Unit Roots in Inflation and Aggregation Bias

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Abstract

We examine whether UK inflation is characterized by aggregation bias using unit root tests. Our results suggest aggregation bias exists. While a unit root cannot be rejected for aggregate inflation, it can be rejected for some of its sectoral components, with rejection frequencies increasing when we use more disaggregate data. Structural break analysis indicates that monetary policy shifts are the main factor behind breaks in UK inflation. The panel results typically indicate that the unit root hypothesis can be rejected for pooled sectoral inflation rates. Our findings have important implications for econometric analysis and the conduct of monetary policy.

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1. Introduction

Is the inflation rate a unit root process? There is presently no straightforward answer to this recurrent question. Nelson and Plosser (1982) were early exponents of the view that many macroeconomic time series were a random walk and international evidence employing standard tests suggests that inflation contains a unit root.[1] However, more nuanced evidence on a unit root in inflation is provided by Ng and Perron (2001) and indeed support for inflation stationarity has recently been offered by unit root tests that allow for shifts in mean inflation (Gadzinki and Orlandi, 2004), non-linearities in inflation (Gregoriou and Kontonikas, 2006), and panel unit root tests assuming cross sectional independence (Culver and Papell, 1997).

Identifying whether inflation is a unit root process is a highly important macro-econometric issue. If inflation is infinitely persistent, it is unlikely to return to its initial level following an exogenous shock, implying huge output costs for disinflation policies. Furthermore, the degree of inflation persistence has implications for the conduct of monetary policy by determining how quickly the inflation process responds to changes in interest rates. It is therefore important to identify the degree of inflation persistence in order to gain a better understanding of the dynamic effects of exogenous price shocks and monetary policy shocks.

Studying inflation persistence is also useful to potentially improve inflation forecasts (see Hendry and Hubrich, 2006). These are crucial in monetary policy formulation, especially in inflation targeting countries such as the United Kingdom whereupon our analysis focuses. Moreover, a vast amount of empirical work on equilibrium economic relationships depends upon assuming whether inflation is, or is not, a unit root process. Finally, the degree of inflation persistence critically differentiates among competing theoretical models of inflation, for example the

hybrid and New Keynesian Phillips Curves. In particular, the hybrid Phillips Curve, $\pi_t = \gamma_b \pi_{t-1} + \gamma_f E_t \pi_{t+1} + \lambda y_t + u_t$, where π_t is inflation, y_t the output gap, u_t an inflation-shock, γ_b, γ_f and λ are parameters, reduces to the New Keynesian Phillips Curve, if inflation is not persistent (i.e. $\gamma_b = 0$).[2]

While the standard New Keynesian Phillips Curve rules out intrinsic inflation persistence deriving from the dependence of current inflation upon its lagged values (see Calvo, 1983), the hybrid Phillips Curve allows for such persistence (see Galí and Gertler, 1999). The hybrid framework can be motivated theoretically in various ways, for example through the assumption of indexation, or rule-of-thumb price setting.[3] However, as Rudd and Whelan (2005, p.20) point out, all these approaches are "arguably more *ad hoc* than micro-founded."

Aggregation bias is an alternative explanation for aggregate inflation persistence which does not require such strong assumptions, and instead relies on the statistical properties of the time series. In particular, since the persistence of aggregate inflation is mainly driven by the properties of its most persistent components, aggregate inflation may be characterised by substantial persistence, while disaggregate prices are, on average, less persistent. Since, at least, Granger (1980) it has been recognised that an aggregate series is expected to display greater autocorrelation than the average autocorrelation of its components. Most simply, aggregating an I(0) and I(1) statistical process, results in an I(1) process.[4] If the degree of inflation persistence varies considerably across different sectors of the economy, then it may be appropriate for monetary policy to respond more actively to shocks affecting sectors that are characterised by very high persistence and that are unlikely to return quickly to equilibrium. Aoki (2001) develops a theoretical model with a sticky-price sector and a flexible-price sector and shows that the optimal monetary

policy response to relative-prices changes is to target sticky-price inflation rather than a broad inflation measure. Thus, analysing disaggregate inflation data can inform policy makers about important stylised facts and may have serious implications for the conduct of monetary policy. Importantly, our paper provides information on the properties of disaggregate UK inflation.

There has been a burgeoning empirical literature examining disaggregate Euro Area inflation data which emphasizes that, in line with the aggregation bias hypothesis, adjustment at the disaggregate level is much more rapid than at the aggregate level (see e.g. Altissimo et al., 2007; Lünnemann and Mathä, 2004). On the other hand, Clark (2006) and Bilke (2004) using US and French data, respectively, show that if structural breaks are taken into account, both aggregate and disaggregate inflation exhibit low persistence. Nevertheless, there is a paucity of studies which examine UK inflation data for aggregation bias. This is rather surprising given that since 1992 inflation is the focal variable for the UK monetary policy regime. Establishing which sectors are characterised by extreme persistence and which are not, will provide the Bank of England with important information in order to calibrate the appropriate policy response to the various shocks hitting the UK economy.

In this paper, our main aim is to gain some further insight in UK inflation persistence and the potential aggregation bias through the application of recently developed unit root tests to aggregate UK inflation and three sets of increasingly disaggregated inflation data.[5] We tackle the possibility of obtaining spuriously high estimates of persistence due to structural breaks, by applying the single-break unit root test of Perron (1997), and the two-break test of Lee and Strazicich (2003), in addition to the standard no-break ADF test. Following the recent suggestion of Pesaran (2007), unit root rejection frequencies are then calculated for each level of

disaggregation as a whole, allowing us to examine whether the aggregation bias prediction of higher rejection rates at higher levels of disaggregation can be verified. Moreover, we deal with the widespread concern about the low power of univariate unit root tests and hence their inability to discriminate between a unit root null and near unit root alternative, by utilising panel testing frameworks. As well as applying first generation panel unit root tests (Im, Pesaran and Shin, 2003; Im, Lee and Tieslau, 2005) and stationarity tests (Hadri, 2000) that assume no cross-sectional correlation, we further contribute to the literature on inflation persistence by following Bai and Ng (2004) and allowing for stochastic common factors among the sectoral inflation rates. We emphasize those tests that utilize averaging of the disaggregate inflation series which will consequently avoid the bias of applying tests to aggregate inflation series.

The remainder of the paper is structured as follows. The following section, discusses the inflation data. Section 3 outlines the time-series unit root tests and results, talking account of the possibility of structural breaks. Section 4 outlines the panel unit root tests and results, whilst Section 5 concludes.

2. Data

Our dataset is comprised of monthly aggregate and disaggregate UK inflation. The price level data, on the basis of which inflation is calculated, was obtained from the UK *Office for National Statistics*. The raw monthly price level series are seasonally adjusted and the annualised monthly inflation rate is computed as: $\pi_t = 1200*[\ln(P_t) - \ln(P_{t-1})]$, where P_t denotes the relevant price index. Since the adoption of inflation targeting on October 1992, monetary policy in the UK has been focused on consumer price, rather than producer price, inflation. We therefore measure aggregate inflation using the all items Consumer Price Index (CPI), while for

sectoral inflation we utilise three different levels of CPI disaggregation. Disaggregation level one considers twelve components of the broad CPI, while disaggregation levels two and three further break-down broad CPI into thirty nine and eighty five sectors, respectively. Data on disaggregation level one commences in 1988, hence the full sample period under investigation is 1988-2006, providing us with 223 observations for aggregate inflation and level one disaggregation. Data on disaggregation levels two and three is available over the shorter period 1996-2006, yielding 127 observations.

[FIGURE 1 HERE]

Figure 1 plots aggregate inflation over time. It appears that aggregate inflation was higher, on average, prior to 1992 reaching its maximum value on April 1991. This evidence supports the existence of inflationary pressures towards the end of the 1980s-beginning of the 1990s that eventually dissipated following the introduction of inflation targeting.

[TABLE 1 HERE]

Table 1 presents descriptive statistics for aggregate inflation and level one sectoral inflation rates. Average aggregate inflation rate over the full sample period 1988-2006 is 2.7%, declining to 1.55% over the 1996-2006 sub-period. In the full sample, the highest average growth rate of prices is observed within the education sector (6.72%), followed by the alcoholic beverages, tobacco and narcotics sector (4.67%), and the hotels, cafes and restaurants sector (4.55%). For level one sectoral prices only two out of twelve exhibit negative growth rates: clothing and footwear, and communication. When the shorter period 1996-2006 is considered, the deflationary pressures in these sectors become more pronounced, with the average cost for clothing and footwear, and communication declining by almost 5% and 2%, respectively.

Overall, UK sectoral inflation rates exhibit a great degree of heterogeneity and is portentous of heterogeneous time series properties more generally; with some sectors being in deflation, while in others price increases have been much greater as compared to the broad CPI. Sectors are also differentiated by the volatility of their inflation rates. Over the 1996-2006 sub-period, clothing and footwear inflation exhibits the highest volatility, followed by transport, and education.

3. Time series methods

3.1 Unit root test

The standard Augmented Dickey-Fuller (ADF, Said and Dickey, 1984) test uses the following regression model to examine whether inflation contains a unit root:

$$\Delta\pi_t = \gamma_0 + \gamma_1 t + \rho\pi_{t-1} + \sum_{j=1}^{k} c_j \Delta\pi_{t-j} + \varepsilon_t \qquad (1)$$

where π_t is the inflation rate (t = 1,…,N), $\varepsilon_t \sim iid(0,\sigma_\varepsilon^2)$ is a random disturbance term, t is a deterministic time trend, γ_0 and γ_1 are estimated parameters. The first differenced inflation terms, $\Delta\pi_{t-j}$, are included to remove any remaining serial correlation in the disturbance term. The number of lags k is determined by the Akaike Information Criterion (AIC). Rejecting the null of non-stationarity requires $\hat{\rho} < 0$.

[TABLE 2 HERE]

In Table 2 we present the ADF results for our aggregate data and a summary of the rejection rates (number of rejections over total cases) for the null hypothesis of a unit root in the disaggregate data.[6] In line with previous evidence for UK and other industrialised countries (see Levin and Piger, 2004), we find that we can not reject the null hypothesis of unit root for the aggregate UK inflation both for a shorter or longer span of data. Such a high level of inflation persistence is hard to comprehend,

especially over the 1996-2006 sub-period when the UK was operating under an inflation targeting regime which anchored inflation expectations and led to lower and less volatile inflation (see Kontonikas, 2004).

According to the aggregation bias hypothesis, the observed high level of persistence in aggregate inflation is driven by the properties of its more persistent components and on average disaggregate inflation rates are less persistent. Therefore, if we move from aggregate inflation to its constituents, we should be able to obtain more rejections of the unit root hypothesis. Indeed, at the 5% level of significance, we find that we can reject the unit root null hypothesis between 33% and 42% of the times with disaggregation level one and a longer span of data, depending on the specification of the deterministic components in the ADF model.[7] There appears to be considerable heterogeneity across level one sectors' inflation persistence, with some, such as education, exhibiting unit root behaviour, while others, such as food and non-alcoholic beverages, are not particularly persistent. These results are important since it is well known that non-stationarity in the aggregate inflation may be the result of heterogeneity in the level of persistence of its components (see Granger, 1980).

Moving from the full sample to the 1996-2006 sub-period, the unit root rejection rates increase with level one disaggregate data. For instance, at the 5% level of significance the null hypothesis is rejected between 42% and 50% of the times. According to the aggregation bias hypothesis, as we increase the level of disaggregation we should obtain even higher rejection rates. Indeed, a large increase in the rejection rates occurs when we switch from disaggregation level one to level two. Using the second disaggregation, we can reject the null between 85% and 87% of the times at the 5% significance level, indicating that the majority of aggregate

inflation's components exhibit low persistence. Finally, with level three data we can reject the null hypothesis of unit root 87% of the times.[8] Overall, the ADF results suggest that as we move to more disaggregate inflation data we can reject the unit root null more often thereby supporting the aggregation bias hypothesis.[9]

3.2 Unit root tests with structural breaks

3.2.1 Single-break unit root test

A potential shortcoming of the ADF unit root test is that a stationary variable that is subject to structural breaks may appear non-stationary. Since Perron (1989), it has been recognised that ignoring an existing structural break results in a greater tendency to under-reject the null of unit root when the stationary alternative is true.[10] In other words, ignoring breaks in inflation could result in spuriously high estimates of inflation persistence. Potentially there is a difference preponderance of structural breaks in the more aggregate time series and this may potentially mask our results. Also, given that Figure 1 and Table 1 suggest the mean of inflation has changed over time, it is essential that we take into account structural breaks in our unit root tests.

