



Economic Commentary

Price dynamics in Sweden: Insights from a new dataset

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Summary

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The nature of price setting has important implications for the conduct of monetary policy. In this Commentary, we use detailed micro price data for the Swedish economy for the period from 2010 to 2018 to better understand the drivers of aggregate inflation. We find that the average size of price changes has been quite stable whereas the price changing frequency has been monotonically increasing over the sample period.

Moreover, the results indicate a strong correlation between aggregate inflation and the relative frequency of price increases versus decrease. We also detect significant heterogeneity in price adjustments within and across different groups of products.

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1 How price changes affect inflation

Price changes are an important subject in macroeconomics. First, inflation-targeting central banks, like Sveriges Riksbank, aim to stabilize aggregate price changes, i.e. inflation. Secondly, the nature of price setting influences the behavior of relative prices, like the real exchange rate, the terms of trade or the real wage that are of great interest for an open economy like Sweden.

In this Commentary, we present novel insights from a detailed dataset that covers micro price developments in Sweden. More precisely, we analyse price dynamics underlying the aggregate consumer price index, which measure the price development for the whole private consumption in Sweden. The dataset includes information about price changes for different products and across several groups on a monthly basis ranging between 2010 and 2018. Overall, the dataset covers more than 5 million price observations. We use these micro price data to calculate descriptive statistics like the frequency and the average size of price changes.

Our main findings can be summarized as follows: We find that when firms adjust their price, the average absolute size of price changes is 12 per cent, and this has been relatively stable over the sample period. Moreover, on average, firms are changing their price more often later in the sample: the frequency of price changes has increased from around 20 per cent to 30 per cent per month. That is, in 2010 around one fifth of prices were adjusted in a given month, but in 2018 close to one third of prices were adjusted in a month. In addition, we show that the correlation between the aggregate inflation rate and the relative size of price increases versus decreases is low, whereas the correlation between the aggregate inflation rate and the relative frequency of price increases versus decreases is significant and strong. This finding is consistent with the US evidence provided by Nakamura et al. (2018) that the price changing frequency is the most important driver for changes in inflation over time. Finally, we detect significant heterogeneity in price adjustments within and across groups. For example, for food there are many product groups with relatively small and infrequent price changes, while most energy product groups show a low size of price changes but high frequency.

The rest of the Commentary is organized as follows. Section 2 presents our main findings. Finally, Section 3 concludes

2 Results

2.1 The micro price data

In the following, we will use detailed micro data on consumer prices to document several facts underlying price dynamics in the Swedish economy. The data cover individual price notations on the product level from the Swedish consumer price index (CPI) surveys for the period from 2010 to 2018. With these data we are able to track individual products over time and hence to document when prices are changed and by how much. In addition, the data allow us to look at different product groups on a monthly frequency, which enables us to detect seasonal patterns and investigate price dynamics within and across different groups. The dataset covers more than 5 million price observations in total. Each individual product has its own associated CPI basket weight and can be weighted and summed per product group. The product groups can then again be weighted to create an aggregate measure handling diverse sample sizes. In the data, there exist around 330 product groups per year, which can be further aggregated into groups, where each has a different number of product groups and individual products under them. The groups are food, goods, services and energy. For example food have approximately 100 product groups and 30 000 individual products per year for the years 2013 and after, while services have nearly 70 product groups and 3 600 individual products.

Our dataset on consumer prices covers only nine full years from 2010-2018. Hence a deep analysis about what drives inflation is hard to do. Instead we will focus on descriptive statistics to give an overview about how prices underlying the CPI changed. In particular, we will take a closer look at the behaviour of price changing frequencies and the average sizes of price changes over time.

