Persistens för tjänstepriser i KPI

För information

Bifogad artikel handlar om fenomenet oförändrade priser, s.k. prispersistens. Artikeln skrevs tillsammans med Riksbanken till en FN-konferens (UNECE) inom prisstatistik i Genève, 7-9 maj 2018. Avsikten är att resultaten ska kunna användas som stöd när Riksbanken undersöker hur transmissionsmekanismen fungerar. Det vill säga, om penningpolitiken ändras, hur snabbt slår detta igenom i verkligheten.
I artikeln fokuseras främst på tjänstepriser.

Varaktigheten på oförändrade priser benämns ofta som duration, dvs hur lång tid ett pris varit oförändrat. Duration mäts på både ett direkt sätt och ett indirekt sätt.
På det direkta sättet görs analysen genom att räkna antal månader som priset är oförändrat i datamaterialet. Det finns dock ett problem med denna ansats: vi ser inte hela prisets livslängd i KPI-data eftersom observationsfönstret är begränsat, bland annat p.g.a. årlig urvalsrotation. För att komma förbi detta problem räknas även duration på ett indirekt sätt, dvs genom andelen oförändrade priser och därefter invertering av andelen. Om exempelvis 1/3 av priserna ändrats en månad blir durationen 3 månader enligt den indirekta metoden.

Kort sammanfattning av artikelns resultat:

- Varor har kortare duration än tjänster i Sverige, vilket är i linje med i stort sett alla tidigare studier på andra länder.

- Durationen för tjänster är i linje med resultaten från Storbritannien och USA, även om det finns jämförelseproblem gentemot resultaten från andra studier, exempelvis på grund av metodval.

- Vår studie indikerar kortare durationer i mer konkurrensutsatta sektorer.

Frågor till nämnden

- Utifrån studiens resultat, ser nämnden något särskilt vi borde fortsätta kolla närmare på ur datavalideringsperspektiv?

- Har nämnden andra synpunkter relaterat till frågan, t.ex. angående varukorgen?

Price Persistence of Services in the Swedish CPI

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Abstract

An analytical issue in CPI is the presence of price persistence, i.e. prices that change rarely over time. This is a phenomenon of specific interest for monetary policy, where the degree of persistence in changes in inflation is important when analysing how monetary policy affects inflation (the transmission mechanism). Persistence is likely to depend on the nature of basket items. By expectation, items based on world market spot prices such as perishable food, should show lower persistence than should for instance administrative services provided by e.g. the government.

In this study, the feature of price persistence is analysed in terms of price duration. Several aspects are illuminated. The first natural break-down of the problem is the division into goods and services. Valid price comparisons over time are typically ensured both through annual resampling of the basket and quality adjustments of item changes in the basket. A hypothesis is that several service items in the basket are unchanged for a longer period compared to the basket of goods where more item changes occur. Microdata from CPI/HICP will be used to describe different services and goods in the basket regarding persistence, with the aim of contributing to an improved macroeconomic analysis.

Keywords: CPI, HICP, CPIF, Persistence, Duration, Price Spells

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Introduction

Statistics Sweden collects and compiles price data continuously in order to disseminate a monthly CPI (Consumer Price Index) and related measures, such as the HICP (Harmonised Index of Consumer Prices) and CPIF (Consumer Price Index with a fixed interest rate). These price indices has multi-purpose use in Sweden, mainly in three areas; compensating for price changes, deflating National Accounts and as a target variable for monetary policy. As a primary user of inflation data Sweden's central bank, The Riksbank, devotes a lot of time analysing inflation in different ways. A current analytical issue is the presence of price persistence i.e. prices that change rarely over time. This is a phenomenon is of specific interest for monetary policy as it tells something about the transmission mechanism, i.e. by how much and how fast monetary policy affects inflation.

This paper is a joint work by Statistics Sweden and the Riksbank to put forward an introductory analysis on price persistence using micro data in the Swedish CPI. The ambition for the paper has been to make a primary assessment of the topic as it to our knowledge is unaddressed for the Swedish case. The assessment is based on methodology established in other preceding international studies of the topic.

The paper is organized as follows. To start with, the last decade of inflation development and inflation analysis in Sweden is briefly addressed. After the economic introduction, some terminology is established concerning the analysis of price persistence in the methodology section and followed by an empirical analysis, broken down on different services and goods. The results are then interpreted and the study is concluded.

