R_t}$$

$$v_t = a_t - E[a_t | \{\boldsymbol{R_t}\}_{t=1}^{T}]$$

$$\boldsymbol{\rho_t} = E[\boldsymbol{F_t} | \{\boldsymbol{R_t}\}_{t=1}^{T}]$$

Unobserved Components Model:

$$\pi_{it} = a_t + {\gamma_i}' \boldsymbol{R_t} + u_{it}$$

$$\boldsymbol{\varphi(L)} \begin{pmatrix} a_t \\ \boldsymbol{R_t} \end{pmatrix} = \epsilon_t$$

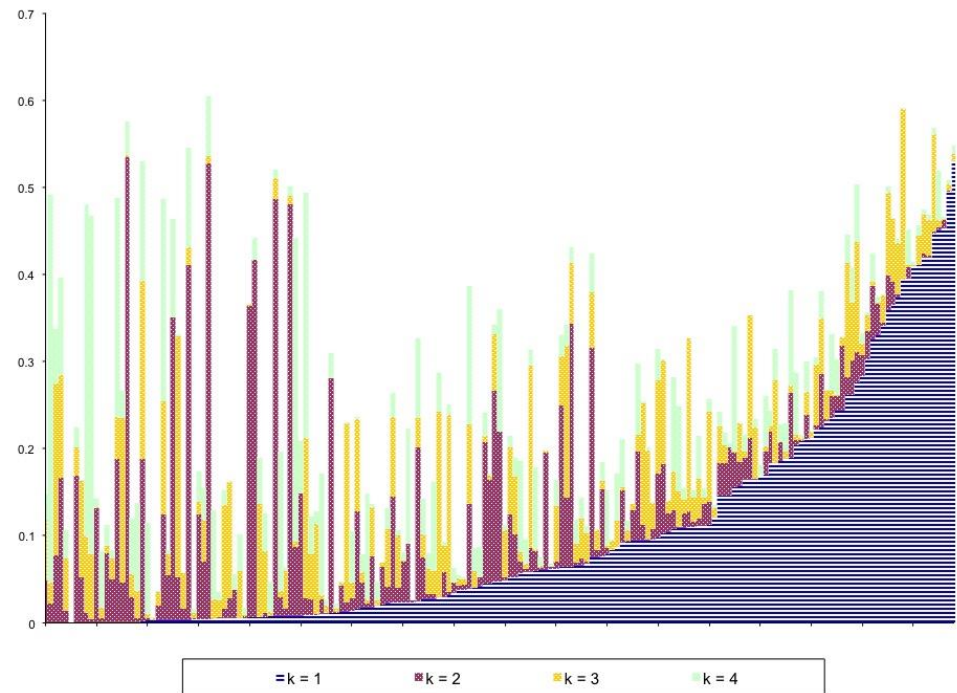$$\beta_i(L) u_{it} = c_i + e_{it}$$

- Data: 2002Q2-2018Q2, 179 ELIs (64.4% coverage of CPI)
- Based on statistical tests, we choose three factors

Eigenvalues for the correlation matrix
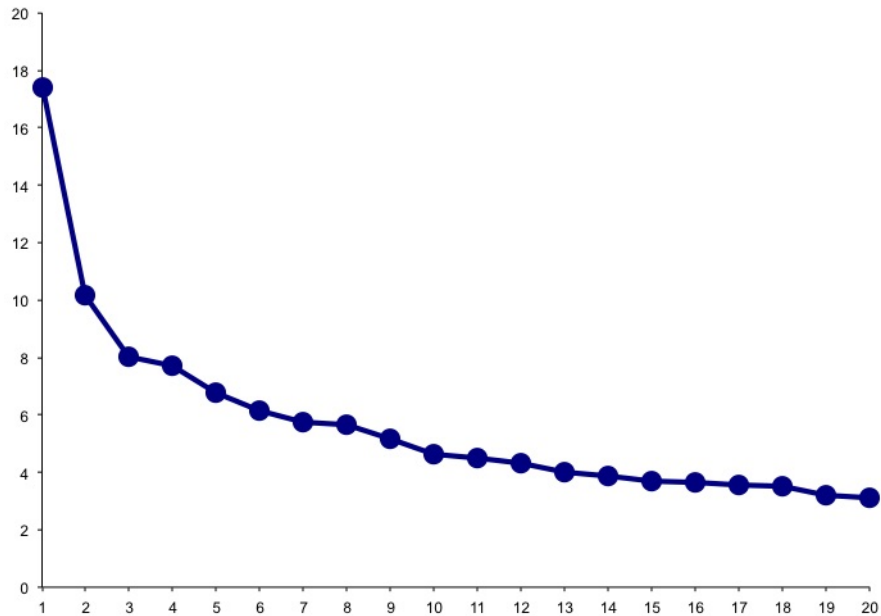
Number of factors

Note: Plotted are the eigenvalues of the correlation matrix of inflation rates in the dataset.

Note: Plotted is the fraction of sample variance of inflation explained by k factors where k varies from 1 to 4. The horizontal axis is ordered by the fraction of variance explained by the 1-factor model for the 179 ELIs.