Perron's (1989) initial approach was to allow for a single exogenously imposed structural break under both the null and alternative hypotheses. Subsequent literature has emphasized the need to determine the break endogenously from the data. Following Perron (1997), we consider three alternative models that allow for a single endogenously determined break:

$$\pi_t = \mu + \theta DU_t + \beta t + \delta D(T_b)_t + \alpha \pi_{t-1} + \sum_{j=1}^{k} c_j \Delta \pi_{t-j} + \varepsilon_{1t} \tag{2}$$

$$\pi_t = \mu + \theta DU_t + \beta t + \gamma DT_t + \delta D(T_b)_t + \alpha \pi_{t-1} + \sum_{j=1}^{k} c_j \Delta \pi_{t-j} + \varepsilon_{2t} \tag{3}$$

$$\pi_t = \mu + \theta DU_t + \beta t + \gamma DT_t^* + \tilde{\pi}_t \tag{4.1}$$

$$\tilde{\pi}_t = \alpha \tilde{\pi}_{t-1} + \sum_{j=1}^{k} c_j \Delta \tilde{\pi}_{t-j} + \varepsilon_{4t} \qquad (4.2)$$

Equation (2) is a type-1 innovative outlier model (IO1) and allows only for a change in the intercept, where T_b denotes the time at which the change in the trend function occurs. It is assumed that this change takes place gradually and is related to the correlation structure of the noise function. Consequently, we have $DU_t = 1$ ($t > T_b$), with $D(T_b)_t = 1(t = 1+T_b)$ and 1(.) is the indicator function in equation (2). Equation (3) gives the type-2 innovative outlier model (IO2), allowing both the intercept and the slope to change at the break date and here $DT_t = 1$ ($t > T_b$)t and $DT_t^* = 1(t > T_b)(t - T_b)$. Finally, we have the additive outlier model (AO), given by equations (4.1) and (4.2), which assume that the structural break takes place quickly.[11]

The unit root test is performed using the *t*-statistic for $\alpha = 1$ in equations (2), (3) and (4): $t_{\hat{\alpha}}(i, T_b, k)$ $(i = 2,3,4)$. The break date T_b and the truncation lag parameter k are both treated as unknown. T_b is determined endogenously using the following sequential method. Equations (2)-(4.2) are estimated using the full sample for each possible break date. Then, we select the T_b which minimizes the *t*-statistic for testing $\alpha = 1$:[12]

$$t_a^*(i) = \min_{T_b \in (k+1, T)} t_{\hat{\alpha}}(i, T_b, k) \quad (i = 2,3,4) \qquad (5)$$

The null hypothesis is rejected if t_a^* exceeds (in absolute value) the corresponding critical value. Perron's approach is similar to Zivot and Andrews (1992) with the exception that he shows that there is no need for arbitrary trimming at the end of the sample. The lag length k is chosen endogenously using the 't-sig' approach, as suggested by Perron (1997). In particular, we set an upper bound of twelve for our lag length ($k = 12$) and test down until a significant (at the 10% level) lag is found. If all lags are insignificant, then we set k equal to zero.

[TABLE 3 HERE]

In Table 3 we present the results from Perron's (1997) unit root test for our aggregate data and a summary of the rejection rates for the null hypothesis of unit root in the disaggregate data.[13] Contrary to the no-break ADF results in the previous section, the results from Perron's single break test indicate that taking into account a structural break there is some evidence in favour of rejecting the unit root hypothesis for aggregate inflation. The evidence is rather weak, though, since both the IO1 and IO2 models suggest broken trend stationarity only at the 10% level of significance. In both models, the break date is around 1992, the year during which Sterling exited the Exchange Rate Mechanism (ERM) of the European Monetary System and adopted inflation targeting.[14] The break date is also consistent with the graphical evidence in Figure 1. The Akaike Information Criterion (AIC) is employed in order to choose a 'preferred' model. In this case, IO2 is the preferred model since it minimizes the AIC.

Moving on to the disaggregate data, in general terms the IO1 and IO2 model are the preferred models. Comparing the unit rejection rates in Tables 2 and 3, we notice that the rejection rates obtained with the Perron test are typically higher compared to those obtained with the ADF test only when level one data is considered. For example, during the full sample period, we note that while at the 1% level of significance the ADF rejection rates are between 25% and 33%, the Perron rejection rates are between 33% and 50%, depending on the specification of the model. However, at higher levels of disaggregation, we obtain higher rejection rates using the ADF as opposed to the Perron test.[15] Previous studies (see among others Levin and Piger, 2004; Gadzinksy and Orlandi, 2004; Marques, 2004) show that by allowing for a structural break in aggregate inflation, we are more likely to reject the unit root null hypothesis. Our results show that this finding can be extended to disaggregate

inflation only at a low level of disaggregation. It is also interesting to observe in Table A2 in the Appendix that most of the breaks in the level one data (full sample results) occur in the early 1990s, that is, when aggregate inflation exhibits a structural break.[16] The clustering of aggregate and disaggregate inflation rates' break dates around the period of UK ERM membership-exit and adoption of inflation targeting supports the notion that breaks in UK inflation during the period under investigation are largely driven by changes in the monetary policy regime.[17]

In line with the ADF results, the Perron results also support the existence of aggregation bias since by switching from the least disaggregate to the more disaggregate datasets we typically increase the number of times we reject the null unit root hypothesis. For example, using the IO2 model, the unit root rejection rates at the 5% level of significance increase from 58% to 75% when we move from disaggregation level one to three. In a similar fashion to the ADF results, most of the increases in the rejection rates occur when we switch from level one to three. Table 4 further summarises the results by re-calculating the rejection rates taking into account the number of times that the model (IO1, IO2, AO) was chosen by the AIC.[18] The rejection rates typically exhibit large increases when we move from disaggregation level one to two, and remain stable or modestly decline when we further break down the overall CPI.

[TABLE 4 HERE]

3.2.2 Two-break unit root test

In order to account for the possibility of more than one structural break in our series, we additionally utilise the endogenous two-break unit root test of Lee and Strazicich (2003). The two-break test counterbalances the potential loss of power of

tests that ignore more than one break. Unlike the Lumsdaine and Papell (1997) two-break unit root test,[19] the Lee and Strazicich test includes breaks under both the null and the alternative hypotheses, with rejections of the null unambiguously implying trend stationarity. Allowing for breaks in the form of two shifts in the level of inflation, the null and alternative hypotheses are:

$$\pi_t = \mu_0 + d_1 B_{1t} + d_2 B_{2t} + \pi_{t-1} + \upsilon_{1t} \qquad \textit{Null} \qquad (6)$$

$$\pi_t = \mu_1 + \gamma t + d_1 D_{1t} + d_2 D_{2t} + \upsilon_{2t} \qquad \textit{Alternative} \qquad (7)$$

where the error terms ($\upsilon_{1t}, \upsilon_{2t}$) are stationary processes; $B_{jt} = 1$ for $t = T_{bj} + 1$ (j = 1,2) and 0 otherwise; $D_{jt} = 1$ for $t \geq T_{bj} + 1$ (j=1,2) and 0 otherwise. An LM score principle is used to estimate the Lee and Strazicich (2003) unit root test statistic based on the following regression model:

$$\Delta\pi_t = \delta' \Delta Z_t + \phi \tilde{S}_{t-1} + u_t \qquad (8)$$

where $Z_t = [1, t, D_{1t}, D_{2t}]'$, $\tilde{S}_t = \pi_t - \tilde{\psi}_x - Z_t \tilde{\delta}$; t = 2,…,T; $\tilde{\delta}$ are coefficients in the regression of $\Delta\pi_t$ on ΔZ_t; $\tilde{\psi}_x = \pi_1 - Z_1 \tilde{\delta}$, where π_1 and Z_1 denote the first observations of π_t and Z_t, respectively. We can consequently test the unit root null hypothesis by examining the t-statistic ($\tilde{\tau}$) associated with $\phi = 0$.

[TABLE 5 HERE]

Table 5 contains the results from Lee and Strazicich's two-break test for aggregate inflation and a summary of the rejection rates for the unit root null in the disaggregate data.[20] The null hypothesis cannot be rejected for aggregate inflation,[21] with both breaks occurring around 1990, the year of UK entrance to the ERM. The (full sample) results in Table A3 in the Appendix indicate that breaks in the early 1990s can also be identified in all level one sectoral inflation rates. Hence, the two-

break analysis concurs with the single-break analysis that monetary policy shifts may be the underlying factor behind breaks in inflation.

Switching from the least disaggregate to the more disaggregate datasets, the null hypothesis of unit root is rejected more often thereby supporting the aggregation bias hypothesis. For instance, at the 5% significance level the unit root rejection rates increase from 69% to 88% when we move from disaggregation level one to three. Comparing the rejection rates in Tables 4 and 5, we can also note that when we take into account two structural breaks, as opposed to one, the rejection frequencies typically increase, indicating power gains. For example, using level three data, the rejection rate at the 5% significance level is 71% in the single-break test and 88% in the two-break test.

4. Panel time series methods

4.1 First generation panel unit root tests

It is widely recognised that univariate unit root tests may suffer from low power in small samples, hence, in this section we consider more powerful panel approaches to examine the degree of non-stationarity in our inflation dataset. Firstly, we utilise panel unit root tests which assume that the residual error term in the panel regression is $\sigma^2 I$, where I is the identity matrix. This is consistent with the idea that the cross sections are not affected by common shocks, an approach adopted by Culver and Papell (1997) when examining aggregate inflation data. Therefore, we use the tests of Im, Pesaran and Shin (IPS, 2003), Hadri (2000), and a panel LM test from Schmidt and Phillips (1992) developed in Im et al. (2005) which takes into account structural breaks in the deterministic component of the regression.

The IPS test utilises a panel version of the Dickey Fuller model as follows:

$$\Delta\pi_{it} = \alpha_i + \phi_i \pi_{it-1} + \varepsilon_{it} \tag{9}$$

where π_{it} is the inflation rate in sector $i = 1,\ldots,N$ at time period $t = 1,\ldots,T$; α_i is a cross section specific intercept and $\varepsilon_{it} \sim iid(0,\sigma_i^2)$. The IPS test has a null hypothesis that all sectoral inflation rates are random walks with drift:

$$H_0 : \phi_1 = \phi_2 = \ldots = \phi_N = \phi = 0 \tag{10}$$

Against a heterogeneous alternative hypothesis:

$$H_1 : \phi_1 < 0,\ldots,\phi_{N_1} < 0, \quad N_1 \le N \tag{11}$$

The test statistic, $Z_{\tilde{t}bar}$ is based on an average of the individual cross section ADF test statistics. In particular,

$$Z_{\tilde{t}bar} = \sqrt{N}\{\tilde{t}bar_{NT} - E(\tilde{t}_T)\}/\sqrt{Var(\tilde{t}_T)} \qquad \Rightarrow \mathsf{N}(0,1) \tag{12}$$

where $\mathsf{N}(0,1)$ is the standard normal distribution. Also $\tilde{t}bar_{NT} = 1/N\sum_{t=1}^{N}\tilde{t}_{iT}$ and $\tilde{t}_{iT}$ are the standard cross section unit root test statistics.

Hadri's (2000) test is based on the null hypothesis of stationarity and has a normal distribution once we correct for the mean and the variance. The panel test statistic based on the average of the individual KPSS tests statistics. Consider the following regression model:

$$\pi_{it} = \gamma' y_{it} + e_{it} \tag{13}$$

where y_{it} is a random walk and $e_{it} \sim iid(0,\sigma_e^2)$, Hadri's stationarity test statistics has the representation:

$$LM = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{\frac{1}{T^2}\sum_{t=1}^{N}S_{it}^2}{\hat{\sigma}_{\varepsilon,i}^2}\right) \quad . \tag{14}$$

where $S_{it}=S_{it}=\sum_{j=1}^{t}\hat{e}_{ij}$ and $\hat{\sigma}_e^2=\langle 1/NT\rangle\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{e}_{it}^2$. The LM tests statistic is distributed as a standard normal once we make a correction for mean and variance.

Im et al.'s (2005) panel LM unit root test is a first generation test that allows for breaks under both the null and alternative hypotheses. Consider the following model:

$$\pi_{it}=\delta_{1i}+\delta_{2i}t+\delta_{3i}D_{it}+e_{it}, \qquad e_{it}=e_{it-1}+u_{it} \tag{15}$$

This can be solved to produce an equation of the form:

$$\Delta e_{it}=\Delta\pi_{it}-\delta_{2i}-\delta_{3i}\Delta D_{it} \tag{16}$$

where $\Delta D_{it}=0$ ($T<T_i$) and = 1 ($T>T_i$). Firstly, we compute a univariate LM unit root statistic for each country (LM_i) and hence utilise equation (8) to obtain the individual cross sectional regression statistics. The standardized panel LM statistic is consequently obtained by utilising a mean and variance correction. The null and alternative hypotheses are the same as in the IPS panel unit root test.

[TABLE 6 HERE]

Table 6 presents the results from the panel unit root tests that we discussed above. The IPS test results suggest that we can reject the null hypothesis of unit root at all three levels of disaggregation.[22] As we increase the number of cross-sections in the panel by moving from disaggregation level one towards three, the value of the IPS test statistic increases indicating a stronger rejection of the panel unit root null hypothesis. Results from the LM panel test that accounts for breaks are similar to the IPS results, with the exception of the panel based on the level one disaggregation data over the longer time span (1988-2006), where the unit root null is not rejected. Finally, the results from Hadri's test indicate that the null of stationarity cannot be rejected for all panels under investigation.