Inflation developments in Sweden since the financial crisis

The objective for monetary policy is to maintain price stability. The Riksbank has defined this as a 2 per cent annual increase in the CPIF. The last 10 years have been dramatic in many ways. As the effects of the financial crisis spread to Sweden in 2008, the momentum of the Swedish economy changed drastically and CPIF-inflation slowed. However, the drop was not drastic and towards the end of 2009 CPIF inflation was back to around 2 per cent. Inflation remained at that level until the beginning of 2011, when it started to decline further and stabilised at a level of around 1 per cent from 2012. After that CPIF-inflation fell even further and reached record low levels in the spring of 2014. However, since then the trend have been broken and inflation has risen from very low levels. In recent years, the Swedish economy has been characterised by relatively high growth, rising employment and falling unemployment. At the same time, inflation has continued to rise. CPIF-inflation was 2 per cent on average during 2017, i.e. completely in line with the inflation target. This can be seen in Figure 1 in which CPIF is displayed for the period between January 2006 and January 2018.

Figure 1. CPIF-inflation in years January 2006- January 2018

Annual percentage change
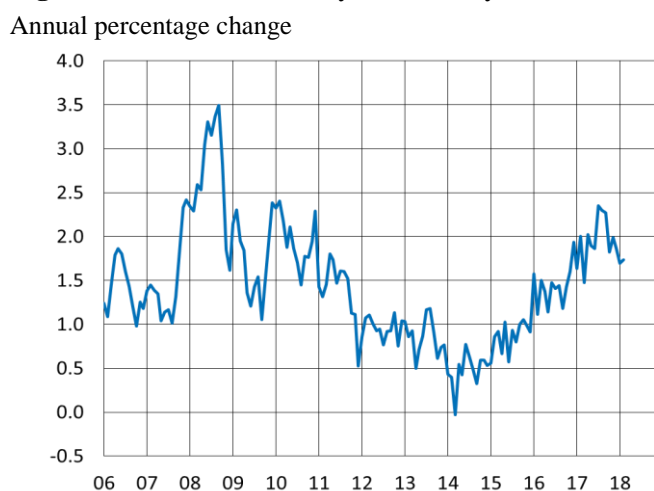
Source: Statistics Sweden

Inflation analysis during recent years

The Riksbank devoted a lot of time to analysing the causes of the low inflation between 2011 and 2014. The results were relatively concordant: weak international economic developments and low commodity prices – especially for energy – held back cost increases. Swedish demand was also affected by international developments, which contributed to low domestic price increases in general. In addition, supply factors may also have played a role: companies' margins appear to have developed more weakly than normal. Stiff competition and rapid structural change, for instance due to increased sales through e-commerce, appear to have held back prices. The fact that CPIF inflation since then has risen to a level close to target is partly due to the faster rate of increase in energy prices. But most of the inflation upturn can be explained by the fact that prices for services have increased more quickly than before. An important explanation for this is the strong economic activity in Sweden as service prices are, to a large extent, influenced by domestic demand. Capacity utilisation in the manufacturing sector 2017 was close to the level that prevailed prior to the financial crisis. The Riksbank's resource utilisation indicator, which is an aggregate measure of the amount of spare capacity in the economy, also attained historically high levels in 2017.

When analysing recent inflation developments in Sweden and elsewhere, it is customary to divide consumer prices into different sub-indices.[3] Consumer prices for energy and food are often affected by the development of commodity prices on the world market. Prices in the service sector are probably less affected by volatility in the exchange rate and imported input goods and to a larger extent influenced by domestic wage costs and demand.[4] This justifies why one sometimes want to study goods and services prices separately.

Properties of different sub-indices in CPI and CPIF

Table 1 below displays annual inflation rates for CPI/CPIF sub-indices. It can be seen that the average rate of increase in food and energy prices have been the same (although differing in variation) and clearly above the rates for other goods prices and service prices since 2006. The standard deviations are also higher for those sub-indices than for other goods and service price indices. This means that such prices have been more volatile during this period.

The average rate of increase in service prices has been above the rates for goods (excluding food, alcohol, tobacco and energy) since 2006. The measure of costs that is most often used to explain the companies' pricing over time is the unit labour costs.[5] These are determined by the development of wages and productivity. Unit labour costs normally increase more rapidly in service sectors than in goods sectors as productivity increases more slowly in the service sector while wage increases are roughly the same in the different sectors. This is the main explanation why service prices in CPI and CPIF tend to increase faster than goods prices. Service prices are also the least volatile in this period.

