

**MEDIUM-TERM ADJUSTMENT THEOREM
SECTION 3: INFLATION DYNAMIC AND
NEW KEYNESIAN ECONOMICS**

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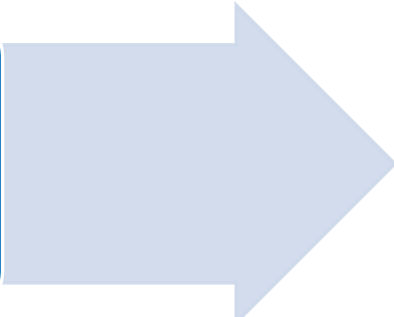
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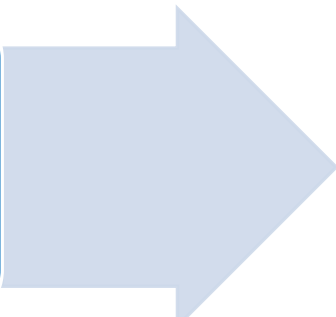
Historical timeline of macroeconomic theory

Between 1960s and 1980s, we have seen many changes in the macroeconomic paradigms (thinking framework)

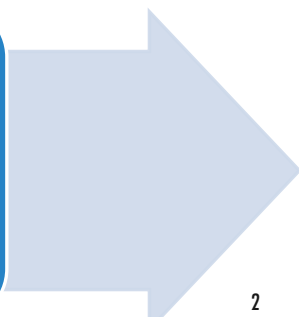
1960: Phillips curve

- The discovery of Phillips relation
 - Tradeoff & pro-growth policies
 - The Keynesian and Monetarism debates
- 

1970: The breakdown

- Illusive relation & the periods of accelerating inflation spiral
 - *New Classical economics* and the rational expectation
 - Medium-term self-adjustment
- 

1980: The era of solid macroeconomics framework

- The rise of *micro-foundataion approach* for macroeconomic analysis
 - The rise of *New Keynesian economics*
- 

What's wrong with the New Classical economics?

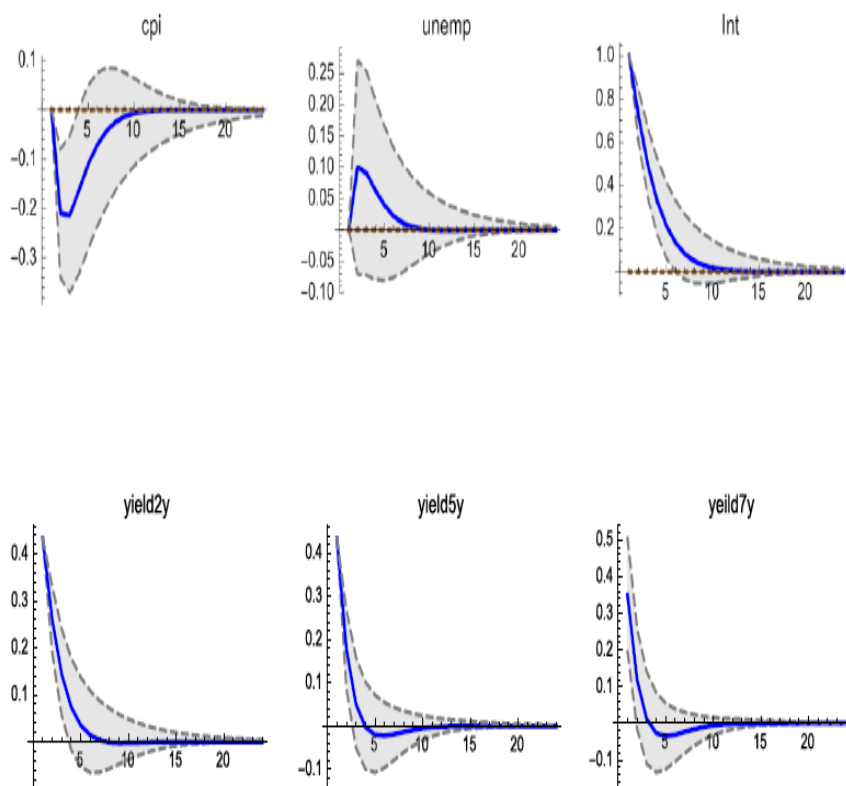
While the framework offers a good *qualitative* background on the theory of medium-term adjustment, the model does not do a good job at explaining the *quantitative* pattern observed

- **Question:** Can New Classical economics framework explain the pattern of business cycles? **How well does it explain the data?**

- Unfortunately, the answer is **NO**.
 - Demand shocks have **short-lived effect in their model**; gone within a period
 - Empirical evidence suggests otherwise; ***the impact of demand shocks is quite persistent***