4.2 PANIC

It should be emphasized that the first generation panel unit root tests assume no cross sectional correlation. The PANIC (Panel Analysis of Non-stationarity in Idiosyncratic and Common components) approach to panel unit root testing was introduced by Bai and Ng (2004) and uses a factor structure to understand the nature of non-stationarity in panel time series. This is useful to identify whether non-stationarity is pervasive or variable specific. We can also utilise the Bai and Ng (2002) information criteria to identify the number of common factors in the series. Therefore PANIC is much more successful in modelling commonality across the panel, unlike other factor approaches which assume *a priori* that there is a particular number of common factors or that the factors themselves are stationary processes (see Breitung and Peseran, 2007). In the presence of an intercept, the Bai and Ng (2004) PANIC model is as follows:

$$\pi_{it} = c_i + \lambda_i' F_t + e_{it} \tag{17}$$

where π_{it} is the sum of a cross section specific constant, a common component, $\lambda_i' F_t$, and an error term, e_{it}, that represents the idiosyncratic component.

In this set up π_{it} is non-stationary if the common factors or the idiosyncratic component, or both, are non-stationary. PANIC therefore allows us to identify whether non-stationarity is variable specific or much more pervasive in a panel. We utilise two test statistics which are a standard ADF test applied to the common factors and a Fisher-type pooled test based on the p-values of ADF tests on the idiosyncratic error terms $p(i)$ as follows:

$$P_{\hat{e}}^{c} = \left(-2\sum_{i=1}^{N} \log p(i) - 2N\right) \Big/ 4N \qquad \Rightarrow \mathsf{N}(0,1) \tag{18}$$

[TABLE 7 HERE]

In Table 7, we present the PANIC results. We find no common factor in our least disaggregated panel (N = 12) for either the full sample 1988-2006 or the sub-period 1996-2006. Nevertheless, we impose one factor[23] and find that while we cannot reject the null hypothesis of unit root in the common factor over the full sample period, we can reject it using shorter span data. When we increase the level of disaggregation, there is more evidence for stationary common factors in sectoral inflation rates. In particular, we find that there are two common factors in disaggregation level two, out of which only one is stationary, and three common factors in level three, all stationary. Finally, we find that the idiosyncratic component of inflation is stationary, with the test statistic increasing as we move towards a higher level of disaggregation indicating stronger rejection of the unit root null hypothesis. Also, it should be noted that in our example there can be no cointegration between the common factors themselves and/or the idiosyncratic component. There is at most one stochastic factor for UK inflation which can not, by definition, cointegrate with itself. Overall the panel results suggest that as we disaggregate the data we find more evidence that inflation is a stationary process.

5. Conclusions

In this paper, we examine whether UK inflation persistence is characterized by aggregation bias using a battery of time series and panel unit root tests. A better understanding of inflation persistence and its sources is essential to select among competing theoretical models of inflation and to improve out-of-sample inflation forecasts which are essential for UK monetary policy formulation within the inflation targeting regime. Most of the previous empirical studies have focused on US and Euro Area inflation persistence, with little evidence existing on the potential aggregation

bias due to heterogeneity in the persistence of UK sectoral inflation rates, and the impact of structural breaks.

In order to examine the aggregation bias hypothesis, this paper utilises three sets of disaggregate UK inflation data. Time series unit root tests are performed for each sectoral inflation rate in the particular disaggregation and subsequently unit root rejection rates are calculated for the disaggregation as a whole. Our results support the existence of aggregation bias since while the unit root hypothesis cannot be rejected for aggregate inflation, it can be rejected for some of its sectoral components, with the rejection frequencies typically increasing when we use more disaggregate data. We believe that this is an important result, not least due to the recent advocacy of unit root cross sectional rejection frequencies by Pesaran (2007).

Results from structural break analysis indicate that monetary policy shifts are the main factor behind breaks in UK inflation. The implied break dates for both aggregate and disaggregate inflation series are clustered around the early 1990s period, during which the UK entered and exited the ERM, and subsequently adopted inflation targeting. Additionally, due to issues of low power in univariate approaches we implement panel unit root tests to examine the persistence of UK inflation. The panel unit root test results typically indicate that the unit root hypothesis can be rejected. Hence, pooling sectoral inflation rates within the same country or pooling aggregate inflation rates across different countries, as is standard in the previous literature, see Culver and Papell (1997), leads to the same conclusion that, overall, inflation is not fully persistent. Finally, when we take into account the possibility of correlation among the sectoral inflation rates that constitute the panel, we find more evidence for stationary common factors by increasing the level of disaggregation.

We show that there are important differences in the properties of inflation across different sectors of the UK economy. Although UK monetary policy makers target aggregate inflation, they should nevertheless be aware of the different speeds of adjustment of sectoral prices when implementing monetary policy. Closer attention should be paid to sectors that exhibit high inflation persistence, especially if they receive a great weight in the calculation of the overall CPI. This is due to the fact that economic shocks affecting these sectors are likely to result into permanent changes in sectoral and aggregate inflation, thereby threatening the aggregate inflation target.

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Figure 1: Aggregate UK inflation rate, 1988-2006

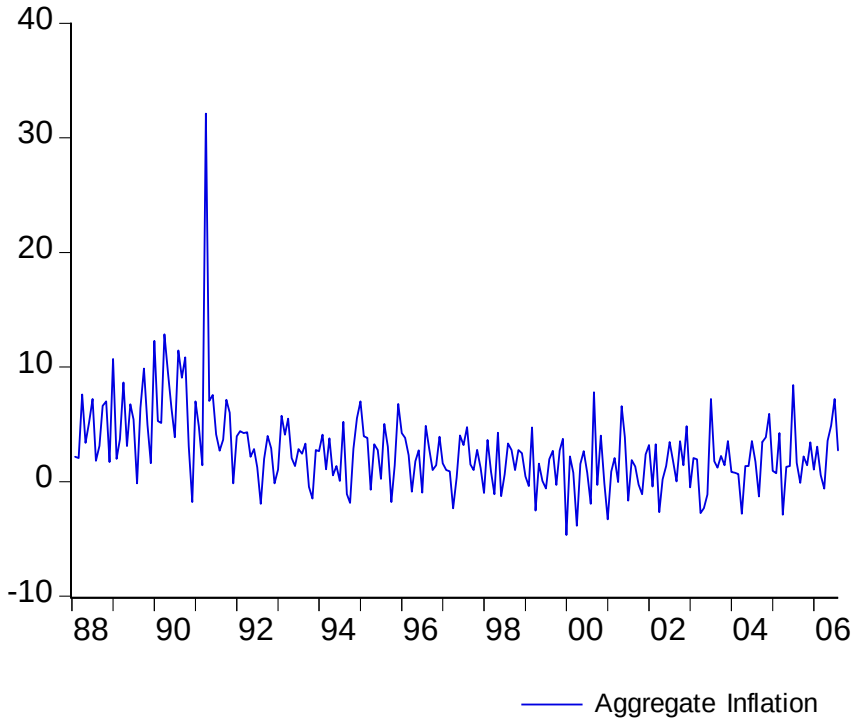

Table 1: Descriptive statistics

Indices	1988.02-2006.08		1996.02-2006.08	
	Mean	Standard Deviation	Mean	Standard Deviation
CPI All	2.70	3.59	1.55	2.38
Disaggregation Level 1				
1 Food and non-alcoholic beverages	2.31	6.58	1.21	6.63
2 Alcoholic beverages, tobacco and narcotics	4.67	8.25	3.42	5.71
3 Clothing and footwear	-2.84	11.07	-5.07	10.82
4 Housing, water, electricity and fuels	4.31	5.85	3.21	5.02
5 Furniture, household equip. and routine repair	0.90	7.46	-0.19	6.75
6 Health	3.73	12.51	2.93	6.53
7 Transport	3.52	8.27	2.69	8.24
8 Communication	-0.62	8.31	-1.99	7.34
9 Recreation and culture	1.46	3.84	0.07	2.86
10 Education	6.72	8.80	5.45	8.19
11 Hotels, cafes and restaurants	4.55	4.03	3.33	1.87
12 Miscellaneous goods and services	3.49	4.26	3.06	3.74

Table 2: ADF unit root test results

	Constant	Constant and Trend
	ADF *t*-stat	**ADF *t*-stat**
CPI All : 1988:02-2006:08	-1.49 [11]	-1.20 [11]
CPI All : 1996:02-2006:08	-2.01 [11]	-1.75 [11]
Disaggregation Level 1 [1988:02-2006:08]		
Unit Root Rejection Rate		
10% Significance Level	50%	50%
5% Significance Level	42%	33%
1% Significance Level	25%	33%
Disaggregation Level 1 [1996:02-2006:08]		
Unit Root Rejection Rate		
10% Significance Level	67%	50%
5% Significance Level	50%	42%
1% Significance Level	33%	42%
Disaggregation Level 2 [1996:02-2006:08]		
Unit Root Rejection Rate		
10% Significance Level	85%	87%
5% Significance Level	85%	87%
1% Significance Level	79%	74%
Disaggregation Level 3 [1996:02-2006:08]		
Unit Root Rejection Rate		
10% Significance Level	87%	88%
5% Significance Level	87%	87%
1% Significance Level	81%	81%

NOTES: Numbers in square brackets indicates the number of lagged difference terms k in equation (1), chosen by the Akaike Information Criterion. The reported t-statistics test the null hypothesis that inflation contains a unit root. ***, **, * indicate rejection of the null-unit root hypothesis at 1, 5, 10% level of significance. For critical values see MacKinnon (1996).

Table 3: Single-break unit root test results

	IO1 Model			IO2 Model			AO Model		
	t-ratio: $\alpha = 1$	**AIC**	**Break Date**	**t-ratio: $\alpha = 1$**	**AIC**	**Break Date**	**t-ratio: $\alpha = 1$**	**AIC**	**Break Date**
CPI All: 1988.02-2006.08	-4.71 [11]*	2.181	1992.02	*-4.91 [11] **	*2.157*	*1991.10*	-2.41 [11]	2.357	1997.10
Disaggregation Level 1 [1988:02-2006:08]									
Unit Root Rejection Rate									
10% Significance Level	58%			67%			42%		
5% Significance Level	50%			58%			42%		
1% Significance Level	50%			50%			33%		
Preferred Model	50%			50%			0%		
Disaggregation Level 1 [1996:02-2006:08]									
Unit Root Rejection Rate									
10% Significance Level	50%			58%			33%		
5% Significance Level	50%			58%			33%		
1% Significance Level	50%			58%			33%		
Preferred Model	50%			42%			8%		
Disaggregation Level 2 [1996:02-2006:08]									
Unit Root Rejection Rate									
10% Significance Level	79%			77%			56%		
5% Significance Level	79%			72%			49%		
1% Significance Level	67%			69%			44%		
Preferred Model	72%			26%			2%		
Disaggregation Level 3 [1996:02-2006:08]									
Unit Root Rejection Rate									
10% Significance Level	79%			78%			64%		
5% Significance Level	75%			75%			59%		
1% Significance Level	69%			71%			52%		
Preferred Model	69%			24%			7%		

NOTES: Numbers in square brackets indicate the number of lagged difference terms in equations (2)-(4.2), chosen by the 't-sig' approach. The break date was chosen by minimizing the t-statistic for testing $\alpha = 1$ in equations (2)-(4.2). The reported *t*-statistics test the null hypothesis that inflation contains a unit root. See Perron (1997) for critical values. Preferred model, denoted by italics, is the one (among IO1, IO2, AO) that minimises the Akaike Information Criterion. ***, **, * indicate rejection of the null-unit root hypothesis at 1, 5, 10% level of significance.

Table 4: Single-break test results summary taking into account the preferred model

Unit Root Rejection Rate	Level 1 1988.02-2006.08	Level 1 1996.02-2006.08	Level 2 1996.02-2006.08	Level 3 1996.02-2006.08
10% Significance Level	67%	50%	77%	72%
5% Significance Level	50%	50%	77%	71%
1% Significance Level	50%	50%	67%	67%

NOTES: Preferred model is the one (among IO1, IO2, AO) that minimises the Akaike Information Criterion.

Table 5: Two-break unit root test results

	LM-stat	Break Dates		Lag Length
CPI All : 1988:02-2006:08	-3.4315	1989.12	1990.10	12
Unit Root Rejection Rate	**Level 1 1988.02-2006.08**	**Level 1 1996.02-2006.08**	**Level 2 1996.02-2006.08**	**Level 3 1996.02-2006.08**
10% Significance Level	69%	85%	90%	93%
5% Significance Level	62%	69%	87%	88%
1% Significance Level	38%	54%	74%	74%

NOTES: The lag length was chosen by the 't-sig' approach. The critical values for $T = 100$ (model with two intercept breaks) are -4.545, -3.842 and -3.504 at the 1%, 5% and 10% level respectively (see Lee and Strazicich, 2003). ***, **, * indicate rejection of the null-unit root hypothesis at 1, 5, 10% level of significance.