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[3] A well-defined and widespread division of the products in household consumption is the one used by Eurostat for the EU harmonised index of consumer prices (HICP). This index is currently published with a breakdown into 5 main components (non-energy industrial goods, services, unprocessed food, processed food and energy). As the Riksbank's objective is formulated in terms of the CPIF, a breakdown along the lines for HICP has been produced also for this measure. This division is also used when generating forecasts at the Riksbank, especially inflation forecasts in the shorter run, i.e. one to three months ahead.

[4] Although service prices also have significant import content the proportion of imports is higher in goods than in services.

[5] Unit labour cost is defined as the average cost of labour per unit of output produced. It can be expressed as the ratio of total labour compensation per hour worked to output per hour worked (labour productivity).

Table 1. CPI/ CPIF main components

Weights (2017), average annual change and standard deviation (2006-2017)

Category	Weight in basket	Avg. annual percentage change.	Std. dev.
Food, alcohol and tobacco	18.0	2.3	1.8
Energy	7.0	2.3	5.4
Goods excl. food, alcohol, tobacco and energy	26.9	−0.5	0.9
Services	44.5	1.7	0.5
CPIF		1.4	0.7

Sources: Statistics Sweden and the Riksbank

Developments of different sub-index in service prices

The fact that CPIF inflation has risen to a level close to target is mainly due to the faster rate of increase in service prices. An important explanation for this is the strong economic activity in Sweden, as service prices are, to a large extent, influenced by domestic demand. A more detailed breakdown of them is given in Table 2 below. The table shows the average rate of price increase 2017 for various sub-indices in relation to the years between 2006 and 2016, inclusively. Rents, which comprise just over 20 per cent of the service aggregate in Sweden, increased much more slowly than their average and the contribution to CPIF inflation was low in 2017. The sub-index "Other Services", which accounts for more than 70 percent of all service prices, is particularly interesting. Notable products in this category are health care as well as restaurants and hotels. These prices are considered to be influenced by economic conditions to a greater extent than other service prices. It is therefore important to get a more in-depth knowledge of these prices.

Table 2. Sub-indices within services

Weights (2017), average annual change (2006-2016 and 2017)

Sub-index	Weight in CPI/CPIF	2006-2016	2017
Services	44.5	1.6	2.4
Rent	9.8	1.9	0.8
Property tax	0.7	−0.7	2.4
Foreign Travel	2.1	1.1	3.0
Other Services	31.9	1.6	2.7

Sources: Statistics Sweden and the Riksbank

The experience from the past ten years has made it clear that it is important to learn more about how inflation is measured and how the different building blocks have developed. Analysing different sub-indices at the micro level can provide new knowledge about the aggregate price trend.

Previous international studies using micro data

To this day, numerous studies have examined price persistence, see for example the literature overview by Nakamura and Steinsson (2013). In Europe, studies from the European central bank utilise CPI micro data to examine price rigidity for Eurozone countries, e.g. Álvarez *et al*. (2005) and Baumgartner and Glatzer (2005). Later noteworthy studies on other European countries include the UK (Bunn and Ellis, 2012), Norway (Wulfsberg, 2016) and Switzerland (Schnell *et al*., 2015). Moreover, several studies have examined other aspects of price changes and the price-setting behaviour of firms. A good summary of such findings up to 2009 is provided by Klenow and Malin (2010).

Methodology

Various measures are typically used in order to describe the nature of price changes, as can be found in the related literature. The topic in question, price persistence, can be described at least through two approaches; directly through exact duration computations or indirectly through implied duration. In order to distinguish between the two approaches, duration itself must be clarified. In the context of price changes, duration is defined as the time the same price is observed consecutively in price collection for a product offer.[6]

Price censoring and spot prices

The price lifespan can be denoted as the price trajectory (Baumgartner and Glatzer, 2005). This trajectory is subject to a measurement problem: prices may, and most often do, exist both before and after the observation period in the CPI, as illustrated in Table 3. Analysing CPI data unconditionally renders censored prices. In our data, annual resampling practices is the important cause of censoring as there is a rotation principle applied to the sample of outlets, generally with a rotation after five years for exchangeable stores/outlets. However this principle does not apply to certain goods or services, especially not those provided by government/administrations.

