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Inflation Persistence in Austria:
First Results for Aggregate and Sectoral Price Series

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Abstract

Based on univariate AR models, the sum of the AR-parameters is defined as a measure of persistence. As for other OECD countries estimates for a long sample period (almost 40 years) show a very high degree of inflation persistence and the presence of a unit root in the inflation process could not be rejected. We find evidence that 3 structural breaks occurred in the inflation process: in the mid seventies, eighties and nineties. If these structural breaks are taken into account, the persistence measures are dramatically smaller. We further investigate the influence of the data frequency, treatment of seasonality, the estimation methods, and the aggregation level of the CPI on both the evidence of structural breaks and the degree of inflation persistence.

Keywords: Structural breaks, inflation persistence
JEL classification: E31, C22, C11

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1. Introduction and Motivation

Inflation persistence refers to the (possibly sluggish) return of the rate of inflation to its long-run mean after a shock occurred. For central banks this is import to know in order to assess the short-run impact of monetary policy decisions. Given that inflation is a monetary phenomenon in the long-run and a central banks main target is to achieve price stability, the degree of persistence has a strong influence for the conduct of monetary policy: The higher inflation persistence the earlier and the stronger a central bank will react to disturbances to inflation in order to maintain price stability.

Mainly based on evidence for the U.S.A. and some other OECD countries a high degree of inflation persistence has been viewed as a key stylized macroeconomic fact, which micro-founded macroeconomic models should replicate.[2] An alternative view is that the degree of inflation persistence is not an inherent structural property of the inflation process, but depends on structural changes in economic processes and the institutional environment, as e. g. the monetary policy regime changes.[3] Hence, it is not only the level of persistence that is of interest but also whether persistence has changed over time.

Levin and Piger (2004) show that in their sample of 12 OECD countries the apparent high degrees of inflation persistence declined considerably if structural breaks in the mean of inflation are taken into account. Benati (2004) provides evidence for 20 OECD countries and the euro area and concludes that for some countries and/or sample periods inflation persistence is characterized by a significant amount of uncertainty and high inflation persistence is not a robust feature of the data.

For the euro area recently several studies were conducted to investigate the Euro area wide, as well as the individual country properties of inflation persistence.[4] As pointed out in Altissimo et al. (2005), there is a considerable degree of heterogeneity across countries, but also in the results of the different studies for the same country. In table 1 we report these estimates for Austria. As can be seen, the persistence estimates for CPI inflation vary considerably from 0.33 to 1.03, the last number implies that inflation is a unit root process.

This paper addresses the issue of the wide range of the inflation persistence estimates for Austria, and tries to shed some light on the reasons driving this

[2] See e.g. Nelson and Plosser (1982), Fuhrer and Moore (1995), Stock (2001), Pivetta and Reis (2004).

[3] See e.g. Bordo and Schwartz (1999), Sargent (1999), Cogley and Sargent (2001), Erceg and Levin (2003).

[4] See O'Reilly and Whelan (2004), Gadzinski and Orlandi (2004), Lünneman and Mathä (2004), Corvoisier and Mojon (2005), Cecchetti and Debelle (2005).

heterogeneity in the results. In doing so, we apply the common empirical strategy of the studies mentioned in table 1. Thus the dynamic process of inflation is characterized in a time series framework of univariate autoregressive (AR) models and the degree of persistence is measured in terms of the sum of the AR coefficients (φ).[5] In estimating inflation persistence measures we take into account the influence of structural breaks in the mean of inflation on the level of persistence. We emphasize also the treatment of seasonality which is very pronounced in our data set. The application of standard seasonal adjustment procedures may have undesirable properties, which could introduce an upward bias in the persistence estimates (see Ghysels, 1990). Finally, we investigate the influence of the sample length and the frequency at which the data are observed on results of the structural break tests and the persistence estimates.

The remainder of the paper is organized as follows. In section 2 the data set used for the empirical analysis is described. The econometric methods for estimating the structural breaks and persistence measures are the focus of section 3. In sections 4 and 5 we present the estimates for the number and location of structural breaks and the degree of persistence in the inflation series, respectively. In this discussion we highlight the influence of (i) the treatment of seasonality, (ii) the length of the sample, (iii) the data frequency, (iv) the price variables used and (v) the level of aggregation.

2. Data

As the Governing Council of the ECB holds its monetary policy decision meetings every month it would be appropriate to analyze also the dynamic properties of the inflation process at the monthly frequency. However, most of the empirical evidence in the related literature uses quarterly data and monthly inflation observations are extremely volatile, possibly because of measurement errors or temporary factors unrelated to the underlying inflation trends (see charts 1 and, 2 and table 2). Thus, we present most of the results for quarterly and monthly data and highlight differences in the empirical results due to the frequency of the observations.

2.1 Data Sets and Sources

To analyze the (possibly time varying) properties of inflation persistence in Austria, we use inflation data for different observational frequencies and different levels of aggregation for the period 1966 to 2004. As aggregate price series, which are available on a quarterly frequency, we use four series for the sample period

[5] See Rumler (2005) for estimates of New Keynesian Phillips Curve type equations for Austria.

1966:Q1 to 2004:Q4: GDP deflator (PGDP), private consumption deflator (PCP), wholesales price index (WPI) and consumer price index (CPI).

For the sectoral analysis, two different definitions of CPI subaggregate time series are used at the quarterly and monthly frequency. The first classification is based on the 'use'-classification employed by the Statistics Austria before the COICOP system was introduced in 1996. We slightly deviate from this 10-sector classification as we aggregate food and beverages with tobacco to a single category.[6] The CPI data based on the 'use'-classification are available from 1966:M01 to 2004:M12.

Second, for the period 1977:M01 to 2004:M12 as another sectoral breakdown a data set based on a 'main groups' definition is applied. This definition comes as close as possible to the harmonized index of consumer prices (HICP) subaggregates employed by the ECB, but is built on CPI data instead.[7] Monthly price series for the HICP and its 5 main groups are used for the period 1987:M01 to 2004:M12.

Finally, a data set with monthly time series for 234 individual CPI items (the lowest aggregation level of data – i. e. products – published by Statistics Austria) for the sample period 1977:M01 to 2004:M12 was created.[8] As some of this series show either a very erratic or to the contrary very infrequent discrete price changes (as e.g. postal services) we excluded these 'weird series' which left us with 181 time series of individual CPI items.

With the individual item data factitious subaggregates (main groups and use categories) were created for a comparison with the official subaggregates to get an impression of the representativity of the 181-items subsample for the CPI and its subaggregates (see table 3). The representation based the CPI weights represented by the 181 items is at the highest 50% and declining to 32% for the most recent CPI basket. But based on correlations of year-on-year rates of changes of factitious CPI aggregate with the official aggregate CPI the 181-items subsample matches the official data reasonably well, especially for the period before 2001. However, as shown in table 3, based on the main group definition, services products are underrepresented. One has to keep in mind that constructing long enough time

[6] The 9 use-categories are: food, beverages and tobacco (FB), housing (rent and maintenance; HO), electricity and heating (EH), furniture and household equipment (FH), clothing and personnel equipment (CE), cleaning (apartment, linen and clothes; CL) body and health care (BH), leisure and education (LE) and transport (TT).

[7] The 5 main groups are: unprocessed food (UF), processed food (PF), energy (EN), non-energy industrial goods (NI) and services (SE).
Both data sets were compiled by the Austrian Institute of Economic Research (WIFO) based on published data by Statistics Austria.

[8] The main effort in this task was set by Ernst Glatzer from the Statistics Unit of the Economic Analysis Department of the OeNB, in collaboration with Statistics Austria. This data set was available till April 2003 and was updated by WIFO till December 2004.

series to employ structural break tests comes with the cost that 'modern' products, such as e. g. computers or CD players – which are today a standard in many households – are not included in the 181-items CPI basket. Therefore the expansions of products included in the CPI baskets 1986 and 1996 are necessarily not reflected in the list of the 181 items, and as a consequence the representativity of the subsampleof products has to deteriorate with time.

2.2 Seasonality

As shown in charts 1 and 2 a strong seasonal variation and changes in the seasonal patterns are important time series features visible in (Austrian) CPI data. A closer look at these seasonal properties reveals that changes in the seasonal patterns coincide with changes in the base years and/or changes in statistical concepts and definitions for national accounts based price series (PGDP and PCP). Also for the CPI and its subaggregates changes in the seasonal patterns coincide with changes in the goods baskets (reweighting plus inclusion of new products or exclusion of outdated products) in the years 1976, 1986, 1996 and 2000.[9] Additionally, in 1995 Statistics Austria started to account for price changes due to sales and promotions. As expected the product subcategories clothes and personnel equipment (CE) and non-energy industrial good (NI) were most strongly affected by this change in the CPI concept.

A careful treatment of seasonality is extremely important in estimating the degree of persistence, as very volatile unadjusted series show considerably lower persistence. The previous literature tackled this issue by using seasonally adjusted data, without a further investigation of the possible consequences of seasonal adjustment on the results. As Ghysels (1990) and Ghysels and Perron (1993) point out, the application of seasonal adjustment procedures as X11 has a smoothing effect on the time series with the undesirable consequence of (most likely) inducing an upward bias in persistence, the parameter we want to estimate.

We address the issue of seasonality by applying 5 different treatments of seasonal adjustment for the quarterly data to analyze the effect of seasonal adjustment on the estimated structural breaks and persistence measures. As a benchmark seasonal model we applied Tramo/Seats (Gómez and Maravall, (1994A, B, 2001A, B)) for outlier detection and correction and seasonal adjustment to 4 subperiods to address the issue of changing seasonal pattern (we refer to this adjustment procedure as Tramo/Seats_I later in teh text). The four subsamples are the periods for which the various SNA/ESA base years or definitions (for national accounts based data) and the various CPI baskets were in use. For both sets of

[9] A change in the goods basket becomes visible in the rate of inflation with a lag of one year. So the changes in the seasonal patterns in charts 1 and 2 if they occurred are visible from 1977, 1987, 1997 and 2001 onwards.

series these periods highly overlap and we estimated seasonal models for the following subsamples: 1966:Q1 – 1976:Q4, 1977:Q1 – 1986:Q4, 1987:Q1 – 1996:Q4 and 1997:Q1 – 2004:Q4.[10] With respect to outliers, all spikes according to VAT changes (1973, 1976, 1978, 1981, 1984, 1992) and changes in energy taxes (1980, 1981, 1984, 1992, 1994, 1996, 2000) in the sample periods has been removed by Tramo. Therefore, the identified structural breaks in section 4 should not be due to changes in main excise taxes.

As a second seasonal adjustment procedure we use an autoregressive model of order 4 with seasonal dummy variables applying a different set of dummies for each of the four subsamples described above and also period specific constant and persistence terms. The influences of deterministic seasonality represented by the seasonal dummies effects were then removed from the series. A formal representation of this approach for quarterly data is given by the following equations:

$$Y_t = \alpha_0 + \sum_{j=1}^{k-1} \alpha_j I_{jt} + \varphi Y_{t-1} + \sum_{j=1}^{k-1} \varphi_j I_{jt} Y_{t-1} + \sum_{h=1}^{3} \gamma_h \Delta Y_{t-h} + \sum_{j=1}^{k} \sum_{i=1}^{3} \beta_{ij} I_{jt} S_{ijt} + u_t$$

$$y_t = Y_t - \sum_{j=1}^{k} \sum_{i=1}^{3} \hat{\beta}_{ij} I_{jt} S_{ijt} = \hat{\alpha}_0 + \sum_{j=1}^{k-1} \hat{\alpha}_j I_{jt} + \hat{\varphi} Y_{t-1} + \sum_{j=1}^{k-1} \hat{\varphi}_j I_{jt} Y_{t-1} + \sum_{h=1}^{3} \hat{\gamma}_h \Delta Y_{t-h} + \hat{u}_t$$

where I_{jt} (j=1,...,k) are indicator variables for specific subsamples with $I_{jt} = 1$ within subsample j and 0 otherwise. $S_{it} = D_{it} - D_{4t}$, $(i = 1,\ldots,3)$ are rescaled seasonal dummies, which sum up to zero (see Osborne and Sensier, 2004). y_t (Y_t) is defined as the seasonal (un)adjusted series.[11]

[10] For the subcategories clothing and personnel equipment and non-energy industrial goods the inclusion of sales prices changed the seasonal pattern starting in 1995. As a consequence for these subindices the last two subsamples are1987:Q1 – 1994:Q4 and 1995:Q1 – 2004:Q4.
The last change in the CPI goods basket occurred in 2000. We considered the two 5-year periods as too short to estimate separate models. Fortunately for these periods the seasonal patterns look quite similar (see chart 2). For the CPI main group categories and the HICP series after taking into account the later start of the sample the subsamples definitions are the same.

