WP 33

Seasonality in Swedish Consumer Prices

by

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Abstract

This study analyses seasonal cycles in Swedish consumer prices during 1955-95. The results show that quarterly and monthly changes in consumer prices have become more seasonally dependent over time. Deterministic seasonality appears to be the main factor behind the more pronounced seasonal cycle. The data also reveals some signs of stochastic, stationary seasonality. Possible explanations of the increased seasonality are discussed, they include changed consumption patterns, higher menu costs, increased product differentiation and more integration of price setters.

A majority of the individual CPI components display significant seasonality. The components with most influence on the seasonal cycle of the Swedish CPI are housing costs, which primarily affect the CPI upwards in January, prices of fruits, vegetables and berries which affect CPI upwards in the first half of the year and downwards in the second half, and prices of clothing and shoes, which have a strong seasonal impact.

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1. Introduction

In their development over time, most macroeconomic variables show some form of seasonal cycle. Industrial production is lower during summer than in other seasons, retail sales peak during Christmas shopping in December which is also when monetary aggregates are at their highest levels, unemployment varies with the availability of seasonal work, vacations, holidays, etc. It used to be considered the the development of consumer prices was not very seasonal on the aggregated level. Prices of some fresh food items, such as fish, vegetables and fruits, displayed seasonal patterns but on more aggregated levels there was no evidence of any particular seasonality. However, later studies by Osborn [1990] and Bryan & Cecchetti [1995] have shown that consumer prices in the UK and the US have become more seasonal in the 1980s and '90s. This is generally considered to be a result of more stable development of inflation and that inflation does not follow business cycles as much as it used to. This development is believed to have made seasonality a more obvious and important source of consumer price changes.

In the light of this it is important to have good knowledge about the seasonal patterns in the development of prices for different goods and services, how stable these patterns are and how they evolve over time. An increased knowledge of inflation's seasonal variation would make it easier to judge whether a registered increase in inflation means that inflationary pressures have increased and hence that monetary policy measures should be taken or whether it is a result of seasonal price cycles (or temporary deviations from cycles). Moreover, a better understanding would help to improve forecasts of inflation. Analysis of seasonal cycles may also contribute to a better understanding of the development of business cycles, see for example Barsky & Miron [1989] and Miron & Beaulieu [1995].

The purpose of this study is to describe and analyse the seasonal cycle in the Swedish consumer price index (CPI) and to investigate how this cycle has changed over time. Seasonal cycles in the different CPI components and how they affect the seasonal cycle in the aggregated CPI are also examined.

Section 2 of this paper contains a graphical presentation of how the seasonal pattern in the CPI changes has evolved since 1955. This is followed, in section 3, by more formal econometric estimations of the degree of seasonality in the CPI. The relationship between seasonality in the CPI and generally high price variability is examined in section 4. In section 5, seasonality in 31 different CPI components is analysed. Section 6 discusses different explanations of the changes in seasonality. Finally, conclusions drawn from the study are briefly recapitulated.

2. Seasonality of the CPI

Figure 1 shows each quarter's contribution to the yearly price rise during the period 1955-95.[1] Moving five-year averages are used to make it easier to detect trends in the contributions of different quarters and to remove temporary effects of single large price changes. Seen over the whole period, the first quarter has been a persistent price increasing quarter, i.e. its contribution is consistently above both the 25-percent line and the contributions of the other quarters. The second quarter has been the quarter with the lowest contribution during most of the period, while the contributions of the third and fourth quarter have been more variable. In the last observations the differences between quarters have been on a historically high level. The first and third quarters nowadays contribute over 80 percent of the yearly price increase as against 60 percent in the period up to the mid 1980s.

Obviously, the quarterly pattern of price changes altered in the 1980s. At present, prices are to a large degree unchanged, or even falling, in the second and fourth quarters, while they are rising in the first and third quarters. The low contribution of the second quarter and the high contribution of the third are not historically unique, whereas the large changes in the contributions of the first and fourth quarters have not been seen before. The contribution of the first quarter has grown more than 20 percentage points and the fourth quarter contribution has shrunk about 25 percentage points since the mid 1980s. It is not possible to judge whether the weak tendency of the pattern to return in the very last observations is a sign that the seasonal cycle is shifting back to a less pronounced pattern or whether the cycle is being established at its present level. It is difficult to draw more specific conclusions about the seasonal cycle because changes in indirect taxes and large exchange rate movements in 1991-93 had large effects on price increases in some months. However, the changes in the recent years, when the seasonal cycle has become stronger, are clearly significant.[2]

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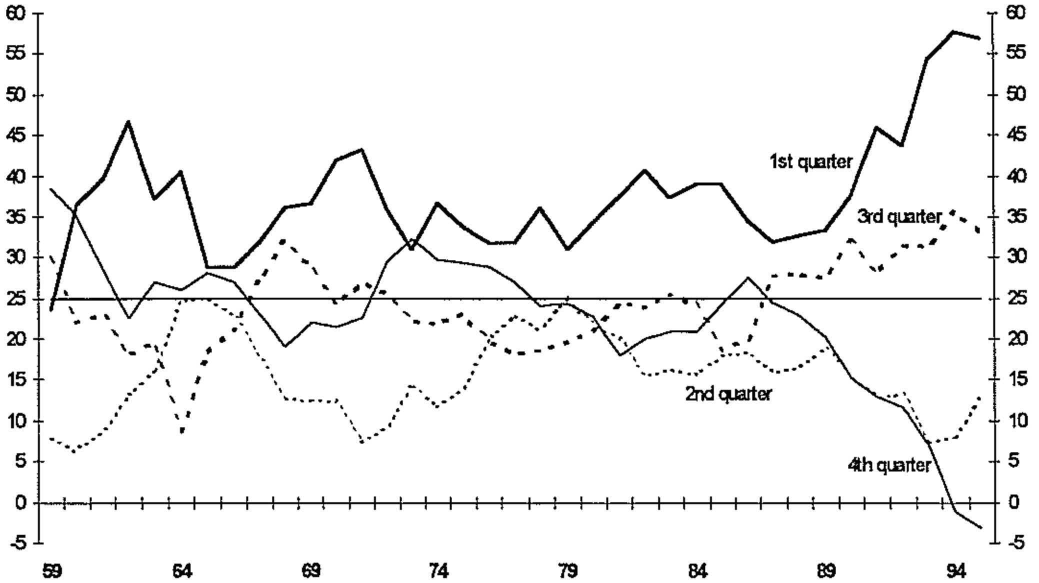
1. Data are monthly and quarterly consumer price indexes from 1955 to 1995 (base year 1980) published by Statistics Sweden. December values are long-term indexes. The CPI change between November and December is thus computed as the change between the short-term index in November and the long-term index in December. This change can differ from the change computed with the short-term index for both months. Short-term indexes for December are however available only from 1981 and the differences are too small to affect the conclusions.
2. Until 1991 Statistics Sweden seasonally adjusted some CPI components before including them in the CPI. These components were mainly fresh vegetables, fruits, berries and flowers and their share of the total CPI is small, about 1 percent. The absensce of adjustment can in no way explain all of the increase in the seasonal variation since the 1980s.

Figure 1. The Quarterly Contribution to the Yearly CPI Change 1959-95, (moving five-year average).*

Percent

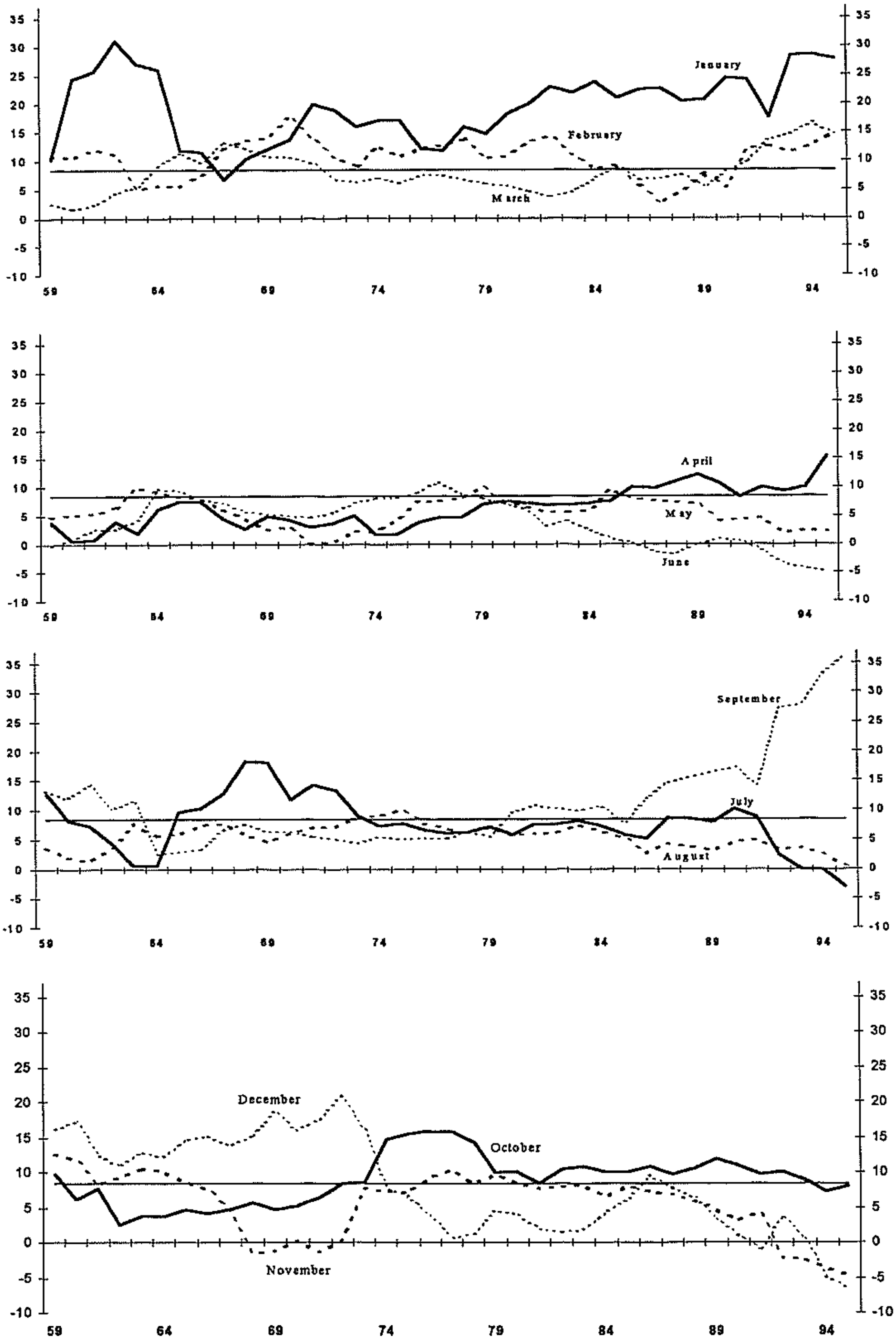


* If price increases had been evenly distributed over the year each quarter would have contributed 25 percent.

Figure 2 presents the monthly contributions to the yearly price change. This figure also shows that the seasonal pattern has been changing over time. The most obvious change probably is the increased contributions of January and September. January's contribution was slightly below 7 percent in the mid 1960s and shows a clearly rising trend since then. September was a normal month until the mid 1980s, with a contribution of 5-10 percent, its share then started increasing rapidly and in the 1990s it has reached a level of more than 30 percent.

Increases in the Swedish CPI have, thus, become more concentrated to two months, January and September. These two months contributed an average of over 60 percent of the yearly price rise in the period 1990-95. This is a notable increase from previous periods. Since the mid 1980s the contributions from the summer-months (May to August) and the early winter-months (November and December) have been declining. Prices are now more often unchanged or falling in these months. Moreover, all months in the first quarter have increased their contribution, while all months in the fourth quarter have decreased theirs. The higher September-contribution more than compensates for the lower contributions from July and August.

Figure 2. The Monthly Contribution to the Yearly CPI Change 1959-95,
(moving five-year average).*
Percent



* If price increases had been evenly distributed over the year each month would have contributed 8.33 percent.

3. Types of Seasonal Variation

Normally, three broad classes of seasonal variation are identified. The first and most common, deterministic seasonality, is the variation that can be ascribed to factors that can be placed in a calendar, like climate, weather, holidays, school vacations and other reoccurring events. The effect of this form of seasonality is that the mean of the examined variable varies with the season. This type of seasonality often results in stable and predictable seasonal patterns and can generally be described by $x_t = \Sigma\alpha_s d_{st} + \varepsilon_t$ with dummy variables (d) for different seasons (s), i.e. months, quarters or half years, and ε_t as a stationary stochastic process.