Product offers entering the data collection can be referred to as left censored regarding their price as it is unknown when the price was set prior to the observation period. The opposite case can be referred to as right censored: it is not known if prices remain identical after product offers are excluded from data collection.

In addition to the censoring, it should be noted that the observed prices are restricted to the observation moment: traditional price collection renders discrete observations, i.e. spot prices. If price collection shows systematic patterns, as is the case with measuring mid-month working-day prices, there is a risk of capturing systematic price patterns that do not reflect temporarily adjusted prices related to actual shopping patterns (week-end, evening) with respect to campaigns and special offers, either physically or online, as pointed out by Boskin *et al.* (1997).

Treatment of temporary discounts

The treatment of temporary discounts, i.e. discounts that within a short period goes back to the regular price, are treated differently in different studies. Some treat this just as any price change, i.e. the counting of duration time starts over. Other studies filter out such changes and do not allow it to break the duration time, arguing that only more long-lasting price changes are relevant for macro-economic analysis. In our study we do not filter out temporary discounts.

Directly computed duration

When computed directly, duration is defined as the length of the time interval in which prices are non-changed as observed in price collection. The pitfall of the directly computed approach is the censoring: in order to mitigate censoring, a data reduction must often take place to isolate those prices that show a change within the observation period. This renders a bias towards shorter durations since those lasting from outside the observation period, in both sides (beginning/end) are excluded from the analysis.

Table 3. Example of the price lifespan/ price trajectory

		Left censored prices							Observation period in CPI												
Month	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Price	10	10	10	10	10	10	12	12	12	12	12	12	15	15	15	15	15	15	18	18	18
Actual duration						5						5						5			
Measured direct duration												3						5			2

A more elaborated direct measure of price rigidity is presented in Baumgartner and Glatzer (2005) which aims to numerically adjust for the censored objects. First, the length and number of durations are measured for each

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[6] The time interval in which prices are constant is sometimes referred to as *price spell* (e.g. Baumgartner and Glatzer, 2005).

type of spell, i.e. left, right, double and non-censored. Then a formula is applied to calculate an unbiased estimate of f_i. We abstain from this elaborated approach and instead rely mainly on the frequency approach (implied duration), as described below, for inference.

Indirectly computed *implied* duration

As an alternative to the direct option, which embeds the censoring bias, a measure of implied duration can be applied. An assumption for using this computation strategy is that the underlying price changes are homogenous within the aggregate for which the formula is applied. Thus, a feasible application could be the elementary aggregates in the CPI, which should be rather homogenous regarding products.

Following the notation in Baumgartner and Glatzer (2005), we denote the share of price changes to the total observed prices (changed + non-changed) in the observation period as f_i, with i being an arbitrary aggregate. From this we can derive a duration indirectly as the inverse of f_i,

$$D_i = \frac{1}{f_i}.$$

The implied duration avoids the need of explicitly treating the censoring of prices, which is a clear advantage. However, as Baumgartner and Glatzer (2005) points out, the underlying assumption for using the above formula would be that all price changes occur in the end of each month (since one observation per month is recorded in the CPI). This assumption can be relaxed (Baumgartner and Glatzer, 2005) to allow for a continuous time perspective. Assuming an exponential distribution ofthe duration of prices , the following expression is used for calculating the implied average duration:

$$D_i^{(avg)} = \frac{-1}{\ln(1-f_i)},$$

and analogically, the implied median duration is calculated as

$$D_i^{(med)} = \frac{\ln 0.5}{\ln(1-f_i)}.$$

The above presented methods are not further elaborated in this analysis or discussed as the study is restricted to an application.

For aggregate average durations, we use the following formula (in accordance with for example Hansen & Hansen 2006) , where w_i is the CPI weight for elementary aggregate i:

$$D_{agg} = \sum_i w_i \times D_i$$

Non-duration

Prices with no duration can be accounted for in some way. As a complimentary measure to the directly computed duration, all non-during movements can be denoted as noise. The noise ratio of non-during changes over all changes (both those non-during and those during) is reported here since it hints at the instability of the CPI group in question and, respectively, how much data can be used for the analysis.