[11] In principle, we could include all seasonal dummies in the linear model (1) discussed below. But the approximate critical values for the Andrews and Ploberger (1994) tests are tabled in Hansen (1997) for up to 20 variables. For the monthly series (not reported here) the number of estimated parameters would be too large to apply Hansen p-values, so we followed the approach described above.

As other seasonal adjustment procedures we applied: fourth seasonal difference to outlier adjusted series (D4); X12-Arima (Findley et al., (1998)) to the total sample as the seasonal filter uses moving averages which are in principle able to account for the changing seasonal pattern; Tramo/Seats to the total sample (Tramo/Seats_II).[12] In charts 1 and 2 for the 4 aggregate series and 9 CPI use categories the original, Tramo/Seats_I and Tramo/Seats_II adjusted series are are shown. The last procedure creates the smoothest series and therefore we expect higher persistence estimates for these series.

In the discussion of the results in sections 4 and 5 we use the estimates for quarterly data adjusted with Tramo/Seats_I as a benchmark to which the results based on monthly data and other seasonal adjustment procedures are compared.

3. Methodology

3.1 Persistence Measure

We define inflation πt as the first differences of price series in logarithmic terms

$$\pi_t = \log(P_t) - \log(P_{t-1}),$$

on which the seasonal adjustment procedures described in the previous section are applied. As much of the related literature, we characterize the dynamics of each inflation time series by an univariate autoregressive (AR) model of order p, selected by the Hannan-Quinn (HQ) information criterion with a maximum order of 4 quarters (12 months). Following the discussion in Andrews and Chen (1994) persistence is measured as the sum of the AR coefficients (φ), estimated by the reformulated AR model

$$\begin{aligned}\pi_t &= \alpha_0 + \alpha_1\pi_{t-1} + \cdots + \alpha_p\pi_{t-p} + \varepsilon_t \\ &= \alpha_0 + \varphi\pi_{t-1} + \sum_{i=1}^{p-1}\beta_i\Delta\pi_{t-i} + \varepsilon_t \quad .\end{aligned}$$

The persistence parameter (φ) is estimated for the total sample and for subsamples conditional on the occurrence of structural breaks in the mean of the inflation process. We apply (multiple) structural breaks tests introduced by Andrews and Ploberger (1994) and Bai and Perron (1998, 2003A) and estimate the number and dates of the break points. In the following we give a brief sketch of these tests.

[12] Tramo/Seats_I stands for the seasonal adjustment applied to 4 subsamples, whereas Tramo/Seats_II indicates the use of all observations.

3.2 Andrews-Ploberger Structural Break Tests

Consider a univariate time series yt, (t = 1,...T), which under the null hypothesis is i.i.d. with a constant mean μ and finite variance. Under the alternative, y_t is subject to a single change in mean at some unknown break date T_b,

$$y_t = \mu_1 + \mu_2 1(t > T_b) + e_t \tag{1}$$

with et~i.i.d.(0,σ2e) and 1(•) is an indicator function for the break [i.e.,1(•) = 1 for $t>T_b$, and T_b= 0 otherwise]. Letting $F_T(T_b)$ be the Wald (or LM or LR) test statistic of the equality of the coefficients $\mu_1 = \mu_2$ under the null hypothesis, that there is no break, Quandt (1958, 1960) introduced what is now known as supF test, that the most probable break date is T_b where $F_T(T_b)$ takes the highest value. However, as T_b is a nuisance parameter, that appears only under the alternative hypothesis the limiting distribution is non-standard and was unknown until Andrews (1993) generalized the solution to this problem and proposed the test statistic

$$SupF_T = \sup_{T_1 \le T_b \le T_2} F_T(T_b),$$

now known as Andrews-Quandt test, derived its asymptotic properties and asymptotic critical values. T_1 and T_2 are the lower and upper bound defining the range within the possible break point is located. Andrews and Ploberger (1994) proposed an analogous class of tests that a single structural change occurs at an unknown date, but with stronger optimality properties and introduced

$$ExpF_T = \ln\left(\frac{1}{T_2 - T_1 + 1}\sum_{T_b = T_1}^{T_2} \exp\left(\tfrac{1}{2} F_T(T_b)\right)\right),$$

which is an exponentially weighted average of the test statistics $F_T(T_b)$. Hansen (1997) presented an approximation of the asymptotic p-value function for $ExpF_T$ (and $AveF_T$).[13]

In our application to test for single breaks in the unconditional mean of inflation, we apply Andrews-Ploberger's $ExpF_T$ test with Hansen's approximate p-values, use the LM statistic for F_T and follow the usual convention and exclude the first and last 15% of the observations from the consideration as potential structural change dates (T_1=0.15T, T_2=0.85T).

Based on simulation results discussed in Vogelsang (1997, 1999), Perron (2005) conjectures that most test will suffer from important power problems if the number of breaks under the alternative hypothesis is higher than the number of breaks

[13] Andrews and Ploberger (1994) also proposed an $AveF_T$ test, which is not presented here, as the authors express a mild recommendation for $ExpF_T$ (p. 1398). However, based on simulation results Andrews et al. (1996) recommend $AveF_T$ for small shifts and $ExpF_T$ for moderate to large shifts.

explicitly accounted for in the construction of the tests. Hence, substantial power gains may result from applying multiple structural change tests. Therefore we also applied Bai and Perron's (1998, 2003A) test to account for multiple break points in the sample period.

3.3 Bai – Perron Multiple Structural Break Test

Bai and Perron (1998, 2003A) discuss the issue of estimating and testing break dates in a linear regression model with *m* unknown breaks (or *m*+1 regimes) of the form

$$y_t = x_t'\beta + z_t'\delta_j + u_t \qquad t = T_{j-1} + 1,...,T_j \tag{2}$$

for $j = 1,...,m+1$, with y_t is the dependent variable, x_t (p x 1) and z_t (q x 1) are vectors of possible covariates with the corresponding parameter vectors β and δ_j, respectively, and u_t represents the error term at time t. The unknown break points $(T_1,...,T_m)$ and the unknown regression parameters β and δ_j are jointly estimated.[14] Equation (2) represents a partial structural change model since the vector β is not subject to shifts. When $p = 0$ the pure structural change model is obtained.
In matrix notation the model has the form

$$Y = X\beta + \overline{Z}\delta + U \ ,$$

where $Y = [y_1,...,y_T]'$, $X = [x_1,...,x_T]'$, $U = [u_1,...,u_T]'$, $\delta = [\delta_1',\delta_2',...,\delta_{m+1}']'$ and $\overline{Z}$ is the matrix which diagonally partitions Z at $(T_1,...,T_m)$, i.e. $\overline{Z} = \text{diag}[Z_1', Z_2',...,Z_{m+1}']$ with $Z_i = [z_{T_{i-1}+1},...,z_{T_i}]'$.

The estimation method is based on the least-squares principle. For each *m*-partition $(T_1,...,T_m)$, the associated least-squares estimates of β and δj are obtained by minimizing the sum of squared residuals

$$U'U = (Y - X\beta + \overline{Z}\delta)'(Y - X\beta + \overline{Z}\delta) = \sum_{i=1}^{m+1} \sum_{t=T_{i-1}+1}^{T_i} (y_t - x_t'\beta - z_t'\delta)^2 \ .$$

Let $\hat{\beta}(\{T_j\})$ and $\hat{\delta}(\{T_j\})$ be the estimates for a given partition $(T_1,...,T_m)$ denoted $\{T_j\}$ and substituting these in the objective function and denoting the resulting sum of squared residuals as $S_T(T_1,...,T_m)$, then the estimated break points are such that

$$(\hat{T}_1,...,\hat{T}_m) = \arg\min_{(T_1,...,T_m)} S_T(T_1,...,T_m) \,,$$

where the minimization is taken over some set of admissible partitions (see section 3.1 and chart 1 in Bai and Perron, 2003A). The regression estimates are those with the associated *m*-partition $\{T_j\}$. A method based on a dynamic programming

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[14] By convention $T_0 = 0$ and $T_{m+1} = T$.

algorithm to efficiently compute these estimates is presented in Bai and Perron (2003A).

They considered the *supF* type test of no structural break *i.* e., $m = 0$ vs. $m = \text{k}$ breaks. Let $(T_1,...,T_k)$ be a partition such that $T_i = T\lambda_i$ $(i = 1,...,k)$ and R be a matrix such that $R\delta = (\delta_1{}'-\delta_2{}',....,\delta_k{}'-\delta_{k+1}{}')$ and define

$$F_T(\lambda_1,...,\lambda_k;q) = \frac{1}{T}\left(\frac{T-(k+1)q-p}{kq}\right)\hat{\delta}'R'(RV(\hat{\delta})R')^{-1}R\hat{\delta}$$

with $V(\hat{\delta})$ is an estimate of the variance-covariance matrix of $\hat{\delta}$ that is robust to serial correlation and heteroscedasticity, the proposed test is the type $SubF_T = F_T(\hat{\lambda}_1,...,\hat{\lambda}_k;q)$, where $(\hat{\lambda}_1,...,\hat{\lambda}_k)$ minimize the global sum of squared residuals. The asymptotic distribution of this test is non-standard and tabulated in Bai and Perron (1998, 2003B) and depends on the trimming parameter $\varepsilon = h/T$, where h is the minimum length of a segment.

In addition Bai – Perron propose a test of ℓ vs. $\ell+1$ breaks, $SupF_T(\ell\,|\,\ell+1)$ to perform a sequential testing procedure, i. e. applying of $\ell+1$ tests of the null hypothesis of no structural change vs. the alternative of a single change. The test is applied to each segment containing the observations $\hat{T}_i - 1$ to $\hat{T}_i$, $(i = 1,...,\ell+1)$. Bai – Perron conclude for a rejection in favor of a model with $\ell+1$ breaks if the overall minimal value of the sum of squared residuals is sufficiently smaller than the RSS from the ℓ breaks model.

Bai – Perron discuss also the application of a BIC and a modified Schwartz information criteria (LWZ, as it was introduced by Lui et al., 1997). They conclude from simulation studies that the BIC and LWZ works well under some conditions, while performs less so in the presence of serial correlation in the errors, as the chosen number of breaks is too high.

Next, the most important assumptions imposed on the regressors and errors in the Bai – Perron framework are briefly mentioned.15 It is allowed for the distribution of the regressors to vary across regimes but it is required that they are weakly stationary stochastic processes. Hence, integrated variables are precluded as regressors. A wide class of potential correlation and heterogeneity (also conditional heteroscedasticity) and lagged dependent variables are allowed, but error terms with a unit root are ruled out.

In the empirical implication to test for multiple breaks in the unconditional mean of inflation we selected a pure change model with an intercept only. We have chosen a minimum span of 24 quarters (72 months) which lead to a trimming parameter for the total sample of around 15%. In the testing procedure we allowed

[15] See Bai and Perron (1998, 2003A, B) for details and Perron (2005) for possible relaxations of these assumptions.

a maximum number of 4 breaks, and have chosen the BIC as a selection criterion for the number of breaks. Although the properties of this selection criterion is in some occasions less favorable to the sequential subF test, for the estimates of the 181 individual CPI items and the many variants of the model we estimated, the last procedure is computationally too burdensome.

For shorter sample periods (1977 – 2004) [1987 - 2004] we also reduced the parameters for the minimum span (20 quarters) [16 quarters] and the maximum number of breaks (2) [3].

4. Results of the Structural Break Tests[16]

In this section we discuss the results on the estimated number and the dates of structural breaks for the inflation series described in section 2. We applied break tests according to Andrews and Ploberger (1994) and Bai and Perron (1998, 2003A) discussed in section 3.

The overall evidence based on the aggregate, sectoral and item level structural change analysis is consistent, in the way that in the mid eighties and early/mid nineties structural breaks in the unconditional mean of the rate of inflation series are detected. For all aggregate series and CPI subaggregate series break points are shown in the time intervals 1982:Q2 – 1986:Q3 (except body and health care) and 1993:Q3 – 1995:Q4 (except for transport; see table 4A). In addition, for the GDP deflator and the CPI-total and some CPI subaggregates also in the mid/late seventies a structural break is detected (1974:Q1 – 1977:Q3).

According to the evidence based on the 181 individual CPI items an accumulation of break points is also found in the mid eighties and nineties (see chart 3).

For monetary policy analysis and inflation forecasting especially the last break date is the most important one, as forecasts based on data before the break occurred, could give misleading signals about the future dynamics of inflation.

Next we discuss the stability of this evidence with respect to the estimation method, data frequency, the sample period and the various treatments of seasonality.