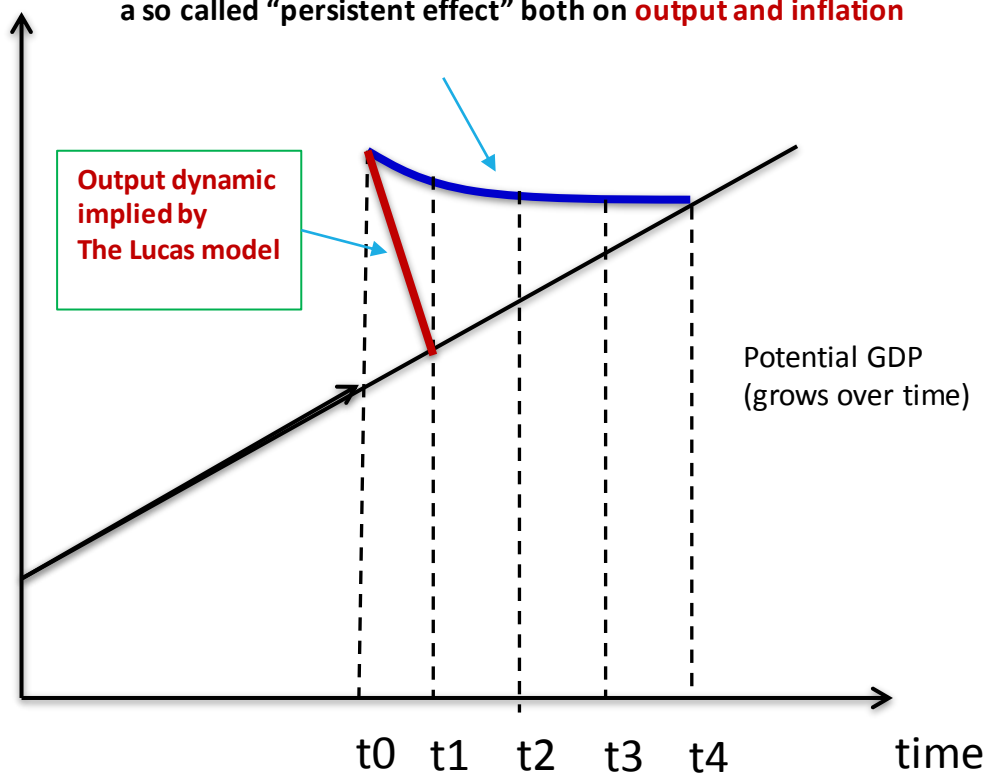
Consider an example: the effect of monetary policy

Conventional understanding is that the effect of monetary policy lasts quite long; the effect of shock slowly dies down



Hypothetical time path and Actual time path

Empirically, money shock generates a so called “persistent effect” both on **output** and **inflation**



Source: Sripinit (2017)

New interpretations to the business cycles: New Keynesian

So, everything that Keynes said might be right;
the rigidities strike back

- Slow adjustment might be due to the *incomplete in wage and price adjustment*, i.e. price and wage stickiness (rigidity)
- So, what Keynes earlier argued were right, **but incomplete** from the theoretical point of view; the framework lacked of the **micro-foundataion**

The rise of New Keynesian economics

1980s was considered as the period of the rising recognition of New Keynesian economics, or so called “neo-synthesis” of Keynesian economics

- Criticize the ground on which New classical economics used for the interpretation of business cycles and its adjustment process.
 - Argue for the role of rigidity and imperfection as the important way that can account for the persistent pattern in medium-term adjustment.
- Offer some novel story and emphasize at *theoretical underpinnings* that justify the existence of key frictions, i.e. nominal rigidities and imperfection
 - Fix the original ideas with more emphasis at micro-foundation
- Arguably, the framework offers many implications that better explaining the empirical regularities observed over the business cycles. (than the New Classical one)

Some examples of novel key frictions include

- Examples
 - **Nominal Rigidities**
 - Labor market imperfection
 - Coordination failure

Nominal rigidities

Nominal rigidities refer to various situations in which agents cannot adjust the value of some nominal variables.

- Commonly used to refer to the situation in which firms and labor cannot adjust their *price* and *money-wage*, respectively.
- The prevalence of nominal rigidities is one of the very first reasoning used to explain the pattern in which our economy slowly reverts to long-term trend.