The second class of seasonal variation arises when unit roots at seasonal levels are present. This class is called non-stationary stochastic seasonality. The variable's value at each season will then follow a stochastic process where shocks have permanent effects. The simplest form of this variation is $x_t = x_{t-s} + \varepsilon_t$ where shocks are specific to the season and independent of shocks that occur in other seasons. In the absence of shocks this form can not be separated from deterministic seasonality. With stochastic shocks, the seasonal pattern will be unstable and can evolve over time in a way that, according to both theoretical and empirical studies of price developments, is most unlikely. Therefore it is highly probable that there are no seasonal unit roots in the CPI. This is also confirmed by Barsky & Miron [1989], Miron [1990] and Osborn [1990]. Indeed, various and abrupt changes in seasonal cycles may occur, e.g. due to temporary or permanent shifts in supply and demand, but price changes are not totally random and independent of previous price changes. Moreover, the methods developed to test for unit roots at seasonal level have proved to be very sensitive to different specifications.[3] Therefore this study will not consider the case of non-stationary stochastic seasonality.

The third class of seasonal variation is stationary stochastic seasonality. This kind of variation is not qualitatively different or logically separable from stochastic variation at non-seasonal frequencies. It appears when there are seasonal dynamics in the price changes. A price shock then has effects on price changes in the coming months, depending on the structure of the seasonal serial correlation. The simplest form may be written as $x_t = \varepsilon_t + \theta\varepsilon_{t-s}$.[4] If price shocks ($\varepsilon_t$) are seasonally dependent, the seasonal pattern of x_t will be relatively stable. Price shocks may originate from either supply or demand. Stochastic seasonality reveals itself as prices adjusting to shocks in an obviously seasonal manner. Suppose the price of an imported intermediate good rises unexpectedly and thus increases production costs. Since producers do not know whether the increased costs are permanent or temporary and do not want to risk losing customers by raising prices too much straight away, they may choose to make price

3. See Hylleberg, Engle, Granger & Yoo [1990], Dickey, Haza & Fuller [1984] and Ghysel, Lee & Noh [1994] for different methods to test for unit roots at seasonal levels.

4. Another form is : $x_t = \rho x_{t-s} + \varepsilon_t$, $|\rho| < 1$.

adjustments in steps. In this way there may be some direct price increase, some increase after a certain number of months, a further increase after a year and so on. Stationary stochastic seasonality can also arise as a result of interaction between the seasonal cycle and the business cycle. Canova & Ghysels [1994] find evidence that the degree of seasonality varies with the stages in the business cycle.

To investigate how much of the total variation in the CPI can be explained by seasonality a simple model with deterministic seasonality was estimated :

$$\Delta_1 \log(CPI_t) = \sum_{s=1}^{12} \alpha_s d_{st} + \varepsilon_t \qquad (1).$$

Since it is changes in the price level that are interesting and not the price level itself, the log difference of CPI is used. Dummy variables (d_s) for each month are included and variation not attributable to deterministic seasonality will end up in ε_t.

The model can explain only 11 percent of the variation in the period 1955-69, while it can explain 38 percent in the period 1980-95 (see table 1).[5] Estimated coefficients (α_1 - α_{12}) agree well with the results in the previous section. Price increases in January and September have become larger while prices are more unchanged or falling in the summer and early winter.[6]

The results can be explained in two ways. The seasonal cycle may actually have become stronger over time or it may have been as strong, but concealed by variation due to other factors, in earlier periods. Seasonal variation, Var(s), has increased in every period. However, only in the latest periods has a clear pattern been present and it has been possible to discern larger differences between different months. This has coincided with an increase in total variation, Var(tot). Since the amount of variation not explained by seasonality has increased simultaneously with seasonality, it is not probable that other factors affected price patterns in the earlier periods so that the variation due to them "drowned" the seasonal cycle. It seems much more likely that the higher R^2 is explained by a more seasonally driven price behaviour.

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5. The periods have been chosen partly for statistical reasons but also because they represent different epochs in Swedish economic history. The period 1955-69 was stable with high growth and low inflation, 0.3 percent a month on average. During 1970-79 the economy was hit by repeated oil price shocks which caused large swings in economic activity and inflation increased to a monthly average of 0.7 percent. The 1980s was a period where capacity utilisation was low at the beginning and gradually rose to a situation where the economy was overheated in the final years. Growth, however, remained slack and inflation was rather high. The 1990s started with a severe recession and falling inflation. In the period 1980-95 monyhly inflation has averaged 0.5 percent.

6. See appendix A for full results of the estimations.

Table 1. Results of Model (1), CPI*

Period (no. of obs)	1955-69 (179)	1970-79 (120)	1980-95 (192)
R^2	0.11	0.21	0.38
Var(s)	2.1	7.5	17.9
Var(tot)	19.3	36.0	47.1

* Seasonal variation, Var(s), computed from the regressions.
Both measures of variation have been multiplied by 10^6.

To examine stochastic seasonality and test the significance of the different classes of seasonality, another model was estimated[7] :

$$\Delta_1 \log(CPI_t) = \sum_{s=1}^{12} \alpha_s d_{st} + \beta \Delta_1 \log(CPI_{t-12}) + \varepsilon_t \qquad (2).$$

Dummy variables to remove outliers had to be included to ensure normality of ε_t and make it possible to test the significance of the estimates. The outliers were mainly those observations where large changes in indirect taxes and subsidies had serious effects on the CPI.[8] The presence of stochastic stationary seasonality was checked by testing if the β–estimate was significantly different from zero. Deterministic seasonality was checked in the same way by testing if the α-estimates were significantly different from each other.[9]

R^2 in model (2) turned out to be considerably higher than in model (1) with only dummies for months. This is primarily due to the inclusion of dummies to remove outliers. As in model (1), seasonality's share of the total variation has increased over time. Deterministic seasonality proved to be significant at the 1 percent level in all periods (see table 2). Stochastic seasonality was insignificant in the period 1970-79. However, it was slightly significant in the period 1955-69 and clearly significant in the period 1980-95.[10] This points to the conclusion that the seasonal cycle is dominated by deterministic seasonality but that stochastic seasonality may

7. This model contains stochastic, stationary seasonality at the level t-12 only. The results are, however, indifferent to the inclusion of other seasonal levels, e.g. t-3 or t-6.

8. The actual observations were: Nov. 1956, Jan. 1960, Jan. 1962, Jul. 1965, Jan. 1971, Feb. 1974, Oct. 1974, May. 1975, Jun. 1977, Jan. 1978, Jan. 1980, Sep. 1980, Jan. 1990, Mar. 1990, Jul. 1990, Jan. 1991, Feb. 1991, Jan. 1992 and Jan. 1993.

9. The model was estimated with White's heteroskedasticity-consistent method. Breusch-Godfrey's LM-test of serial correlation, Engle's LM-test of ARCH-effects, Ramsey's RESET-test and Jarque-Bera's normality test did not show any serious flaws in the specification. See appendix A for full results.

10. β-estimates were -0.11 for the period 1955-69 and 0.21 for the period 1980-95.

occur in certain periods. The results are somewhat surprising as studies of consumer price changes in other countries, i.e. Osborn [1990] in the UK 1955-88 and Bryan & Cecchetti [1995] in the US 1982 -93, do not find any evidence of stochastic seasonality in consumer prices.

Table 2. Results of Model (2), CPI.*

Period (No. of obs.)	1955-69 (167)	1970-79 (120)	1990-95 (181)
R^2	0.57	0.57	0.67
χ^2-test. deterministic coefficients**	23.04 (0.00)	33.30 (0.00)	43.2 (0.00)
χ^2-test. stochastic coefficients***	5.24 (0.02)	0.16 (0.69)	6.49 (0.01)

* Estimated with White's heteroskedasticity-consistent method, p-values in parentheses.
** Wald test of hypothesis : $\alpha_1 = \alpha_2 = ... = \alpha_{12}$.
*** Wald test of hypothesis : $\beta = 0$.

Estimations on alternative periods and analysis of the stability of the seasonal cycle showed that CPI followed a relatively stable pattern until the mid 1970s. However, the seasonal variation was small and there were virtually no differences between price changes in individual months. Then the seasonal cycle shifted; January and February developed into price increasing months while price increases in December declined. The seasonal pattern also became more influenced by stochastic seasonality and hence less stable. The different estimation indicates that stochastic seasonality has co-incided with adjustments to the oil price shocks. In the mid 1980s the cycle changed again. The February price increases ceased and increases in the summer months became smaller. Stochastic seasonality also disappeared and for a few years the seasonal cycle was very stable. Some signs show that the seasonal pattern shifted again around 1990. September became a special price rising month and the summer months and the fourth quarter turned into price falling periods. It is hard to determine the exact timing of the shifts in the seasonal cycle since the sporadic presence of stochastic seasonality makes the cycle unstable and changing. Moreover, changes in the cycle are more likely to be spread over a longer period of time than to be sudden and instantaneous.

It appears as if the shifts in the seasonal pattern may have something to do with other incidents that could have had an impact on consumer price development. They can, for example, be linked to the big changes in international oil prices in 1974, 1986 and 1990 that shocked the whole economy's price development. In the first oil price shock in 1974 oil prices tripled when OPEC decided to cut supplies. In 1986 oil prices were halved when OPEC-members could not agree on production cuts. In connection with the Kuwait war in 1990, oil prices in some months were twice as high as the months before and after. However, in this setting it seems strange that the seasonal pattern was virtually unchanged by the oil price shock in 1979, when prices soared from 15 to 45 dollars a barrel. An explanation could be that price dynamics prompted by the first shock had not had the time to settle down.

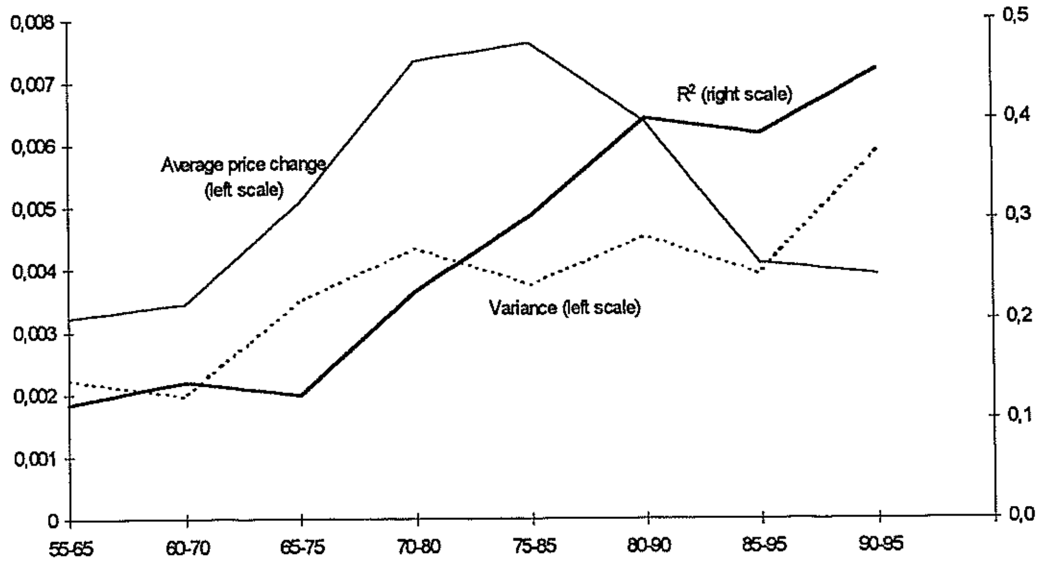
The shifts in the seasonal cycle may also be explained by shifts in the Swedish rate of inflation. After the oil price shock in 1974 the Swedish economy experienced a period of high and variable inflation. The seasonal price pattern was strongly influenced by stochastic seasonality and behaved unpredictably. In the early 1980s inflation declined somewhat. In the years around 1990 inflation was relatively high again and then fell sharply in 1992. Since 1992 inflation has remained low. This low rate of inflation may have contributed to the stronger seasonal cycle.

In conclusion, seasonal patterns in the development of the Swedish CPI have become more apparent over time. Deterministic seasonality is the most common form of seasonality that shows up in the CPI. Stationary stochastic seasonality has been present at times but seems to be primarily generated by exogenous events that increase trend inflation and price variability. A more stable rate of inflation should therefore make the seasonal cycle more stable and predictable in the future.

4. Seasonal Variation and Other Variation

Figure 3 shows how average monthly price changes, variance of price changes and R^2 in model (1) have evolved over different periods of time. R^2 has increased in nearly all periods. A great deal of this increase occurred in the period 1965-90. Until the period 1975-85 variation and average price changes also increased. Thus it seems as if R^2 has been increasing simultaneously with inflation and inflation variability. However in the following periods inflation decreased without a corresponding fall in R^2. Hence, there is no apparent correlation between seasonality, rate of inflation and price variability. It is likely that seasonal patterns will remain important in the future regardless of whether inflation stays low or not. During the last six years almost 50 percent of the variation in the CPI-changes has been due to seasonality. As seasonality seems insensitive to shifts in total variance, a decreased total variation will probably not lead to decreased seasonality. Rather there is reason to believe that seasonal cycles will get stronger as inflation becomes more stable.

Figure 3. Average Monthly Price Changes, Variance of Price Changes and R^2 in Model (1) CPI, 1955-1995.*



* Average price changes are expressed in logarithmic form; variances have been multiplied by 1000.