As most series exhibit more than one break according to the Bai – Perron test, hence the results of these two tests are not totally comparable. However, the single

[16] The estimation results are presented in tables 4 to 13. Panels A contain the results of the structural break tests. In panels B the OLS estimates for the intercept and the persistence parameters for the total sample as well as for various subsample according to the structural breaks detected for this series are shown To safe space we refer to table x – panel A and table x - panel B as table xA and. table xB, respectively (with x = 4 to 13). Tables 4 to 9 present the results for quarterly data, whereas for monthly data the results are in tables 10 to 13. The results of different treatments of seasonality could be found in tables 6 to 9.

break dates detected by the Andrews-Ploberger test are in almost any case also detected by the Bai - Perron procedure. For all of the aggregate series and most of the CPI subindices the Andrews-Ploberger test detects the break in the mid eighties. Therefore for these series, although there are possibly additional breaks, this evidence suggests that the most dominant break in the inflation process occurred in the mid eighties.

A comparison of quarterly and monthly CPI series shows, that the frequency of the data does not have an important influence on the number and dates of structural breaks, if the trimming parameter, which means the minimum time span between to possible breaks, is equivalent (table 4A and table 10A). The break point in the mid seventies is not detected for the monthly CPI-total and for some CPI-subaggregates. But more important, for the last break, when it is detected using quarterly series it is also detected in the monthly series (except transport).

When analyzing the consequences of a shorter sample, one has to decide either holding the minimum time span between two consecutive breaks constant and therefore increasing the trimming parameter for the shorter sample or doing it the other way round i.e. a constant trimming parameter and thus a shorter minimum span for the shorter sample. We decided for the first option (see table 4 A vs. table 5A and table 10A vs. table 11A).

The comparison of the estimates for the total sample (1966 - 2004) with shorter subsamples for both quarterly data (see table 4 A vs. table 5A) as well as for the monthly data (see table 10A vs. table 11A and table 12A) for a medium (1997 – 2004) and a short (1987 – 2004) sample period shows a good correspondence of the estimated break points.

For the sample 1987 – 2004 we can compare the CPI results with the HICP inflation series (see table 12A vs. table 13A). There is a high accordance in the timing of the break dates between this two price concepts. The Bai-Perron test also depicts not more than one break point and the estimated dates show in almost all cases a perfect correspondence with the Andrews-Ploberger findings.

With respect to the various seasonal adjustment procedures, we found that for the seasonal dummy variable approach (table 6A) a lower number of breaks is estimated for the CPI subindices: in 4 out of 8 cases where a break in the benchmark case (table 4A) is found for the mid nineties no breaks are detected if data based on a seasonal dummy variable adjustment are applied. For the seasonal fourth differences adjustment (table 7A) overall the accordance for the aggregate and subaggregate series is reasonably consistent. The X12-adjusted series show for the aggregated as well as for the subindices a lower number of breaks (table 8A). The accordance with the benchmark is very good for the break in the eighties, whereas there is less evidence for the CPI subaggregates for breaks in the seventies and nineties. For the smoother Tramo/Seats_II series (table 9A) the pattern in the number of the detected break point and the overall location is very similar, but in some cases the difference to the same break point in table 4A is as large as 4 years.

5. Results of the Inflation Persistence Estimates

In this section we present OLS estimates of the persistence measures. As seasonal adjustment tends to induce an upward bias in the persistence estimates and as OLS point estimates have a downward bias for highly persistent series (for φ>0.7 or so) these effects balance to some (unknown) extent. Especially for subsamples the OLS estimates are quite low, thus OLSestimates should be appropriate (see Cecchetti and Debelle, (2005)).

For the estimates of the total sample over 4 decades we can confirm the international evidence of high inflation persistence also for Austria (see table 4B). For the aggregate as well as for the subaggregates series persistence estimates in many cases are well above 0.8 and a unit root could probably not be rejected for many series. However, if the occurrence of structural breaks is taken into account, the persistence estimates for the subsample are much lower and in several cases they became negative and insignificant.

Overall these results hold also for monthly data (table 10B), but for some subindices the estimates based on monthly series are considerably smaller, reflecting the higher volatility of this series.

As the sample size is reduced to a sample of medium size (1977 – 2004; table 4B vs. table 5B and table 10B vs. table 11B) and to a short one (1987 – 2004; table 10B vs. table 12B and table 13B) in general also the estimated persistence measures decrease.

With respect to the seasonal adjustment procedures we find that for series adjusted with seasonal dummy variables, the estimates for the CPI and its subaggregates with the total sample are (slightly) lower (table 6B). The opposite is true in the case of a seasonal differences treatment of seasonality: the estimates for (φ) are larger (table 7B). X12 (table 8B) and Tramo/Seats_II (table 9B) adjusted series show roughly the same persistence estimates, in some cases even smaller values. This is surprising as X12 and Tramo/Seats_II adjusted series look smoother then Tramo/Seats_I adjusted series. Overall, in our case study we found only a minor effect of the seasonal adjustment procedure for the persistence estimates.

6. Summary

In this study we present empirical results for the occurrence of structural breaks and the level of persistence for aggregate inflation indicators as well as for and CPI subaggregate time series. We find strong evidence for a structural break in the inflation process in the mid eighties for the aggregate, subaggregate and individual CPI items. For the mid seventies as well as for the mid nineties we find significant breaks at the aggregate CPI level but to a lesser extent for the more disaggregated inflation data. A comparison of the results for the CPI total with its subaggregates reveals that the timing of the detected shifts in the mean tends to be consistent, although some series, as housing and body and health care (and to a lesser extent) transport, tend to follow their own dynamic processes. There is good accordance of the estimated break points for different data frequencies, and sample periods. No difference in the results occurs if CPI data are used instead of HICP data.

The differences with respect to methods of seasonal adjustment indicate some uncertainty with respect to the estimated break points: there is an overwhelming and highly consistent evidence for the occurrence of structural break in the mid of the eighties. For the occurrence of additional breaks in the mid seventies and in the mid nineties the evidence for the CPI-total is also strong, but less so for the CPI subindices.

Persistence in the inflation series is very high when the models are estimated for the total sample of 40 years. But as for other OECD countries this finding is not robust. Once one controls for breaks in the mean of inflation, estimates for persistence are considerably lower, in several cases they become even insignificant. This suggests that the weight of the backward looking part in the formation of inflations expectations decreased over time.

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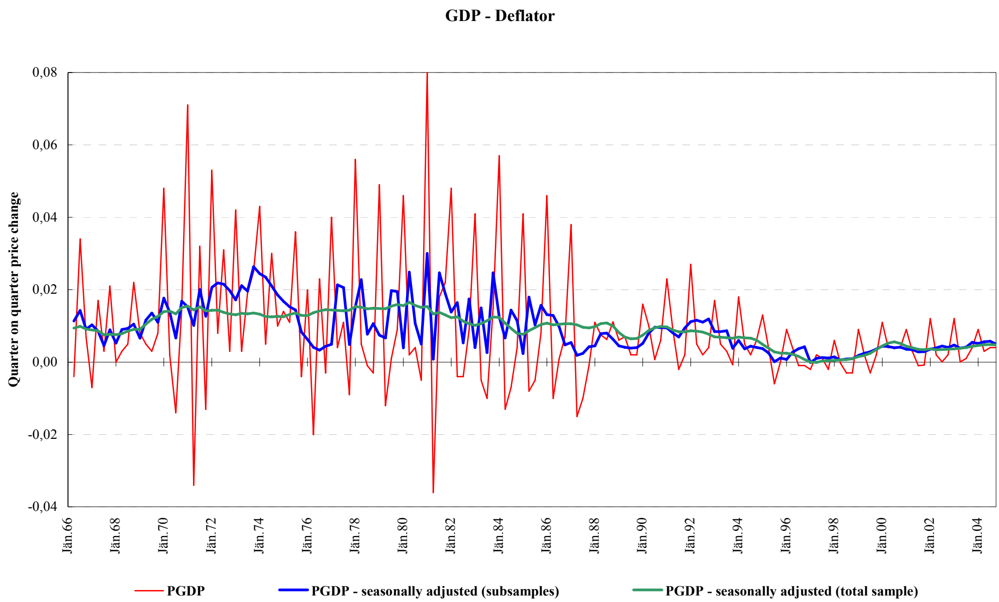
Appendix A: Charts

Chart 1: Aggregate Inflation Series



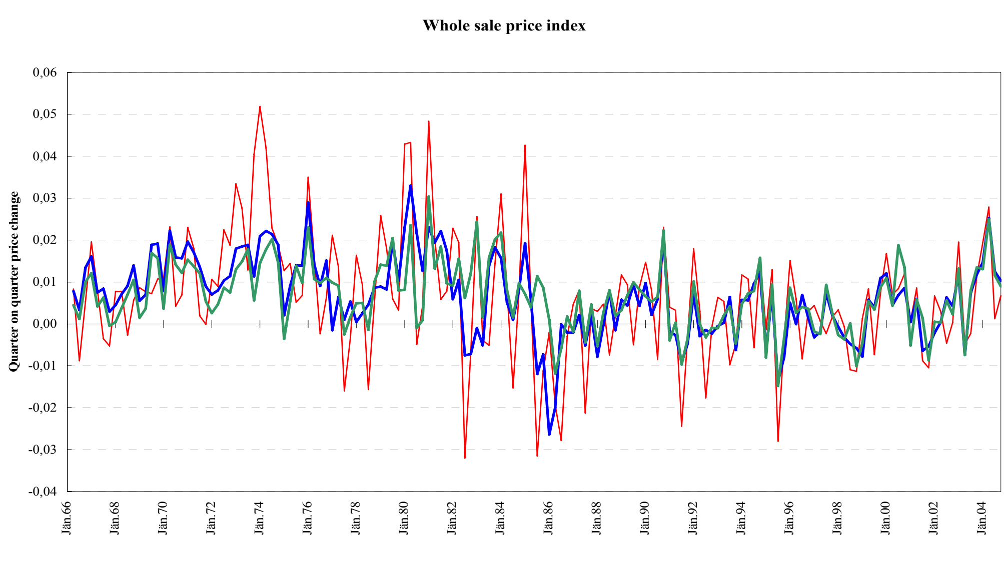
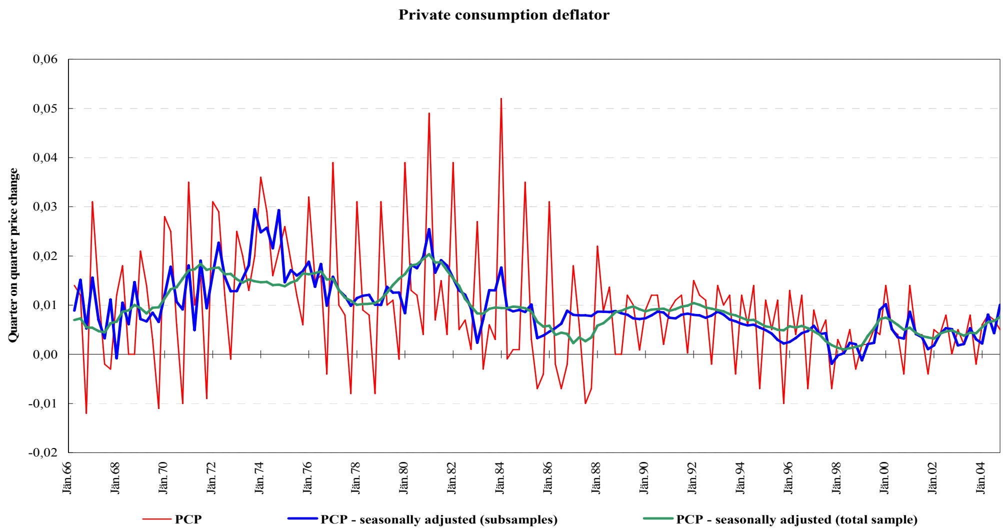