Nominal rigidities: price rigidities

Price rigidities refer to the situation when firms do not often adjust their price

- What do we mean by nominal price/wage rigidities?
 - Price and wage fixed → sound right, but not 100% correct
- *Price and wage cannot be frequently adjusted; moreover, the adjustment speed varies*
 - *Staggered price adjustment*
- To understand this, let's consider some evidences on microeconomic price setting, and then followed by the wage setting

Nominal rigidities: Firms' price setting

There have been a number of studies that focus on firms' price setting behavior; the evidence of price rigidity is clear!

of price change per year

What's shown in the last column on the table represents "average" of the duration in month that firms keep their price fixed, i.e. inactive price adjustment

Country	Paper	<1	1	2-3	≥4	Median	Mean (in months)
Austria	Kwapil et al. (2005)	24	51	15	11	1	12.7
Belgium	Aucremann and Druant (2005)	18	55	18	8	1	11.9
Canada	Amirault et al. (2006)	8	27	23	44	2-3	6.8
Estonia	Dabusinskas and Randveer (2006)	14	43	25	18	1	10.0
Euro Area	Fabiani et al. (2005)	27	39	20	14	1	12.3
France	Loupas and Ricart (2004)	21	46	24	9	1	11.8
Germany	Stahl (2005)	44	14	21	21	1	13.5
Italy	Fabiani et al. (2007)	20	50	19	11	1	11.9
Japan	Nakagawa et al. (2000)	23	52	11	14	1	12.5
Luxembourg	Lünnemann and Mathä (2006)	15	31	27	27	2-3	9.0

Country	Paper	<1	1	2-3	≥4	Median	Mean (in months)
Mexico	Castanon et al. (2008)	—	—	—	—	—	5.7
Netherlands	Hoerberichts and Stokman (2006)	10	60	19	11	1	10.7
Portugal	Martins (2005)	24	51	14	12	1	12.7
Romania	Copaciu et al. (2007)	—	—	—	—	—	4.1
Spain	Álvarez and Hernando (2007a)	14	57	15	14	1	11.1
Sweden	Apel et al. (2005)	29	43	6	20	1	12.7
Turkey	Sahinoz and Saracoglu (2008)	—	—	—	—	—	3.0
United Kingdom	Hall et al. (2000)	6	37	44	14	2-3	8.2
United States	et al. (1998)	10	39	29	22	1	8.8

Source: Klenow and Malin (2010)

Note: Source is Álvarez (2008), Table 3. Mean implicit durations obtained from the interval-grouped data using the following assumptions: for firms declaring "at least four price changes per year," 8 price changes are considered (i.e., mean duration of 1.33 months); for those declaring "two or three price changes per year," 2.5 price changes are considered (i.e., 4.8 months); for those declaring "one change per year" a duration of 12 months, and for those declaring "less than one price change per year," a change every two years is considered (i.e., 24 months).

Nominal rigidities: Firms' price setting

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CPI

PPI

Country	Paper	Sample Period	Frequency (in %)	Country	Paper	Sample Period	Frequency (in %)
Austria	Baumgartner <i>et al.</i> (2005)	1996:01 – 2003:12	15.1	Belgium	Cornille and Dossche (2008)	2001:01 – 2005:01	24
Belgium	Aucremanne and Dhyne (2004)	1989:01 – 2001:01	16.9	Colombia	Julio and Zarate (2008)	1999:06 – 2006:10	20.2
Brazil	Barros <i>et al.</i> (2009)	1996:03 – 2008:12	37.2	Euro Area	Vermuelen <i>et al.</i> (2007)	Various	21
	Gouvea (2007)	1996:01 – 2006:12	37.0	France	Gautier (2008)	1994:01 – 2005:06	25
Chile	Medina <i>et al.</i> (2007)	1999:01 – 2005:07	46.1	Germany	Stahl (2006)	1997:01 – 2003:09	22
Denmark	Hansen and Hansen (2006)	1997:01 – 2005:12	17.3	Italy	Sabbatini <i>et al.</i> (2006)	1997:01 – 2002:12	15
Euro Area	Dhyne <i>et al.</i> (2006)	1996:01 – 2001:01	15.1	Portugal	Dias <i>et al.</i> (2004)	1995:01 – 2001:01	23
Finland	Vilmunen and Laakkonen (2005)	1997:01 – 2003:12	16.5	South Africa	Creamer (2008)	2001:12 – 2006:02	19.5
France	Baudry <i>et al.</i> (2007)	1994:07 – 2003:02	18.9	Spain	Álvarez <i>et al.</i> (2008)	1991:01 – 1999:02	21
Germany	Hoffmann and Kurz-Kim (2006)	1998:02 – 2004:01	11.3	United Kingdom	Bunn and Ellis (2009)	2003:01 – 2007:12	26
Hungary	Gabriel and Reiff (2008)	2001:12 – 2007:06	15.1	United States	Nakamura-Steinsson (2008a)	1988:01 – 2005:12	24.7
Israel	Baharad and Eden (2004)	1991:01 – 1992:12	24.5		Goldberg-Hellerstein (2009)	1987:01 – 2008:10	33.3
Italy	Fabiani <i>et al.</i> (2006)	1996:01 – 2003:12	10.0				
Japan	Saita <i>et al.</i> (2006)	1999:01 – 2003:12	23.1				
Luxembourg	Lunnemann and Matha (2005)	1999:01 – 2004:12	17.0				
Mexico	Gagnon (2009)	1994:01 – 2004:12	29.4				
Netherlands	Jonker <i>et al.</i> (2004)	1998:11 – 2003:04	16.5				
Norway	Wulfsberg (2009)	1975:01 – 2004:12	21.3 (21.9)				
Portugal	Dias <i>et al.</i> (2004)	1992:01 – 2001:01	22.2				
Sierra Leone	Kovanen (2006)	1999:01 – 2003:04	51.5				
Slovakia	Coricelli and Horvath (2006)	1997:01 – 2001:12	34.0				
South Africa	Creamer and Rankin (2008)	2001:12 – 2006:02	16.0				
Spain	Álvarez and Hemando (2006)	1993:01 – 2001:12	15.0				
United Kingdom	Bunn and Ellis (2009)	1996:01 – 2006:01	15 (19)				
United States	Bils and Klenow (2004)	1995:01 – 1997:12	26.1				
	Klenow and Kryvtsov (2008)	1988:02 – 2005:01	29.9 (36.2)				
	Nakamura and Steinsson (2008a)	1988:01 – 2005:12	21.1 (26.5)				