Figure 1. CPIF inflation rate in Sweden

Annual percentage change



Source: Statistics Sweden

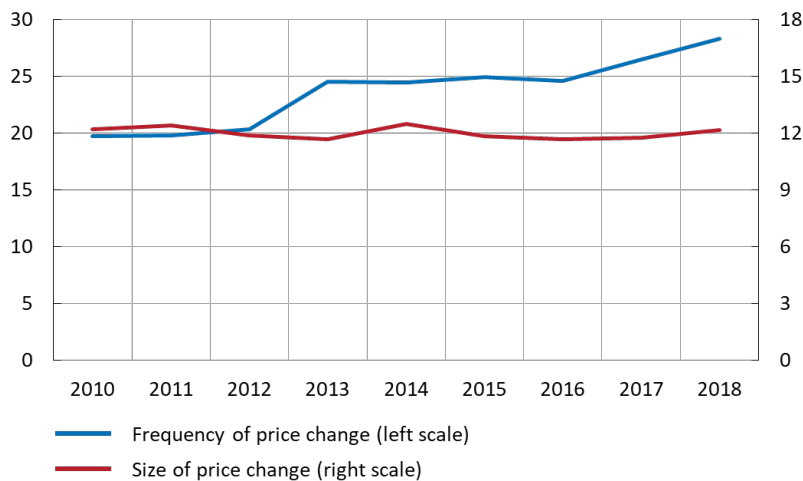
Before we move to the analysis of the micro price data, we take a look at the aggregate inflation development in Sweden. Figure 1 shows the monthly CPIF inflation rate from 2000 to 2021. The CPIF refers to the common consumer price index but assigning a fixed interest for housing expenditures.² The shaded area indicates the sub-period our micro dataset covers. Between 2010 and 2018, Swedish inflation showed mild fluctuations with the highest value around 2.5 percent at the beginning and end of the sample period and the lowest value of around 0 percent in 2014.

2.2 Large increase in price changing frequency over time with a pronounced seasonal pattern

Next, we use our micro price data and first take a look at the data on an aggregated level. Here the different product groups are weighted together using their weights in the CPI basket to get an aggregated measure which is not sensitive to different sample sizes in the survey for different products. Meaning that if we for example have 200 different bread prices and only two petrol prices, these will be weighted and summed to an aggregate measure where the price of bread not necessarily is 100 times more important than the price of petrol. In Figure 2 we show both how the price changing frequency (left scale) and average absolute size of price change (right scale) have evolved between 2010 and 2018. Both measures, the price changing frequency and the average size of price changes, provide summary statistics for all price changes. Because they include price increases and price decreases at the same time, they do not directly provide a direct indicator for the aggregate inflation rate.

Figure 2. Annual frequency and absolute size of price changes

Per cent



Source: Statistics Sweden and the Riksbank

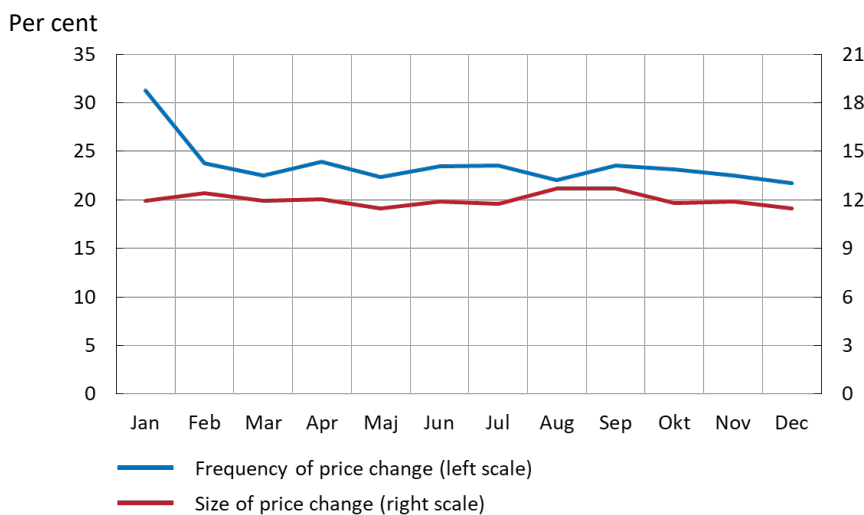
The average absolute price change has been remarkably stable at around 12 per cent that is when firms change prices the average increase or decrease is about 12 per cent. This number is comparable to the US evidence by Nakamura et al. (2018) who

² Since 2017, the Riksbank expresses its inflation target in terms of the CPIF inflation rate.

report an average absolute size of price change of around 10 per cent. The price changing frequency, that is the average share of products that get a new price in a given month, however, seems to have been increasing over time from around 20 per cent to almost 30 per cent. However, one should be careful about making any economic interpretations about this as some survey methods have changed during this time period. For example, in 2013, scanner data was widely introduced for groceries and as a result the measured price changing frequency increased significantly.

In Figure 2 we look at the average size and frequency as an average over a year, thus filtering out strong movements on a monthly frequency. To detect signs of seasonal patterns we can instead study the same data but looking at the average for each month over the time period as shown in Figure 3. Again, the size of the price change is quite stable over time at around 12 per cent. The share of investigated products that get a new price every month is higher in the beginning of the year and the price changing frequency gradually decreases thereafter for the rest of the year. Thus, while the average size of price changes does not show any sign of seasonality, the price changing frequency is characterised by a more pronounced seasonal pattern.