Chart 1 continued: Aggregate Inflation Series



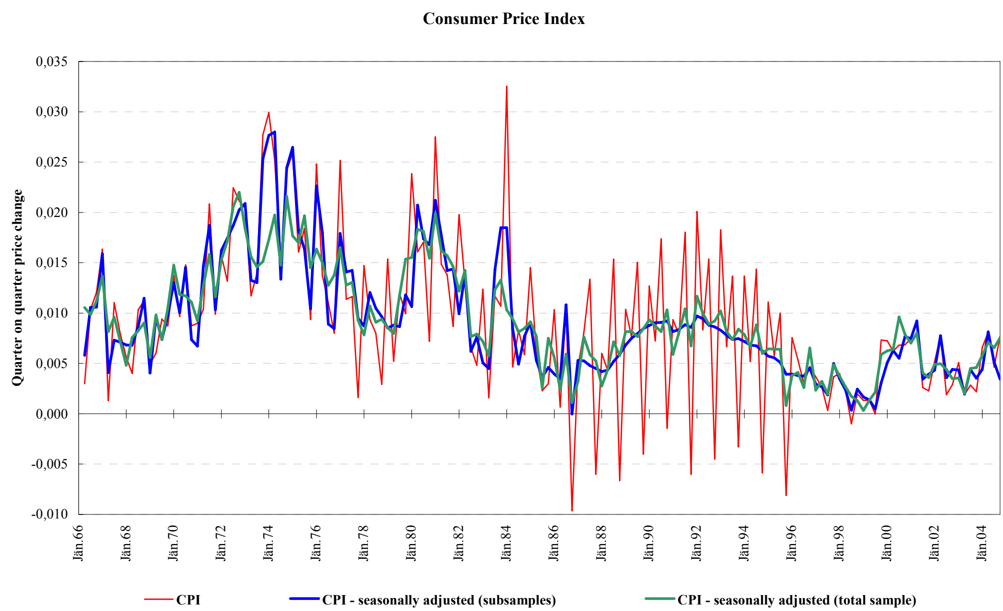
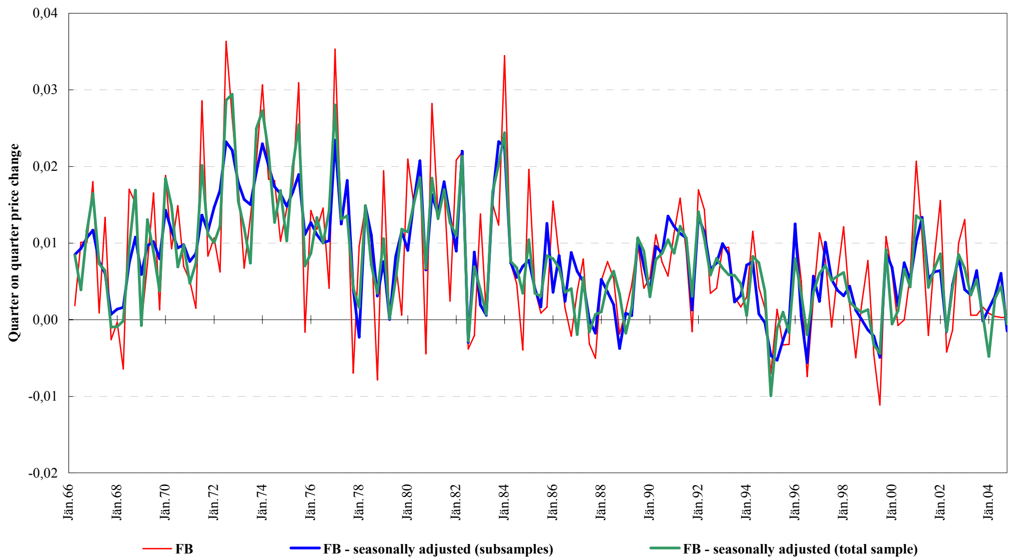


Chart 2: CPI Subaggregate Indices

Food, beverages and tobacco



Housing
(rent and maintance)

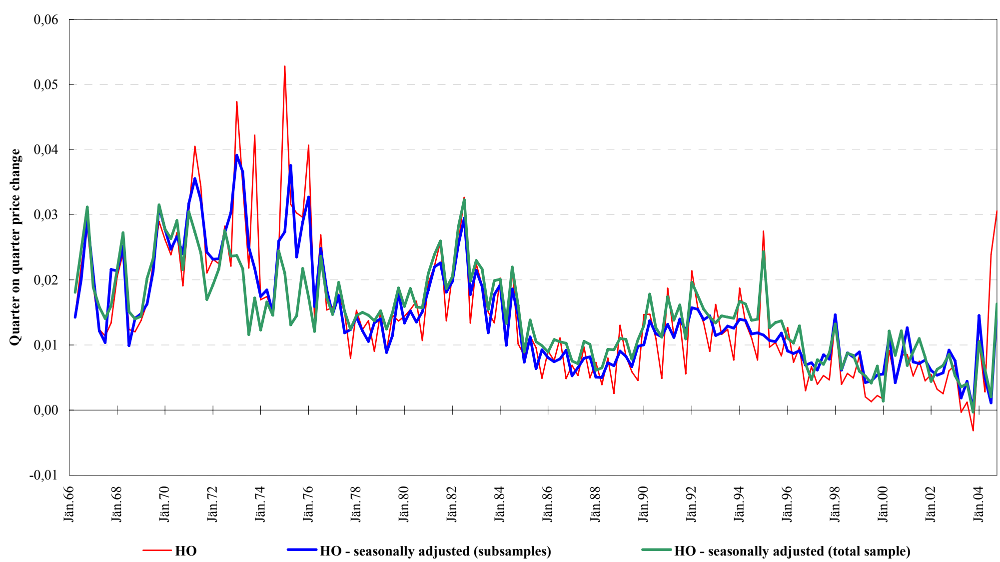
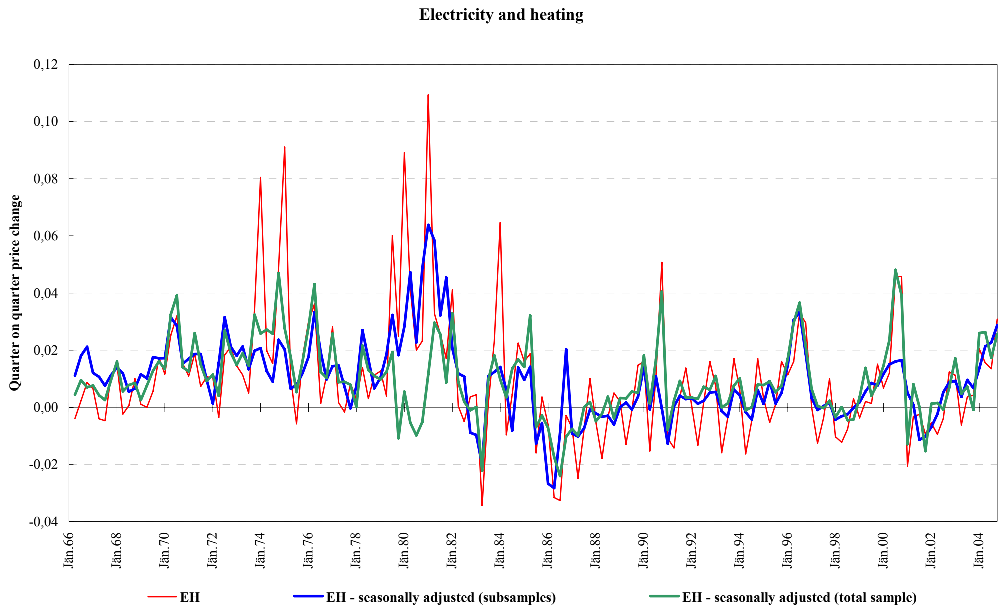


Chart 2 continued: CPI Subaggregate Indices



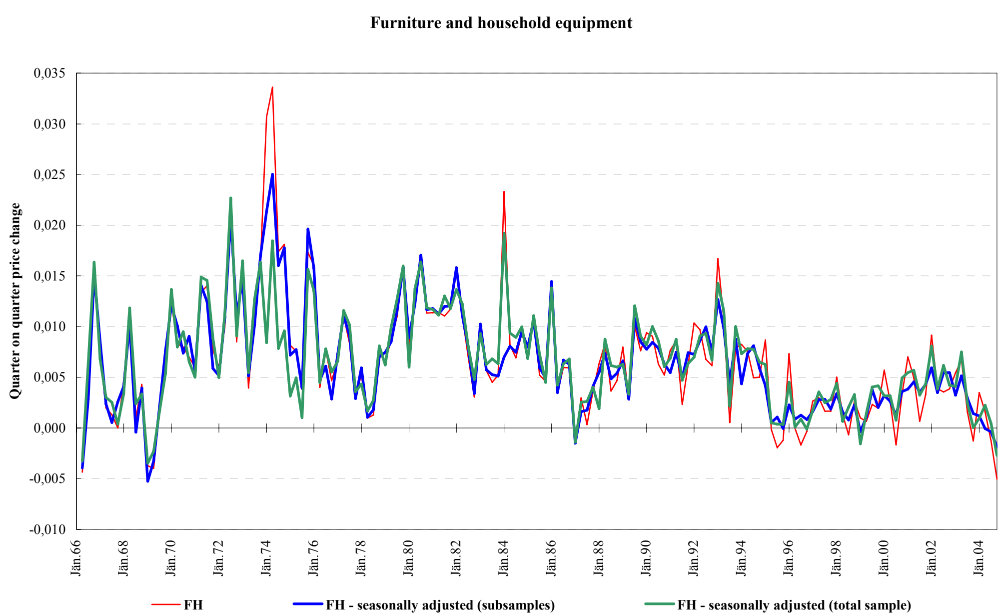
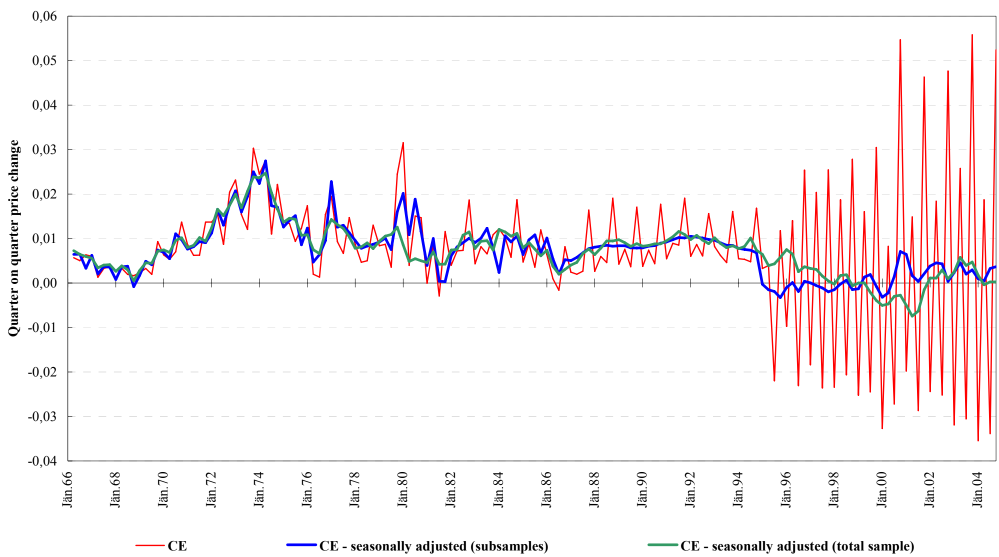


Chart 2 continued: CPI Subaggregate Indices

Clothing and personnel equipment



Cleaning
(apartment, linen and clothes)