Nominal rigidities: Firms' price setting

Micro evidences on price settings: Klenow and Malin (2010)

Observation 1: Each firm has an **unequal frequency** of price change in a year

Observation 2: PPI seems to be less sticker than CPI

Observation 3: On average, firms keep their price fixed **for 3-4 quarters**.

Observation 4: The frequency of price changes varies across; **high inflation countries tend to have firms changed their price more often.**

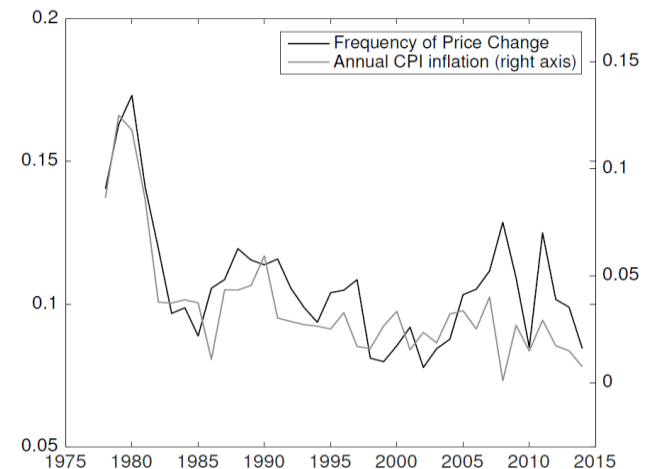
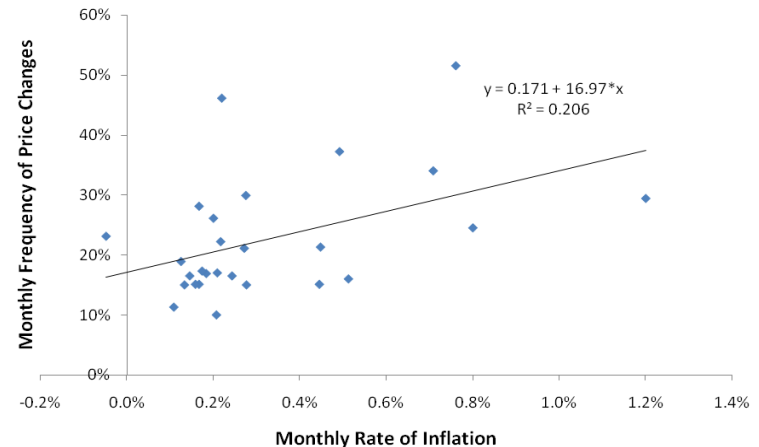


Figure 12: Frequency of Price Changes in U.S. Data

Source: Nakamura-Steinsson-Sun-Villar (2016)

Nominal rigidities: Firms' price setting

It is clear that the behavior of price setting varies across items of goods; the case for *heterogeneity* of price setting among firms, both within the same sector and across sector

