New Facts on Consumer Price Rigidity in the Euro Area

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The aggregate rate of inflation is the sum of heterogeneous individual price setting decisions. Firms, from largest to smallest, adjust the price or their goods and services when these are misaligned from their target value. Both individual price increases and decreases can be large, asymmetric, and may exhibit different degrees of time- or state-dependency (that is, they may occur in specific periods during the year, and/or as a result of specific macroeconomic conditions). Further, price changes are typically infrequent, and occur in response to either idiosyncratic shocks, impacting the firm itself or the sector to which it belongs, or to the overall macroeconomic conditions under which the firm operates. Infrequent price adjustment is critical for the design of monetary policy, as it affects the degree to and speed with which shocks impact inflation (so-called "monetary transmission"). But in addition to this nominal rigidity, the size by which the adjustment in individual prices takes place can also impact inflation dynamics, and a successful design of monetary policy requires understanding which prices adjust the most, and under which circumstances they do. Yet, understanding prices at such a level of disaggregation for the Euro area requires the use and analysis of extensive microdata, which is often scarce and typically only available for a few selected countries.

In this paper, we document new facts on consumer price rigidity for the euro area. To do so, we combine a unique and comprehensive micro pricing dataset including data for eleven euro area countries (Austria, Belgium, France, Germany, Greece, Italy, Latvia, Lithuania, Luxembourg, Slovakia and Spain), which we compile from data provided by each country's national statistical institute. The time periods covered by the national datasets differ somewhat

Table 1
FREQUENCY OF PRICE CHANGES (in %)

	Including sales		Excluding sales (NSI flag if available)		Excluding sales (sales filter)		% of sales	
	Frequency of price change	% price increase	Frequency of price change	% price increase	Frequency of price change	% price increase	NSI flag	*Sales filer*
EURO AREA	12.3	64.0	8.5	68.8	8.0	66.4	4.4	4.9
By Sector								
Unprocessed Food	31.4	54.5	24.0	57.6	20.6	58.3	7.4	10.1
Processed Food	15.4	57.0	10.4	61.8	9.2	62.0	4.3	5.7
Non-Energy Industrial Goods	12.9	48.2	6.4	59.8	6.8	54.8	8.6	7.5
Services	6.0	82.5	5.7	82.4	5.5	80.4	0.5	1.2
BY COUNTRY								
France	12.7	60.8	9.8	66.9	8.1	64.8	5.5	5.1
Germany	12.7	61.9	9.2	67.2	8.4	66.8	4.1	4.7
Italy	10.3	69.9	4.8	75.6	6.1	67.0	4.3	5.4
Spain	13.5	64.0	9.0	65.3	9.0	65.3	NA	5.1

NOTES: Statistics are based on the country-specific period and on products that are common to at least 3 of the 4 largest countries. Price changes due to replacement are excluded beforehand (except Greece and Slovakia). Seasonal sales are excluded in the Belgian dataset but temporary promotions are included. Results excluding sales are based on (1) NSI sales flag (if available, and sales filter otherwise) or (2) common sales filter for all countries.

Table 2
SIZE OF PRICE CHANGES (in %)

	Including sales		Excluding sales (NSI flag if available)		Excluding sales (sales filter)	
	Median increase	Median decrease	Median increase	Median decrease	Median increase	Median decrease
EURO AREA	9.6	13.0	8.7	7.2	8.0	66.4
By Sector						
Unprocessed Food	12.6	15.0	11.0	10.8	20.6	58.3
Processed Food	9.2	12.0	6.5	6.0	9.2	62.0
Non-Energy Industrial Goods	13.9	19.2	10.7	9.0	6.8	54.8
Services	5.6	8.2	7.9	5.7	5.5	80.4
BY COUNTRY						
France	7.8	11.9	7.3	5.6	8.1	64.8
Germany	11.6	16.1	11.0	9.0	8.4	66.8
Italy	9.1	11.4	5.5	5.4	6.1	67.0
Spain	8.9	11.1	10.4	8.1	9.0	65.3

NOTES: Statistics are based on the country specific period and on products that are common to at least 3 of the 4 largest countries. Price changes due to replacement are excluded to at least 3 of the 4 largest countries. Price changes due to replacement are exclude but temporary promotions are included. Results excluding sales are based on (1) NSI sales flag (if available, and sales filter otherwise) or (2) common sales filter for all countries.