Table 6: First generation panel unit root tests results

Indices	Unit root test statistic		
	IPS Panel Unit Root	Hadri (2000)	Panel LM with Level Shift
Level 1, 1988-2006 $N = 12; T = 223$	-8.096*	0.280	1.086
Level 1, 1996-2006 $N = 12; T = 127$	-10.096*	0.282	-7.368*
Level 2, 1996-2006 $N = 35; T = 127$	-13.787*	0.190	-9.763*
Level 3, 1996-2006 $N = 79; T = 127$	-21.351*	0.100	-17.523*

NOTES: N denotes the number of cross sections and T the number of time series observations per cross section. Sectors with data starting later than 1996.02 are removed from the panel resulting in a loss of four sectors in Disaggregation Two and six sectors in Disaggregation Three. The Im et al. (2003) test has a 5% critical value of -1.65 and a unit root null. The Hadri (2000) test has a null hypothesis of stationarity and is distributed as standard normal. Using a sequential general to specific approach to determine the number of lagged augmentations, the Panel LM test statistics are distributed as standard normal. * indicates rejection of the null-unit root hypothesis at 5% level of significance.

Table 7: PANIC unit root test results

Indices	Bai and Ng (2004) Unit root test statistic		
	IC	Factors	Idiosyncratic Component
Level 1, 1988-2006 $N = 12; T = 223$	0	-2.365	15.664*
Level 1, 1996-2006 $N = 12; T = 127$	0	-3.731*	8.170*
Level 2, 1996-2006 $N = 35; T = 127$	2	-5.326*, -2.818	12.774*
Level 3, 1996-2006 $N = 79; T = 127$	3	-7.335*, -3.027*, -4.921*	20.550*

NOTES: This table presents results from the Bai and Ng (2004) PANIC model which can be utilised to test for a panel unit root. The null is applied to both the common factor and the idiosyncratic error. The number of common factors is determined by Bai and Ng's (2002) third information criterion (IC) which takes account of cross sectional correlation in the idiosyncratic component, based on a panel Bayesian approach. For the unit root null the common factor has a 5% critical value of -2.86 and the idiosyncratic error has a critical value of 1.64. * indicates rejection of the null-unit root hypothesis at 5% level of significance.

APPENDIX

Table A1: ADF unit root test results

Indices	Constant	Constant and Trend
	ADF *t*-stat	ADF *t*-stat
CPI All : 1988:02-2006:08	-1.49 [11]	-1.20 [11]
Disaggregation Level 1 : 1988.02-2006.08		
1 Food and non-alcoholic beverages	-8.80 [1] ***	-14.22 [0] ***
2 Alcoholic beverages, tobacco and narcotics	-2.08 [11]	-2.93 [11]
3 Clothing and footwear	-2.01 [11]	-1.90 [11]
4 Housing, water, electricity and fuels	-0.97 [11]	-0.40 [11]
5 Furniture, household equip. and routine repair	-1.96 [12]	-2.60 [11]
6 Health	-2.89 [9] **	-3.25 [9] *
7 Transport	-2.99 [11] **	-3.26 [11] *
8 Communication	-8.10 [1] ***	-11.87 [0] ***
9 Recreation and culture	-2.70 [5] *	-4.48 [5] ***
10 Education	-2.12 [11]	-2.85 [11]
11 Hotels, cafes and restaurants	-1.57 [11]	-2.18 [11]
12 Miscellaneous goods and services	-6.51 [2] ***	-6.84 [2] ***
Unit Root Rejection Rate		
10% Significance Level	50%	50%
5% Significance Level	42%	33%
1% Significance Level	25%	33%

	Constant	Constant and Trend
CPI All : 1996:02-2006:08	-2.01 [11]	-1.75 [11]
Disaggregation Level 1 : 1996.02-2006.08		
1 Food and non-alcoholic beverages	-10.13 [0] ***	-10.13 [0] ***
2 Alcoholic beverages, tobacco and narcotics	-1.63 [12]	-2.01 [12]
3 Clothing and footwear	-2.23 [11]	-1.94 [11]
4 Housing, water, electricity and fuels	0.83 [11]	-0.55 [11]
5 Furniture, household equip. and routine repair	-3.27 [12] **	-3.01 [12]
6 Health	-3.17 [11] **	-3.15 [11] *
7 Transport	-2.33 [11]	-2.32 [11]
8 Communication	-9.49 [0] ***	-9.53 [0] ***
9 Recreation and culture	-2.74 [5] *	-11.58 [0] ***
10 Education	-4.00 [11] ***	-4.06 [11] ***
11 Hotels, cafes and restaurants	-2.60 [11] *	-2.94 [11]
12 Miscellaneous goods and services	-12.47 [0] ***	-12.59 [0] ***
Unit Root Rejection Rate		
10% Significance Level	67%	50%
5% Significance Level	50%	42%
1% Significance Level	33%	42%

Disaggregation Level 2 : 1996.02-2006.08	**Constant**	**Constant and Trend**
1.1 Food	-10.18 [0] ***	-10.25 [0] ***
1.2 Non-alcoholic beverages	-1.73 [7]	-1.455 [7]
2.1 Alcoholic beverages	-15.79 [0] ***	-7.77 [3] ***
2.2 Tobacco	-10.67 [0] ***	-10.89 [0] ***
3.1 Clothing	-1.95 [11]	-1.68 [11]
3.2 Footwear including repairs	-2.54 [11]	-2.54 [11]
4.1 Actual rents for housing	-10.41 [0] ***	-10.49 [0] ***
4.2 Regular maintenance and dwelling repair	11.99 [0] ***	-12.65 [0] ***
4.3 Other dwelling related services	-11.15 [0] ***	-11.15 [0] ***
4.4 Electricity, gas and other fuels	0.16 [6]	-6.89 [0] ***
5.1 Furniture, furnishing, carpets & other coverings	-9.17 [3] ***	-9.14 [3] ***
5.2 Household textiles	-14.29 [0] ***	-14.41 [0] ***

5.3 Major househ. appliances incl. fittings & repairs	-3.83 [11] ***	-3.91 [11] **
5.4 Glassware, tableware and household utensils	-10.80 [1] ***	-7.70 [3] ***
5.5 Tools and equipment for house and garden	-11.23 [0] ***	-11.23 [0] ***
5.6 Goods & serv. for routine househ. maintenance	-12.36 [0] ***	-12.40 [0] ***
6.1 Medical products, appliances & equipment	-10.66 [1] ***	-5.79 [7] ***
6.2 Out-patient services	-9.47 [0] ***	-9.42 [0] ***
6.3 Hospital services	-9.62 [0] ***	-9.89 [0] ***
7.1 Purchase of vehicles	-2.35 [12]	-2.52 [12]
7.2 Operation of personal transport equipment	-2.48 [11]	-2.46 [11]
7.3 Transport services	-5.12 [11] ***	-5.15 [11] ***
8.1 Postal services	-12.68 [0] ***	-12.89 [0] ***
8.2 Telephone and telefax equipment and services	-9.31 [0] ***	-9.34 [0] ***
9.1 Audiovisual photography and data process equip.	-11.34 [0] ***	-11.31 [0] ***
9.2 Other major durables for recreation & culture	-6.81 [1] ***	-6.78 [1] ***
9.3 Other recreational items, gardens & pets	-3.79 [5] ***	-4.15 [8] ***
9.4 Recreational and cultural services	-3.43 [6] **	-3.47 [6] **
9.5 Books, newspapers and stationery	-9.79 [1] ***	-9.76 [1] ***
9.6 Package holidays	-3.17 [1] **	-3.46 [1] **
10 Education	-4.00 [11] ***	-4.06 [11] ***
11.1 Catering	-11.89 [0] ***	-12.43 [0] ***
11.2 Accommodation services	-3.62 [5] ***	-3.49 [5] **
12.1 Personal care	-4.14 [3] ***	-4.32 [3] ***
12.2 Personal effects (not elsewhere classified)	-5.79 [2] ***	-9.81 [1] ***
12.3 Financial services (not elsewhere classified)	-11.07 [0] ***	-11.06 [0] ***
12.4 Social protection	-5.88 [5] ***	-6.21 [5] ***
12.5 Insurance	-3.68 [8] ***	-3.84 [8] **
12.6 Other services (not elsewhere classified)	-10.96 [0] ***	-11.24 [0] ***
Unit Root Rejection Rate		
10% Significance Level	85%	87%
5% Significance Level	85%	87%
1% Significance Level	79%	74%

Disaggregation Level 3 : 1996.02-2006.08	**Constant**	**Constant and Trend**
1.1.1 Bread and cereals	-11.82 [0] ***	-5.69 [8] ***
1.1.2 Meat	-12.81 [0] ***	-12.78 [0] ***
1.1.3 Fish	-1.98 [6]	-1.89 [6]
1.1.4 Milk	-3.03 [11] **	-3.97 [11] **
1.1.5 Oil and Fats	-4.62 [11] ***	-4.55 [11] ***
1.1.6 Fruit	-13.14 [0] ***	-13.09 [0] ***
1.1.7 Vegetables including potatoes and tubers	-11.03 [0] ***	-11.03 [0] ***
1.1.8 Sugar, jam, syrups, chocolate & confectionery	-9.48 [0] ***	-7.13 [2] ***
1.1.9 Food products (not elsewhere classified)	-6.35 [3] ***	-6.84 [3] ***
1.2.1 Coffee, tea, cocoa	-6.57 [1] ***	-6.52 [1] ***
1.2.2 Mineral waters, soft drinks and juices	-8.57 [2] ***	-8.74 [2] ***
2.1.1 Spirits	-9.20 [2] ***	-9.25 [2] ***
2.1.2 Wine	-7.80 [3] ***	-7.77 [3] ***
2.1.3 Beer	-16.81 [0] ***	-8.92 [2] ***
2.2 Tobacco	-10.67 [0] ***	-10.89 [0] ***
3.1.1 Garments	-1.99 [11]	-1.71 [11]
3.1.2 Other clothing and clothing accessories	-3.96 [5] ***	-3.97 [5] **
3.1.3 Cleaning, repair and hire of clothing	-11.24 [0] ***	-11.37 [0] ***
3.2 Footwear including repairs	-2.45 [11]	-2.54 [11]
4.1 Actual rents for housing	-10.41 [0] ***	-10.49 [0] ***
4.2.1 Materials for maintenance and repair	-13.63 [0] ***	-13.62 [0] ***
4.2.2 Services for maintenance and repair	-12.11 [0] ***	-12.46 [0] ***
4.3.1 Water supply	-11.15 [0] ***	-11.24 [0] ***
4.3.2 Sewerage collection	-11.15 [0] ***	-11.12 [0] ***
4.4.1 Electricity	1.48 [10]	-4.33 [3] ***
4.4.2 Gas	0.54 [8]	-6.47 [1] ***
4.4.3 Liquid fuels	-10.27 [0] ***	-10.36 [0] ***
4.4.4 Solid fuels	-3.91 [3] ***	-12.70 [0] ***
5.1.1 Furniture and furnishings	-9.00 [3] ***	-8.97 [3] ***