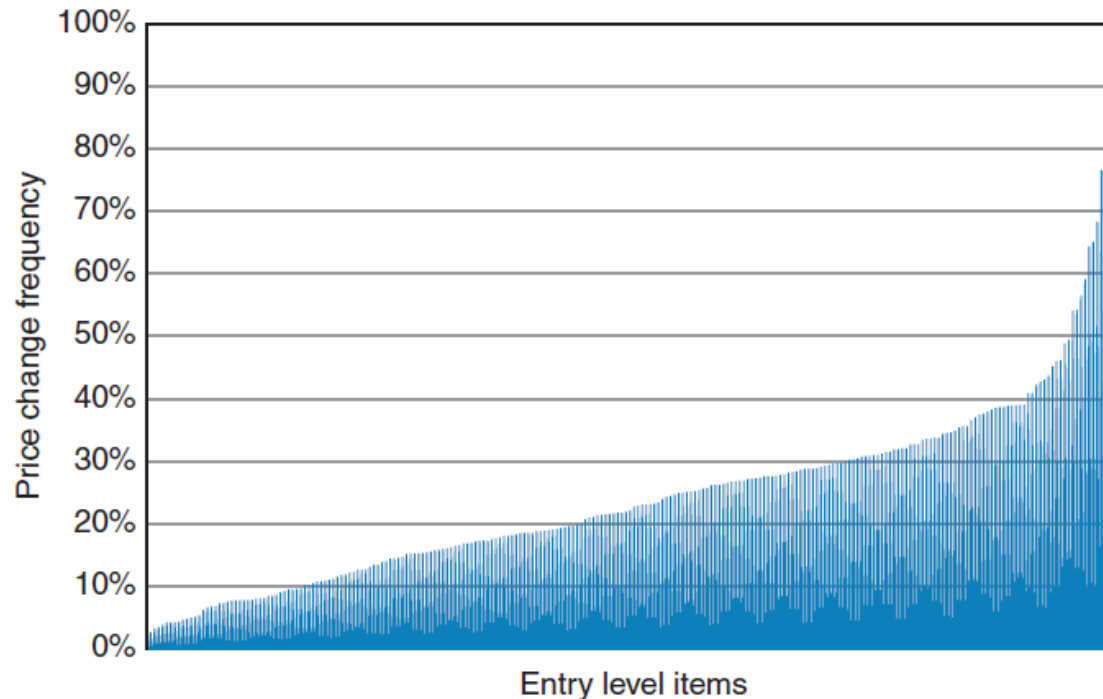


Figure 1 Price change frequency by product category. *Source:* CPI-RDB. Data are for the top three cities (New York, Los Angeles, and Chicago) January 1988 through October 2009. Each bar corresponds to an ELI product category (weighted by expenditure), and price change frequency is calculated as the weighted average across quotes within the ELI. Prices include sales and regular prices.

Nominal rigidities: Firms' price setting

Using the finer disaggregate data of prices, we find high degree of heterogeneity in sectoral price rigidities

Durations in Months	Posted		Regular		% of CPI
	Median	Mean	Median	Mean	
All items	3.4	6.2	6.9	8.0	100.0%
Durable Goods	1.8	3.0	1.8	5.0	21.7
Nondurable Goods	3.4	5.8	7.3	8.3	48.6
Services	7.6	9.4	7.6	9.6	29.7
Raw Goods	1.0	1.1	1.0	1.2	12.0
Processed Goods	4.4	6.9	7.7	8.9	88.0
Apparel	2.8	2.9	9.2	10.1	7.0
Education and Communication	5.4	6.2	6.7	6.3	7.3
Food	3.4	6.9	8.5	9.3	22.4
Home Furnishings	1.9	3.5	2.0	5.4	17.0
Medical Care	10.0	14.2	12.6	14.7	7.8
Recreation	6.3	7.5	9.4	9.8	8.5
Transportation	1.8	3.7	1.8	3.8	24.5
Other Goods and Services	8.6	14.7	12.1	16.7	5.5

Source: CPI-RDB. Data are for the top three cities (New York, Los Angeles, and Chicago) from February 1988 through October 2009. Durations are weighted medians or means of implied durations from weighted average frequencies within ELIs. Durables, Nondurables, and Services coincide with U.S. National Income and Product Account classifications. Raw goods include gasoline, motor oil and coolants, fuel oil and other fuels, electricity, natural gas, meats, fish, eggs, fresh fruits, fresh vegetables, and fresh milk and cream. Apparel, etc., are Major Groups in the CPI (1998-onward definition).