Figure 3. Seasonal pattern of frequency and absolute size of price changes



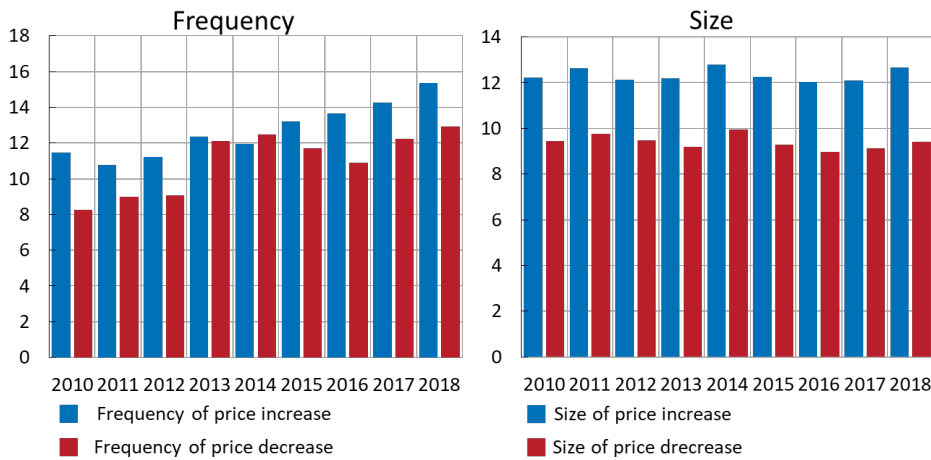
Source: Statistics Sweden and the Riksbank

2.3 Price increases and decreases and their correlation with aggregate inflation

While Figures 2 and 3 do not control for the specific sign of the price change, it is also interesting to separate between price increases and price decreases. Figure 4 shows the frequencies and the average size of price increases and decreases. While there seem to be some fluctuations over time when it comes to the frequencies of increases and decreases, the size of those again seems to be quite stable.

Figure 4. Annual frequency and size of price increases and decreases

Per cent



Source: Statistics Sweden and the Riksbank

As a next step, we can try to see if the relative difference of price changing frequencies and sizes are related to the overall inflation dynamics between 2010 and 2018. While the correlation between CPIF inflation and the relative size of price increases versus decreases is low, the correlation between CPIF inflation and the relative frequency of price increases versus decreases, seen in Figure 5, is quite high and significant, around 0.8. This is consistent with the US finding by Nakamura et al. (2018) that the price changing frequency is the most important driver for changes in inflation over time. However, one has to keep in mind that our dataset covers only a relatively short time period with modest price changes, whereas Nakamura et al. (2018) use the large changes in US inflation during the 70s and 80s for their study. Therefore, our preliminary conclusion for the Swedish economy should be interpreted with some caution.

Figure 5. Annual difference between frequency of price increase and decreases and CPIF inflation rate

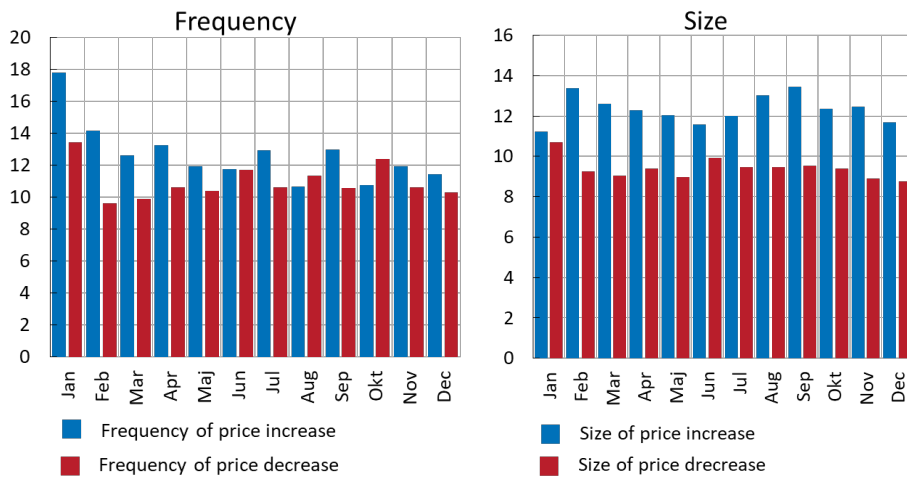
Percentage points (red) and annual percentage change (blue)



Source: Statistics Sweden and the Riksbank

In Figure 6, we do the same exercise as before but now take an average over months to detect any seasonal variation in price changes. As before, we find a strong seasonal pattern for the price changing frequency, where both the frequency of price increases and decreases is largest in the first month of the year. Also for the size of price increases and decreases there seems to be some seasonal dynamics. For example, the relative size of price decreases to the size of increases is high in months where sales are common, like in January and June.