Empirical analysis

Swedish CPI/CPIF data

The following analysis covers data for the Swedish CPI/CPIF between the years 2011 to 2017, inclusively, collected by Statistics Sweden. The study focuses on services although results are presented for goods as well, for comparison. It should be noted that Statistics Sweden applies scanner data within substantial parts of the basket, e.g. for daily necessities, alcoholic beverages and pharmaceutical drugs, within goods. Due to the nature of scanner data with average weekly prices that include e.g. membership-discounts tailored to each customer, practically all such prices show at least a small change every week. It would be somewhat misleading for the macroeconomic analysis if such goods were included. A way of circumventing this would be to filter out small price changes and treat them as no change. But as the focus in this study is services, we do not elaborate on this. The scanner data for foods, alcoholic beverages and pharmaceuticals constitute close to some 20 percent of the basket weight and is thus discarded from analysis. Alcoholic beverages have, due to state monopoly, administrative price movements in general and are also for that reason less interesting when studying the transmission mechanism. Scanner data do however remain for some other goods in the analysis, limited to some 3 percent of the basket, e.g. within personal hygiene products.. As the main focus is on service prices, energy goods are excluded from the analysis for practical purposes in data preparation

For data included in the analysis, some imputations were carried out. In some cases the two summer months, July and August, were missing and imputed. The imputation value was chosen as June (should it exist) for both months unless there was a July value when August is missing. In that case the July value was used for imputing August.

Variables in the analysis as reported in Tables 4a and 4b

The *Median* and *Mean* values are for the directly computed duration based on a reduced sample in accordance with the methodology. The column *Remain. share* (remaining share) conveys the amount of data available for direct computations, whereas *Implied median* and *Implied Mean* are based on the full sample (complete CPI data). The variable Noise indicates, for the full sample, the share of data points that were identified as non-during changes, i.e. volatility. The *Weight* variable is the sum of all included product groups according to COICOP within the specified output group (*Service group /Goods group*) in accordance with the Riksbank's definitions. Since several years are included, the average weight for each product group (COICOP) in the basket is used in the summations. Hence, the weight variable is the sum of averages and reflects the service group's /good group's total basket weight in average over the period.

Results and analysis

Tables 4a and 4b are sorted in descending order by the variable implied mean duration (in months). Comparing the last rows ("Total") in each table, we can clearly see that for the selected products in this study (roughly 61 per cent of the CPI weight), services have a longer duration of prices than goods. This is expected and in line with studies from practically all other countries (e.g. Dhyne *et al*. 2005, Nakamura & Steinsson 2008, Higo & Saita 2007, Wulfsberg 2016).

Table 4a. Services: duration (in months) and related statistics

Service Group	Median (direct)	Mean (direct)	Implied median	Implied mean	Noise (%)	Remain. share	Weight (‰)
TV license	17	17	29	41	0.00	0.23	4.81
Postal services	11	14	17	24	1.90	0.45	1.69
Repair of domestic appliances	11	11	15	22	6.00	0.27	7.14
Funeral services	11	13	14	20	2.90	0.38	1.87
Wine, spirit and beer, restaurants	6	8	13	19	9.20	0.22	8.34
Owner-occupied housing: water, sewage, cleaning, chimney-sweeping	11	13	13	18	4.30	0.44	17.68
Personal care, services	9	11	12	17	6.30	0.28	15.7
Dental services	11	11	10	14	7.10	0.56	9.81
Home insurance, financial services, education	9	9	10	14	31.70	0.47	18.34
Rentals for housing, cooperative flats, garages *	-	-	8	12	-	-	115.8
Catering services	4	6	8	12	14.20	0.29	47.39
Tele communication	4	8	8	11	18.80	0.48	12.44
Repair and maintenance, cars	5	7	7	10	8.00	0.58	14.68
Entertainment and recreation, excl. TV license and gambling	7	8	7	10	27.50	0.44	30.09
Owner-occupied housing: insurance fees	5	6	3	4	53.80	0.59	3.56
Inspection, driver education, car insurance	5	7	3	4	63.30	0.43	13.86
Domestic transport services, excl. boat trips and removals	2	7	2	3	68.70	0.66	23.73
Accommodation services	1	2	1	1	74.20	0.64	5.48
Foreign travel	5	4	0	0	92.20	0.28	20.86
Total	6	8	8	11			∑373.27

*Only implied duration calculated since data is outside the main production system. Rents are regulated in Sweden and hence surveyed in a different manner than ordinary price collection.