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Nominal rigidities: Firms' price setting

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Observation 5: Regular price remains in active for longer duration than posted price

Observation 6: Duration for which firms set price varies across sectors;

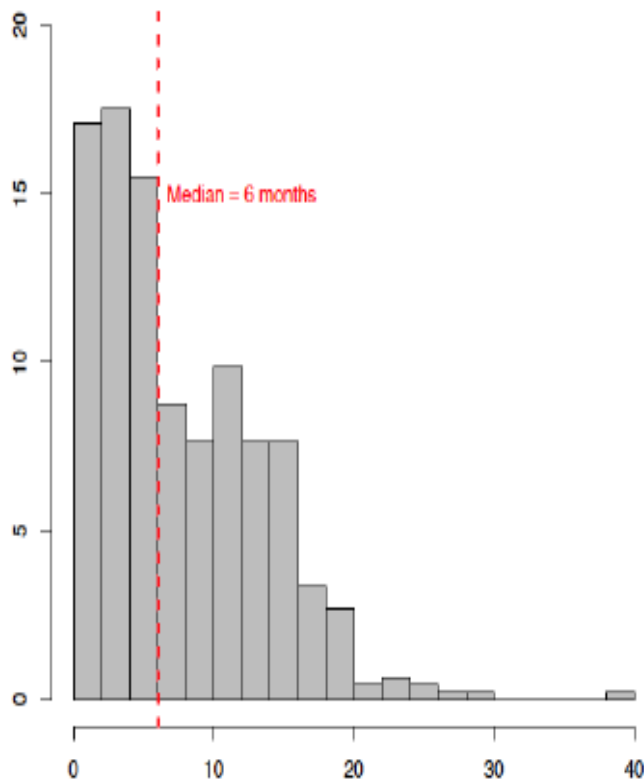
Service > Non-durable > Durable

Processed goods > Raw goods

Nominal rigidities: Firms' price setting

Micro evidences on price settings: Aphaithan and Pym (2018)