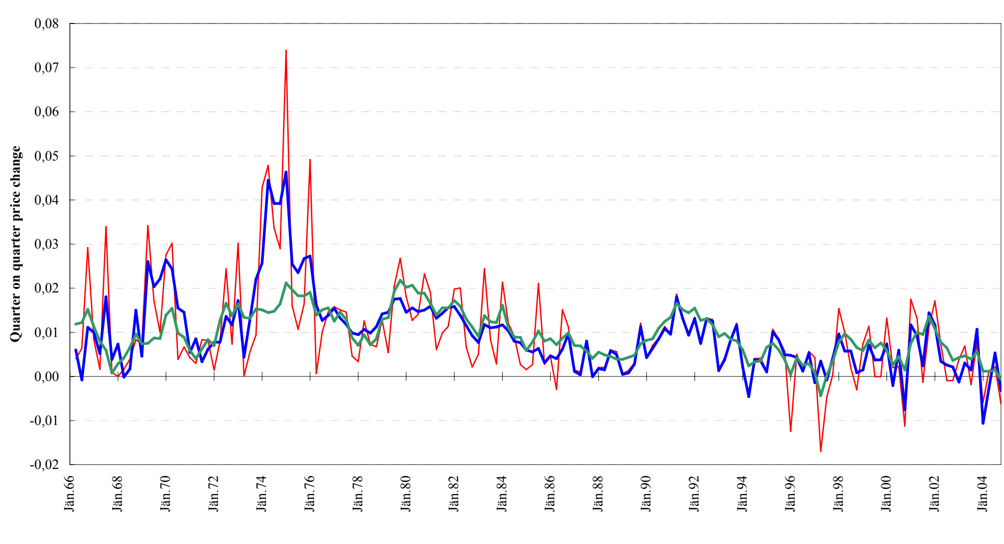
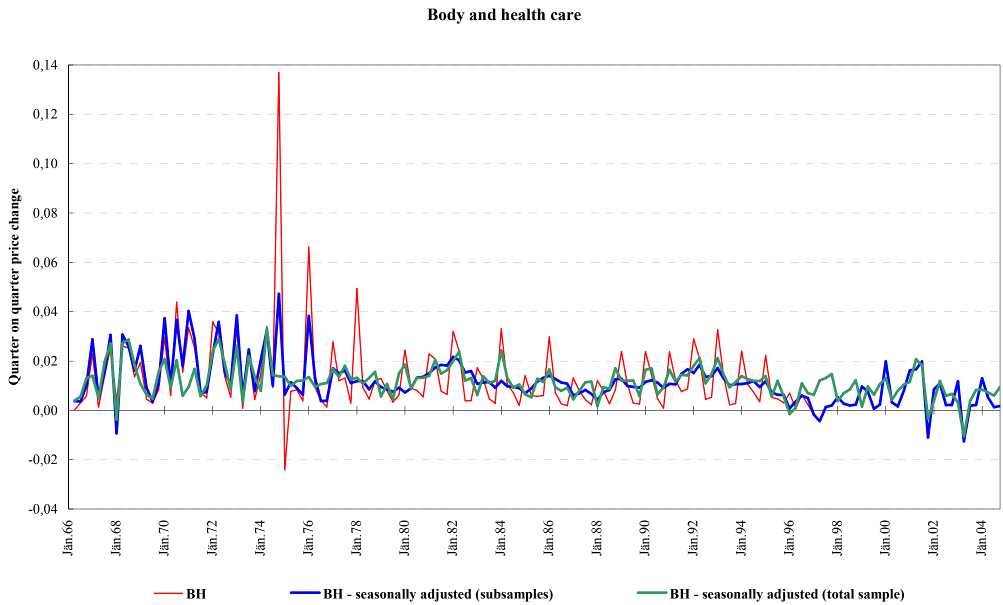


Chart 2 continued: CPI Subaggregate Indices



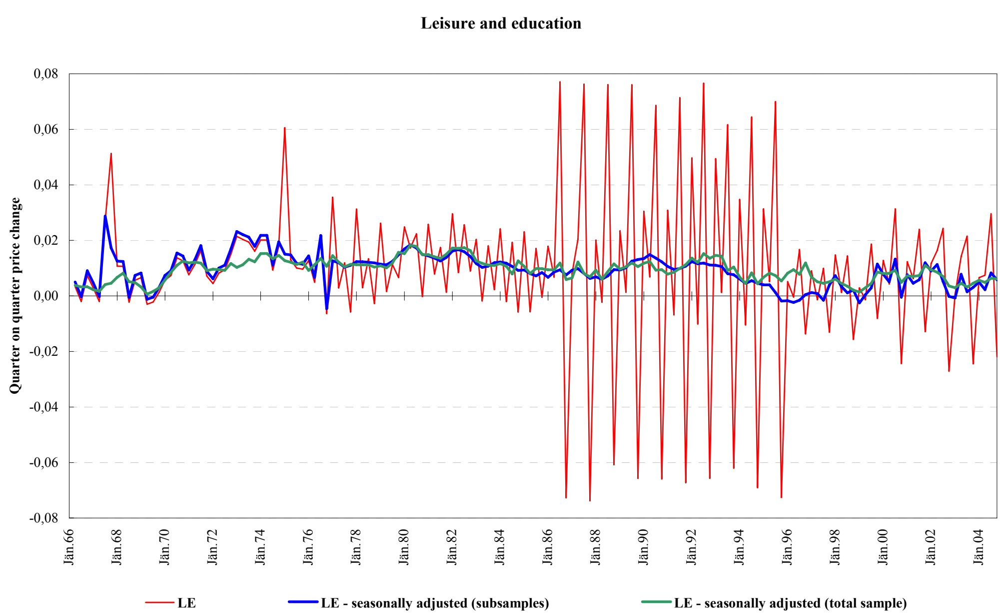


Chart 2 continued: CPI Subaggregate Indices

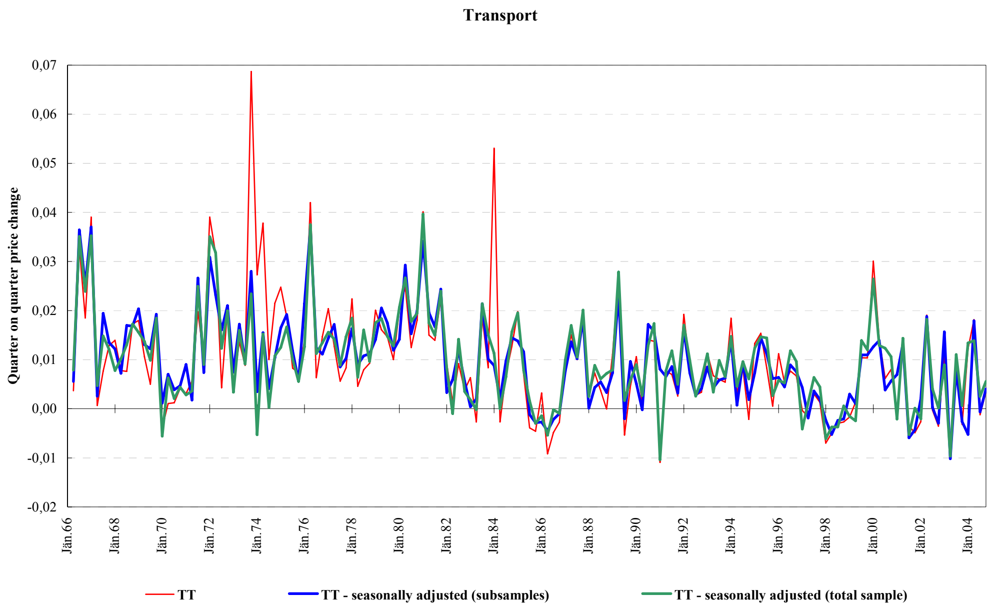
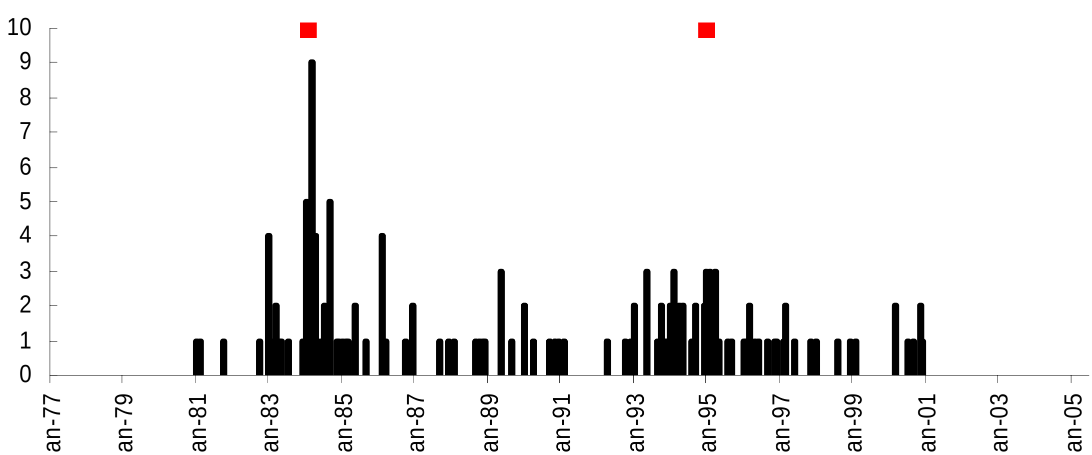


Chart 3: Distribution of Structural Breaks for the 181 Individual CPI items



Note: The squares indicate break points detected for the aggregate CPI for the sample period 1979:M02 to 2004:M12 (table 11 – Panel A).

Appendix B: Tables

Table 1: Evidence on Inflation Persistence for Austria

	Variable	Sample	Frequency	Structural break date	Persistence Method	φ
Gazinski - Orlandi (2005)	PGDP	1988:Q3 - 2003:Q2	Quarterly	1995:Q3	Hansen (1999)	-0.14
	PCP	1984:Q1 - 2003:Q1	Quarterly	–	Hansen (1999)	0.77
	CPI	1984:Q1 - 2003:Q1	Quarterly	–	Hansen (1999)	1.03
Lünnemann - Mathä (2004)	HICP	1995:Q1-2003:Q4	Quarterly	–	OLS	0.43
Ceccetti - Debelle (2005)	HICP	1987:1 - 2003:M1	Montly	1994:M10	OLS	0.33
Benati (2004)	PGDP	1964:Q2 - 2003:Q4	Quarterly	1971:Q2	Hansen (1999)	0.94
	CPI	1950:Q1 - 2002:Q2	Quarterly	1957:Q4	Hansen (1999)	0.44

Table 2: Descriptive Statsitics for Annualized Quarterly Rates of Inflation)*

Series	Obs	Mean	SE	Min	Max	Obs	Mean	SE	Min	Max
		1966:2 1976:4					1977:1 1986:4			
PGDP	43	5.29	8.00	-13.84	27.44	40	4.77	9.76	-14.67	30.78
PCPR	43	5.36	5.19	-4.83	14.15	40	4.60	6.46	-3.21	20.28
WPI	43	5.22	5.13	-3.53	20.22	40	2.62	7.95	-13.00	18.87
CPI	43	5.42	2.77	0.52	11.79	40	4.23	3.13	-3.88	12.81
FB	43	4.76	3.81	-2.58	14.28	40	3.91	4.30	-3.15	13.88
HO	43	9.65	3.84	4.52	20.58	40	5.84	2.36	1.93	12.85
EH	43	6.04	7.64	-2.31	34.86	40	5.73	11.23	-13.99	41.49
FH	43	3.58	3.19	-1.74	13.22	40	3.45	1.78	0.39	9.22
CE	43	4.01	3.00	0.53	11.93	40	3.64	2.70	-1.16	12.43
CL	43	6.32	6.39	0.00	28.52	40	4.46	2.95	-1.18	10.57
BH	43	6.92	9.17	-9.74	51.34	40	4.89	4.18	0.77	19.24
LE	43	4.63	4.90	-2.55	23.52	40	4.51	8.21	-30.19	29.69
TT	43	6.23	5.52	-1.56	26.58	40	4.43	4.72	-3.69	20.68
		1987:1 1996:4					1997:1 2004:4			
PGDP	40	2.43	3.76	-6.05	14.92	32	1.18	1.72	-1.20	4.77
PCPR	40	2.71	3.17	-4.02	8.70	32	1.54	1.86	-2.81	5.56
WPI	40	0.64	4.56	-11.35	9.10	32	1.39	3.70	-4.55	10.98
CPI	40	2.72	3.11	-3.26	7.96	32	1.66	1.09	-0.39	3.65
FB	40	1.86	2.37	-2.98	6.72	32	1.55	2.74	-4.47	8.19
HO	40	4.19	2.08	1.03	10.84	32	2.52	2.56	-1.26	12.06
EH	40	1.17	6.11	-10.06	19.80	32	1.73	6.10	-8.31	17.93
FH	40	2.16	1.67	-0.78	6.63	32	1.01	1.13	-2.02	3.65
CE	40	2.68	3.77	-9.32	10.03	32	0.52	12.34	-14.43	21.72
CL	40	2.31	2.25	-5.03	7.39	32	1.27	3.20	-6.84	6.94
BH	40	4.00	3.36	0.27	12.84	32	1.89	2.98	-5.06	7.86
LE	40	2.81	19.75	-30.63	29.52	32	1.75	6.39	-10.99	12.33
TT	40	3.06	2.78	-4.40	10.44	32	1.46	3.54	-3.99	11.85

*Note: *) $\pi(t)$) = 400*[P(t)/P(t-1)]. For labels see section 2 in the paper.*

Table 3: Representativness of 181 CPI-Items for the Austrian CPI

Main groups	**No. of series**	**CPI Weighting structure**				**Sample of 181 Products Weighting Structure**			
		1976	1986	1996	2000	1976	1986	1996	2000
Unprocessed food	24	8.6	6.2	5.2	5.7	12.3	9.4	7.2	8.8
Processed food	43	19.2	14.2	12.0	11.1	16.7	14.2	13.2	14.8
Energy	7	7.6	9.1	7.9	7.4	9.3	10.4	8.2	8.7
Non-energy industrial goods	82	26.8	31.0	33.4	34.0	44.5	39.4	40.4	41.7
Services	25	37.8	39.5	41.5	41.9	17.2	26.6	31.0	25.9
Total CPI	181								
Correlation of year-on-year changes of CPI with a 181-items CPI						0.82	0.74	0.77	0.81
Coverage of the 181 Products in terms of the CPI weights included:						54.3	48.5	42.3	32.5