5. Seasonality of the Individual CPI Components

The seasonal patterns in price development vary across components.[11] Table 3 shows the results of regressions of model (1) and (2) on 31 CPI components in the period 1988-95. The R^2 in model (1) goes from 0.09 (e.g. interest costs for owner occupied housing) to 0.82 (clothing).[12] Primarily, components with high seasonality, Var(s), have the highest R^2. This is the case for clothing, footwear, health and medical care and lodging services. Although certain components may show high values for seasonal variation, this class of variation remains a small part of total variation, Var(tot). Price changes for motor fuel, fruits, vegetables, berries and rented dwellings display relatively large seasonal variation but this variation cannot explain more than 25 percent of total variation. Prices for articles for recreation and furniture show relatively little seasonal variation but this small seasonality can explain 35 to 40 percent of total variation.

A large number of components, primarily those where prices are set administratively, have seasonal price patterns where January makes a large positive contribution to the yearly price changes. This is most obvious for housing-related components like rented dwellings, heating,

11. Appendix B presents graphical descriptions of the CPI components' seasonal patterns. Some components' seasonal development is affected by Statistics Sweden not measuring all prices every month. Prices of, for example, alcoholic beverages are usually measured in four out of twelve months. Primarily this affects seasonal patterns of prices of lodging services, books, papers, alcoholic beverages and tobacco.
12. Data are price indexes for the different components from 1988 to 1995 (base year 1980), where December values are short-term indexes. Estimations of models (1) and (2) are presented in appendix C.

electricity and gas, where 50 to 80 percent of the yearly price increases occurs in January and only minor adjustments are made in the other months. Other components whose prices are raised in January and then remain relatively unchanged in the other months are health and medical care, telephone and postal services, alcoholic beverages and tobacco.

Price rises for a number of products are usually involved giving January a large share of the yearly increase in aggregated CPI. Most marked is the contribution from housing costs (excl. interest costs for owner occupied housing). Excluding this component from the CPI reduces January's contribution to the yearly CPI increases from about 25 percent to 15 percent. If one also exclude fruits and vegetables, whose prices tend to go up in the first half year and down in the second half, January actually turns into a price falling month. However, housing costs and prices of fruits and vegetables also counter the seasonal pattern of aggregated CPI in certain months, primarily decreasing the contribution from September but also lowering the contributions of other months.

Table 3. Results of model (1) and (2), CPI components 1988-95.

	Model (1)*			Model (2)**		
Component (weight in CPI, 1995)	R^2	Var(s)	Var(tot)	R^2	p-value deterministic coefficients ****	p-value stochastic coefficients *****
Rented dwellings (15.5 %)***	0.24	143.9	612.3	0.96	0.00	0.70
Food (exc. fruits, vegetables and berries) (12.5 %)	0.15	11.3	76.2	0.82	0.34	0.12
Interest costs for owner occupied housing (9.5 %)	0.09	13.8	160.0	0.75	0.13	0.66
Other services, owner-occupied housing (5.6 %)	0.43	195.2	451.1	0.99	0.01	0.23
Alcoholic beverages and tobacco (5.0 %)***	0.11	22.3	206.9	0.89	0.00	0.53
Clothing (4.8 %)	0.83	1835.9	2206.6	0.92	0.00	0.00
Motor fuel (4.1 %)	0.19	241.4	1247.3	0.88	0.18	0.42
Operation costs for cars (exc. motor fuel) (3.9 %)	0.36	24.51	68.1	0.69	0.01	0.10
Entertainment and recreation (3.4 %)	0.18	11.8	64.4	0.39	0.01	0.64
Articles for recreation (3.3 %)	0.42	15.6	37.4	0.42	0.00	0.79
Public transportation (3.1 %)	0.41	190.2	464.1	0.65	0.04	0.08
Vehicles (3.1 %)	0.28	11.6	41.7	0.53	0.00	0.15
Food, restaurants (2.9 %)	0.20	31.6	161.9	0.86	0.03	0.00
Heating, electricity, owner-occupied housing (2.7 %)	0.30	133.7	443.2	0.92	0.00	0.03
Fruits, vegetables and berries (2.5 %)	0.25	245.0	972.3	0.34	0.00	0.65
Health and medical care (2.4 %)***	0.51	188.9	372.5	0.83	0.00	0.03
Telephone and postal services (2.3 %)***	0.30	146.4	490.5	0.96	0.00	0.48
Furniture, carpets and lamps (2.0 %)	0.35	13.0	37.0	0.46	0.07	0.10
Books, papers and magazines (1.7 %)***	0.60	54.2	90.6	0.88	0.02	0.54
Personal care (1.4 %)	0.15	25.9	169.9	0.86	0.04	0.24
Electricity and gas, rented dwellings (1.2 %)***	0.44	246.3	561.2	0.95	0.00	0.85
Footwear (0.9 %)	0.78	401.2	516.7	0.89	0.00	0.80
Household utensils (0.9 %)	0.09	5.4	58.2	0.31	0.00	0.06
Household textiles (0.8 %)	0.18	14.6	82.4	0.36	0.07	0.37
Other goods (0.8 %)	0.09	4.4	47.5	0.18	0.14	0.04
Other services (0.7 %)***	0.43	245.0	576.4	0.82	0.04	0.00
Household equipment (0.7 %)	0.19	9.7	50.12	0.40	0.00	0.06
Radio and TV (0.7 %)	0.19	16.5	86.82	0.23	0.03	0.08
Household appliances (0.5 %)	0.21	20.2	97.71	0.33	0.09	0.00
Alcoholic beverages, restaurants (0.5 %)	0.12	18.2	152.4	0.85	0.95	0.28
Lodging services (0.3 %)***	0.70	702.5	1004.2	0.83	0.24	0.29

* Seasonal variation, Var(s), has been computed from the regression. Both measures of variation have been multiplied by 10^6.

** Estimated with White's heteroskedasticity-consistent method.

*** Residuals in model (2) are not normally distributed. This tends to make tests uncertain.

**** Wald test of hypothesis : $\alpha_1 = \alpha_2 = ... = \alpha_{12}$.

***** Wald test of hypothesis : $\beta = 0$.

Prices of clothing and footwear seem to follow a very clear and stable seasonal pattern. Prices are lowered in the winter, mainly in the January sell-outs, then raised in the spring; they fall during the summer and rise in September and October. Price increases in the fall, which is when many companies launch new collections, have large effects on the seasonal pattern of the aggregated CPI. During the last years clothing price increases in September have been approximately 10 to 15 percent. Sell-outs in the summer also have effects on the CPI in that they strengthen the CPI's unchanged or falling tendency in these months. However, clothing and footwear prices are two of the very few components whose pricedevelopment counteracts other price rises in January. Post-Christmas discounts of 5 to 10 percent lower the contribution of January to the yearly increase of aggregated CPI by almost 20 percentage points.

As for the remaining components, prices of vehicles have a tendency to go up in the fall and winter, stay unchanged in the spring and then decrease during the summer. Prices for radio- and TV-equipment and other electronic devices usually rise in the first quarter and are unchanged or falling in the rest of the year. The same thing goes for articles for recreation (cameras, CD-records, flowers, sporting gear, toys, etc.) but these prices are normally raised somewhat a second time in October and November. Prices for hotel stays and other lodging services and prices for public transportation are often lower in June and July when business travellers are few but are restored in August or September.

In the regressions of model (2) on some of the components dummies to remove outlying observations had to be included in order to make ε_t follow a normal distribution and allow tests to be carried out.[13] The great differences in R^2 between model (1) and model (2) are primarily a result of the inclusion of these dummies. Tests for deterministic and stochastic seasonality gave the result that 22 out of 31 components' price development showed significant deterministic seasonality at the 5 percent level, while stochastic seasonality was found to be significant for 7 components. In four cases, when stochastic seasonality was found significant, the estimated parameter was negative.

From the regressions of model (2) one can distinguish four groups among the individual components of the CPI. The first group has seasonal price patterns that are clearly deterministic. Stochastic seasonality, as measured in the regressions, is non-existent or very weak. The seasonal cycles appear to be rather stable as well. In this group we find 17 components, among others rented dwellings and other services for owner-occupied housing (repair, insurance, property taxes, water, sewage, waste disposal). The group makes up about 55 percent of the goods and services included in the CPI. Several explanations for the seasonal cycle of these components' prices can be found, i.e. climate and weather (e.g. fruits, vegetables and berries), administrative pricing (e.g. rented dwellings, alcoholic beverages and tobacco, telephone and postal services, electricity), the habit of presenting new varieties at specific times

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13. In a few cases more lags had to be included to solve problems of serial correlation. Included dummy variables and lags are shown in appendix C.

of the year (e.g. vehicles and footwear) or a combination of above mentioned factors (e.g. public transportation).

The second group of components has seasonal price patterns that are a mixture of deterministic and stochastic seasonality. This means that their prices have some stability in their seasonal cycles but that the seasonal pattern has a tendency to fluctuate. Some components, e.g. prices of clothing, have very stable seasonal cycles. Other components whose prices show this kind of mixed seasonality are heating and electricity in owner-occupied housing, health and medical care, restaurant services and other services (home insurance and burial costs). Totally this group makes up about 14 percent of the CPI.

The third group consists of only two components, other goods (bags, jewellery, writing material, etc.) and household appliances, which together amount to 1 percent of consumption included in the CPI. Seasonal patterns are dominated by stochastic seasonality and deterministic seasonality is weak. This means that seasonal patterns are stable only in the absence of shocks.

Finally we have those components whose prices do not seem to follow a seasonal cycle at all, neither deterministic nor stochastic seasonality are significant. These seven components' weights sum up to about 30 percent of the CPI. Some prices, i.e. interest costs for owner-occupied housing and prices on motor fuel, vary a lot due to other factors. This makes it impossible to distinguish any seasonal-looking pattern at all. In this group there are also components like books, papers and lodging services where R^2 in model (1) was rather high but none of the forms of seasonality could be found.

The conclusions from this chapter are that a majority of the individual components of the CPI show a significant seasonality in their price development. Seasonal patterns differ greatly. Deterministic seasonality seems to dominate and certain components have a very stable seasonal price pattern. Altogether, the components with the greatest influence on the seasonal development of the aggregated CPI appear to be housing costs and prices of fruits, vegetables, clothing and footwear.

6. Possible Explanations of the Increased Seasonality

Swedish consumer prices have become more influenced by seasonality. This ought to be a result of price setting becoming more time-dependent and co-ordinated. It is possible that some underlying relationship exists where factors, i.e. supply and demand, that give rise to price shocks have become more seasonal and tend to increase the seasonality of prices. However, price development is affected by a large number of factors, e.g. how the exchange rate and interest rates develop, which obviously are independent of seasonal cycles. Moreover, the weak stochastic seasonality seems to contradict this explanation. The necessary conditions for prices to become more seasonal are thus that they show some form of rigidity and that agents co-ordinate their price changes over time to a larger degree.

Changes in consumption patterns may have contributed to the increased price seasonality through increased consumption of traditionally price rigid products compared to consumption of products whose prices are more volatile. Especially price rigid are those goods and service whose prices are set administratively. Examples are telephone and postal services, health and medical care and other public utilities such as water, sewage and waste disposal. Rigidities in these prices are large; often prices change only once or twice a year. Rents, housing costs, heating and electricity also have increased their share of consumption. These components' prices show a vast amount of stickiness and co-ordination between price setters over time because prices are often controlled by authorities or set in yearly negotiations among organisations of producers and consumers. Deregulation of some markets, e.g. telephone services and energy markets, may however have counteracted some price rigidities in these areas.

Increased indirect taxation on consumption of goods and services may also have contributed to the increased seasonality, as several of these taxes are regularly changed in January. A comparison of the net price index (NPI), which excludes indirect taxes and subsidies, and the CPI shows that the NPI appear to be almost as seasonal as the CPI. The January increases in the NPI are somewhat lower while the price rises in September are bigger than the corresponding increases in the CPI. Hence, indirect taxes and subsidies can only explain a small and limited amount of seasonality in the CPI.[14]

Another possible explanation is that prices may have become more sticky in general as a consequence of increased regulation, a larger degree of monopolisation or higher menu costs. This may have resulted in a longer interval between price changes. If regulation or monopolisation increase price rigidity and co-ordination between price setters also increases, this should be a plausible explanation. However with the last years deregulation of the Swedish economy, entry into the EU, the tax reform etc. it does not seem reasonable to attribute the increased price seasonality to increased regulation or lower competition.

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14. Appendix D contains a graphical description of the seasonal pattern in the NPI and the results of regressions of models (1) and (2).

Ball & Mankiw [1992] argues that menu costs make companies change their prices only when they are hit by larger shocks but leave them unchanged at minor disturbances. A reasonable explanation for the seasonal patterns' tendency to become more distinct could then be that recent price shocks have been fewer and less severe than earlier. This could, through decreased price disturbances and less stochastic seasonality, have stabilised the seasonal price cycle. Another explanation is that higher menu costs, through a lower sensitivity of prices to shocks, have made price changes occur less frequently.