5.1.2 Carpets and other floor coverings	-9.60 [2] ***	-9.56 [2] ***
5.2 Household textiles	-14.29 [0] ***	-14.41 [0] ***
5.3.1 Major appliances & small electrical goods	-4.27 [11] ***	-4.24 [11] ***
5.3.2 Repair of household appliances	-11.18 [0] ***	-7.84 [2] ***
5.4 Glassware, tableware and household utensils	-10.80 [1] ***	-7.70 [3] ***
5.5 Tools and equipment for house and garden	-11.23 [0] ***	-11.23 [0] ***
5.6.1 Non-durable household goods	-12.26 [0] ***	-12.24 [0] ***
5.6.2 Domestic services and household services	-4.69 [2] ***	-2.79 [5]
6.1.1 Pharmaceutical products	-3.60 [6] ***	-10.13 [1] ***
6.1.2 Other medical and therapeutic equipment	-10.67 [1] ***	-11.62 [1] ***
6.2.1 Medical services and paramedical services	-10.18 [0] ***	-10.12 [0] ***
6.2.2 Dental services	-2.31 [11]	-2.87 [11]
6.3 Hospital services	-9.62 [0] ***	-9.89 [0] ***
7.1.1 New cars	-1.98 [10]	-2.07 [10]
7.1.2 Second-hand cars	-6.58 [0] ***	-6.78 [0] ***
7.1.3 Motorcycles and bicycles	-10.07 [1] ***	-10.10 [1] ***
7.2.1 Spare parts and accessories	-6.45 [1] ***	-6.47 [1] ***
7.2.2 Fuels and lubricants	-2.57 [11]	-2.51 [11]
7.2.3 Maintenance and repairs	-11.10 [0] ***	-11.43 [0] ***
7.2.4 Other services	-10.87 [0] ***	-10.83 [0] ***
7.3.1 Passenger transport by railway	-13.15 [0] ***	-13.19 [0] ***
7.3.2 Passenger transport by road	-10.44 [0] ***	-10.43 [0] ***
7.3.3 Passenger transport by air	-5.46 [11] ***	-5.59 [11] ***
7.3.4 Passenger transport by sea & inland waterway	-4.62 [11] ***	-4.66 [11] ***
8.1 Postal services	-12.68 [0] ***	-12.89 [0] ***
8.2 Telephone and telefax equip. and services	-9.31 [0] ***	-9.34 [0] ***
9.1.1 Reception & reproduction of sound & pictures	-2.99 [5] **	-11.27 [0] ***
9.1.2 Photographic, cinematogr. & optical equip.	-1.58 [12]	-2.16 [6]
9.1.3 Data processing equipment	-6.18 [2] ***	-6.92 [2] ***
9.1.4 Recording data	-12.39 [0] ***	-12.54 [0] ***
9.1.5 Repair of audiovisual equip. & related products	-11.31 [0] ***	-11.26 [0] ***
9.2 Other major durables for recreation & culture	-6.81 [1] ***	-6.78 [1] ***
9.3.1 Games, toys and hobbies	-4.25 [5] ***	-4.35 [5] ***
9.3.2 Equipment for sport and open-air recreation	-13.18 [0] ***	-13.15 [0] ***
9.3.3 Gardens, plants and flowers	-11.61 [1] ***	-11.56 [1] ***
9.3.4 Pets, related products and services	-13.43 [0] ***	-13.38 [0] ***
9.4.1 Recreational and sporting services	-11.48 [0] ***	-11.49 [0] ***
9.4.2 Cultural services	-3.26 [6] **	-3.34 [6] *
9.5.1 Books	-3.18 [11] **	-3.53 [11] **
9.5.2 Newspapers and periodicals	-11.96 [0] ***	-11.93 [0] ***
9.5.3 Misc. printed matter, station.& drawing maters.	-13.31 [0] ***	-13.92 [0] ***
9.6 Package holidays	-3.17 [1] **	-3.46 [1] **
10. Education	-4.00 [11] ***	-4.06 [11] ***
11.1.1 Restaurants and cafes	-10.95 [0] ***	-11.28 [0] ***
11.1.2 Canteens	-9.62 [1] ***	-10.21 [1] ***
11.2 Accommodation services	-3.62 [5] ***	-3.49 [5] **
12.1.1 Hairdressing and personal grooming establish.	-12.24 [0] ***	-13.04 [0] ***
12.1.2 Appliances and products for personal care	-6.57 [1] ***	-6.78 [1] ***
12.2.1 Jewellery, clocks and watches	-2.36 [5]	-2.64 [5]
12.2.2 Other personal effects	-10.52 [1] ***	-10.48 [1] ***
12.3 Financial services (not elsewhere classified)	-11.07 [0] ***	-11.06 [0] ***
12.4 Social Protection	-5.88 [5] ***	-6.21 5] ***
12.5.1 House contents insurance	-10.24 [0] ***	-10.24 [0] ***
12.5.2 Health insurance	-2.11 [5]	-2.70 [5]
12.5.3 Transport insurance	-4.68 [2] ***	-5.24 [2] ***
12.6 Other services (not elsewhere classified)	-10.96 [0] ***	-11.24 [0] ***
Unit Root Rejection Rate		
10% Significance Level	87%	88%
5% Significance Level	87%	87%
1% Significance Level	81%	81%

NOTES: Numbers in square brackets are the number of lagged difference terms in equation (1). It was chosen by the Akaike Information Criterion. The reported *t*-statistics test the null hypothesis that inflation contains a unit root. ***, **, * indicate rejection of the null-unit root hypothesis at 1, 5, 10% level of significance. For critical values see MacKinnon (1996).

Table A2: Single-break unit root test results

Indices	IO1 Model			IO2 Model			AO Model		
	t-ratio: a=1	**AIC**	**Break Date**	**t-ratio: a=1**	**AIC**	**Break Date**	**t-ratio: a=1**	**AIC**	**Break Date**
CPI All: 1988.02-2006.08	-4.71 [11]*	2.181	1992.02	*-4.91 [11] **	*2.157*	*1991.10*	-2.41 [11]	2.357	1997.10
Disaggregation Level 1 : 1988.02-2006.08									
1 Food and non-alcoholic beverages	-14.91 [0] ***	3.718	2000.06	*-15.02 [0]* ***	*3.716*	*2000.06*	-14.66 [0]***	3.732	2006.02
2 Alcoholic beverages, tobacco and narcotics	*-4.34 [11]*	*3.528*	*1991.03*	-5.38 [11]**	4.059	1991.11	-3.15 [11]	4.178	1990.05
3 Clothing and footwear	*-4.76 [11]* *	*3.88*	*2002.07*	-4.76 [11]	3.89	2002.07	-3.89 [11]	4.743	2000.11
4 Housing, water, electricity and fuels	*-2.28 [11]*	*3.299*	*1991.05*	-2.55 [11]	3.332	1999.12	-2.63 [11]	3.378	2001.03
5 Furniture, household equip. and routine repair	-4.46 [11]	3.239	1991.07	*-4.98 [11]**	*3.219*	*1991.07*	-3.166 [11]	3.999	1993.09
6 Health	-8.95 [5] ***	4.639	1993.05	*-9.28 [5]***	*4.622*	*1993.05*	-8.46 [5]***	5.049	1993.10
7 Transport	*-4.26 [11]*	*4.194*	*2002.08*	-4.6 [12]	4.207	2000.10	-4.00 [11]	4.218	2001.06
8 Communication	*-13.19 [0]* ***	*4.085*	*2000.12*	-13.15 [0]***	4.093	2000.12	-12.44 [0]***	4.172	1996.09
9 Recreation and culture	-6.17 [5] ***	2.024	1991.03	*-6.37 [5]***	*2.022*	*1991.03*	-4.62 [5]**	2.45	1994.01
10 Education	-4.01 [11]	4.117	1994.07	*-4.19 [11]*	*4.092*	*1992.02*	-3.13 [11]	4.337	1996.09
11 Hotels, cafes and restaurants	-6.83 [11] ***	1.693	1991.03	*-7.13 [11]***	*1.68*	*1991.03*	-2.81 [11]	2.61	1995.03
12 Miscellaneous goods and services	*-7.88 [2]* ***	*2.832*	*1991.11*	-7.86 [2]***	2.838	1991.11	-7.29 [2] ***	2.866	2004.01
Unit Root Rejection Rate									
10% Significance Level	58%			67%			42%		
5% Significance Level	50%			58%			42%		
1% Significance Level	50%			50%			33%		
Preferred Model	50%			50%			0%		
Unit Root Rejection Rate with Preferred Model									
10% Significance Level	50%			83%			NA		
5% Significance Level	33%			67%			NA		
1% Significance Level	33%			67%			NA		

CPI All: 1996.02-2006.08	*-3.74 [11]*	*1.577*	*1999.02*	-3.92 [11]	1.617	1999.11	-3.52 [11]	1.731	2000.05
Disaggregation Level 1 : 1996.02-2006.08									
1 Food and non-alcoholic beverages	*-10.86 [0]* ***	*3.709*	*2001.04*	-10.83 [0] ***	3.724	2001.04	-10.51 [0] ***	3.787	2006.03
2 Alcoholic beverages, tobacco and narcotics	*-7.3 [9]* ***	*3.404*	*2001.02*	-10.75 [0] ***	3.45	1999.03	-2.47 [12]	3.487	2004.01
3 Clothing and footwear	-4.02	4.092	2002.07	*-4.2 [11]*	*4.079*	*2002.07*	-3.00 [11]	4.777	2000.08
4 Housing, water, electricity and fuels	-3.25 [12]	3.008	2004.08	*-4.82 [12]*	*2.909*	*2003.02*	-4.21 [12]	3.001	2003.09
5 Furniture, household equip. and routine repair	-3.95 [11]	3.392	1999.02	*-4.97 [11]*	*3.321*	*2000.11*	-3.72 [11]	3.851	1999.05
6 Health	*-4.38 [11]*	*3.486*	*2000.11*	-5.21 [6]	3.495	1998.01	-3.77 [11]	3.789	1996.10
7 Transport	-3.75 [11]	4.247	2002.04	*-7.15 [5]* ***	*4.167*	*2002.11*	-3.5 [11]	4.235	2001.04
8 Communication	-9.5 [0] ***	4.012	2002.05	-9.47 [0] ***	4.027	2002.05	*-3.44 [9]*	*4.003*	*1999.11*
9 Recreation and culture	*-12.99 [0]* ***	*1.962*	*2002.09*	-12.94 [0] ***	1.978	2002.09	-12.21 [0] ***	2.021	2001.07
10 Education	-6.68 [10] ***	3.826	2003.08	*-9.22 [10]* ***	*3.553*	*2002.08*	-6.37 [10] ***	4.02	2002.11
11 Hotels, cafes and restaurants	*-3.39 [11]*	*1.091*	*2000.05*	-3.52 [11]	1.097	2000.05	-2.96 [11]	1.264	1996.08
12 Miscellaneous goods and services	*-12.58 [0]* ***	*2.604*	*2003.09*	-12.61 [0] ***	2.61	2003.09	-12.34 [0] ***	2.661	2004.03
Unit Root Rejection Rate									
10% Significance Level	50%			58%			33%		
5% Significance Level	50%			58%			33%		
1% Significance Level	50%			58%			33%		
Preferred Model	50%			42%			8%		
Unit Root Rejection Rate with Preferred Model									
10% Significance Level	67%			40%			0%		
5% Significance Level	67%			40%			0%		
1% Significance Level	67%			40%			0%		

Disaggregation Level 2 : 1996.02-2006.08									
1.1 Food	*-10.62 [0]* ***	*3.849*	*2000.06*	-10.58 [0] ***	3.864	2000.06	-10.55 [0] ***	3.873	2006.04
1.2 Non-alcoholic beverages	*-9.17 [2]* ***	*3.575*	*1998.10*	-9.134 [2] ***	3.591	1998.10	-2.97 [7]	3.677	2004.09
2.1 Alcoholic beverages	*-8.97 [2]* ***	*3.235*	*2004.01*	-8.9 [2] ***	3.331	2001.04	-8.88 [2] ***	3.482	2001.05
2.2 Tobacco	-11.35 [0] ***	4.402	2000.09	-11.49 [0] ***	4.398	1997.12	*-2.7 [12]*	*4.393*	*1997.08*
3.1 Clothing	-3.59 [10]	4.239	1999.09	*-4.647 [10]*	*4.177*	*2002.07*	-3.92 [10]	4.699	2000.08
3.2 Footwear including repairs	*-4.36 [11]*	*4.049*	*2004.05*	-4.082 [11]	4.091	2002.11	-3.03 [11]	4.371	2003.07
4.1 Actual rents for housing	*-3.69 [8]*	*1.156*	*2004.03*	-11.41 [0] ***	1.416	2002.05	-2.25 [11]	1.4	2003.10
4.2 Regular maintenance and dwelling repair	*-7.63 [2]* ***	*2.911*	*2006.04*	-7.76 [2] ***	2.935	2005.04	-7.73 [2] ***	2.919	1996.07
4.3 Other dwelling related services	*-20.41 [0]* ***	*4.504*	*2000.03*	-20.44 [0] ***	4.508	2000.03	-11.69 [0] ***	5.669	2000.03
4.4 Electricity, gas and other fuels	-7.1 [0] ***	4.31	2000.10	*-7.79 [2]* ***	*4.205*	*2005.03*	-8.02 [2] ***	4.328	2005.07
5.1 Furniture, furnish., carpets & other coverings	*-11.19 [2]* ***	*4.43*	*2005.11*	-11.07 [2] ***	4.44	2005.11	-9.5 [3] ***	4.823	1999.07