Table 4 – Panel A: Structural Breaks for Inflation in Austria
Aggregate and CPI Subaggregate Indices (Quarterly Data, 1967:Q2 – 2004:Q4)
Minimum Span 24 Quarters

	Andrews - Ploberger Test		Bai-Perron Test for Mutiple Breaks *)				
	No. of Break	Break date	No. of Breaks	Break dates			
				1	2	3	4
Aggregate series							
GDP deflator	1	86:Q3	3	75:Q3	86:Q3	93:Q3	
Private consumption deflator	1	84:Q1	2	82:Q3	94:Q3		
Whole sale price index	1	82:Q2	2	82:Q2	99:Q4		
Consumer price index	1	84:Q1	3	76:Q2	84:Q1	95:Q2	
Use categories							
Food, beverages and tobacco	1	84:Q1	3	77:Q3	84:Q1	94:Q2	
Housing (rent and maintainance)	1	77:Q4	4	76:Q1	84:Q3	90:Q3	96:Q3
Electricity and heating	1	82:Q2	3	76:Q1	82:Q1	95:Q1	
Furniture and household equipment	1	95:Q4	2	82:Q2	95:Q4		
Clothing and personnel equipment	1	95:Q4	2	81:Q4	95:Q4		
Cleaning (apartment, linen and clothes)	1	82:Q3	3	74:Q1	82:Q2	94:Q4	
Body and health care	1	75:Q4	2	74:Q2	95:Q1		
Leisure and education	1	93:Q3	2	84:Q2	94:Q4		
Transport	1	82:Q4	1	82:Q4			

Note: Seasonal adjustment with TRAMO/SEATS applied to 4 subsamples: 1966:Q2–1976:Q4, 1977:Q1–1986:Q4, 1987:Q1–1996:Q4, 1997:Q1–2004:Q4
**) For the Bai-Perron Test a minimum span of 24 quarters and a maximum of 4 breaks are assumed.*

Table 4 – Panel B: Intercept and Persistence Parameters for Inflation in Austria
Aggregate and CPI Subaggregate Indices (Quarterly Data, 1967:Q2 – 2004:Q4)
*Total Sample and Various Regimes – Conditional on the Occurence of Structural Breaks (24 Quarters) *)*

	NB	Total Sample		Regime 1		Regime 2		Regime 3		Regime 4		Regime 5	
		α	ρ	α	ρ	α	ρ	α	ρ	α	ρ	α	ρ
Aggregate series													
GDP deflator	3	0.34 **	0.63 ***	0.51 **	0.71 ***	2.10 ***	-0.79	0.20 ***	0.72 ***	0.10 **	0.68		
Private consumption deflator	2	0.13 **	0.87 ***	0.52 ***	0.66 ***	0.45 ***	0.42 **	0.22 ***	0.43 ***				
Whole sale price index	2	0.21 ***	0.66 ***	0.68 **	0.50 **	0.08	0.18	0.35 ***	0.22 **				
Consumer price index	3	0.08 *	0.91 ***	0.53 **	0.72 ***	0.90 ***	0.29 *	0.34 ***	0.46 ***	0.19 **	0.54		
Use categories													
Food, beverages and tobacco	3	0.26 ***	0.67 ***	0.52 ***	0.65 ***	0.89 ***	0.15	0.43 ***	0.29 *	0.21 **	0.28		
Housing (rent and maintainance)	4	0.20 **	0.86 ***	1.19 ***	0.57 ***	1.02 ***	0.36 **	0.47 ***	0.42 ***	0.20	0.82 ***	0.98 ***	-0.38
Electricity and heating	3	0.26 ***	0.75 ***	1.43 ***	0.07	0.86 **	0.69 ***	-0.01	0.30 **	0.24 **	0.72 ***		
Furniture and household equipment	2	0.10 *	0.85 ***	0.47 **	0.60 ***	0.51 ***	0.24	0.13 ***	0.47 ***				
Clothing and personnel equipment	2	0.10 **	0.87 ***	0.30 **	0.77 ***	0.54 ***	0.32 *	0.05	0.42 ***				
Cleaning (apartment, linen and clothes)	3	0.14 **	0.84 ***	0.75 ***	0.45 ***	0.36 **	0.78 ***	0.21 **	0.69 ***	0.48 **	-0.32		
Body and health care	2	0.23 *	0.76 ***	6.65 ***	-1.05 **	1.10 ***	0.07	0.43 ***	0.16				
Leisure and education	2	0.17 **	0.81 ***	0.49 ***	0.62 ***	0.19 **	0.80 ***	0.18 **	0.53 ***				
Transport	1	0.44 ***	0.51 ***	1.13 ***	0.26 *	0.50 ***	0.13						

*Note: NB No. of structural breaks; Areas in light grey indicate persistence estimates; OLS Estimates with heteroskedasticity and autocorrelation consistent (HAC) Seasonal adjustment with TRAMO/SEATS applied to 4 subsamples: 1966:Q2–1976:Q4, 1977:Q1–1986:Q4, 1987:Q1–1996:Q4, 1997:Q1–2004:Q4. covariance matrix; ***, **, * indicate statistical significance at the 1, 5 and 10 percent level, respectively.*
**) Structural break dates for various regimes are based on Bai-Perron's test with a minimum span of 24 quarters and a maximum of 4 breaks.*

Table 5: Structural Breaks, Intercept and Persistence Parameters for Inflation in Austria
Aggregate and CPI Subaggregate Indices (Quarterly Data, 1978:Q2 – 2004:Q4)
*Total Sample and Various Regimes – Conditional on the Occurence of Structural Breaks (20 Quarters) *)*

	Panel A: Structural Break Tests						**Panel B: Intercept and Persistence Parameters**									
	A-P Test		BP - Test for Mutiple Breaks				Total Sample		Regime 1		Regime 2		Regime 3		Regime 4	
	NB	BD	NB	Break dates 1	2	3	α	ρ	α	ρ	α	ρ	α	ρ	α	ρ
Aggregate series																
GDP deflator	1	86:Q3	2	86:Q2	93:Q3		0.07 *	0.83 ***	1.30	-0.06	0.23	0.69 ***	0.11 **	0.65 ***		
Private consumption deflator	1	84:Q1	2	85:Q1	94:Q3		0.14 **	0.77 ***	0.88 **	0.31	0.74	0.03	0.31 **	0.21		
Whole sale price index	1	85:Q1	2	85:Q1	99:Q4		0.11 *	0.62 ***	0.39 **	0.59 ***	-0.02	0.23	0.29 ***	0.46 **		
Consumer price index	1	84:Q1	2	85:Q1	95:Q2		0.11 **	0.82 ***	0.54 **	0.54 ***	0.15	0.77 ***	0.19 **	0.54 ***		
Use categories																
Food, beverages and tobacco	1	84:Q1	2	85:Q1	94:Q2		0.27 ***	0.54 ***	1.00 ***	0.12	0.34	0.44 **	0.21 **	0.28		
Housing (rent and maintainance)	1	85:Q4	3	85:Q1	91:Q1	97:Q1	0.22 **	0.80 ***	1.02 ***	0.41 **	0.18	0.81 ***	-0.05	1.01 ***	0.99 ***	-0.38
Electricity and heating	1	83:Q1	2	85:Q2	94:Q3		0.19 **	0.58 ***	0.70 **	0.43 ***	-0.16	-0.02	0.40 ***	0.39 **		
Furniture and household equipment	1	95:Q4	2	86:Q1	95:Q4		0.05	0.87 ***	0.35 **	0.61 ***	0.28	0.55 ***	0.07	0.66 ***		
Clothing and personnel equipment	1	95:Q4	1	95:Q4			0.05 *	0.89 ***	0.71 **	0.13	0.05	0.47 **				
Cleaning (apartment, linen and clothes)	1	84:Q2	2	85:Q1	94:Q4		0.21 ***	0.64 ***	0.09	0.89 ***	0.32	0.52 ***	0.36 ***	-0.05		
Body and health care	1	95:Q1	1	95:Q1			0.23 **	0.74 ***	0.39 ***	0.66 ***	0.43	0.16				
Leisure and education	1	94:Q4	2	85:Q1	94:Q4		0.11 **	0.84 ***	0.16	0.87 ***	0.28	0.71 ***	0.21 **	0.46 **		
Transport	1	85:Q2	1	85:Q2			0.39 ***	0.44 **	0.80 ***	0.39 ***	0.44	0.15				

*Note: NB No. of structural breaks; Areas in light grey indicate persistence estimates; OLS Estimates with heteroskedasticity and autocorrelation consistent (HAC) covariance matrix; ***, **, * indicate statistical significance at the 1, 5 and 10 percent level, respectively.*
Seasonal adjustment with TRAMO/SEATS applied to 3 subsamples: 1977:Q1–1986:Q4, 1987:Q1–1996:Q4, 1997:Q1–2004:Q4.
**) Structural break dates for various regimes are based on Bai-Perron's test with a minimum span of 24 quarters and a maximum of 4 breaks.*
A-P Test: Andrews and Ploberger test for a single break point.

Table 6 – Panel A: Structural Breaks for Inflation in Austria
Aggregate and Subaggregate Indices (Quarterly Data, 1967:Q2 – 2004:Q4; Minimum Span 24 Quarters)
Seasonal Adjustment: Seasonal Dummy Variables

	Andrews - Ploberger Test		Bai-Perron Test for Mutiple Breaks *)				
	No. of Break	Break date	No. of Breaks	Break dates			
				1	2	3	4
Aggregate series							
GDP deflator	1	84:Q1	2	75:Q3	87:Q1		
Private consumption deflator	1	84:Q1	2	84:Q1	94:Q3		
Whole sale price index	1	82:Q4	1	82:Q4			
Consumer price index	1	84:Q2	3	76:Q2	84:Q2	95:Q2	
Use categories							
Food, beverages and tobacco	1	84:Q2	2	77:Q2	84:Q2		
Housing (rent and maintainance)	1	77:Q4	4	76:Q1	85:Q4	91:Q4	97:Q4
Electricity and heating	1	82:Q2	1	82:Q2			
Furniture and household equipment	1	94:Q3	2	76:Q1	95:Q1		
Clothing and personnel equipment	1	95:Q2	2	80:Q3	95:Q2		
Cleaning (apartment, linen and clothes)	1	82:Q2	2	76:Q1	84:Q2		
Body and health care	1	75:Q4	2	75:Q4	95:Q3		
Leisure and education	1	86:Q3	1	86:Q3			
Transport	1	82:Q4	1	82:Q4			

*Note: *) For the Bai-Perron Test a minimum span of 24 quarters and a maximum of 4 breaks are assumed.*

Table 6 – Panel B: Intercept and Persistence Parameters for Inflation in Austria
Aggregate and CPI Subaggregate Indices (Quarterly Data, 1967:Q2 – 2004:Q4)
*Total Sample and Various Regimes – Conditional on the Occurence of Structural Breaks (24 Quarters) *)*
Seasonal Adjustment: Seasonal Dummy Variables

	NB	Total Sample		Regime 1		Regime 2		Regime 3		Regime 4		Regime 5	
		α	ρ	α	ρ	α	ρ	α	ρ	α	ρ	α	ρ
Aggregate series													
GDP deflator	2	0.11	0.72 ***	1.70	-0.09	2.02 ***	-1.40 **	0.07	0.44 *				
Private consumption deflator	2	0.15 *	0.82 ***	0.75 **	0.46 **	0.54 **	0.05	0.19 *	0.26				
Whole sale price index	1	0.15 *	0.57 ***	0.70 **	0.41 *	-0.08	0.28 *						
Consumer price index	3	0.15 ***	0.80 ***	0.79 **	0.50 ***	0.81 ***	0.23	0.40 ***	0.22	0.20 ***	0.26		
Use categories													
Food, beverages and tobacco	2	0.25 ***	0.52 ***	1.21 ***	0.00	0.68 ***	0.10	0.11 **	0.33 ***				
Housing (rent and maintainance)	4	0.22 ***	0.82 ***	2.54 ***	0.01	0.89 ***	0.34 **	0.62 ***	-0.16	0.80 **	0.17	0.14	0.80 *
Electricity and heating	1	0.38 **	0.56 ***	1.48 ***	0.29 ***	0.09	0.45 ***						
Furniture and household equipment	2	0.21 ***	0.67 ***	0.67 ***	0.45 ***	0.45 ***	0.34 **	0.11 **	0.25				
Clothing and personnel equipment	2	0.17 **	0.68 ***	0.42 **	0.65 ***	0.45 **	0.21	-0.20	-0.93 ***				
Cleaning (apartment, linen and clothes)	2	0.21 **	0.65 ***	0.79 **	0.55 ***	1.18 ***	-0.20	0.15 **	0.27 *				
Body and health care		0.18	0.41 **	3.39 **	-0.92 *	0.45 ***	-0.30 **	-0.27 *	0.25				
Leisure and education	1	0.56 ***	-0.36	0.64 ***	0.25 *	0.18	-1.65 ***						
Transport	1	0.27 **	0.48 ***	0.78 **	0.34 **	0.13	0.21						