Blinder [1994] shows in an empirical study of the pricing behaviour of American companies that the average number of times a private company changes its prices during a year is 1.3 and that they instead, to a larger degree, choose to vary factors like stocks, delivery time, service and quality when demand is changing. To be able to set optimal prices, companies need vast amounts of information on production costs, sales, orders, competition, etc. The costs of gathering this information are generally not negligible. The amount of available information is often largest at the end of the financial year, when accounts, cost estimates and budgets are compiled. Since the financial year in most Swedish companies goes from January to December, the amount of information is largest in December and January. Accordingly, most price changes are carried out in January. If prices are changed at other times it is probably due to factors like the introduction of new products, changes in wages and taxes or large investments, i.e. a major price shock has hit the company. In this perspective a possible explanation for the stronger seasonality in prices may be that information costs, due to more complicated production processes and growing difficulties in measuring demand, have increased and made companies change their prices less often. However, this should have been counteracted by the developments in information processing, mainly better computers and software, which have lowered costs of gathering and processing information.

Another factor that can explain the increased price seasonality is the increased differentiation of products. It is becoming increasingly common for companies to keep on developing their products and present new varieties on a regular basis. If the new varieties are presented at given times of the year, price increases will probably be highest at those times. Presumably they will become lower in the run-up to those times next year again. The CPI increases in September can then be explained by the fact that some sectors, i.e. furniture, clothing and footwear, present new collections in this month and that prices are adjusted upwards at that time. Other sectors where this kind of seasonal behaviour is common are vehicles, electronics, travelling and appliances.

Two additional factors that may have contributed to stronger price seasonality are the increased integration of companies both within and between different stages of production and distribution. Both vertical and horizontal integration have increased since the 1950s. Vertical integration denotes the connection between different stages of production, for example when a company buys one of its suppliers. In this way the company can more easily control the costs of intermediate goods and fluctuations in commodity prices do not have to be passed on to the next stage of production. Horizontal integration increases when the bonds between different companies in the same stage of production are strengthened. A typical example of horizontal integration is the increased numbers of big chains of retail stores. The increased integration has enlarged the possibilities of price co-ordination, allowing for greater synergy effects. An example of synergism in pricing is when marketing and advertising have larger effects when carried out by a chain of retailers than by each store by itself. Thus, seasonality may have been strengthened by increased price co-ordination as integration among price setters has become larger and synergy effects have been important.

There are several possible explanations for the increase in seasonality. A closer investigation of which factors have been most important is however too extensive for this study. It appears as if changing consumption patterns in the direction of more administrative pricing, the increasing product differentiation and the higher rigidity of prices due to less severe price shocks are the most relevant factors. Lower inflation and less variability in inflation do not seem to explain the extent of price seasonality. Neither is it reasonable that decreased competition and more regulations should have increased price rigidity; if anything competition probably has increased and regulations softened. The question of the extent to which menu costs and integration between different stages of production and distribution have increased and the implications of this for pricing behaviour remains to beinvestigated.

7. Conclusions

The pattern of seasonality in the Swedish CPI has changed. In the 1950s, 1960s and 1970s, quarterly and monthly changes in consumer prices were spread out relatively evenly. Since then price increases have become more concentrated to the first and third quarters, mainly to January and September. During the summer months and the fourth quarter, prices to a larger degree are unchanged or falling.
The share of the total variation in the CPI-changes that can be attributed to seasonality has increased in the 1980s and 1990s. The trend towards a more obvious seasonal price pattern can be explained by a growing share of consumption being made up of products where pricing is administrative. It is also possible that price shocks have been less severe in the 1980s and 1990s. Seasonality may also have been reinforced by increased menu costs, larger product differentiation and increased integration of price setters.

The seasonal variation in the CPI-changes appears to be caused primarily by deterministic seasonality. Stochastic (stationary) seasonality seems to occur mainly in the presence of price shocks such as the oil shocks of the mid and late 1970's.

Seasonality's share of the total price variation differs greatly from one CPI component to another. Components also show large differences in the stability of the seasonal price cycle and the occurrence of stochastic seasonality. About 70 percent of the prices included in the CPI show some form of seasonality. Some prices, especially those for clothing and footwear, show very clear and stable seasonal patterns. Components like rented dwellings, electricity, heating, postal and telephone services, alcoholic beverages and tobacco also have obvious seasonal patterns in their pricing. Since prices are changed only once or twice a year, and then usually upwards, the choice of time will have big effects on the stability of these seasonal price cycles. Another group of products are those where price variations due to other factors than seasonality are so big that they drown any possible seasonal pattern. These products include e.g. interest costs for owner occupied housing and motor fuel.

The components that contribute most to the seasonality of the aggregated CPI appear to be clothing, footwear, fruits, vegetables and housing related costs. Housing costs, which make up about 25 percent of the CPI, make a major contribution to the CPI increases in January. Prices of fruits and vegetables usually rise in the first half of the year and then fall in the second half. The seasonal cycles in prices of clothing and footwear, where prices rise 10-15 percent in the fall and spring and go down by as much in the winter and summer, have large effects on the CPI's development over the year.

Bibliography :

Ball L. & Mankiw N. G.; [1992], "Relative-Price Changes as Aggregate Supply Shocks", NBER Working Paper 4168.

Barsky R.B. & Miron J.A., [1989], "The Seasonal Cycle and the Business Cycle", in *Journal of Political Economy 97(3)*, 503-534.

Blinder A.S., [1994], "On Sticky Prices: Academic Theories Meet the Real World" in Mankiw N.G., ed., Monetary Policy, The University of Chicago Press, 117-54.

Bryan F.B. & Cecchetti S. G., [1995], "The Seasonality of Consumerprices", NBER Working Paper 5173.

Canova F. & Ghysels E., [1994], "Changes in Seasonal Patterns, Are They Cyclical?", in *Journal of Economic Dynamics and Control 18*, 1143-1171.

Dickey H.A., Haza D.P. & Fuller W.A., [1984], "Testing for Unit Roots in Seasonal Time Series", *Journal of American Statistical Association 79*, 335-67.

Franses P.H., [1992], "Testing for Seasonality", *Economic Letters* 38, 259-62.

Ghysels E., Lee H.S. & Noh J., [1994], "Testing for Unit Roots in Seasonal Time Series, Some Theoretical Extensions and a Monte Carlo Investigation.", *Journal of Econometrics 62*, 415-442.

Hylleberg S., Engle R.F., Granger C.W.J. & Yoo B.S., [1990], "Seasonal Integration and Cointegration", *Journal of Econometrics 44*, 215-238.

Miron J.A., [1990], "The Economics of Seasonal Cycles", NBER Working Paper 3522.

Miron J.A. & Bealieu J.J., [1995], "What have Macroeconomists Learned about Business Cycles from the Study of Seasonal Cycles?", NBER Working Paper 5258.

Osborn D.R, [1990], "A Survey of Seasonality in UK Macroeconomic Variables", *International Journal of Forecasting 6*, 327-336.

Appendix A. Results of estimations, CPI 1955-95

Results model (1), CPI*

Period (No. of obs.)	1955-69 (179)	1970-79 (120)	1980-95 (192)
α_1	0.006 (0.00)	0.010 (0.00)	0.016 (0.00)
α_2	0.003 (0.00)	0.006 (0.00)	0.007 (0.00)
α_3	0.003 (0.00)	0.004 (0.00)	0.006 (0.00)
α_4	0.002 (0.00)	0.005 (0.04)	0.005 (0.00)
α_5	0.002 (0.00)	0.007 (0.00)	0.003 (0.00)
α_6	0.002 (0.00)	0.006 (0.00)	0.000 (0.64)
α_7	0.004 (0.02)	0.007 (0.00)	0.004 (0.00)
α_8	0.002 (0.06)	0.005 (0.00)	0.003 (0.00)
α_9	0.002 (0.02)	0.010 (0.01)	0.010 (0.00)
α_{10}	0.002 (0.01)	0.007 (0.00)	0.006 (0.00)
α_{11}	0.003 (0.00)	0.004 (0.00)	0.003 (0.00)
α_{12}	0.006 (0.00)	0.005 (0.02)	0.000 (0.80)
R^2	0.11	0.21	0.38
Var(s)**	2.1	7.5	17.9
Var(tot)**	19.3	36.0	47,1

* p-values in parentheses.
** Seasonal variation, Var(s), has been computed from the regressions. Both measures of variation have been multiplied by 10^6.

Results model (2), CPI*

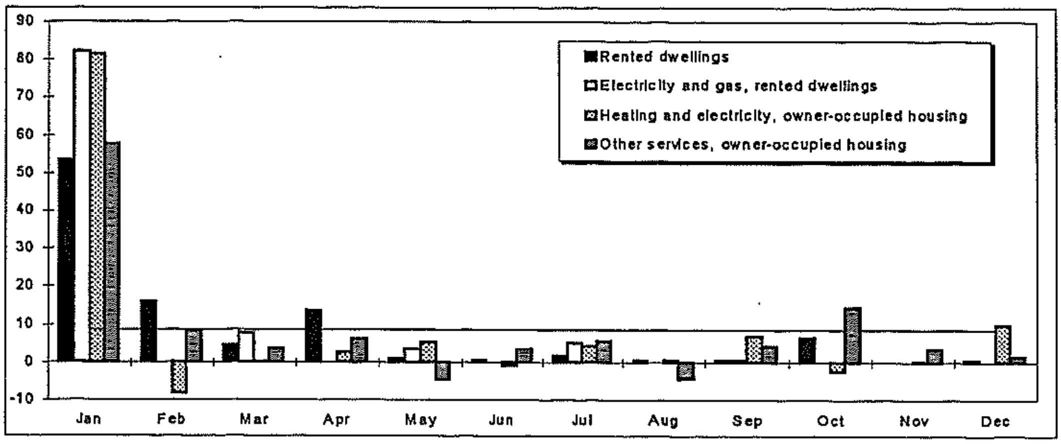
Period (No. of obs.)	1955-69 (167)	1970-79 (120)	1980-95 (181)
α_1	0.004 (0.00)	0.009 (0.00)	0.009 (0.00)
α_2	0.004 (0.00)	0.008 (0.00)	0.004 (0.01)
α_3	0.003 (0.00)	0.006 (0.00)	0.004 (0.00)
α_4	0.002 (0.00)	0.004 (0.03)	0.004 (0.00)
α_5	0.002 (0.00)	0.004 (0.02)	0.003 (0.00)
α_6	0.002 (0.00)	0.005 (0.00)	0.000 (0.71)
α_7	0.003 (0.00)	0.006 (0.00)	0.003 (0.03)
α_8	0.002 (0.07)	0.007 (0.00)	0.002 (0.01)
α_9	0.002 (0.02)	0.004 (0.00)	0.007 (0.00)
α_{10}	0.002 (0.01)	0.008 (0.00)	0.005 (0.00)
α_{11}	0.002 (0.01)	0.007 (0.00)	0.002 (0.01)
α_{12}	0.007 (0.00)	0.004 (0.03)	0.000 (0.73)
β	-0.107 (0.02)	0.024 (0.69)	0.206 (0.01)
DUM1**	0.012 (0.00)	0.012 (0.00)	0.007 (0.00)
DUM2**	0.017 (0.00)	0.016 (0.00)	-
DUM3**	0.024 (0.00)	0.022 (0.00)	0.020 (0.00)
DUM4**	-	-	-0.015 (0.00)
R^2	0.57	0.57	0.67
Breusch-Godfrey serial correlation test	4.27 (0.12)	2.98 (0.22)	1.56 (0.46)
ARCH test	0.21 (0.64)	0.30 (0.59)	3.35 (0.07)
Ramsey's RESET test	0.56 (0.46)	0.00 (0.99)	5.96 (0.02)
Jarque-Bera's normality test	1.53 (0.47)	1.26 (0.53)	8.34 (0.02)
χ^2-test. deterministic coefficients***	23.04 (0.00)	33.30 (0.00)	43.22 (0.00)
χ^2-test. stochastic coefficients****	5.24 (0.02)	0.16 (0.69)	6.50 (0.01)

* Estimated with White's heteroskedasticity-consistent method, p-values in parentheses.
** Dummy variables to remove outliers. The outliers were :
DUM1 = (Nov. 56, May. 75, Jan. 78, Jul. 90),
DUM2 = (Jan. 62, Feb. 74, Jun. 77),
DUM3 = (Jan. 60, Jul. 65, Jan. 71, Oct. 74, Jan. 80, Sep. 80, Jan. 90, Mar. 90, Jan. 91, Feb. 91, Jan. 93).
DUM4 = (Jan. 92)
*** Wald test of hypothesis : $\alpha_1 = \alpha_2 = ... = \alpha_{12}$.
**** Wald test of hypothesis : $\beta = 0$.