5.2 Household textiles	*-15.28 [0] ****	*3.908*	*2000.07*	-14.94 [0] ***	3.929	2004.10	-14.67 [0] ***	4.031	2006.03
5.3 Major househ. appl. incl. fittings & repairs	-6.51 [10] ***	4.663	2001.09	*-7.8 [3] ****	*4.493*	*2006.02*	-4.07 [11]	4.689	1999.09
5.4 Glassware, tableware and household utensils	*-11.55 [1] ****	*4.059*	*2000.06*	-11.58 [1] ***	4.068	2000.06	-11.02 [1] ***	4.18	2000.01
5.5 Tools and equipment for house and garden	*-7.42 [3] ****	*3.632*	*2000.12*	-8.47 [4] ***	3.66	2002.02	-3.69 [9]	3.75	2003.06
5.6 Goods & serv. for routine househ. maintenance	-12.76 [0] ***	3.009	2005.04	*-13.24 [0] ****	*2.986*	*1997.02*	-12.71 [0] ***	3.02	2004.08
6.1 Medical products, appliances & equipment	*-12.03 [1] ****	*3.631*	*2000.09*	-12.02 [1] ***	3.632	1997.03	-6.07 [7] ***	3.754	1997.08
6.2 Out-patient services	*-10.17 [0] ****	*3.995*	*2004.09*	-10.09 [0] ***	4.02	2004.09	-3.56 [9]	4.03	2003.11
6.3 Hospital services	*-5.61 [12] ***	*2.749*	*2006.02*	-5.58 [12] *	2.823	2004.05	-4.51 [12] *	2.821	2004.11
7.1 Purchase of vehicles	-3.67 [12]	3.064	2001.02	*-3.62 [12]*	*3.05*	*2001.03*	-2.39 [12]	3.227	1998.12
7.2 Operation of personal transport equipment	*-4.42 [11]*	*4.726*	*2000.05*	-4.35 [11]	4.743	2000.05	-2.79 [11]	4.92	1996.12
7.3 Transport services	*-9.46 [10] ****	*6.209*	*2001.07*	-9.43 [10] ***	6.225	2001.07	-5.17 [11] **	6.754	1996.12
8.1 Postal services	*-15.86 [0] ****	*3.939*	*2006.03*	-14.04 [0] ***	3.955	2006.03	-3.5 [11]	4.477	2004.12
8.2 Telephone and telefax equipment and services	*-5.36 [8] ***	*4.101*	*2001.11*	-5.35 [8] *	4.117	2001.11	-3.17 [9]	4.111	1999.10
9.1 Audiovisual photography and data process equip.	*-12.04 [0] ****	*3.971*	*1999.07*	-12.05 [0] ***	3.974	2002.02	-11.88 [0] ***	3.982	2001.08
9.2 Other major durables for recreation & culture	*-8.64 [0] ****	*3.332*	*2003.09*	-8.55 [0] ***	3.351	2003.09	-8.33 [0] ***	3.496	2001.12
9.3 Other recreational items, gardens & pets	-5.67 [8] **	3.772	2003.06	*-5.82 [8] ****	*3.714*	*2003.06*	-5.44 [8] **	3.898	2002.09
9.4 Recreational and cultural services	*-4.15 [6]*	*3.392*	*2001.04*	-4.13 [6]	3.41	2001.04	-3.54 [6]	3.426	2006.07
9.5 Books, newspapers and stationery	*-5.17 [12] ***	*3.164*	*2005.12*	-5.18 [12]	3.197	2004.09	-4.79 [12] *	3.29	2005.10
9.6 Package holidays	-4.68 [11]	2.67	2003.01	*-5.05 [11]*	*2.624*	*2002.09*	-4.18 [11]	3.019	2001.07
10 Education	-6.68 [10] ***	3.826	2003.08	*-9.22 [10] ****	*3.553*	*2002.08*	-6.37 [10] ***	4.02	2002.11
11.1 Catering	*-12.42 [0] ****	*0.596*	*1998.04*	-4.75 [9]	0.628	1999.04	-3.31 [10]	0.616	1996.07
11.2 Accommodation services	*-4.67 [3]*	*2.654*	*1999.11*	-4.66 [3]	2.67	1999.11	-4.13 [11]	2.69	2006.07
12.1 Personal care	*-12.66 [0] ****	*3.123*	*1998.09*	-12.67 [0] ***	3.131	1998.07	-12.46 [0] ***	3.17	2005.05
12.2 Personal effects (not elsewhere classified)	-10.14 [1] ***	3.339	2005.09	*-10.77 [1] ****	*3.298*	*2003.10*	-4.05 [10]	3.336	2005.12
12.3 Financial services (not elsewhere classified)	*-12.61 [0] ****	*6.724*	*1999.09*	-12.58 [0] ***	6.739	1999.09	-4.57 [11] *	6.897	2001.04
12.4 Social protection	*-7.12 [4] ****	*1.23*	*2001.11*	-7.01 [4] ***	1.261	2005.09	-7.06 [4] ***	1.469	2005.05
12.5 Insurance	-5.38 [8] **	4.464	1999.05	*-5.97 [8] ***	*4.428*	*1999.05*	-5.46 [8] ***	4.519	1999.12
12.6 Other services (not elsewhere classified)	*-12.63 [0] ****	*3.078*	*1997.12*	-12.73 [0] ***	3.08	1997.12	-11.26 [0] ***	3.204	1996.04
Unit Root Rejection Rate									
10% Significance Level	79%			77%			56%		
5% Significance Level	79%			72%			49%		
1% Significance Level	67%			69%			44%		
Preferred Model	72%			26%			2%		
Unit Root Rejection Rate with Preferred Model									
10% Significance Level	82%			70%			0%		
5% Significance Level	82%			70%			0%		
1% Significance Level	71%			60%			0%		

Disaggregation Level 3 : 1988.02-2006.08									
1.1.1 Bread and cereals	*-6.14 [8] ****	*3.255*	*2003.09*	-6.05 [8] **	3.27	2003.09	-5.72 [8] ***	3.329	2003.10
1.1.2 Meat	*-14.86 [0] ****	*4.205*	*2001.02*	-14.93 [0] ***	4.208	2001.02	-14.06 [0] ***	4.447	1996.10
1.1.3 Fish	*-2.91 [11]*	*5.069*	*2006.05*	-3.22 [11]	5.123	2004.11	-3.14 [11]	5.268	2005.04
1.1.4 Milk	-6.12 [3] ***	3.634	2006.02	*-12.48 [0] ****	*3.549*	*2006.02*	-4.15 [11]	3.909	1997.04
1.1.5 Oil and Fats	-5.45 [11] **	4.678	2006.01	*-5.19 [11]*	*4.603*	*2005.02*	-5.28 [11] **	4.717	2006.02
1.1.6 Fruit	*-13.64 [0] ****	*6.265*	*1999.09*	-13.63 [0] ***	6.277	1999.09	-13.33 [0] ***	6.31	2006.05
1.1.7 Vegetables including potatoes and tubers	*-11.61 [0] ****	*7.101*	*2000.06*	-11.57 [0] ***	7.114	2000.06	-4.21 [12]	7.148	1997.01
1.1.8 Sugar, jam, syrups, chocolate & confectionery	*-9.86 [0] ****	*3.043*	*1996.04*	-9.67 [0] ***	3.058	1996.04	-9.48 [0] ***	3.071	1996.03
1.1.9 Food products (not elsewhere classified)	*-7.17 [3] ****	*3.533*	*2004.09*	-7.01 [3] ***	3.57	2004.11	-5.54 [6] ***	3.746	2006.07
1.2.1 Coffee, tea, cocoa	*-3.85 [12]*	*4.952*	*1998.05*	-3.68 [12]	4.98	2000.05	-2.53 [12]	5.038	2005.02
1.2.2 Mineral waters, soft drinks and juices	*-10.21 [2] ****	*3.681*	*2005.05*	-10.19 [2] ***	3.695	1998.10	-10.01 [2] ***	3.95	2004.05
2.1.1 Spirits	*-11.21 [1] ****	*4.136*	*2003.06*	-11.17 [1] ***	4.151	2003.06	-9.33 [2] ***	4.214	2006.07
2.1.2 Wine	*-8.72 [2] ****	*4.018*	*2005.06*	-7.89 [3] ***	4.062	1997.10	-6.06 [6] ***	4.17	2006.06
2.1.3 Beer	*-9.15 [2] ****	*4.57*	*1998.01*	-9.13 [2] ***	4.582	1998.01	-8.32 [3] ***	4.834	2006.03
2.2 Tobacco	-11.35 [0] ***	4.402	2000.09	-11.49 [0] ***	4.398	1997.12	*-2.7 [12]*	*4.393*	*1997.08*
3.1.1 Garments	-3.31 [11]	4.339	2002.07	*-4.69 [10]*	*4.316*	*2002.07*	-3.02 [11]	4.815	2000.08
3.1.2 Other clothing and clothing accessories	*-10.66 [1] ****	*4.851*	*1999.06*	-8.55 [3] ***	4.891	2001.03	-8.33 [3] ***	5.005	2000.08
3.1.3 Cleaning, repair and hire of clothing	-5.04 [7] *	2.001	1999.06	-4.99 [7]	2.014	1999.09	*-3.61 [8]*	*1.97*	*2001.03*
3.2 Footwear including repairs	*-4.36 [11]*	*4.049*	*2004.05*	-4.08 [11]	4.091	2002.11	-3.03 [11]	4.371	2003.07
4.1 Actual rents for housing	*-3.69 [8]*	*1.156*	*2004.03*	-11.41 [0] ***	1.416	2002.05	-2.25 [11]	1.4	2003.10
4.2.1 Materials for maintenance and repair	-6.75 [4] ***	3.815	2006.05	*-7.58 [4] ****	*3.737*	*2005.06*	-6.98 [4] ***	3.806	2006.01
4.2.2 Services for maintenance and repair	*-14.54 [0] ****	*2.826*	*1996.12*	-14.52 [0] ***	2.836	1996.12	-12.83 [0] ***	3.157	1996.06
4.3.1 Water supply	-14.62 [0] ***	4.829	2005.03	*-15.3 [0] ****	*4.783*	*2000.03*	-11.75 [0] ***	5.34	2000.05
4.3.2 Sewerage collection	*-25.56 [0] ****	*4.458*	*2000.03*	-25.57 [0] ***	4.461	2000.03	-11.61 [0] ***	6.087	2000.03
4.4.1 Electricity	-7.35 [2] ***	3.587	2005.06	*-7.63 [2]****	*3.572*	*2004.11*	-7.8 [2] ***	3.917	2005.06
4.4.2 Gas	*-8.11 [2] ****	*4.692*	*2006.02*	-8.38 [2] ***	4.698	2004.11	-8.44 [2] ***	4.859	2005.05
4.4.3 Liquid fuels	-3.86 [12]	8.703	2000.08	-4.59 [12]	8.686	2000.10	*-2.96 [12]*	*8.679*	*1999.07*
4.4.4 Solid fuels	*-5.91 [2] ****	*3.846*	*2006.04*	-12.81 [0] ***	3.992	2002.09	-3.26 [12]	3.984	2006.05
5.1.1 Furniture and furnishings	*-11.21 [2] ****	*4.771*	*2006.03*	-11.07 [2] ***	4.787	2006.03	-9.23 [3] ***	5.181	1999.07
5.1.2 Carpets and other floor coverings	*-5.01 [10] **	*4.735*	*2003.04*	-4.98 [10]	4.752	2003.04	-4.91 [10] **	5.022	1998.04
5.2 Household textiles	*-15.28 [0] ****	*3.908*	*2000.07*	-14.94 [0] ***	3.929	2004.10	-14.67 [0] ***	4.031	2006.03
5.3.1 Major appliances & small electrical goods	-7.01 [10] ***	4.853	2001.09	*-7.27 [10] ****	*4.835*	*2000.12*	-4.14 [11]	4.933	1996.02
5.3.2 Repair of household appliances	*-12.65 [2] ****	*3.341*	*1997.03*	-12.57 [2] ***	3.358	1997.03	-8.13 [2] ***	4.456	1997.01
5.4 Glassware, tableware and household utensils	*-11.55 [1] ****	*4.059*	*2000.06*	-11.58 [1] ***	4.068	2000.06	-11.02 [1] ***	4.18	2000.01
5.5 Tools and equipment for house and garden	*-7.42 [3] ****	*3.632*	*2000.12*	-8.47 [4] ***	3.66	2002.02	-3.69 [9]	3.75	2003.06
5.6.1 Non-durable household goods	*-13.44 [0] ****	*4.097*	*1996.12*	-13.38 [0] ***	4.113	1996.12	-12.96 [0] ***	4.202	2004.06
5.6.2 Domestic services and household services	-4.4 [5]	1.739	1999.03	-13.21 [0] ***	1.733	1999.03	*-13.22 [0] ****	*1.728*	*2000.11*
6.1.1 Pharmaceutical products	*-7.72 [4] ****	*3.707*	*2001.05*	-10.33 [1] ***	3.928	2001.10	-6.72 [4] ***	3.963	2006.05
6.1.2 Other medical and therapeutic equipment	*-11.93 [1] ****	*4.169*	*1996.09*	-12.01 [1] ***	4.171	1996.09	-11.72 [1] ***	4.306	2003.05
6.2.1 Medical services and paramedical services	-4.89 [11] *	5.248	2004.07	-4.87 [12]	5.3	2003.10	*-4.05 [11]*	*5.162*	*2003.10*