Table 4b. Goods: duration (in months) and related statistics

Goods Group	Median (direct)	Mean (direct)	Implied median	Implied mean	Noise (%)	Remain. share	Weight (‰)
Textiles, yarns and sewing materials	5	8	11	16	12.70	0.27	0.65
Spare parts, cars	4	6	6	9	20.20	0.32	9.32
Furniture, carpets and lighting	4	6	6	8	28.50	0.38	17.58
Purchase of vehicles	4	5	5	7	10.60	0.4	29.76
Other goods, excl. maintenance and gold	3	4	5	7	30.00	0.38	6.19
Gold goods	3	5	5	7	31.00	0.4	2.16
Toys, games and hobbies	3	5	4	6	39.10	0.41	7
Newspapers and magazines	3	5	4	6	22.60	0.61	6.25
Household textiles, other furnishing	2	4	4	5	41.40	0.42	9.75
Sport equipment and other recreational items	3	4	3	5	21.90	0.61	5.25
Men's clothes	2	3	3	4	36.50	0.57	17.18
Children's and sports clothes	2	4	3	4	33.40	0.58	7.47
Footwear, excl. Services	2	3	2	4	30.40	0.59	8.08
Women's clothes	2	3	2	3	37.90	0.65	19.55
Household appliances, excl. maintenance	2	4	2	3	39.10	0.62	4.79
Cameras, incl. colour film	2	3	2	3	38.20	0.73	0.94
Flowers, etc.	2	3	2	3	39.00	0.5	6.61
Household utensils	2	4	1	2	76.20	0.33	11.12
Radio, TV, video, etc.	2	3	1	2	45.90	0.68	13.22
Health and medical goods	2	5	1	2	80.00	0.32	4.77
Household items	1	2	0	1	88.00	0.26	6.98
Music instruments, records and cassettes	1	2	1	1	74.10	0.58	3.95
Other recreational items, excl. maintenance	2	3	1	1	85.70	0.3	9.54
Books	1	2	0	1	85.20	0.74	3.2
Medicine	2	3	1	1	85.10	0.38	11.16
Personal care, goods	2	3	1	1	83.40	0.28	12.56
Total	3	4	3	4			∑235.05

Within services, transport and accommodation exhibit the shortest durations. Characteristic for many companies in these sectors is the flexible pricing strategies where the price often change every time a product offer is purchased. The group with car related services also have a rather short duration. This is however mainly because of car rentals which exhibit a very short duration (also flexible pricing strategy), whereas prices on car inspection, driver education and car insurance etc. seems to be much more persistent. Approximately 70 per cent of services exhibits a duration between 10 and 14 month. Within these services we find for example catering services, prices on recreation and culture, telecommunications, dental services and rents. Services where prices are directly determined or heavily regulated by the government or local authorities exhibits longer durations in general, such as the fee for state television[7] and postal services. Exceptions are funeral services and alcoholic beverages at restaurants.

Álvarez *et al*. (2005) recapitulates the literature on reasons for differences between sectors in price rigidity. The higher the labor intensity in a sector, the lower is the frequency of price changes. On the other hand, a higher share of intermediate goods in the overall outputs has the opposite effect. The intuition for this being that wages typically changes once a year, while prices for goods are more volatile. Furthermore, if the market competition situation is perceived as high, prices tend to be less sticky.

There are some indications that the latter relationship may also exist in Sweden. In a survey carried out in 2017 by Statistics Sweden on commission for the Swedish agency for economic and regional growth (Tillväxtverket, 2017), companies were asked how they perceive competition in terms of price. The result is presented for several sectors. In Figure 2 we map the result for each sector together with the corresponding duration in months. Note that the sectors in this report are much broader than the product categories presented in Tables 4a and 4b and most product categories are therefore combined to achieve a reasonably comparable match. Also, the results from the report (Tillväxtverket, 2017) makes no distinction between business-to-business and business-to-consumer markets, therefore a certain amount of care must be used before drawing conclusions.

In the tables (4a and b), only such sectors are included where the market competition in terms of price is relatively free. This means that we exclude sectors where prices are directly determined or heavily regulated by the government or local authorities (TV-license, postal services, rents, municipality services such as water, sewage and chimney sweeping) – here the competition in terms of prices is either absent or negligible.

In Figure 2, the bars indicate duration in months for each sector and the dashed line is calculated as a share (1-x), where x is the share of companies that perceives high or very high competition. For sector categories perceiving the lowest degree of competition, the duration in prices is also shortest.