*Note: NB No. of structural breaks; Areas in light grey indicate persistence estimates; OLS Estimates with heteroskedasticity and autocorrelation consistent (HAC) covariance matrix; ***, **, * indicate statistical significance at the 1, 5 and 10 percent level, respectively.*
**) Structural break dates for various regimes are based on Bai-Perron's test with a minimum span of 24 quarters and a maximum of 4 breaks.*

*Table 7: Structural Breaks, Intercept and Persistence Parameters for Inflation in Austria Aggregate and CPI Subaggregate Indices (Quarterly Data, 1967:Q2 – 2004:Q4) Total Sample and Various Regimes – Conditional on the Occurence of Structural Breaks (24 Quarters) *) Seasonal Adjustment: Fourth Seasonal Differences (D4)*

	Panel A: Structural Break Tests						**Panel B: Intercept and Persistence Parameters**									
	A-P Test		B-P Test for Mutiple Breaks *)				Total Sample		Regime 1		Regime 2		Regime 3		Regime 4	
	NB	BD	NB	Break dates 1	2	3	α	ρ	α	ρ	α	ρ	α	ρ	α	ρ
Aggregate series																
GDP deflator	1	85:Q4	3	76:Q1	85:Q4	95:Q2	0.37 **	0.90 ***	1.39 **	0.79 ***	4.74 ***	0.03	1.37 ***	0.53 ***	0.24 **	0.78 ***
Private consumption deflator	1	85:Q4	3	74:Q2	83:Q4	95:Q2	0.21 **	0.94 ***	-0.03	1.07 ***	1.09 ***	0.81 ***	0.78 **	0.73 ***	0.41 **	0.74 ***
Whole sale price index	1	82:Q2	1	82:Q2			0.22 **	0.92 ***	0.73 ***	0.87 ***	0.21 **	0.75 ***				
Consumer price index	1	85:Q4	3	77:Q2	85:Q4	95:Q2	0.14 *	0.96 ***	0.50 **	0.92 ***	1.21 ***	0.75 ***	0.56 ***	0.79 ***	0.47 **	0.72 ***
Use categories																
Food, beverages and tobacco	1	85:Q4	2	85:Q4	95:Q4		0.21 *	0.93 ***	1.07 ***	0.79 ***	0.43 **	0.81 ***	0.82 ***	0.41 **		
Housing (rent and maintainance)	1	85:Q4	3	77:Q4	85:Q4	97:Q4	0.25 *	0.96 ***	2.19 **	0.81 ***	1.69 ***	0.75 ***	0.57 ***	0.86 ***	0.92 ***	0.62 ***
Electricity and heating	1	82:Q3	2	74:Q2	82:Q2		0.41 **	0.90 ***	0.56	0.96 ***	1.81 *	0.80 ***	0.27	0.81 ***		
Furniture and household equipment	1	95:Q1	3	74:Q2	85:Q4	95:Q2	0.20 **	0.92 ***	0.10	1.08 ***	1.10 ***	0.72 ***	0.86 ***	0.67 ***	0.25 **	0.76 ***
Clothing and personnel equipment	1	95:Q2	3	74:Q2	82:Q4	95:Q2	0.18 *	0.93 ***	0.06	1.05 ***	1.45 **	0.68 ***	0.82 ***	0.75 ***	0.08	0.57 ***
Cleaning (apartment, linen and clothes)	1	85:Q4	3	74:Q2	82:Q3	94:Q1	0.41 ***	0.89 ***	2.30 ***	0.54 ***	1.36 ***	0.79 ***	0.56 **	0.80 ***	0.51 **	0.60 ***
Body and health care	1	79:Q4	2	79:Q4	96:Q4		1.08 **	0.77 ***	6.46 ***	0.12	1.57 **	0.64 ***	0.64 ***	0.68 ***		
Leisure and education	1	86:Q3	3	74:Q2	83:Q2	94:Q1	0.56 **	0.83 ***	0.66 **	0.84 ***	0.97 *	0.82 ***	2.59 **	0.26	0.71 ***	0.52 ***
Transport	1	85:Q2	1	85:Q2			0.46 **	0.88 ***	1.52 **	0.75 ***	1.12 ***	0.50 ***				

*Note: NB No. of structural breaks; Areas in light grey indicate persistence estimates; OLS Estimates with heteroskedasticity and autocorrelation consistent (HAC) covariance matrix. ***, **, * indicate statistical significance at the 1, 5 and 10 percent level, respectively.*
**) Structural break dates for various regimes are based on Bai-Perron's test with a minimum span of 24 quarters and a maximum of 4 breaks.*
A-P Test: Andrews and Ploberger test for a single break point.

Table 8: Structural Breaks, Intercept and Persistence Parameters for Inflation in Austria
Aggregate and CPI Subaggregate Indices (Quarterly Data, 1967:Q2 – 2004:Q4)
*Total Sample and Various Regimes – Conditional on the Occurence of Structural Breaks (24 Quarters) *)*
Seasonal Adjustment: X12-Arima

	Panel A: Structural Break Tests						**Panel B: Intercept and Persistence Parameters**									
	A-P Test		B-P Test for Mutiple Breaks *)				Total Sample		Regime 1		Regime 2		Regime 3		Regime 4	
	NB	BD	NB	Break dates 1	2	3	α	ρ	α	ρ	α	ρ	α	ρ	α	ρ
Aggregate series																
GDP deflator	1	84:Q1	1	84:Q1			0.32 **	0.64 ***	1.52 ***	-0.08	0.27 **	0.44 **				
Private consumption deflator	1	84:Q1	2	84:Q1	94:Q3		0.14 *	0.85 ***	0.64 ***	0.57 ***	0.44 *	0.33	0.25 *	0.36		
Whole sale price index	1	82:Q2	1	82:Q2			0.21 ***	0.70 ***	0.54 **	0.63 ***	0.13	0.30 **				
Consumer price index	1	84:Q1	2	82:Q2	94:Q3		0.11 **	0.88 ***	0.31 **	0.79 ***	0.45 ***	0.38 **	0.23 **	0.45 **		
Use categories																
Food, beverages and tobacco	1	84:Q2	1	84:Q2			0.29 ***	0.64 ***	0.91 ***	0.25 *	0.24 ***	0.43 ***				
Housing (rent and maintainance)	1	84:Q1	3	76:Q3	85:Q4	96:Q3	0.13 *	0.90 ***	1.47 *	0.43	0.68 ***	0.57 ***	0.24 **	0.75 ***	0.58 ***	-0.08
Electricity and heating	1	82:Q2	2	74:Q2	82:Q2		0.37 **	0.63 ***	0.83 **	0.41 **	1.46 **	0.41 ***	0.16	0.51 ***		
Furniture and household equipment	1	95:Q4	2	82:Q2	95:Q1		0.09 *	0.85 ***	0.30 **	0.72 ***	0.45 **	0.33 *	0.14 **	0.37 *		
Clothing and personnel equipment	1	95:Q1	2	80:Q3	95:Q1		0.16 **	0.78 ***	0.26 **	0.79 ***	0.50 **	0.35	0.07	0.07		
Cleaning (apartment, linen and clothes)	1	84:Q2	1	84:Q2			0.29 ***	0.66 ***	0.66 ***	0.54 ***	0.34 ***	0.28 *				
Body and health care	1	79:Q4	2	79:Q4	95:Q1		0.27 **	0.73 ***	3.68 **	-1.12	0.76 **	0.31	0.46			
Leisure and education	1	95:Q3	1	95:Q3			0.56 ***	0.37 **	1.00 ***	0.10	0.58 ***	-0.67				
Transport	1	82:Q4	1	82:Q4			0.42 ***	0.55 ***	0.89 ***	0.42 **	0.44 **	0.24				

*Note: NB No. of structural breaks; Areas in light grey indicate persistence estimates; OLS Estimates with heteroskedasticity and autocorrelation consistent (HAC) covariance matrix; ***, **, * indicate statistical significance at the 1, 5 and 10 percent level, respectively.*
**) Structural break dates for various regimes are based on Bai-Perron's test with a minimum span of 24 quarters and a maximum of 4 breaks.*
A-P Test: Andrews and Ploberger test for a single break point.

Table 9: Structural breaks, Intercept and Persistence Parameters for Inflation in Austria
Aggregate and CPI Subaggregate Indices (Quarterly Data, 1967:Q2 – 2004:Q4)
*Total Sample and Various Regimes – Conditional on the Occurence of Structural Breaks (24 Quarters) *)*
Seasonal Adjustment: Tramo/Seats (Total Sample)

	Panel A: Structural Break Tests						**Panel B: Intercept and Persistence Parameters**									
	A-P Test		B-P Test for Mutiple Breaks *)				Total Sample		Regime 1		Regime 2		Regime 3		Regime 4	
	NB	BD	NB	Break dates												
				1	2	3	α	ρ	α	ρ	α	ρ	α	ρ	α	ρ
Aggregate series																
GDP deflator	1	84:Q1	2	84:Q1	95:Q4		0.20 **	0.78 ***	1.04 ***	0.28	0.82 ***	-0.10	0.11	0.62 ***		
Private consumption deflator	1	82:Q3	2	82:Q2	95:Q4		0.03	0.96 ***	0.41 ***	0.71 ***	0.20 ***	0.75 ***	0.13 **	0.68 ***		
Whole sale price index	1	86:Q4	1	86:Q4			0.39 ***	0.40 ***	0.80 ***	0.15	0.26 ***	0.32 **				
Consumer price index	1	82:Q2	2	82:Q2	94:Q3		0.10 **	0.90 ***	0.37 ***	0.74 ***	0.33 ***	0.56 ***	0.25 **	0.48 ***		
Use categories																
Food, beverages and tobacco	1	84:Q2	2	84:Q1	94:Q3		0.37 ***	0.53 ***	1.10 ***	-0.01	0.37 ***	0.40 ***	0.30 ***	0.25 *		
Housing (rent and maintainance)	1	85:Q4	3	74:Q2	85:Q4	96:Q3	0.08	0.93 ***	0.98 **	0.58 ***	0.64 **	0.64 ***	0.44 **	0.63 ***	0.57 **	0.15
Electricity and heating	1	77:Q1	3	79:Q3	88:Q2	96:Q4	0.22 **	0.78 ***	0.77 ***	0.57 ***	-0.09	0.52 **	0.58 ***	0.03	0.41 **	0.69 ***
Furniture and household equipment	1	95:Q1	3	78:Q3	86:Q1	95:Q1	0.27 ***	0.60 ***	0.40 ***	0.47 ***	0.53 ***	0.46 ***	0.64 **	0.10	0.30 ***	-0.03
Clothing and personnel equipment	1	95:Q1	2	80:Q4	96:Q2		0.04	0.95 ***	0.12 **	0.91 ***	0.16 **	0.78 ***	0.02	0.73 ***		
Cleaning (apartment, linen and clothes)	1	84:Q3	2	84:Q3	94:Q4		0.47 ***	0.48 ***	1.19 ***	0.05	0.60 **	0.29	0.58 ***	-0.19		
Body and health care	1	95:Q1	2	77:Q4	95:Q1		0.65 ***	0.45 **	1.65 **	-0.50	0.89 ***	0.34 *	1.25 ***	-0.35		
Leisure and education	1	94:Q4	3	79:Q3	88:Q1	97:Q4	0.11 ***	0.89 ***	0.16 ***	0.87 ***	0.74 ***	0.45 ***	0.26 **	0.71 ***	0.28 ***	0.42 **
Transport	1	82:Q4	1	82:Q4			0.51 ***	0.47 ***	1.04 ***	0.32 **	0.52 ***	0.14				

*Note: NB No. of structural breaks; Areas in light grey indicate persistence estimates; OLS Estimates with heteroskedasticity and autocorrelation consistent (HAC) covariance matrix; ***, **, * indicate statistical significance at the 1, 5 and 10 percent level, respectively.*
**) Structural break dates for various regimes are based on Bai-Perron's test with a minimum span of 24 quarters and a maximum of 4 breaks.*
A-P Test: Andrews and Ploberger test for a single break point.