Figure 6. Seasonal pattern of frequency and size of price increases and decreases
Per cent

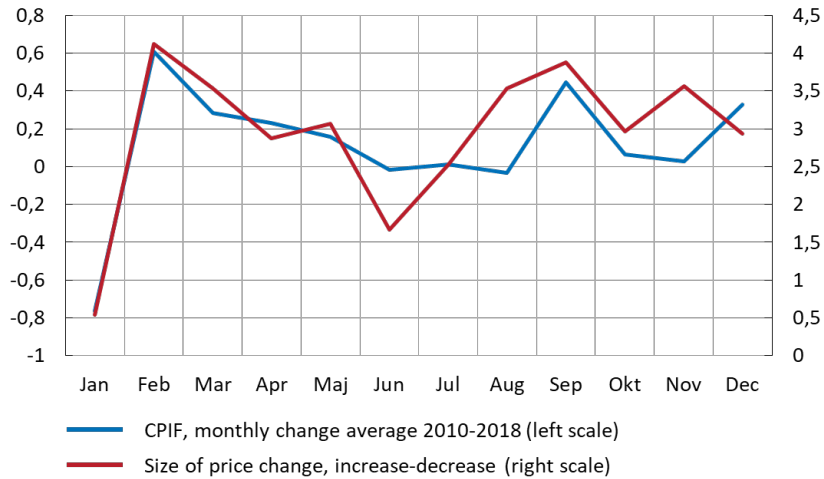


Source: Statistics Sweden and the Riksbank

If we again try to relate the relative difference of price increases and decreases frequency and size to the CPI inflation rate we now obtain a slightly different picture. The correlation between the relative frequency of price increases versus decreases and the average monthly inflation rate for the different months during 2010-2018 is quite low. Instead, the correlation between monthly inflation and the relative size of price increases versus decreases is now relatively high and significant, around 0.85. Taken together this might suggest that medium to long-run changes in inflation are mainly due to the price changing frequency (see Figure 5), whereas adjustments at a higher frequency like seasonal patterns are driven by the relative size of price changes.

Figure 7. Monthly difference between size of price increase and decreases and CPIF inflation rate

Per cent (left scale) and percentage points (right scale)



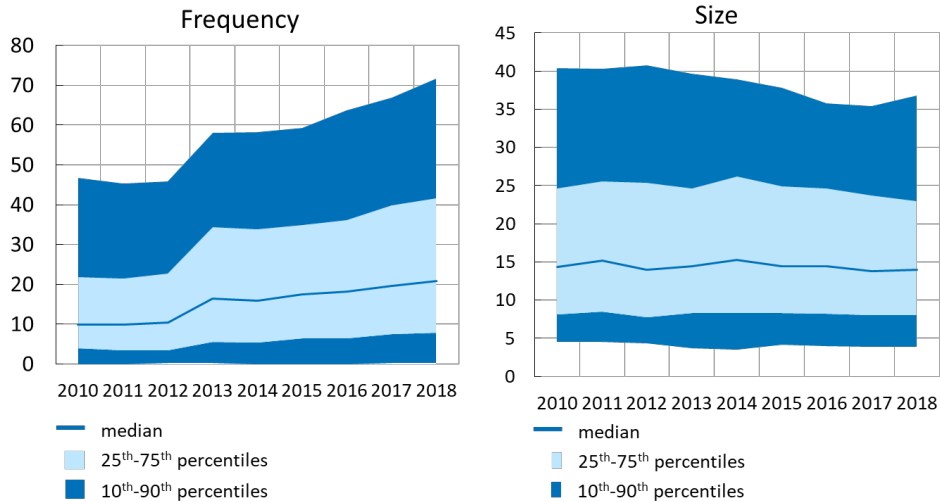
Source: Statistics Sweden and the Riksbank

2.4 Large variations in price adjustments within and between groups

So far, the analysis focused on the aggregated dynamics, thus filtering out heterogeneous price adjustments across product groups. Now, we instead turn to the cross sectional dimension of our data. The data allow us to look separately at different product groups in the CPI basket. In total, we have data from around 350 different product groups. In Figure 8, we look at the distribution of the frequency and size of price changes among different product groups. The figure shows that there is a quite a lot of heterogeneity for both price changing frequencies and sizes. For example in 2018 the price changing frequency is 40 per cent or higher among the quarter of product groups that observe most price changes while the quarter of product groups that experience the fewest price changes had a frequency of less than 10 per cent. Similarly in 2010 the size of a price change is 25 per cent or larger for the quarter of product groups with the largest price changes.