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[7] Regarding the fee for state television ("TV license"), it can furthermore be noted that the share of remaining prices for analysis is quite low, 0.23. This means that roughly 77 per cent of the data is affected by censoring, so only 23 per cent can be used when calculating direct duration. This is an example of why implied duration is a more meaningful measure for macroeconomic analysis.

Figure 2. Implied mean duration and perceived competition, by sector category
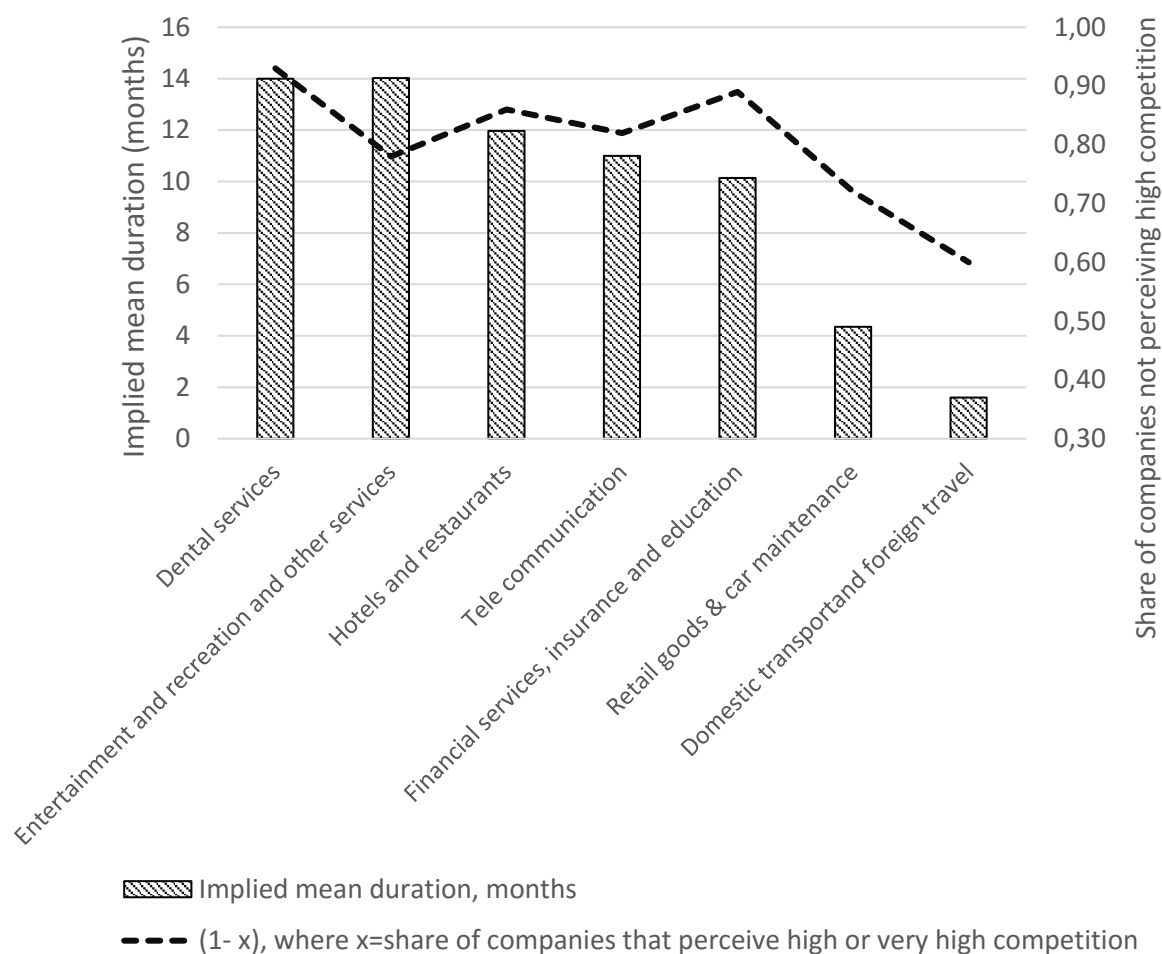
Sources: Tillväxtverket (2017) and Statistics Sweden

Monitoring non-moving prices in the Swedish CPI production

Although the duration of prices are treated here, it should be borne in mind that non-moving prices may be conspicuous in some situations – and even be incorrect. It is thus substantive to design the CPI data monitoring and incorporate expectations, as can for instance be inferred from the results in this study.