Table 10 – Panel A: Structural Breaks for Inflation in Austria
CPI Subaggregate Indices (Monthly Data, 1967:M02 – 2004:M12)
Minimum Span 72 Months

	Andrews - Ploberger Test		Bai - Perron Test for Mutiple Breaks*)				
	No. of Break	Break date	No. of Breaks	Break dates			
				1	2	3	4
Aggregate series							
1 Consumer price index	1	82:M05	2	82:M05	95:M12		
Use categories							
7 Food, beverages and tobacco	1	84:M06	1	84:M06			
8 Housing (rent and maintainance)	1	76:M09	4	76:M09	84:M09	90:M09	96:M09
9 Electricity and heating	1	85:M04	1	85:M04			
10 Furniture and household equipment	1	95:M02	2	82:M04	95:M02		
11 Clothing and personnel equipment	1	95:M01	2	75:M08	95:M01		
12 Cleaning (apartment, linen and clothes)	1	82:M06	3	77:M02	84:M07	93:M11	
13 Body and health care	1	74:M11	2	74:M11	95:M01		
14 Leisure and education	1	95:M04	2	83:M12	95:M04		
15 Transport	1	81:M10	1	81:M10			

Note: Seasonal adjustment with TRAMO/SEATS applied to 4 subsamples: 1966:M02–1976:M12, 1977:M01–1986:M12, 1987:M01–1996:M12, 1997:M01–2004:M12
**) Structural break dates for various regimes are based on Bai-Perron's test with a minimum span of 72 Months and a maximum of 4 breaks.*

Table 10 – Panel B: Intercept and Persistence Parameters for Inflation in Austria
CPI Subaggregate Indices (Montly Data, 1967:M2 – 2004:M12)
*Total Sample and Various Regimes – Conditional on the Occurence of Structural Breaks (72 Months) *)*

	NB	Total Sample		Regime 1		Regime 2		Regime 3		Regime 4		Regime 5	
		α	ρ	α	ρ	α	ρ	α	ρ	α	ρ	α	ρ
Aggregate series													
Consumer price index	2	0.03 *	0.90 ***	0.13 **	0.75 ***	0.13 **	0.49 **	0.07 **	0.49 **				
Use categories													
Food, beverages and tobacco	1	0.10 ***	0.62 ***	0.34 ***	0.20	0.10 **	0.34 *						
Housing	4	0.04 **	0.90 ***	0.40 ***	0.52 ***	0.24 ***	0.53 ***	0.15 ***	0.49 ***	0.15 **	0.60 ***	0.16 **	0.31
Electricity and heating	1	0.19 ***	0.37 ***	0.55 ***	-0.01	0.06 *	0.24 *						
Furniture and household	2	0.05 **	0.76 ***	0.16 ***	0.56 ***	0.17 ***	0.21	0.07 *	0.06				
Clothing and personnel equipment	2	0.03	0.90 ***	0.08 **	0.86 ***	0.40 ***	-0.38 *	0.01	0.47 **				
Cleaning (apartment, linen and clothes)	3	0.13 ***	0.57 ***	0.16 **	0.75 ***	0.19 ***	0.49 ***	0.18 ***	0.22 **	0.14 **	-0.27		
Body and health care	2	0.06 *	0.82 ***	1.65 **	-1.42	0.38 ***	-0.01	0.10 ***	0.45 ***				
Leisure and education	2	0.08 **	0.73 ***	0.14 *	0.68 ***	0.30 **	0.04	0.10 ***	0.18				
Transport	1	0.25 ***	0.18 **	0.59 ***	-0.17	0.18 ***	0.05						

*Note: NB No. of structural breaks; Areas in light grey indicate persistence estimates; OLS Estimates with heteroskedasticity and autocorrelation consistent (HAC) covariance matrix; ***, **, * indicate statistical significance at the 1, 5 and 10 percent level, respectively.*
Seasonal adjustment with TRAMO/SEATS applied to 4 subsamples: 1966:M02 - 1976:M12, 1977:M01 - 1986:M12, 1987:M01 - 1996:M12, 1997:M01 - 2004:M12.
**) Structural break dates for various regimes are based on Bai-Perron's test with a minimum span of 72 months and a maximum of 4 breaks.*

Table 11: Structural Breaks, Intercept and Persistence Parameters for Inflation in Austria
CPI Subaggregate Indices (Montly Data, 1978:M02 – 2004:M12)
*Total Sample and Various Regimes – Conditional on the Occurence of Structural Breaks (60 Months) *)*

	Panel A: Structural Break Tests						**Panel B: Intercept and Persistence Parameters**									
	A-P Test		Bai - Perron Test for Mutiple Breaks *)				Total Sample		Regime 1		Regime 2		Regime 3		Regime 4	
	NB	BD	NB	Break dates 1	2	3	α	ρ	α	ρ	α	ρ	α	ρ	α	ρ
Aggregate series																
Consumer price index	1	85:M04	2	84:M02	95:M12		0.03 *	0.87 ***	0.16 *	0.64 ***	0.09 *	0.59 **	0.06 **	0.55 **		
Main groups																
Unprocessed food	0		0				0.25 ***	-0.24 **								
Processed food	1	86:M07	1	86:M07			0.14 ***	0.25 ***	0.21 ***	0.29 **	0.14 ***	-0.08				
Energy	1	85:M05	1	85:M05			0.13 **	0.36 ***	0.29 ***	0.46 ***	0.06	0.24 **				
Non-energy industrial goods	1	94:M08	2	85:M12	94:M08		0.01	0.93 ***	0.35 **	-0.16	0.16 **	0.28	0.03 **	0.20		
Services	1	85:M05	2	84:M02	95:M07		0.04 *	0.87 ***	0.23 *	0.55 **	0.13 **	0.63 ***	0.15 ***	0.26		
Use categories																
Food, beverages and tobacco	1	84:M06	1	84:M06			0.09 **	0.56 ***	0.27 **	0.32	0.10 **	0.36 *				
Housing (rent and maintainance)	1	84:M09	3	84:M09	90:M09	96:M09	0.04 *	0.88 ***	0.15 **	0.71 ***	0.15 ***	0.49 ***	0.15 **	0.60 ***	0.16 **	0.31
Electricity and heating	1	85:M04	2	85:M04	91:M04		0.11 ***	0.51 ***	0.54 ***	0.01	-0.05	0.22	0.11 **	0.27		
Furniture and household	1	95:M02	2	85:M06	95:M02		0.06 ***	0.69 ***	0.12 **	0.59 ***	0.20 ***	0.03	0.08 **	-0.05		
Clothing and personnel equipment	1	95:M01	1	95:M01			0.02	0.89 ***	0.35 ***	-0.20	0.01	0.47 **				
Cleaning (apartment, linen and clothes)	1	84:M07	2	84:M07	93:M11		0.20 ***	0.09	0.20 ***	0.46 ***	0.19 ***	0.18	0.13 **	-0.22		
Body and health care	1	95:M01	2	83:M06	96:M12		0.06 **	0.80 ***	0.30 **	0.32	0.26 ***	0.25	0.12 **	0.26		
Leisure and education	1	95:M04	1	95:M04			0.09 **	0.67 ***	0.23 **	0.36 *	0.10 ***	0.18				
Transport	1	81:M10	1	85:M04			0.20 ***	0.19 **	0.33 ***	0.26 *	0.16 ***	0.01				

*Note: NB No. of structural breaks; Areas in light grey indicate persistence estimates. OLS Estimates with heteroskedasticity and autocorrelation consistent (HAC) covariance matrix. ***, **, * indicate statistical significance at the 1, 5 and 10 percent level, respectively.*
Seasonal adjustment with TRAMO/SEATS applied to 3 subsamples: 1977:M01–1986:M12, 1987:M01–1996:M12, 1997:M01–2004:M12.
**) Structural break dates for various regimes are based on Bai-Perron's test with a minimum span of 60 months and a maximum of 3 breaks.*
A-P Test: Andrews and Ploberger test for a single break point.

Table 12: Structural Breaks, Intercept and Persistence Parameters for Inflation in Austria
CPI Subaggregate Indices (Montly Data, 1988:M02 – 2004:M12)
*Total Sample and Various Regimes – Conditional on the Occurence of Structural Breaks (48 Months) *)*

	Panel A: Structural Break Tests					**Panel B: Intercept and Persistence Parameters**					
	A-P Test		B-P Test *)			Total Sample		Regime 1		Regime 2	
	NB	BD	NB	Break dates 1	2	α	ρ	α	ρ	α	ρ
Aggregate series											
Consumer price index	1	95:M12	1	95:M12		0.04 **	0.78 ***	0.11 **	0.62 ***	0.08 **	0.42 **
Main groups											
Unprocessed food	0		0			0.21 ***	-0.21 *				
Processed food	1	90:M03	1	93:M06		0.14 ***	-0.04	0.12 ***	-0.16	0.14 ***	0.04
Energy	0		0			0.13 **	0.10				
Non-energy industrial goods	1	94:M08	1	94:M08		0.01	0.90 ***	0.12	0.52	0.03 **	0.20
Services	1	95:M07	1	95:M07		0.12 ***	0.54 ***	0.24 ***	0.30 *	0.16 ***	0.21
Use categories											
Food, beverages and tobacco	0		0			0.08 ***	0.53 ***				
Housing (rent and maintainance)	1	96:M09	1	96:M09		0.12 ***	0.59 ***	0.13 ***	0.63 ***	0.21 ***	0.10
Electricity and heating	1	2002:M04	1	95:M04		0.11 **	0.07	0.06	-0.10	0.15 **	0.09
Furniture and household	1	95:M02	1	95:M02		0.09 ***	0.34 ***	0.24 ***	-0.06	0.08 ***	-0.10
Clothing and personnel equipment	1	95:M01	1	95:M01		0.01	0.91 ***	0.16 **	0.46 *	0.01	0.47 **
Cleaning (apartment, linen and clothes)	0		0			0.18 ***	-0.14				
Body and health care	1	95:M01	1	95:M01		0.06 **	0.78 ***	0.27 ***	0.26	0.12 ***	0.30 **
Leisure and education	1	95:M04	1	95:M04		0.07 **	0.66 ***	0.27 *	0.25	0.10 ***	0.18
Transport	0		0			0.19 ***	-0.01				

*Note: NB No. of structural breaks; Areas in light grey indicate persistence estimates; OLS Estimates with heteroskedasticity and autocorrelation consistent (HAC) covariance matrix; ***, **, * indicate statistical significance at the 1, 5 and 10 percent level, respectively.*
Seasonal adjustment with TRAMO/SEATS applied to 2 subsamples: 1987:M01–1996:M12, 1997:M01–2004:M12.
**) Structural break dates for various regimes are based on Bai-Perron's test with a minimum span of 48 months and a maximum of 2 breaks.*
A-P Test: Andrews and Ploberger test for a single break point.

Table 13: Structural Breaks, Intercept and Persistence Parameters for Inflation in Austria
HICP Subaggregate Indices (Montly Data, 1988:M02 – 2004:M12)
*Total Sample and Various Regimes – Conditional on the Occurence of Structural Breaks (48 Months) *)*

	Panel A: Structural Break Tests					**Panel B: Intercept and Persistence Parameters**					
	A-P Test		B-P Test			Total Sample		Regime 1		Regime 2	
	NB	BD	NB	Break dates							
				1	2	α	ρ	α	ρ	α	ρ
Aggregate series											
Harmonized consumer price index	1	94:M09	1	94:M09		0.13 ***	0.20	0.19 ***	0.15	0.14 ***	-0.10
Main groups											
Unprocessed food	0		0			0.25 **	-0.15				
Processed food	1	90:M01	1	93:M01		0.09 ***	0.08	0.07 **	0.03	0.11 ***	0.07
Energy	0		0			0.15 **	0.20 *				
Non-energy industrial goods	1	95:M01	1	95:M01		0.01	0.89 ***	0.12 **	0.42	0.01	0.09
Services	1	97:M02	1	97:M02		0.19 ***	0.23 *	0.09 ***	0.70 ***	0.21 ***	-0.12

*Note: NB No. of structural breaks; Areas in light grey indicate persistence estimates; OLS Estimates with heteroskedasticity and autocorrelation consistent (HAC) covariance matrix; ***, **, * indicate statistical significance at the 1, 5 and 10 percent level, respectively.*
Seasonal adjustment with TRAMO/SEATS applied to 2 subsamples: 1987:M01–1996:M12, 1997:M01–2004:M12.
**) Structural break dates for various regimes are based on Bai-Perron's test with a minimum span of 48 months and a maximum of 2 breaks.*
A-P Test: Andrews and Ploberger test for a single break point.