Distribution of the duration of price changes



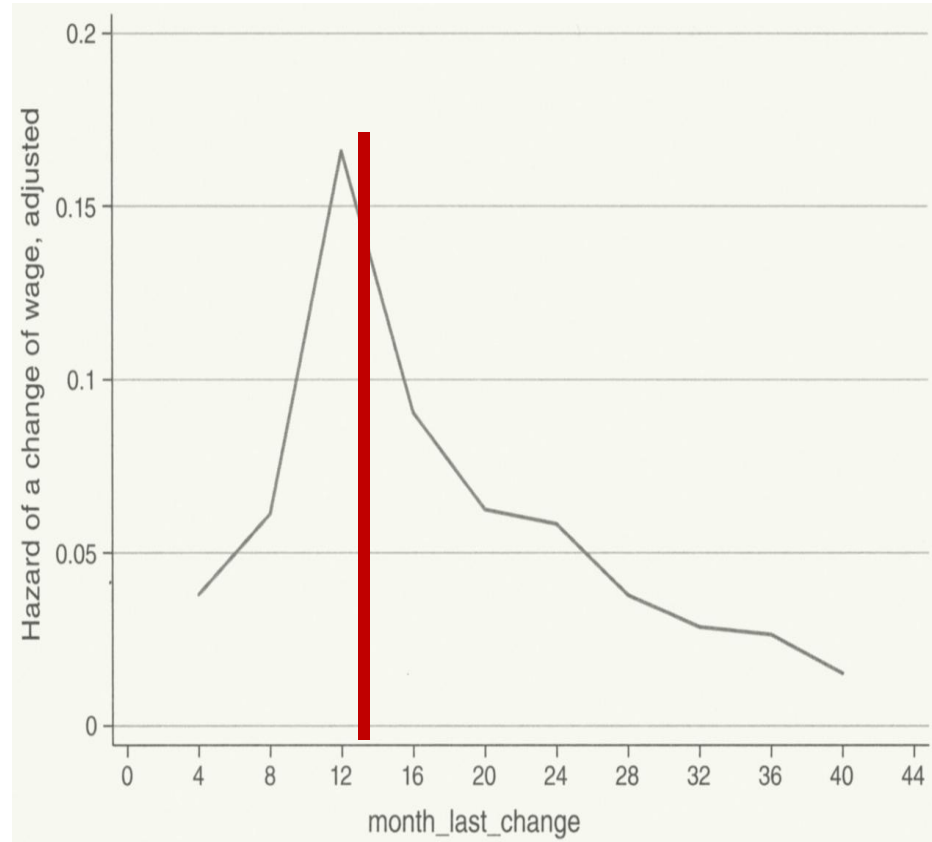
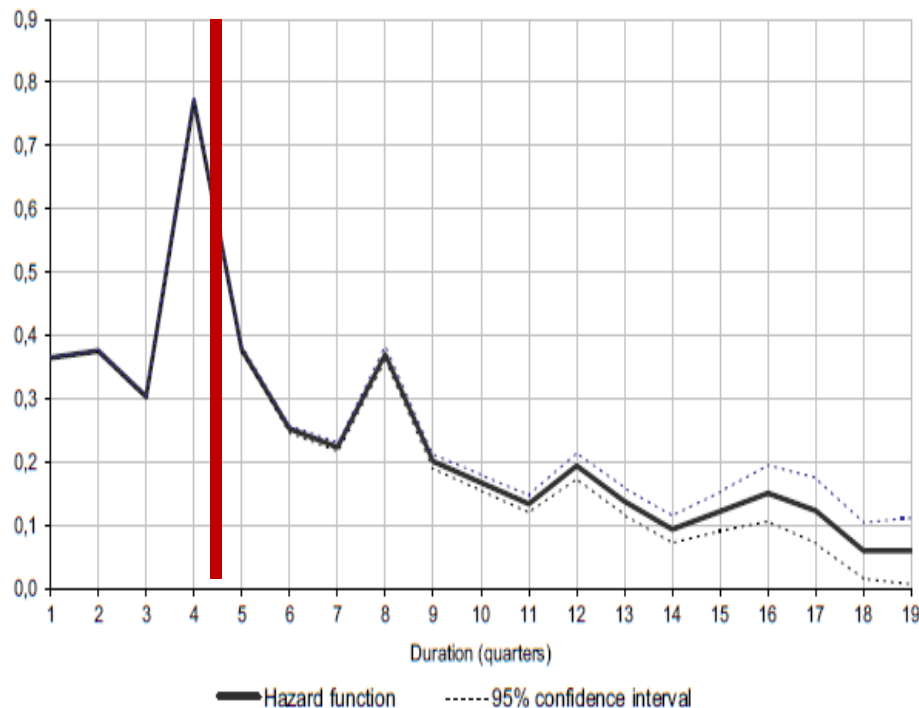
Category	Mean Frequency	Implied Mean Duration (months)	Mean Duration (months)
Food & Non-Alcoholic Beverages	0.23	3.91	5.47
Apparel & Footware	0.03	29.37	13.85
Housing & Furnishing	0.13	7.37	6.57
Medical & Personal Care	0.07	13.03	10.10
Transportation & Communication	0.29	2.86	7.25
Recreation & Education	0.04	22.88	8.79
Tobacco & Alcoholic Beverages	0.11	8.70	7.17
Total CPI	0.20	4.40	7.04

Sector	Mean Frequency	Implied Mean Duration (months)	Mean Duration (months)
Core	0.06	15.13	9.16
Non-core	0.50	1.44	2.50
Control	0.34	2.45	5.28
Non-Control	0.12	7.60	8.10
Service	0.06	16.88	9.72
Non-Service	0.26	3.38	6.07
Durables	0.07	14.38	8.43
Non-Durables	0.22	4.03	6.87
Total CPI	0.20	4.40	7.04