Appendix B. The Monthly Contribution to the Average Price Increase During a Year, 1988-95, Different CPI Components

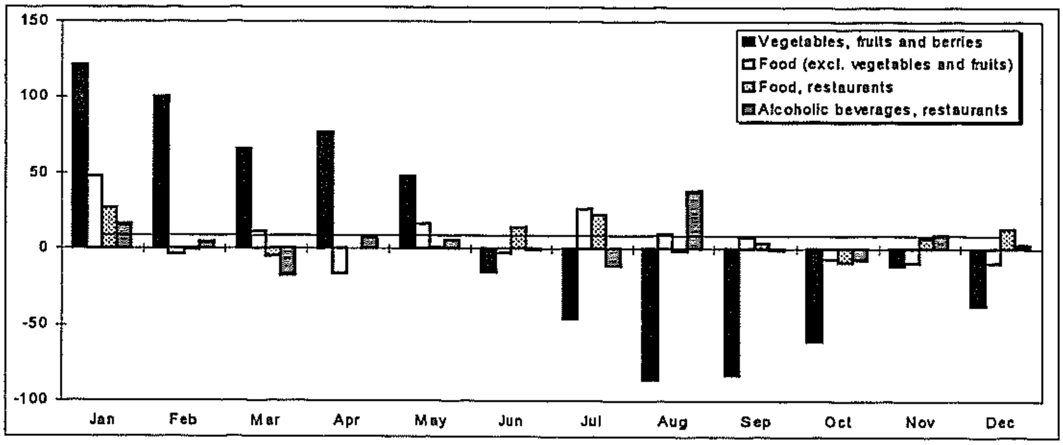
Housing related components

Percent



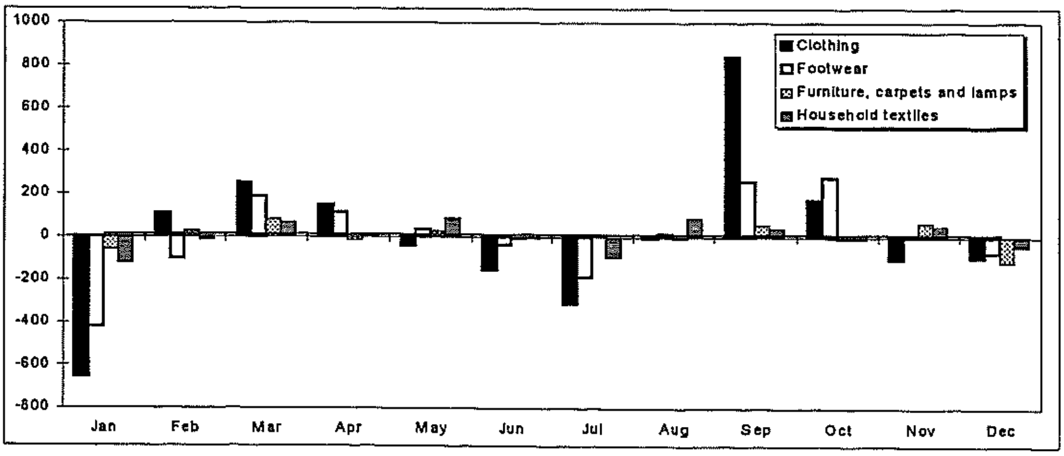
Food related components

Percent



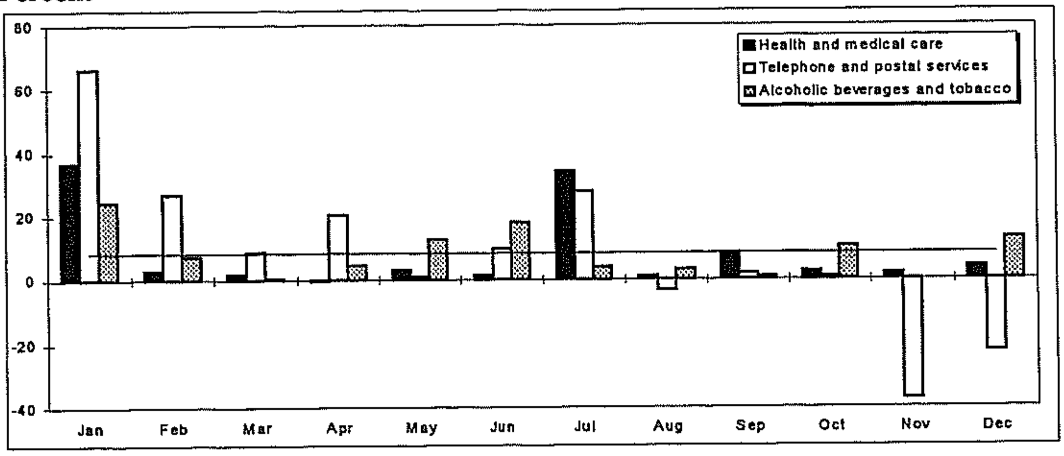
Textile related components

Percent



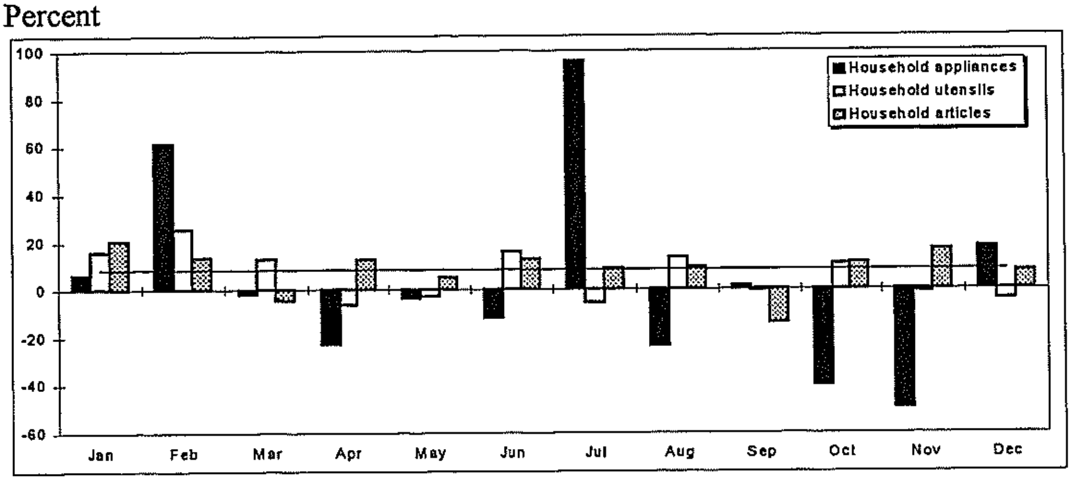
Regulation related components

Percent



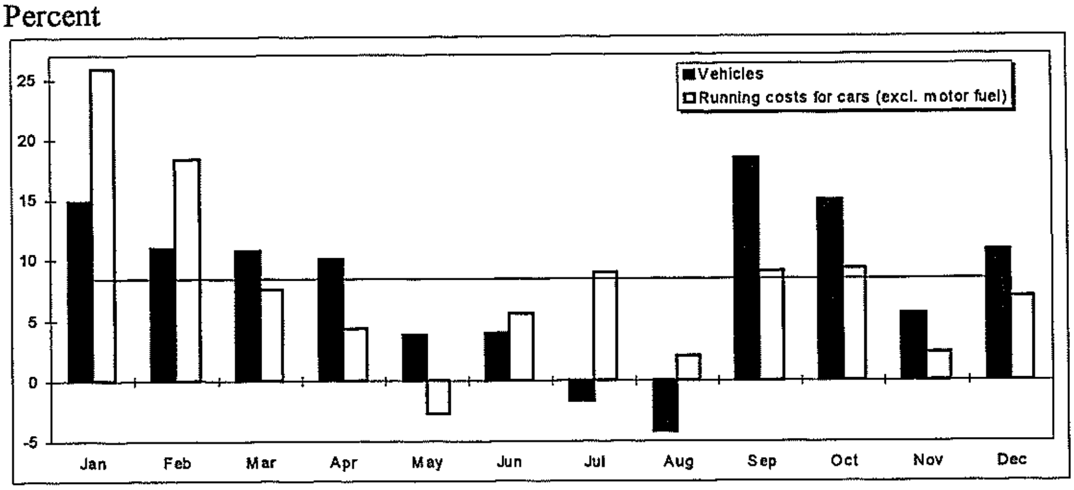
Household related components

Percent



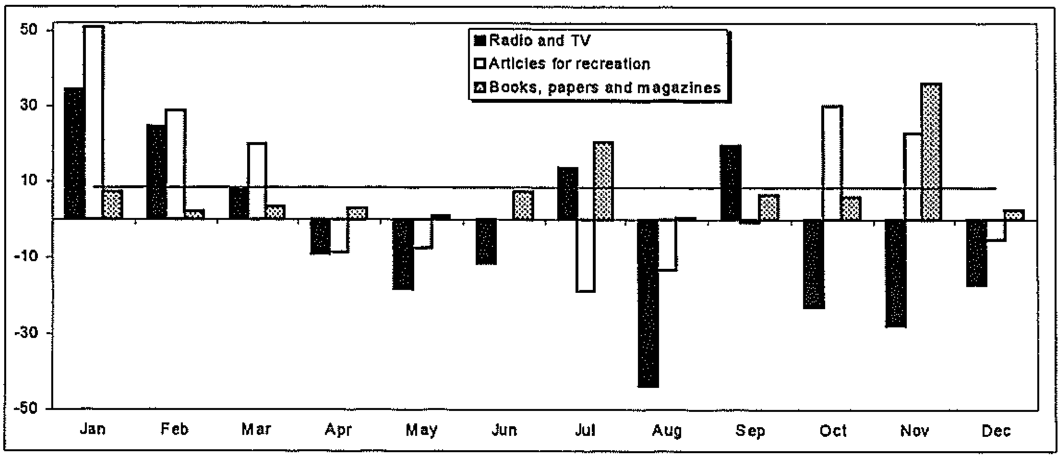
Vehicle related components

Percent



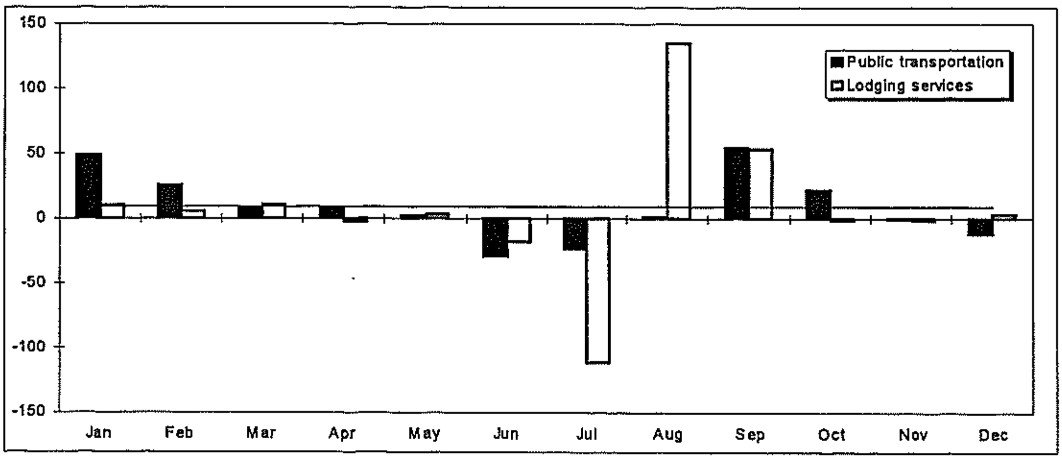
Leisure related components

Percent



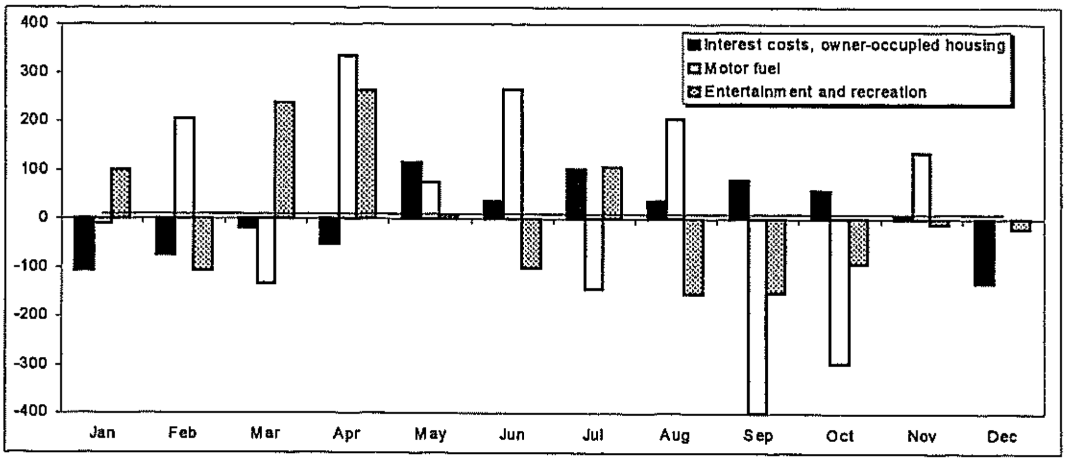
Communication related components

Percent



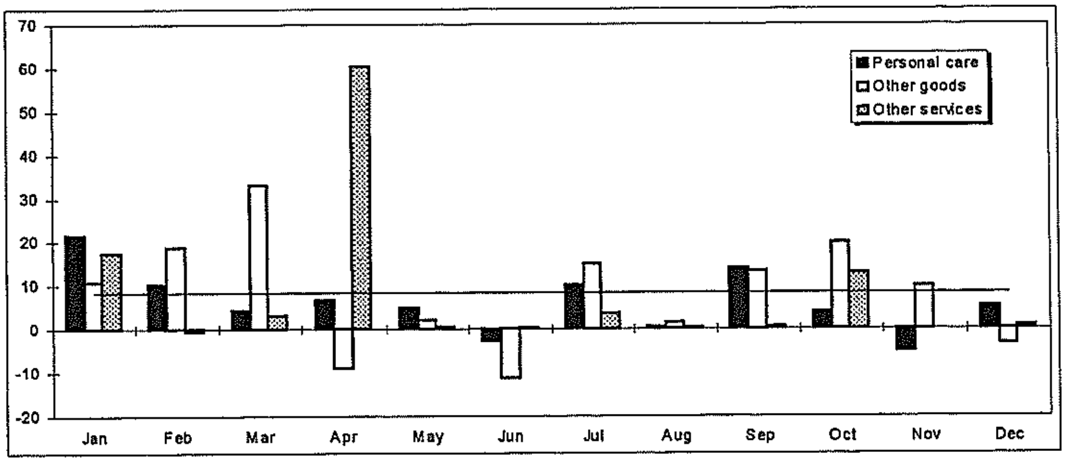
Volatile components

Percent



Other components

Percent



Appendix C. Estimations on the CPI components 1988-95

Results model (1), CPI-components 1988-95.*

	α_1	α_2	α_3	α_4	α_5	α_6	α_7	α_8	α_9	α_{10}	α_{11}	α_{12}	R^2	Var(s) **	Var(tot) **
Rented dwellings	0.039 (0.00)	0.029 (0.00)	0.006 (0.46)	0.011 (0.18)	0.001 (0.95)	0.000 (0.96)	0.002 (0.77)	0.000 (0.98)	0.000 (0.96)	0.005 (0.55)	0.000 (0.98)	0.000 (0.96)	0.24	143.9	612.3
Food (exc. fruits and vegetables)	0.008 (0.02)	0.002 (0.45)	0.002 (0.52)	-0.001 (0.68)	0.003 (0.309	0.000 (0.99)	0.010 (0.00)	0.003 (0.38)	0.002 (0.47)	0.001 (0.67)	-0.001 (0.80)	-0.001 (0.67)	0.15	11.3	76.2
Interest costs for owner occupied housing	0.004 (0.43)	-0.003 (0.50)	0.005 (0.24)	0.004 (0.44)	0.007 (0.14)	-0.003 (0.50)	0.002 (0.69)	0.004 (0.36)	0.011 (0.02)	0.004 (0.43)	0.002 (0.66)	0.003 (0.47)	0.09	13.8	160.0
Other services, owner-occupied housing	0.055 (0.00)	0.005 (0.42)	0.003 (0.62)	0.005 (0.40)	-0.001 (0.86)	0.003 (0.60)	0.004 (0.47)	-0.001 (0.85)	0.002 (0.69)	0.008 (0.17)	0.002 (0.73)	0.000 (0.94)	0.43	195.2	451.1
Alcoholic beverages and tobacco	0.011 (0.03)	0.004 (0.00)	0.000 (0.20)	0.005 (0.18)	0.009 (0.22)	0.014 (0.09)	0.004 (0.19)	0.000 (0.69)	0.001 (0.04)	0.003 (0.06)	0.000 (0.96)	0.012 (0.33)	0.11	22.3	206.9
Clothing	-0.086 (0.00)	0.008 (0.26)	0.036 (0.00)	0.019 (0.01)	-0.004 (0.57)	-0.028 (0.00)	-0.036 (0.00)	0.005 (0.45)	0.102 (0.00)	0.023 (0.00)	-0.012 (0.11)	-0.014 (0.05)	0.83	1835.9	2206.6
Motor fuel	0.047 (0.00)	-0.002 (0.88)	0.026 (0.03)	0.019 (0.11)	0.005 (0.65)	0.001 (0.92)	-0.001 (0.92)	0.005 (0.68)	0.007 (0.57)	-0.008 (0.46)	0.000 (0.99)	-0.014 (0.23)	0.19	241.4	1247.3
Running costs for cars (exc. motor fuel)	0.018 (0.00)	0.014 (0.00)	0.005 (0.07)	0.004 (0.15)	0.000 (0.90)	0.005 (0.04)	0.007 (0.01)	0.001 (0.67)	0.007 (0.01)	0.004 (0.08)	0.003 (0.29)	0.005 (0.05)	0.36	24.51	68.1
Entertainment and recreation	0.008 (0.01)	0.000 (0.98)	0.000 (0.86)	0.005 (0.05)	0.002 (0.41)	0.000 (0.98)	0.007 (0.01)	-0.004 (0.18)	0.008 (0.01)	0.004 (0.13)	0.002 (0.55)	0.002 (0.40)	0.18	11.8	64.4
Articles for recreation	0.010 (0.00)	0.007 (0.00)	0.004 (0.03)	0.002 (0.28)	-0.001 (0.72)	0.001 (0.51)	-0.005 (0.01)	-0.001 (0.65)	0.002 (0.25)	0.007 (0.00)	0.005 (0.00)	0.001 (0.70)	0.42	15.6	37.4
Public transportation	0.004 (0.00)	0.015 (0.02)	0.002 (0.72)	0.002 (0.76)	0.000 (0.94)	-0.014 (0.03)	-0.012 (0.05)	0.004 (0.48)	0.028 (0.00)	0.011 (0.09)	0.000 (0.96)	-0.003 (0.59)	0.41	190.2	464.1
Vehicles	0.009 (0.00)	0.008 (0.00)	0.006 (0.00)	0.006 (0.01)	0.002 (0.31)	0.002 (0.25)	0.000 (0.82)	-0.002 (0.44)	0.009 (0.00)	0.007 (0.00)	0.002 (0.25)	0.005 (0.02)	0.28	11.6	41.7
Food, restaurants	0.023 (0.00)	0.003 (0.54)	0.002 (0.58)	0.000 (0.92)	0.002 (0.66)	0.003 (0.46)	0.005 (0.24)	0.006 (0.19)	0.002 (0.62)	0.000 (0.92)	0.003 (0.51)	0.004 (0.35)	0.20	31.6	161.9
Heating and electricity, owner-occupied housing	0.044 (0.00)	-0.001 (0.89)	0.015 (0.03)	0.001 (0.89)	0.001 (0.83)	0.000 (0.96)	0.007 (0.27)	0.001 (0.82)	0.005 (0.49)	0.001 (0.89)	0.000 (0.95)	0.003 (0.66)	0.30	133.7	443.2