6.2.2 Dental services	*-4.69 [11]*	*3.689*	*2001.08*	-4.64 [11]	3.705	2001.08	-3.29 [11]	4.216	2001.10
6.3 Hospital services	*-5.61 [12]* **	*2.749*	*2006.02*	-5.58 [12] *	2.823	2004.05	-4.51 [12] *	2.821	2004.11
7.1.1 New cars	-3.36 [10]	3.524	1998.12	*-6.22 [2]* ***	*3.331*	*2000.10*	-3.05 [10]	3.692	2000.01
7.1.2 Second-hand cars	*-7.35 [0]* ***	*3.263*	*1996.10*	-7.32 [0] ***	3.278	1996.10	-6.98 [0] ***	3.594	2001.01
7.1.3 Motorcycles and bicycles	-10.94 [1] ***	4.488	1997.12	*-11.37 [1]* ***	*4.461*	*1997.12*	-10.53 [1] ***	4.659	1997.08
7.2.1 Spare parts and accessories	*-8.63 [1]* ***	*2.138*	*2000.12*	-7.2 [9] ***	2.442	2001.11	-6.39 [9] ***	2.508	2000.08
7.2.2 Fuels and lubricants	*-4.56 [11]*	*6.022*	*2000.05*	-4.5 [11]	6.039	2000.05	-2.86 [11]	6.27	2002.06
7.2.3 Maintenance and repairs	*-12.35 [0]* ***	*2.155*	*2002.12*	-12.21 [0] ***	2.17	2002.12	-11.68 [0] ***	2.376	2004.11
7.2.4 Other services	*-13.69 [0]* ***	*2.889*	*2003.02*	-13.49 [0] ***	2.903	2003.02	-11.15 [0] ***	3.329	2005.08
7.3.1 Passenger transport by railway	*-13.84 [0]* ***	*3.218*	*1997.12*	-13.79 [0] ***	3.233	1997.12	-13.51 [0] ***	3.311	2003.02
7.3.2 Passenger transport by road	*-5.42 [12]* **	*3.274*	*2006.02*	-4.62 [12]	3.493	2005.11	-3.98 [12]	3.469	2005.12
7.3.3 Passenger transport by air	*-10.89 [10]* ***	*8.649*	*2001.07*	-10.84 [10] ***	8.666	2001.07	-5.57 [11] ***	9.359	1996.11
7.3.4 Passenger transport by sea & inland waterway	*-7.2 [10]* ***	*7.977*	*2003.10*	-7.27 [10] ***	7.988	1999.07	-6.9 [9] ***	8.207	2006.01
8.1 Postal services	*-15.86 [0]* ***	*3.939*	*2006.03*	-14.04 [0] ***	3.955	2006.03	-3.5 [11]	4.477	2004.12
8.2 Telephone and telefax equip. and services	*-5.36 [8]* **	*4.101*	*2001.11*	-5.35 [8] *	4.117	2001.11	-3.17 [9]	4.111	1999.10
9.1.1 Reception & reproduction of sound & pictures	*-4.7 [4]*	*4.216*	*2005.09*	-11.76 [0] ***	4.235	1999.12	-2.94 [12]	4.232	2003.11
9.1.2 Photographic, cinematogr. & optical equip.	-4.26 [12]	5.523	2005.04	*-4.57 [12]*	*5.512*	*2003.05*	-4.61 [12] *	5.458	2003.02
9.1.3 Data processing equipment	-5.392 [6] **	6.376	1997.12	*-6.56 [6]* ***	*6.29*	*1998.12*	-5.12 [6] **	6.466	2006.01
9.1.4 Recording data	-12.97 [0] ***	5.33	2006.07	-12.97 [0] ***	5.346	2006.07	*-13.18 [0]* ***	*5.323*	*2006.06*
9.1.5 Repair of audiovisual equip. & related products	*-13.29 [2]* ***	*3.173*	*1997.03*	-13.28 [0] ***	4.302	1997.05	-11.46 [0] ***	4.435	1997.03
9.2 Other major durables for recreation & culture	*-8.64 [0]* ***	*3.332*	*2003.09*	-8.55 [0] ***	3.351	2003.09	-8.33 [0] ***	3.496	2001.12
9.3.1 Games, toys and hobbies	-4.52 [12]	4.905	2003.06	*-4.54 [5]*	*4.901*	*2005.12*	-3.81 [12]	5.021	1998.11
9.3.2 Equipment for sport and open-air recreation	-6.18 [7] ***	4.473	2006.07	*-7.45 [7]* ***	*4.359*	*2005.06*	-4.3 [9]	4.477	2006.01
9.3.3 Gardens, plants and flowers	*-11.83 [1]* ***	*5.368*	*1999.12*	-11.81 [1] ***	5.382	1999.12	-5.72 [5] ***	5.513	1996.03
9.3.4 Pets, related products and services	-6.97 [3] ***	2.583	1998.01	*-7.25 [3]* ***	*2.571*	*1998.01*	-4.23 [10]	2.608	1999.07
9.4.1 Recreational and sporting services	*-7.22 [3]* ***	*2.562*	*2005.08*	-7.33 [3] ***	2.563	2005.08	-3.26 [11]	2.76	2003.05
9.4.2 Cultural services	*-13.64 [0]* ***	*3.978*	*2000.10*	-13.58 [0] ***	4.001	2000.10	-3.4 [6]	4.171	2002.07
9.5.1 Books	*-5.98 [10]* ***	*4.761*	*2005.12*	-5.89 [10] **	4.776	2005.12	-4.03 [11]	5.157	2005.12
9.5.2 Newspapers and periodicals	-11.98 [0] ***	4.219	1998.09	*-6.71 [5]* ***	*3.721*	*2002.04*	-4.94 [10] **	4.214	2005.09
9.5.3 Misc. printed matter, station.& drawing maters.	*-5.94 [11]* ***	*3.736*	*1997.12*	-5.73 [11] **	3.744	1997.12	-4.91 [11] **	3.931	1998.11
9.6 Package holidays	-4.68 [11]	2.67	2003.01	*-5.05 [11]*	*2.624*	*2002.09*	-4.18 [11]	3.019	2001.07
10. Education	-6.68 [10] ***	3.826	2003.08	*-9.22 [10]* ***	*3.553*	*2002.08*	-6.37 [10] ***	4.02	2002.11
11.1.1 Restaurants and cafes	*-3.53 [11]*	*0.378*	*1998.12*	-3.59 [11]	0.406	1999.01	-2.61 [11]	0.55	2000.01
11.1.2 Canteens	*-10.28 [1]* ***	*2.575*	*2005.07*	-10.15 [1] ***	2.589	2005.07	-5.86 [7] ***	2.671	2002.02
11.2 Accommodation services	*-4.67 [3]*	*2.654*	*1999.11*	-4.66 [3]	2.67	1999.11	-4.13 [11]	2.69	2006.07
12.1.1 Hairdressing and personal grooming establish.	*-3.65 [12]*	*1.272*	*2001.08*	-3.68 [12]	1.312	2002.05	-3.25 [12]	1.293	1996.06
12.1.2 Appliances and products for personal care	-12.34 [0] ***	3.808	2005.11	*-12.45 [0]* ***	*3.807*	*1998.06*	-6.83 [1] ***	3.884	1996.02
12.2.1 Jewellery, clocks and watches	-4.58 [5]	3.612	2006.03	*-4.75 [5]*	*3.605*	*2005.03*	-4.61 [5] *	3.671	2005.09
12.2.2 Other personal effects	*-11.09 [1]* ***	*4.212*	*2003.11*	-10.97 [1] ***	4.244	2000.05	-10.94 [1] ***	4.313	2000.02
12.3 Financial services (not elsewhere classified)	*-12.61 [0]* ***	*6.724*	*1999.09*	-12.58 [0] ***	6.739	1999.09	-4.57 [11] *	6.897	2001.04
12.4 Social Protection	*-7.12 [4]* ***	*1.23*	*2001.11*	-7.01 [4] ***	1.261	2005.09	-7.06 [4] ***	1.469	2005.05

12.5.1 House contents insurance	*-11.14 [0] ****	*4.983*	*1996.03*	-11.14 [0] ***	4.999	1996.03	-10.84 [0] ***	5.07	1996.08
12.5.2 Health insurance	-9.89 [0] ***	3.787	2006.02	*-10.64 [0] ****	*3.547*	*2004.06*	-10.02 [0] ***	3.76	2005.02
12.5.3 Transport insurance	*-5.84 [2] ****	*5.256*	*1999.06*	-5.56 [8] **	5.344	2000.04	-5.15 [8] **	5.369	1999.01
12.6 Other services (not elsewhere classified)	*-12.63 [0] ****	*3.078*	*1997.12*	-12.73 [0] ***	3.08	1997.12	-11.26 [0] ***	3.204	1996.04
Unit Root Rejection Rate									
10% Significance Level	79%			78%			64%		
5% Significance Level	75%			75%			59%		
1% Significance Level	69%			71%			52%		
Preferred Model	69%			24%			7%		
Unit Root Rejection Rate with Preferred Model									
10% Significance Level	76%			70%			33%		
5% Significance Level	75%			70%			33%		
1% Significance Level	69%			70%			33%		

NOTES: The number in the bracket shows the number of lagged difference terms (k) in the models represented by equations (2)-(4.2). It was chosen by the 't-sig' approach. The break date was chosen by minimizing the t-statistic for testing α=1 in equations (2)-(4.2). The reported t-statistics test the null hypothesis that inflation contains a unit root. See Perron (1997) for critical values. Preferred model, denoted by italics, is the one (among IO1, IO2, AO) that minimises the Akaike Information Criterion. ***, **, * indicate rejection of the null-unit root hypothesis at 1, 5, 10% level of significance.

Table A3: Two-break unit root test results

Indices	LM-stat	Breaks		Lag Length
CPI All : 1988:02-2006:08	-3.4315	1989M12	1990M10	12
Disaggregation Level 1 : 1988.02-2006.08				
1 Food and non-alcoholic beverages	-14.8483***	1992M3	1996M2	0
2 Alcoholic beverages, tobacco and narcotics	-3.3145	1990M3	1991M5	11
3 Clothing and footwear	-4.2026**	1989M12	1991M4	12
4 Housing, water, electricity and fuels	-2.9487	1990M3	1991M4	12
5 Furniture, household equip. and routine repair	-2.8007	1991M1	1991M3	11
6 Health	-9.0055***	1993M4	1993M6	2
7 Transport	-4.3109**	1989M12	1990M10	12
8 Communication	-13.1956***	1991M11	2001M7	0
9 Recreation and culture	-7.2476***	1989M12	1990M11	2
10 Education	-4.0382**	1990M8	1993M1	11
11 Hotels, cafes and restaurants	-3.7714*	1992M5	1992M7	11
12 Miscellaneous goods and services	-7.9165***	1991M11	1993M8	2
Unit Root Rejection Rate				
10% Significance Level	69%			
5% Significance Level	62%			
1% Significance Level	38%			

Indices	LM-stat	Breaks		Lag Length
CPI All : 1996.02-2006.08	-2.93	2001M4	2005M6	12
Disaggregation Level 1 : 1996.02-2006.08				
1 Food and non-alcoholic beverages	-9.7476***	2000M3	2003M3	0
2 Alcoholic beverages, tobacco and narcotics	-11.4839***	1997M7	1998M2	0
3 Clothing and footwear	-3.8309*	1997M4	1997M7	11
4 Housing, water, electricity and fuels	-2.8919	2004M9	2005M7	12
5 Furniture, household equip. and routine repair	-4.0275**	1999M9	2000M3	11
6 Health	-4.831***	1997M5	2002M4	12
7 Transport	-9.6786***	2003M4	2003M11	0
8 Communication	-8.666***	2000M5	2002M5	0
9 Recreation and culture	-13.4541***	2003M2	2003M4	0
10 Education	-4.503**	1999M5	2001M10	11
11 Hotels, cafes and restaurants	-3.5801*	2000M6	2004M7	11
12 Miscellaneous goods and services	-11.3422***	2001M3	2003M5	0
Unit Root Rejection Rate				
10% Significance Level	85%			
5% Significance Level	69%			
1% Significance Level	54%			

Classification Level 2 : 1996.02-2006.08	**LM-stat**	**Breaks**		**Lag Length**
1.1 Food	-9.8928***	2000M3	2003M12	0
1.2 Non-alcoholic beverages	-5.3937***	1997M10	1998M4	1
2.1 Alcoholic beverages	-14.2093***	1998M7	1998M11	0
2.2 Tobacco	-11.4992***	1998M9	2000M6	0
3.1 Clothing	-3.7985*	1998M1	1999M12	10
3.2 Footwear including repairs	-3.8703**	2000M4	2004M8	11
4.1 Actual rents for housing	-11.2214***	1997M6	2001M5	0
4.2 Regular maintenance and dwelling repair	-5.8509***	2001M1	2001M6	1
4.3 Other dwelling related services	-11.515***	1999M4	2001M3	0
4.4 Electricity, gas and other fuels	-6.5814***	1998M12	2004M10	0
5.1 Furniture, furnishing, carpets & other coverings	-14.6081***	2000M2	2000M8	0
5.2 Household textiles	-14.5983***	2000M1	2000M6	0
5.3 Major househ. appliances incl. fittings & repairs	-7.2136***	2000M12	2000M5	10
5.4 Glassware, tableware and household utensils	-9.869***	1999M12	2003M1	0
5.5 Tools and equipment for house and garden	-11.0005***	1998M3	2000M10	0
5.6 Goods & serv. for routine househ. maintenance	-13.0013***	1997M5	2004M11	0
6.1 Medical products, appliances & equipment	-4.9999***	2001M12	2003M6	3
6.2 Out-patient services	-10.5996***	1999M11	2000M10	0
6.3 Hospital services	-9.8237***	1997M9	1998M11	0
7.1 Purchase of vehicles	-2.7463	1999M1	2000M1	8
7.2 Operation of personal transport equipment	-4.9356***	1997M4	2003M6	12
7.3 Transport services	-5.032***	2001M10	2002M12	11
8.1 Postal services	-3.0636	2004M3	2005M4	12
8.2 Telephone and telefax equipment and services	-4.2994**	1997M5	2001M9	11
9.1 Audiovisual photography and data process equip.	-3.3391	1997M7	1999M2	5
9.2 Other major durables for recreation & culture	-8.4715***	1998M2	2000M1	0
9.3 Other recreational items, gardens & pets	-3.054	1997M5	1998M3	11
9.4 Recreational and cultural services	-3.9059**	2004M10	2005M7	11
9.5 Books, newspapers and stationery	-5.5097***	1999M7	2003M2	2
9.6 Package holidays	-5.2091***	2001M4	2002M6	7
10 Education	-6.3032***	1999M5	2002M1	10
11.1 Catering	-4.3371**	2000M5	2001M3	2
11.2 Accommodation services	-4.7529***	2005M4	2005M6	1
12.1 Personal care	-12.8348***	1999M8	2001M5	0
12.2 Personal effects (not elsewhere classified)	-3.8803**	2000M5	2003M10	2
12.3 Financial services (not elsewhere classified)	-10.8144***	2000M4	2000M6	0
12.4 Social protection	-6.4489***	1998M10	2000M9	0
12.5 Insurance	-5.3308***	1999M7	1999M9	8
12.6 Other services (not elsewhere classified)	-10.104***	2000M5	2005M7	0
Unit Root Rejection Rate				
10% Significance Level	90%			
5% Significance Level	87%			
1% Significance Level	74%			