Nominal rigidities: Wage setting

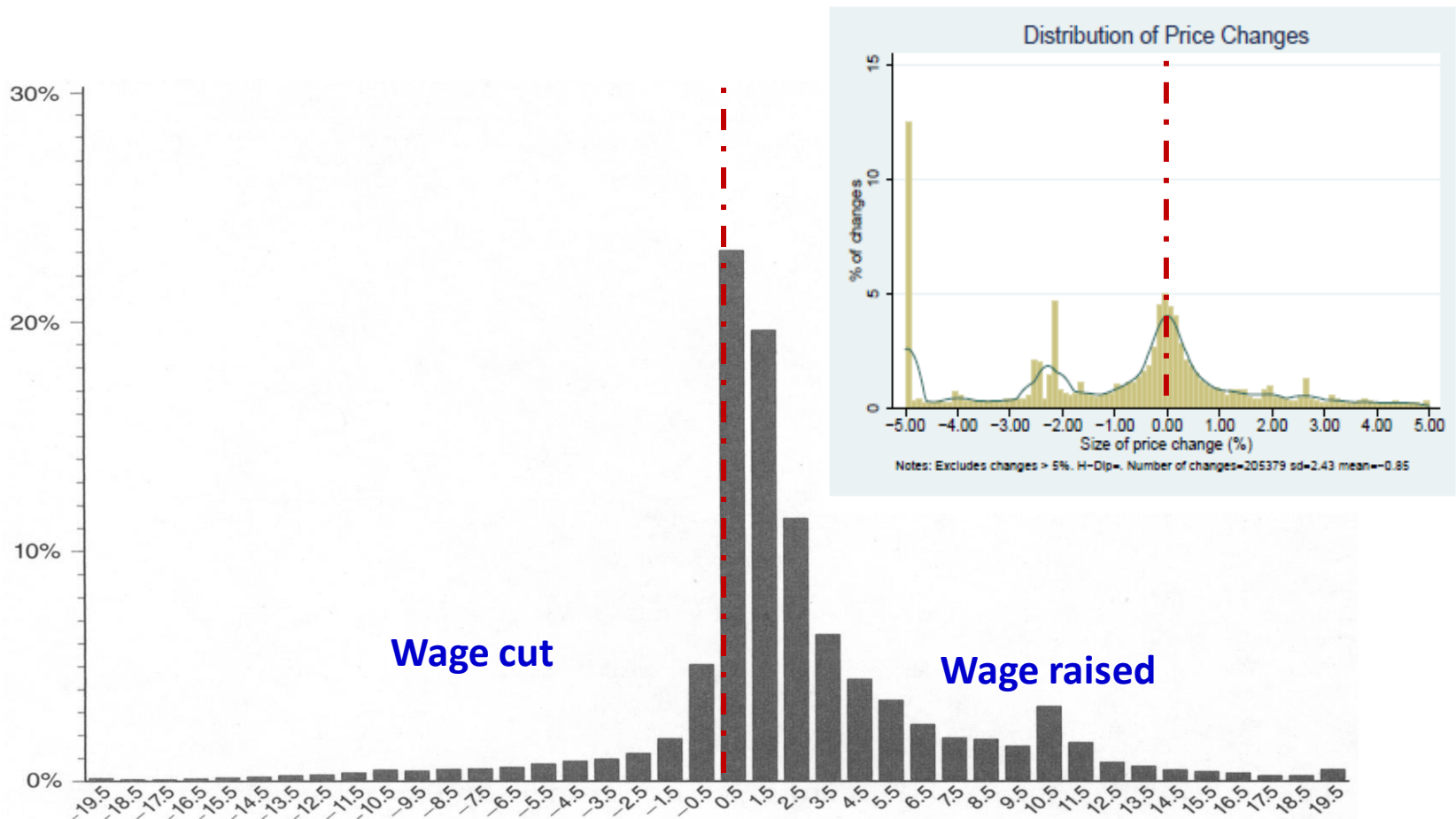
There appears to be many clear evidences that wage lasts longer than price; wage appears to be changed on the yearly basis

Figure 2 : Hazard function of wage changes



Nominal rigidities: Wage setting

While the distribution of price change is more evenly, there is a clear case for *downward wage rigidities*



Why do agents choose to stay *inactive* for a certain period of time?

➤ Costly price adjustment: Menu cost

- Managerial costs : Information / communication cost
- Loss of consumer goodwill: antagonize customer
- Trigger competitive rounds of price cuts: price war

➤ Information problem in labor market

- Efficiency-Wage contract

Nominal rigidities : wage and price rigidity

The nominal rigidities cause a pattern of staggered adjustment; one-time shock generates persistent effect on output and inflation

- In fact, it is the implication of *unsynchronized* adjustment of **prices/wages within and across sector**
- Effect of shocks gets passed on over time through the *staggering* adjustment.
 - Some firms can change their price right away; many keep their price fixed.
 - When firms can change their price, they will take into account what other firms did in the past.
 - The effect of what happens today get delivered into the future; *persistent over time*.
- Similar to the staggering effect generated via wage adjustments

Consider an illustrative example with 4 types of firms

- Consider 4 types of firms with different speed of price adjustment
 - Firms 1: gasoline station (fastest)
 - Firms 2: Logistic company
 - Firms 3: Electronic product
 - Firms 4: Service goods (hair cut / noodle restaurant) (Slowest)

- Suppose that worker for each type of firm can adjust wage at the same time as their firms adjust price.
 - Things would be even more profound if we assume the different degree!

Foundation of NKES AS curve

1. Upward sloping Aggregate **SUPPLY** in goods
 - Many individual firms might have flat supply curve at each point of time.
 - A fraction of firms can adjust the price; individual supply for price-adjusting firm will be upward sloping!.
 - By aggregation, output should increase with the general price level.
2. The similar intuition applies to upward sloping of Aggregate supply in labor.

Nominal rigidities : wage and price rigidity

Implications of nominal price / wage rigidity: intuitions for staggering adjustment (or inertia impacts)