Figure 8. Distribution of frequency and absolute size of price changes across product groups.

Per cent



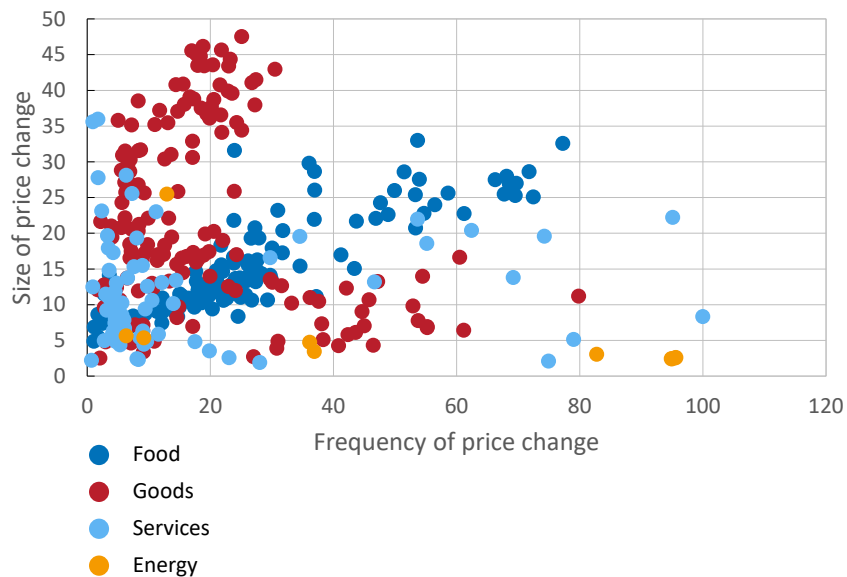
Source: Statistics Sweden and the Riksbank

Finally, in Figure 9 we plot the average monthly price changing frequencies against the monthly average absolute price changing sizes for all product groups. The colours of the dots indicate group, i.e. whether it is a food, good, service or energy related product.

Some clear patterns emerge. On average, goods seem to display a relatively low price changing frequency while for many goods the average size of price changes is quite high. For foods, there is a collection of products groups with relatively small and infrequent price changes while there is another set of product groups, mostly fruits and vegetables, with more frequent and larger changes. For services, there are several product groups with low frequency and small size of price changes, while other service product groups are characterized by either a high frequency and small size of price changes or large size and low frequency. Most product groups in energy show a low size of price changes but high frequency. The observation that, on average, foods and goods change prices more often than services is well in line with earlier studies on other countries (Klenow and Malin 2010). In sum, Figure 9 indicates that there is substantial heterogeneity in price adjustments within and across groups.

Figure 9. Frequency and absolute size of price changes for various product groups

Per cent



Source: Statistics Sweden and the Riksbank

3 Further studies can provide important insights

In this Commentary, we have provided new insights regarding price dynamics in the Swedish economy. In doing so, we have used detailed micro price data underlying the aggregate consumer price index for the period from 2010 to 2018. Our results show only small variations in the aggregate average size of price changes, whereas the frequency of price changes monotonically increased over time. Our main finding suggest that the price changing frequency is the most important driver for changes in inflation over time, through the high and significant correlation between CPIF inflation and the relative difference in price changing frequency. However, one has to keep in mind that our dataset on the Swedish economy covers only a relatively short time period with modest price changes, such that our preliminary conclusion should be interpreted with some caution. Moreover, we detect significant heterogeneity in price adjustments within and across groups.

In future work, we plan to make use of advanced econometric methods to investigate in more detail the underlying drivers of aggregate inflation dynamics. In particular, we intend to estimate panel regressions at the product group level to learn about the relationship between inflation dynamics, average price changes and the frequency of price changes. Furthermore, such an analysis would allow a thorough investigation of heterogeneous price dynamics across product groups and groups. In addition, using our micro price data to study the effect of monetary policy interventions on price changes might offer important insights into the nature of price-setting in Sweden.

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