from one country to another, but most of them cover the period 2010 to 2019. Overall, our dataset includes about 135 million monthly price observations, and is representative of most non-energy sectors of the economy. Although the analysis is conducted in a decentralized way at the country level, we follow a harmonized methodology and use a common sample of products, namely those available for at least three of the four largest euro area countries (Germany, France, Italy and Spain). Our final sample includes 166 products at the COICOP-5 level , covering 59% of the total euro area Harmonized Index of Consumer Prices (HICP) and 65% of the HICP excluding energy products. We then compute the same statistics across countries at the COICOP-5 level (such as average frequency of price changes and several moments of the size distribution) both cross-sectionally and over time, and provide euro area aggregate empirical measures of price rigidity using euro area product-level and country weights.

Our main findings are the following. First, we find that euro area prices are sticky: on average, only 12.3% of prices change in a given month (see Table 1). When we restrict ourselves to regular price changes (i.e. excluding those due to sales and promotions), the average monthly frequency of price changes drops to 8.5%, implying that the typical price quote does not change for about a year. Country differences in frequency numbers are relatively small, while heterogeneity across sectors is much more relevant. At the product level, there is a strong positive correlation across countries: products that change prices most frequently seem to do so across countries by similar amounts. Relative to earlier periods (comparing to a previous study by Dhyne et al. (2006)), the frequency of price changes has increased since the 1990s, but the extent of this increase has been heterogeneous across countries. Moreover, for comparable products, prices seem more rigid in the euro area than in the United States (comparing to previous data provided by Nakamura and Steinsson (2008)), though when we exclude sales the degree of price rigidity seems to be similar across both economic areas.

As for the size of price changes (see Table 2), we find the typical price change to be quite large: in absolute value terms, the median price increase (respectively, decrease) is 9.6% (respectively, 13%). Cross country heterogeneity is

more pronounced than in the case of frequency, though regional differences are small overall. Once again, differences are more noticeable across sectors, with service sectors exhibiting smaller median price changes than other sectors (namely, non-energy industrial products and both processed and unprocessed food products). When price changes due to sales are excluded, the size of price changes are lower for both price increases (7%) and decreases (9-11%, depending on the way that sales are defined). Compared to the United States, on average prices changes are somewhat smaller in the euro area.

Having explored the cross-sectional properties of the frequency and size of individual prices changes, we then proceed to study their time-series properties. Both frequency and size of price changes show large seasonal movements, mostly explained by seasonal sales (especially around January and July), but otherwise neither time series exhibits a significant upward or downward time trend over the time period 2005-2019. This would suggest that the frequency of price changes has not contributed to steepening or flattening the Philips curve over that period.

Taking these dynamics into consideration, we then study how patterns of price adjustment have contributed to overall inflation dynamics in the euro area. In a given month, inflation can go up because more outlets increase their prices, because for the same number of price changes the size of those changes increases, or a combination of both. Our main finding here is that the major contributor to inflation dynamics is the size of price changes, while the frequency of price changes contributed to a much lower degree: most of the short-term variation in inflation is due to variation in the overall size of price changes and not due to variation in the overall frequency. More specifically, inflation is mainly driven by movements in the proportion of price increases and decreases (translating to a change in overall size) and less by changes in the overall frequency or in the average size of price changes. These results are roughly consistent with the predictions of a Calvo (1983) model (in which the sole decision of firms is by how much to adjust prices, not how often), or with a menu cost model in a low-inflation environment (as in Alvarez et at, 2019, or Nakamura and Steinsson, 2018), in which aggregate shocks are relatively small compared to firm-specific shocks and are less of a motive for firms to change their prices.

Finally, we look at the response of micro pricing decisions to various aggregate supply and demand shocks (such as oil shocks, VAT shocks, and monetary policy shocks). We find that firms respond to shocks (regardless of their type) by adjusting the overall size rather than the overall frequency. More specifically, aggregate shocks are transmitted via slow movements in the relative share of price decreases and increases. This would suggest that, in our data, idiosyncratic shocks are a more important driver of micro-pricing decisions than aggregate shocks.

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