A perhaps somewhat overlooked issue in the context of data monitoring is the surveillance of prices that do not change. This topic is addressed in the CPI Manual (pp. 176-176 ILO, 2004), in which a technical risk is pointed out in the data collection: should price collectors have the previous price easily available and displayed when collecting the present round, there is an inherent risk that current prices may be noted identical to the old ones due to convenience. Such price inertia can thus be due to measurement errors and deserves surveillance in the CPI production as well as consideration when updating samples. However, although samples, i.e. basket content can be rotated or updated periodically, some items cannot, and should perhaps not, be exchanged. This is especially the case for services of which many are common to consumers and rather stable over time in terms of specification and content, at least regarding consumer utility.

Comparison with other countries

It can be seen from other studies carried out on services, as reported in Table 5, that durations vary substantially between countries. There may be several reasons for cross-country differences, such as variability in basket composition and use of different price collection methods. It is seen that the time spans vary as well. Caution must therefore be used when drawing conclusions. In several of these studies, it cannot be determined whether travel is included. Shortest durations in the table are found in Turkey (3.4 months) followed by the US for a two-year period (4.7) and Brazil (6.5), whereas the top durations are found in Norway (25.6) and Japan (22.0). In the Turkish study, several rigid categories, such as rents, were however omitted from analysis (Özmen & Sevinc, 2015). Sweden is found below Eurozone average with 11.4 against 17.3 months. Our Swedish sample is covering a more recent time period than all other studies. It is known that at least in Sweden, flexible pricing strategies for transport services have become much more common in recent years. Internet has become an important sales channel and may have lowered the menu costs, i.e. the firm's cost for changing prices. Price collection has also shifted from list prices to online prices. This could explain part of the difference with for example the Eurozone, Denmark and Norway.

Table 5. Implied mean duration for services in various countries

Country	Period	Type of product	Implied mean duration of services	Temporary price reductions	Source
Austria	1996-2003	Services	19.4	Included	Baumgartner & Glatzer (2005)
Austria	1996-2003	Services	20.2	Excluded	Baumgartner & Glatzer (2005)
Brazil	1996-2006	Services	6.5	Included	Gouvea (2007)
Denmark	1997-2005	Services	23,0	Included	Hansen & Hansen (2006)
Eurozone	1994-2004	Services	17.3	Differs depending on country	Dhyne *et al.* (2005)
Japan	1999-2003	Services	22.0	Excluded	Higo & Saita (2007)
Norway	1990-2004	Services	25.6	Included	Wulfsberg (2016)
Sweden	2011-2017	Services	11.4	Included	This study
Sweden	2011-2017	Services (excluding travel)	12.7	Included	This study
Sweden	2011-2017	Travels	1.8	Included	This study
Turkey	2006-2011	Services	3.4	Excluded	Özmen & Sevinc (2015)
UK	1996-2006	Services	11.1	Included	Bunn & Ellis (2012)
US	1995:1997	Services	4.7	Included	Bils & Klenow (2004)
US	1998-2005	Services (excluding travel)	10.9	Excluded	Nakamura & Steinsson (2008)
US	1998-2005	Services (excluding travel)	10.5	Included	Nakamura & Steinsson (2008)
US	1998-2005	Travel	1.7	Excluded	Nakamura & Steinsson (2008)
US	1998-2005	Travel	1.7	Included	Nakamura & Steinsson (2008)

Conclusions

This study is the first to utilize CPI micro data in a macro economical examination of Swedish price rigidity. The results may be used by the Swedish Riksbank in analysis related to the transmission mechanism.

For the studied period, the duration for goods was on average 4 months and for services 11 months. This may partly be related to the fact that price collectors carry out product-replacements for goods more often than for services (goods are more frequently sold out).

Our results confirm those of other studies, i.e. prices for goods changes more frequently than they do for services. The duration in months for services is more similar to the UK and US, rather than the Eurozone or neighbors Finland, Norway or Denmark. Our Swedish study is however based on more recent data than all other studies and it is known that flexible pricing strategies have become more common in recent years. This may explain part of the difference.

Our study also indicates shorter durations in rather competitive markets, in line with previous studies.

This paper has presented an introductory study on the topic of price persistence of services in Sweden. Our results raise some questions for future studies, for example:

- Is the size of a price change related to duration?
- Is the price level related to duration?
- Has the duration changed over time and if so, for which type of products?

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