Fruits, vegetables and berries	0.034 (0.00)	0.018 (0.09)	0.014 (0.17)	0.011 (0.27)	0.008 (0.45)	0.003 (0.80)	-0.016 (0.12)	-0.019 (0.06)	-0.022 (0.03)	-0.008 (0.43)	-0.002 (0.81)	-0.002 (0.84)	0.25	245.0	972.3
Health and medical care	0.043 (0.00)	0.002 (0.66)	0.002 (0.73)	0.000 (0.96)	0.003 (0.60)	0.001 (0.83)	0.036 (0.00)	0.001 (0.87)	0.007 (0.21)	0.002 (0.63)	0.001 (0.80)	0.003 (0.53)	0.51	188.9	372.5
Telephone and postal services	0.046 (0.00)	0.007 (0.31)	0.001 (0.88)	0.003 (0.65)	0.001 (0.93)	0.002 (0.83)	0.011 (0.13)	-0.001 (0.93)	0.001 (0.87)	0.000 (0.99)	0.001 (0.85)	-0.004 (0.61)	0.30	146.4	490.5
Furniture, carpets and lamps	0.000 (0.98)	0.004 (0.03)	0.006 (0.00)	0.005 (0.01)	0.003 (0.13)	0.002 (0.42)	-0.002 (0.34)	0.012 (0.00)	0.005 (0.02)	0.001 (0.64)	0.001 (0.63)	0.000 (0.94)	0.35	13.0	37.0
Books, papers and magazines	0.006 (0.02)	0.001 (0.58)	0.003 (0.18)	0.002 (0.29)	0.001 (0.64)	0.006 (0.01)	0.015 (0.00)	0.001 (0.72)	0.005 (0.04)	0.005 (0.04)	0.027 (0.00)	0.002 (0.31)	0.60	54.2	90.6
Personal care	0.021 (0.00)	0.007 (0.10)	0.002 (0.62)	0.003 (0.50)	0.001 (0.80)	0.000 (0.98)	0.004 (0.42)	0.004 (0.39)	0.006 (0.15)	0.002 (0.59)	0.001 (0.81)	0.003 (0.46)	0.15	25.9	169.9

* p-values in parentheses.

** Seasonal variation, Var(s), has been computed from the regressions.

Both measures of variation have been multiplied by 10^6.

Results model (1), CPI components 1988-95 (cont.)*

	α_1	α_2	α_3	α_4	α_5	α_6	α_7	α_8	α_9	α_{10}	α_{11}	α_{12}	R^2	Var(s) **	Var(tot) **
Electricity and gas, rented dwellings	0.058	0.000	0.021	0.000	0.002	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.44	246.3	561.2
	(0.00)	(1.00)	(0.03)	(1.00)	(0.77)	(1.00)	(0.34)	(1.00)	(0.96)	(1.00)	(1.00)	(1.00)			
Footwear	-0.041	-0.016	0.019	0.017	0.003	-0.003	-0.024	0.002	0.026	0.028	0.004	-0.008	0.78	401.2	516.7
	(0.00)	(0.00)	(0.00)	(0.00)	(0.44)	(0.39)	(0.00)	(0.59)	(0.00)	(0.00)	(0.39)	(0.06)			
Household utensils	0.008	0.005	0.000	0.005	0.002	0.006	0.007	0.000	0.005	0.003	0.004	0.006	0.09	5.4	58.2
	(0.01)	(0.06)	(0.86)	(0.09)	(0.49)	(0.03)	(0.01)	(0.94)	(0.10)	(0.23)	(0.17)	(0.04)			
Household textiles	-0.006	0.000	0.004	0.001	0.005	0.004	-0.004	0.008	0.003	-0.003	0.004	-0.001	0.18	14.6	82.4
	(0.07)	(0.98)	(0.18)	(0.66)	(0.09)	(0.89)	(0.18)	(0.02)	(0.37)	(0.40)	(0.20)	(0.79)			
Other goods	0.002	0.000	0.006	0.000	-0.001	-0.001	0.003	0.001	0.002	0.004	0.002	-0.001	0.09	4.4	47.5
	(0.42)	(0.30)	(0.01)	(0.87)	(0.62)	(0.72)	(0.17)	(0.62)	(0.38)	(0.14)	(0.38)	(0.82)			
Other services	0.006	0.000	0.001	0.057	0.000	0.000	0.001	0.000	0.000	0.011	0.000	0.000	0.43	245.0	576.4
	(0.42)	(0.98)	(0.88)	(0.00)	(0.98)	(0.99)	(0.85)	(0.99)	(0.98)	(0.10)	(1.00)	(0.96)			
Household equipment	0.008	0.009	0.007	0.000	0.001	0.005	0.002	0.008	0.003	0.005	0.000	0.003	0.19	9.7	50.12
	(0.00)	(0.00)	(0.00)	(0.97)	(0.82)	(0.04)	(0.33)	(0.00)	(0.25)	(0.06)	(0.87)	(0.20)			
Radio and TV	0.007	0.005	0.001	-0.002	-0.005	-0.003	-0.001	-0.005	0.001	-0.002	-0.007	-0.006	0.19	16.5	86.82
	(0.04)	(0.13)	(0.80)	(0.55)	(0.09)	(0.40)	(0.75)	(0.12)	(0.84)	(0.58)	(0.04)	(0.05)			
Household appliances	0.005	0.014	0.005	0.000	-0.002	0.002	0.004	0.000	-0.004	0.002	0.001	-0.001	0.21	20.2	97.71
	(0.16)	(0.00)	(0.13)	(0.95)	(0.59)	(0.60)	(0.22)	(0.90)	(0.26)	(0.61)	(0.72)	(0.84)			
Alcoholic beverages, restaurants	0.017	0.002	-0.002	0.002	0.002	0.002	0.002	0.006	0.003	0.000	0.001	0.003	0.12	18.2	152.4
	(0.00)	(0.66)	(0.62)	(0.59)	(0.58)	(0.57)	(0.69)	(0.18)	(0.54)	(0.97)	(0.74)	(0.50)			
Lodging services	0.016	0.001	0.007	0.003	0.001	-0.004	-0.052	0.072	0.018	-0.001	-0.001	0.001	0.70	702.5	1004.2
	(0.03)	(0.91)	(0.30)	(0.65)	(0.91)	(0.57)	(0.00)	(0.00)	(0.01)	(0.94)	(0.93)	(0.83)			

* p-values in parentheses.
** Seasonal variation, Var(s), has been computed from the regressions.
Both measures of variation have been multiplied by 10^6.

Results model (2), CPI components 1988-95*

	Rented dwellings	Food (exc., fruits, vegetables and berries)	Interest costs for owner-occupied housing	Other services, owner-occupied housing	Alcoholic beverages and tobacco	Clothing	Motor fuel
α_1	0.045 (0.00)	0.004 (0.35)	0.004 (0.13)	0.017 (0.02)	0.013 (0.00)	-0.045 (0.00)	0.011 (0.19)
α_2	0.003 (0.29)	0.000 (0.82)	-0.005 (0.15)	0.004 (0.00)	0.003 (0.19)	0.006 (0.06)	-0.001 (0.90)
α_3	0.001 (0.01)	0.001 (0.21)	-0.001 (0.71)	0.003 (0.01)	0.000 (0.87)	0.019 (0.02)	0.000 (0.96)
α_4	0.011 (0.00)	-0.002 (0.08)	0.003 (0.26)	0.003 (0.00)	0.002 (0.35)	0.008 (0.08)	0.011 (0.02)
α_5	0.000 (0.31)	0.003 (0.15)	0.004 (0.19)	0.004 (0.01)	0.002 (0.51)	-0.002 (0.43)	0.002 (0.76)
α_6	0.000 (0.00)	0.000 (0.84)	-0.004 (0.38)	0.002 (0.01)	0.002 (0.49)	-0.013 (0.12)	-0.001 (0.88)
α_7	0.002 (0.28)	0.003 (0.33)	0.002 (0.53)	0.004 (0.02)	0.004 (0.05)	-0.019 (0.00)	-0.004 (0.38)
α_8	-0.001 (0.51)	0.002 (0.21)	0.005 (0.07)	0.002 (0.06)	0.000 (0.82)	0.002 (0.83)	-0.004 (0.44)
α_9	0.000 (0.00)	0.001 (0.38)	0.003 (0.12)	0.002 (0.05)	0.001 (0.80)	0.042 (0.02)	-0.003 (0.54)
α_{10}	0.004 (0.04)	0.001 (0.70)	0.004 (0.02)	0.004 (0.01)	0.004 (0.08)	0.007 (0.28)	-0.010 (0.03)
α_{11}	0.001 (0.56)	-0.001 (0.46)	-0.001 (0.83)	0.002 (0.07)	0.000 (0.99)	-0.007 (0.21)	0.000 (0.96)
α_{12}	0.000 (0.00)	-0.001 (0.01)	-0.003 (0.56)	0.000 (0.76)	-0.001 (0.81)	-0.008 (0.08)	-0.018 (0.07)
β	-0.007 (0.70)	0.245 (0.12)	-0.024 (0.67)	-0.048 (0.24)	0.027 (0.53)	0.573 (0.00)	-0.030 (0.42)
lag(t-1)	-	-	0.509 (0.00)	0.024 (0.01)	-	-	-
DUM1**	0.210 (0.00)	-0.055 (0.00)	0.064 (0.00)	0.073 (0.00)	0.059 (0.00)	0.080 (0.00)	0.205 (0.00)
DUM2**	-0.044 (0.00)	0.023 (0.00)	0.043 (0.00)	0.154 (0.00)	0.060 (0.00)	-	0.165 (0.00)
DUM3**	0.044 (0.00)	0.029 (0.00)	0.044 (0.00)	0.053 (0.00)	0.095 (0.00)	-	0.103 (0.00)
DUM4**	-	0.020 (0.00)	0.024 (0.05)	-0.043 (0.00)	-	-	0.068 (0.00)
DUM5**	-	-	-	-0.027 (0.00)	-	-	0.079 (0.00)
DUM6**	-	-	-	0.024 (0.00)	-	-	0.066 (0.00)
R^2	0.96	0.82	0.75	0.99	0.89	0.92	0.88
Breusch-Godfrey serial correlation test	3.75 (0.15)	4.23 (0.12)	4.10 (0.13)	5.58 (0.06)	0.37 (0.83)	1.78 (0.41)	1.65 (0.44)
ARCH test	0.10 (0.75)	0.31 (0.58)	0.11 (0.74)	0.08 (0.78)	0.63 (0.43)	1.40 (0.24)	5.38 (0.02)
Ramsey's RESET test	0.08 (0.78)	6.13 (0.01)	0.00 (0.96)	4.68 (0.03)	3.11 (0.08)	7.53 (0.01)	0.00 (0.99)
Jarque-Bera's normality test	251.78 (0.00)	2.15 (0.34)	6.53 (0.04)	6.41 (0.04)	161.89 (0.00)	3.11 (0.21)	2.99 (0.22)
χ^2-test, deterministic coefficients***	30.64 (0.00)	0.91 (0.34)	2.30 (0.13)	6.24 (0.01)	31.75 (0.00)	18.60 (0.00)	1.76 (0.18)
χ^2-test, stochastic coefficients****	0.15 (0.70)	2.53 (0.12)	0.19 (0.66)	1.41 (0.23)	0.39 (0.53)	22.38 (0.00)	0.66 (0.42)

* Estimated with White's heteroskedasticity-consistent method, p-values in parentheses.

** Dummy variables to remove outliers. Outliers were : rented dwellings : Mar. 90, Jan. 91, Feb. 91, food (exc. fruits; vegetables and berries) : Jan. 90, Jul. 90, Jan. 92, Jan. 93, interest costs for owner occupied housing : Mar. 90, Nov. 90, Dec. 91, Sep. 92, other services, owner-occupied housing : Jan. 90, Jan. 91, Jan. 93, May. 93, Aug. 95, Oct. 95, alcoholic beverages and tobacco : Jun. 89, May. 90, Dec. 92, clothing : Sep. 91, motor fuel : Apr. 89, Jan. 90, Mar. 90, Aug. 90, Sep. 90, Jan. 93.

*** Wald test of hypothesis : $\alpha_1 = \alpha_2 = ... = \alpha_{12}$.

**** Wald test of hypothesis : $\beta = 0$.

Results model (2), CPI components 1988-95 (cont.)*

	Running costs for cars (exc. motor fuel)	Entertain-ment and recreation	Articles for recreation	Public trans-portation	Vehicles	Food, restaurants	Heating and electricity, owner-occupied housing
α_1	0.007 (0.01)	0.004 (0.02)	0.011 (0.00)	0.020 (0.04)	0.006 (0.00)	0.010 (0.04)	0.032 (0.00)
α_2	0.007 (0.02)	0.000 (0.80)	0.008 (0.00)	0.010 (0.07)	0.004 (0.13)	0.002 (0.30)	-0.001 (0.51)
α_3	0.003 (0.05)	0.000 (0.85)	0.004 (0.03)	0.002 (0.12)	0.004 (0.04)	0.001 (0.51)	-0.002 (0.69)
α_4	0.001 (0.38)	0.005 (0.00)	0.001 (0.51)	0.002 (0.22)	0.005 (0.01)	0.001 (0.37)	0.001 (0.59)
α_5	0.000 (0.86)	0.001 (0.73)	-0.001 (0.47)	-0.001 (0.75)	0.001 (0.58)	0.001 (0.68)	0.002 (0.07)
α_6	0.001 (0.71)	-0.001 (0.68)	0.002 (0.15)	-0.002 (0.64)	0.002 (0.02)	0.002 (0.26)	-0.001 (0.22)
α_7	0.003 (0.06)	0.006 (0.21)	-0.005 (0.01)	-0.011 (0.12)	-0.003 (0.21)	0.004 (0.24)	0.002 (0.60)
α_8	0.001 (0.13)	-0.004 (0.02)	-0.001 (0.68)	0.002 (0.70)	0.000 (0.85)	0.005 (0.13)	0.001 (0.57)
α_9	0.004 (0.03)	0.008 (0.10)	0.004 (0.12)	0.015 (0.01)	0.011 (0.00)	0.000 (0.93)	0.006 (0.03)
α_{10}	0.004 (0.00)	0.002 (0.50)	0.006 (0.00)	0.010 (0.06)	0.005 (0.02)	0.000 (0.90)	0.002 (0.53)
α_{11}	0.002 (0.21)	-0.002 (0.02)	0.004 (0.00)	0.000 (0.65)	0.001 (0.74)	0.002 (0.05)	0.000 (0.81)
α_{12}	0.004 (0.19)	0.002 (0.49)	0.000 (0.83)	-0.003 (0.60)	0.004 (0.01)	0.003 (0.25)	0.002 (0.58)
β	0.179 (0.11)	0.058 (0.64)	-0.029 (0.79)	0.175 (0.08)	-0.148 (0.15)	0.176 (0.00)	-0.095 (0.04)
lag(t-1)	-	-	-	-	0.350 (0.00)	-	-
DUM1**	0.022 (0.00)	0.028 (0.00)	-	0.072 (0.00)	0.020 (0.00)	0.098 (0.00)	0.044 (0.00)
DUM2**	0.022 (0.0)	0.023 (0.00)	-	-	-	-0.030 (0.00)	0.039 (0.00)
DUM3**	0.021 (0.00)	-	-	-	-	-	0.153 (0.00)
DUM4**	0.019 (0.00)	-	-	-	-	-	0.048 (0.00)
R^2	0.69	0.39	0.42	0.65	0.53	0.86	0.92
Breusch-Godfrey serial correlation test	0.28 (0.87)	4.57 (0.10)	0.14 (0.93)	3.55 (0.17)	4.00 (0.14)	1.74 (0.42)	2.46 (0.30)
ARCH test	0.00 (0.97)	1.22 (0.27)	0.04 (0.85)	0.33 (0.56)	0.24 (0.60)	0.62 (0.43)	4.37 (0.04)
Ramsey's RESET test	7.55 (0.01)	3.97 (0.05)	1.50 (0.22)	4.06 (0.04)	0.01 (0.91)	0.06 (0.81)	0.00 (0.99)
Jarque-Bera's normality test	6.80 (0.03)	7.37 (0.03)	1.47 (0.48)	3.28 (0.19)	8.24 (0.02)	1.31 (0.52)	2.35 (0.31)
χ^2-test, deterministic coefficients***	7.00 (0.01)	6.06 (0.01)	10.87 (0.00)	4.21 (0.04)	9.44 (0.00)	4.55 (0.03)	27.54 (0.00)
χ^2-test, stochastic coefficients****	2.66 (0.10)	0.22 (0.64)	0.07 (0.79)	3.10 (0.08)	2.10 (0.15)	19.89 (0.00)	4.66 (0.03)

* Estimated with White's heteroskedasticity-consistent method, p-values in parentheses.

** Dummy variables to remove outliers. Outliers were : operation costs for cars (exc. motor fuel) : Jun. 89, Jan. 90, Jul. 90, Jan. 93, entertainment and recreation : Nov. 89, Jan. 93, public transportation : Jan 91, vehicles : Jan. 93, food, restaurants : Jan. 90, Jan. 92, heating and electricity, owner-occupied housing : Jul. 89, Jan. 90, Mar. 90, Jan. 91.

*** Wald test of hypothesis : $\alpha_1 = \alpha_2 = ... = \alpha_{12}$.

**** Wald test of hypothesis : $\beta = 0$.

Results model (2), CPI components 1988-95 (cont.)*

Component	Fruits, vegetables and berries	Health and medical care	Telephone and postal services	Furniture, carpets and lamps	Books, papers and magazines	Personal care	Electricity and gas, rented dwellings	Footwear
α_1	0.038 (0.01)	0.040 (0.00)	0.010 (0.00)	-0.003 (0.08)	0.006 (0.02)	0.009 (0.04)	0.047 (0.00)	-0.051 (0.00)
α_2	0.017 (0.13)	0.003 (0.01)	0.004 (0.16)	0.004 (0.08)	0.001 (0.21)	0.004 (0.14)	-	-0.025 (0.00)
α_3	0.011 (0.12)	0.002 (0.24)	0.001 (0.42)	0.007 (0.04)	0.002 (0.10)	0.000884 (0.50)	-	0.018 (0.00)
α_4	0.013 (0.04)	-0.000 (0.38)	0.000 (0.57)	0.005 (0.05)	0.001 (0.12)	0.003 (0.15)	-	0.019 (0.00)
α_5	0.016 (0.00)	0.003 (0.10)	0.001 (0.68)	0.003 (0.02)	0.000 (0.42)	0.001 (0.59)	0.002 (0.01)	0.006 (0.00)
α_6	0.004 (0.63)	0.001 (0.05)	0.001 (0.04)	0.00 (0.99)	0.004 (0.01)	-0.001 (0.78)	-	-0.003 (0.13)
α_7	-0.003 (0.88)	0.036 (0.00)	0.007 (0.15)	-0.005 (0.00)	0.010 (0.00)	0.003 (0.03)	0.007 (0.18)	-0.025 (0.00)
α_8	-0.022 (0.07)	0.001 (0.27)	-0.001 (0.37)	0.012 (0.00)	0.000 (0.82)	0.004 (016)	-	-0.002 (0.58)
α_9	-0.021 (0.01)	0.009 (0.22)	0.001 (0.13)	0.005 (0.00)	0.005 (0.00)	0.006 (0.01)	0.000 (0.17)	0.036 (0.00)
α_{10}	-0.010 (0.21)	0.003 (0.04)	0.000 (0.95)	0.000 (0.83)	0.002 (0.21)	0.002 (0.15)	-	0.038 (0.00)
α_{11}	0.002 (0.89)	0.002 (0.07)	0.002 (0.60)	0.002 (0.09)	0.021 (0.00)	-0.001 (0.60)	-	0.009 (0.00)
α_{12}	-0.002 (0.89)	0.004 (0.00)	-0.004 (0.16)	-0.004 (0.03)	0.002 (0.10)	0.003 (0.24)	-	-0.008 (0.00)
β	-0.070 (0.65)	-0.219 (0.03)	-0.016 (0.48)	-0.155 (0.10)	0.051 (0.54)	0.069 (0.25)	0.003 (0.85)	-0.033 (0.80)
lag(t-1)	-	-		-	-	-	-	-0.203 (0.00)
lag(t-4)	-	-		0.397 (0.00)	-	-	-	-
lag(t-6)	-0.245 (0.04)	-		-	-	-	-	-
DUM1**	-	0.070 (0.00)	0.186 (0.00)	-	0.036 (0.00)	0.102 (0.00)	0.166 (1.00)	-0.054 (0.00)
DUM2**	-	0.074 (0.00)	0.043 (0.00)	-	0.027 (0.00)	-0.031 (0.00)	0.061 (0.00)	0.050 (0.00)
DUM3**	-	-	0.040 (0.00)	-	0.018 (0.00)	-	-	-
R^2	0.34	0.83	0.96	0.46	0.88	0.86	0.95	0.89
Breusch-Godfrey serial correlation test	0.09 (0.96)	1.84 (0.40)	7.55 (0.02)	0.65 (0.72)	6.12 (0.05)	5.33 (0.07)	0.02 (0.99)	4.39 (0.11)
ARCH test	3.96 (0.05)	0.56 (0.45)	0.16 (0.69)	0.00 (0.96)	1.40 (0.24)	0.00 (0.96)	0.16 (0.69)	0.13 (0.72)
Ramsey's RESET test	0.45 (0.50)	1.48 (0.22)	0.26 (0.62)	0.75 (0.39)	3.47 (0.06)	3.87 (0.05)	0.00 (0.95)	0.04 (0.85)
Jarque-Bera's normality test	4.87 (0.09)	326.94 (0.00)	58.52 (0.00)	5.92 (0.05)	35.41 (0.00)	4.95 (0.08)	1717.10 (0.00)	0.66 (0.72)
χ^2-test, deterministic coefficients***	7.96 (0.00)	13.92 (0.00)	9.69 (0.00)	3.23 (0.07)	5.46 (0.02)	4.42 (0.04)	51.04 (0.00)	28.25 (0.00)
χ^2-test, stochastic coefficients****	0.21 (0.65)	4.79 (0.03)	0.50 (0.48)	2.84 (0.10)	0.38 (0.54)	1.37 (0.24)	0.03 (0.85)	0.06 (0.80)

* Estimated with White's heteroskedasticity-consistent method, p-values in parentheses.

** Dummy variables to remove outliers. Outliers were : health and medical care : Jan. 91, Jul. 92, telephone and postal services : Jan. 90, Jan. 91, Jul. 92, books, papers and magazines : Oct. 89, Jul. 90, Nov. 91, personal care : Jan. 91, Jan. 93, electricity and gas, rented dwellings : Mar. 90, Jan. 93, footwear Sep. 93, Jan. 94.

*** Wald test of hypothesis : $\alpha_1 = \alpha_2 = ... = \alpha_{12}$.

**** Wald test of hypothesis : $\beta = 0$.

Results model (2), CPI components 1988-95 (cont.)*

Component	House-hold articles	House-hold textiles	Other goods	Other services	Household equipment	Radio and TV	Household appliances	Alcoholic beverages, restaurants	Lodging services
α_1	0.006 (0.00)	-0.007 (0.07)	0.004 (0.15)	0.006 (0.05)	0.008 (0.00)	0.010 (0.03)	0.006 (0.10)	0.000 (0.95)	0.012 (0.25)
α_2	0.006 (0.04)	-0.001 (0.71)	0.002 (0.40)	0.000 (0.33)	0.010 (0.00)	0.006 (0.24)	0.021 (0.00)	0.002 (0.32)	0.000 (0.90)
α_3	-0.001 (0.85)	0.003 (0.28)	0.010 (0.00)	0.001 (0.18)	0.008 (0.00)	0.002 (0.52)	0.007 (0.09)	-0.003 (0.08)	0.004 (0.18)
α_4	0.002 (0.42)	0.002 (0.57)	0.000 (0.93)	0.022 (0.12)	-0.001 (0.64)	-0.002 (0.66)	0.000 (0.80)	0.002 (0.22)	0.003 (0.52)
α_5	0.003 (0.16)	0.004 (0.20)	-0.002 (0.45)	0.000 (0.47)	0.001 (0.66)	-0.007 (0.00)	-0.004 (0.05)	0.001 (0.23)	0.001 (0.84)
α_6	0.005 (0.06)	0.000 (0.98)	-0.002 (0.56)	0.000 (0.33)	0.006 (0.00)	-0.003 (0.22)	0.003 (0.42)	0.001 (0.42)	-0.004 (0.19)
α_7	0.005 (0.19)	-0.005 (0.23)	0.005 (0.02)	0.001 (0.24)	-0.004 (0.40)	-0.001 (0.72)	0.005 (0.29)	0.001 (0.68)	-0.048 (0.00)
α_8	0.001 (0.74)	0.014 (0.00)	0.002 (0.64)	0.000 (0.47)	0.010 (0.00)	-0.006 (0.01)	-0.001 (0.55)	0.009 (0.00)	0.075 (0.00)
α_9	0.007 (0.01)	0.002 (0.26)	0.003 (0.49)	0.000 (0.47)	0.002 (0.43)	0.000 (0.96)	-0.006 (0.11)	0.001 (0.68)	0.017 (0.06)
α_{10}	0.002 (0.24)	-0.001 (0.86)	0.005 (0.07)	0.007 (0.23)	0.006 (0.00)	-0.002 (0.51)	0.001 (0.72)	0.000 (0.86)	-0.001 (0.66)
α_{11}	0.003 (0.17)	0.003 (0.06)	0.003 (0.19)	0.000 (1.00)	-0.001 (0.83)	-0.008 (0.10)	0.002 (0.38)	0.001 (0.58)	-0.001 (0.59)
α_{12}	0.004 (0.17)	-0.001 (0.70)	0.000 (0.69)	0.000 (0.47)	0.004 (0.14)	-0.008 (0.01)	-0.001 (0.79)	0.002 (0.23)	0.001 (0.82)
β	0.202 (0.06)	0.098 (0.37)	-0.250 (0.04)	0.215 (0.01)	-0.231 (0.06)	-0.216 (0.09)	-0.415 (0.00)	0.078 (0.29)	0.149 (0.30)
DUM1**	-0.032 (0.00)	-0.037 (0.00)	-	0.168 (0.00)	0.030 (0.00)	-	-	0.106 (0.00)	0.064 (0.00)
DUM2**	-	-	-	-	-	-	-	-0.023 (0.00)	-0.056 (0.00)
DUM3**	-	-	-	-	-	-	-	-	-0.066 (0.00)
R^2	0.31	0.36	0.18	0.90	0.40	0.23	0.33	0.82	0.83
Breusch-Godfrey serial correlation test	1.56 (0.46)	3.39 (0.18)	5.20 (0.07)	0.14 (0.93)	0.73 (0.70)	2.90 (0.23)	3.66 (0.16)	2.44 (0.30)	2.64 (0.27)
ARCH test	0.08 (0.78)	0.19 (0.66)	0.19 (0.66)	0.39 (0.53)	0.46 (0.50)	0.51 (0.47)	0.00 (0.95)	0.60 (0.44)	0.18 (0.67)
Ramsey's RESET test	0.05 (0.82)	0.60 (0.44)	0.15 (0.70)	4.24 (0.04)	1.44 (0.23)	3.09 (0.08)	0.56 (0.46)	0.89 (0.25)	0.08 (0.78)
Jarque-Bera's normality test	0.97 (0.62)	0.43 (0.81)	4.10 (0.13)	540.93 (0.00)	1.66 (0.44)	0.10 (0.95)	1.19 (0.55)	1.79 (0.41)	19.77 (0.00)
χ^2-test, deterministic coefficients***	12.52 (0.00)	3.29 (0.07)	2.13 (0.14)	4.06 (0.04)	15.15 (0.00)	4.84 (0.03)	2.81 (0.09)	0.00 (0.95)	1.37 (0.24)
χ^2-test, stochastic coefficients****	3.62 (0.06)	0.80 (0.37)	4.31 (0.04)	8.09 (0.00)	3.65 (0.06)	3.03 (0.08)	10.28 (0.00)	1.15 (0.28)	1.11 (0.29)

* Estimated with White's heteroskedasticity-consistent method, p-values in parentheses.

** Dummy variables to remove outliers. The outliers were : household articles : Sep. 94, household textiles : Aug. 93, other services : Apr. 91, household equipment : Jul. 95, alcoholic beverages, restaurants : Jan. 90, Aug. 92, lodging services : Jul. 91, Jul. 93, Aug. 93.

*** Wald test of hypothesis : $\alpha_1 = \alpha_2 = ... = \alpha_{12}$.

**** Wald test of hypothesis : $\beta = 0$.

Appendix D. Seasonality in Net Price Index (NPI)

Model (1) :

$$\Delta_1 \log(NPI_t) = \sum_{s=1}^{12} \alpha_s d_t + \varepsilon_t$$

Results model (1), NPI*

Period (No. of obs.)	1980-95 (191)
α_1	0.010 (0.00)
α_2	0.007 (0.01)
α_3	0.005 (0.00)
α_4	0.005 (0.10)
α_5	0.004 (0.00)
α_6	0.000 (0.72)
α_7	0.002 (0.03)
α_8	0.003 (0.00)
α_9	0.009 (0.00)
α_{10}	0.006 (0.00)
α_{11}	0.003 (0.00)
α_{12}	0.002 (0.05)
R^2	0.22
Var(s)**	8,1
Var(tot)**	37.1

* p-values in parentheses.
** The seasonal variation, Var(s), has been computed from the regressions.
Both measures of variation have been multiplied by 10^6.

Model (2) :

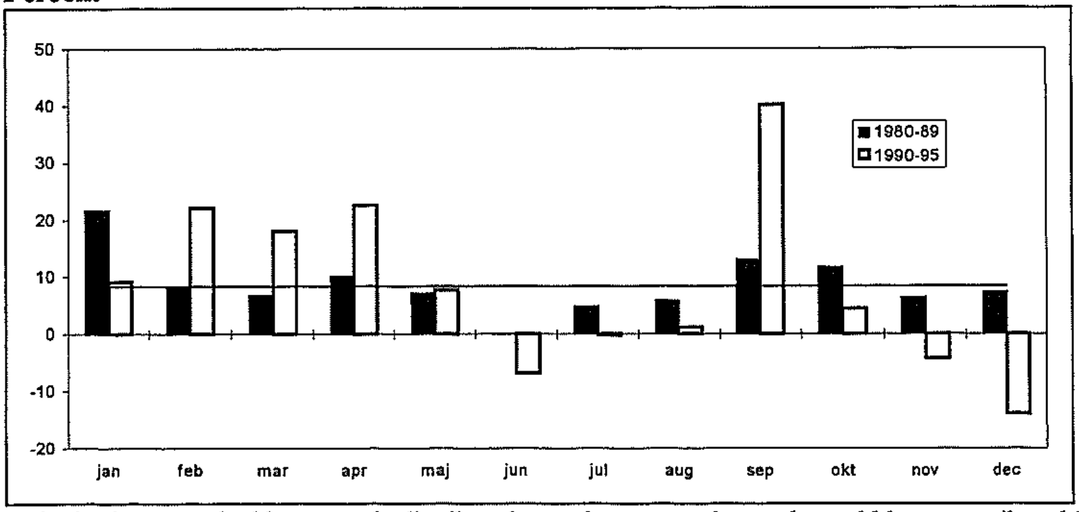
$$\Delta_1 \log(NPI_t) = \sum_{s=1}^{12} \alpha_s d_t + \beta \Delta_1 \log(NPI_{t-12}) + \varepsilon_t$$

Results model (2), NPI*

Period	1980-95
R^2	0.58
p-value deterministic coefficients**	0.00
p-value stochastic coefficients***	0.06

* Estimated with Whites heteroskedasticity-consistent method.
** Wald test of hypothesis : $\alpha_1 = \alpha_2 = ... = \alpha_{12}$.
*** Wald test of hypothesis : $\beta = 0$.

Average contribution to total price increase during a year 1980-95, NPI.*
Percent



* If price increases had been evenly distributed over the year, each month would have contributed 8.33 percent.