Classification Level 3 : 1996.02-2006.08	LM-stat	Breaks		Lag Length
1.1.1 Bread and cereals	-12.1996***	1998M2	1998M11	0
1.1.2 Meat	-12.9399***	1997M5	1999M12	0
1.1.3 Fish	-3.9145**	1997M7	2005M7	12
1.1.4 Milk	-5.4262***	2004M11	2005M7	11
1.1.5 Oil and Fats	-6.1467***	2004M9	2005M6	1
1.1.6 Fruit	-13.2641***	2002M5	2002M8	0
1.1.7 Vegetables including potatoes and tubers	-4.5567***	1997M4	1997M6	12
1.1.8 Sugar, jam, syrups, chocolate & confectionery	-3.4051	2000M1	2003M3	6
1.1.9 Food products (not elsewhere classified)	-5.0843***	2001M8	2004M4	2
1.2.1 Coffee, tea, cocoa	-2.2426	1997M7	1998M1	12
1.2.2 Mineral waters, soft drinks and juices	-2.312	1997M7	1997M10	3
2.1.1 Spirits	-11.2548***	1998M11	2002M11	1
2.1.2 Wine	-15.3978***	2000M12	2005M4	0
2.1.3 Beer	-3.9657**	1997M4	1997M7	10
2.2 Tobacco	-11.4992***	1998M9	2000M6	0
3.1.1 Garments	-3.7654*	1998M1	1999M12	10
3.1.2 Other clothing and clothing accessories	-7.989***	1998M6	2000M8	3
3.1.3 Cleaning, repair and hire of clothing	-4.4378**	2000M2	2005M7	1
3.2 Footwear including repairs	-3.8703**	2000M4	2004M8	11
4.1 Actual rents for housing	-11.2214***	1997M6	2001M5	0
4.2.1 Materials for maintenance and repair	-13.6739***	1998M11	1999M4	0
4.2.2 Services for maintenance and repair	-10.9798***	1997M4	1998M12	0
4.3.1 Water supply	-10.7077***	1997M4	1998M4	0
4.3.2 Sewerage collection	-11.2897***	1999M4	2000M7	0
4.4.1 Electricity	-6.0264***	1997M4	2004M3	2
4.4.2 Gas	-6.9393***	2004M1	2004M11	0
4.4.3 Liquid fuels	-10.0966***	1999M12	2004M3	0
4.4.4 Solid fuels	-11.3168***	1997M4	2002M9	0
5.1.1 Furniture and furnishings	-14.8726***	2003M4	2003M10	0
5.1.2 Carpets and other floor coverings	-14.8914***	2000M2	2002M11	0
5.2 Household textiles	-14.5983***	2000M1	2000M6	0
5.3.1 Major appliances & small electrical goods	-7.3101***	2000M12	2000M5	10
5.3.2 Repair of household appliances	-11.0651***	2002M12	2005M1	0
5.4 Glassware, tableware and household utensils	-9.869***	1999M12	2003M1	0
5.5 Tools and equipment for house and garden	-11.0005***	1998M3	2000M10	0
5.6.1 Non-durable household goods	-13.2314***	1997M4	2004M11	0
5.6.2 Domestic services and household services	-13.2924***	1997M5	1999M4	0
6.1.1 Pharmaceutical products	-3.2512	2004M4	2005M12	2
6.1.2 Other medical and therapeutic equipment	-12.2605***	2004M1	2004M9	0
6.2.1 Medical services and paramedical services	-10.7619***	2000M9	2001M1	0
6.2.2 Dental services	-3.7585*	1997M4	1997M10	12
6.3 Hospital services	-9.8237***	1997M9	1998M11	0
7.1.1 New cars	-2.1387	2000M1	2000M10	3
7.1.2 Second-hand cars	-7.0901***	2001M4	2004M9	0
7.1.3 Motorcycles and bicycles	-10.278***	1997M7	1999M8	1
7.2.1 Spare parts and accessories	-4.1872**	2000M1	2002M8	1
7.2.2 Fuels and lubricants	-4.5676***	1997M4	1998M5	12
7.2.3 Maintenance and repairs	-11.8002***	2001M2	2001M8	0
7.2.4 Other services	-11.0032***	2001M8	2003M4	0
7.3.1 Passenger transport by railway	-6.4059***	1998M7	2002M12	1
7.3.2 Passenger transport by road	-4.8363***	2004M10	2005M1	12
7.3.3 Passenger transport by air	-5.3598***	2000M2	2001M7	11
7.3.4 Passenger transport by sea & inland waterway	-5.0893***	2000M11	2003M1	11
8.1 Postal services	-3.0636	2004M3	2005M4	12
8.2 Telephone and telefax equip. and services	-4.2994**	1997M5	2001M9	11
9.1.1 Reception & reproduction of sound & pictures	-12.0928***	2001M12	2002M4	0
9.1.2 Photographic, cinematogr. & optical equip.	-3.66*	2001M6	2004M11	3
9.1.3 Data processing equipment	-7.1054***	1999M11	2002M4	2
9.1.4 Recording data	-6.0893***	1997M4	2005M7	1
9.1.5 Repair of audiovisual equip. & related products	-11.4844***	1997M6	2001M2	0
9.2 Other major durables for recreation & culture	-8.4715***	1998M2	2000M1	0
9.3.1 Games, toys and hobbies	-4.7239***	1998M11	2002M1	12

9.3.2 Equipment for sport and open-air recreation	-3.9227**	1999M7	2002M8	2
9.3.3 Gardens, plants and flowers	-11.6863***	2001M2	2004M12	1
9.3.4 Pets, related products and services	-4.5293**	2000M10	2004M1	2
9.4.1 Recreational and sporting services	-4.4679**	2001M2	2004M4	11
9.4.2 Cultural services	-3.6379*	2004M10	2005M7	11
9.5.1 Books	-4.0322**	1998M8	1998M10	11
9.5.2 Newspapers and periodicals	-12.5143***	2002M3	2002M10	0
9.5.3 Misc. printed matter, station.& drawing maters.	-4.7599***	1997M4	2001M7	12
9.6 Package holidays	-5.2091***	2001M4	2002M6	7
10. Education	-6.3032***	1999M5	2002M1	10
11.1.1 Restaurants and cafes	-10.7503***	1997M5	1997M7	0
11.1.2 Canteens	-11.8467***	2002M2	2003M2	0
11.2 Accommodation services	-4.7529***	2005M4	2005M6	1
12.1.1 Hairdressing and personal grooming establish.	-12.9693***	2000M4	2004M9	0
12.1.2 Appliances and products for personal care	-12.6215***	1999M9	2001M5	0
12.2.1 Jewellery, clocks and watches	-3.9856**	2004M11	2005M7	8
12.2.2 Other personal effects	-4.0959**	2000M7	2002M9	2
12.3 Financial services (not elsewhere classified)	-10.8144***	2000M4	2000M6	0
12.4 Social Protection	-6.4489***	1998M10	2000M9	0
12.5.1 House contents insurance	-10.7726***	1999M3	2002M9	0
12.5.2 Health insurance	-9.943***	1997M8	2000M1	0
12.5.3 Transport insurance	-9.977***	1999M6	1999M10	0
12.6 Other services (not elsewhere classified)	-10.104***	2000M5	2005M7	0
Unit Root Rejection Rate				
10% Significance Level	93%			
5% Significance Level	88%			
1% Significance Level	74%			

NOTES: The lag length was chosen by the 't-sig' approach. The critical values for $T = 100$ (model with two intercept breaks) are -4.545, -3.842 and -3.504 at the 1%, 5% and 10% level respectively (see Lee and Strazicich, 2003). ***, **, * indicate rejection of the null-unit root hypothesis at 1, 5, 10% level of significance

Endnotes

[1] For evidence that inflation in non-stationary see, *inter alia*, O'Reilly and Whelan (2004) for the Euro Area, and Crowder and Hoffman (1996) and Gadzinski and Orlandi (2004) for the US.

[2] See also Steinsson (2003). Within the hybrid framework three main sources of inflation persistence can be identified: extrinsic persistence which results from persistent movements in the output gap; persistence due to the formation of inflation expectations; intrinsic persistence (the focus of our paper) due to the dependence of inflation on its lagged values.

[3] Galí and Gertler (1999) introduce intrinsic inflation persistence by assuming that a portion of firms follows rule-of-thumb price setting that depends on lagged inflation rate. Christiano, Eichenbaum and Evans (2005) assume that at any point in time only a random fraction of firms reset prices with the aim of profit maximization, with the remainder simply indexing to last period's inflation rate. Alternatively, Fuhrer and Moore (1995) introduce persistence using a model in which groups of workers bargain over the real wage with reference to the real wage of other groups of workers.

[4] See also Zaffaroni (2004).

[5] It should be noted at this point that there are a number of measures of persistence in the literature. These include the sum of the estimated coefficients on the autoregressive coefficients; the half-life of shocks to the inflation process and also the number of times it crosses its mean (see Andrews and Chen, 1994, and Marques, 2004). This paper utilises unit root tests to provide evidence for/against infinite persistence in aggregate and disaggregate inflation series.

[6] Table A1 in Appendix presents the ADF results for all three levels of disaggregation.

[7] As we can see in Table A1 of the Appendix, using level one data and the model with constant and trend, the null of unit root can be rejected (at the 10% significance level or less) in the following sectors: food and non-alcoholic beverages, health, transport, communication, recreation and culture, and miscellaneous goods and services.

[8] The results in Table A1 in the Appendix indicate that the level three inflation rates for which the null of unit root cannot be rejected (at the 10% significance level or less) irrespectively of the specification of the deterministic component of the ADF model are: fish, garments, footwear including repairs, dental services, new cars, fuels and lubricants, photographic, cinemographic and optical equipment, jewellery, clocks and watches, and health insurance. It is important to note that only two out of these nine sectors can be classified as services: dental services, health insurance. Thus, our results for the UK are consistent with Lünnemann and Mathä's (2004) Euro Area results, in showing that services do not seem to be more persistent than other CPI components.

[9] Our results agree with previous evidence by Lünnemann and Mathä (2004) for the UK among the other European Union member countries over the shorter sample period 1995-2003.

[10] Clark (2006) and Levin and Piger (2004) among others allow for the possibility of structural breaks when examining inflation persistence. For a recent survey on unit root tests and structural breaks see Perron (2006).

[11] The AO model allows for a change in the slope but both segments of the trend are joined at the time of the break. Using the AO model, the unit root test is performed in two steps: first, inflation is detrended via equation (4.1) and then the unit root null hypothesis is tested employing the *t*-statistic for $\alpha = 1$ in equation (4.2).

[12] Two alternative methods to identify break dates were also employed with the results remaining qualitatively similar: select T_b so that the absolute value of the t-statistic associated with the change in the intercept in equation (2), or the slope in equation (3) is maximised; select T_b that minimises the t-statistic on the parameter associated with the change in the intercept in equation (2), or the slope in equation (3). The results are not reported here but are available upon request.

[13] Table A2 in the Appendix presents the Perron (1997) results for all three levels of disaggregation.

[14] Our results are consistent with Levin and Piger (2004) and Gadzinsky and Orlandi (2004) among others, who also identify a structural break in UK aggregate inflation in the early 1990s.

[15] For instance, using level three data, at the 1% level of significance the ADF rejection rate is 81% while the Perron rejection rates are between 52% and 71%, depending on the specification of the model.

[16] Focusing on the results from the models that are preferred by the AIC (figures in italics), we can identify an early 1990s break in eight out of the twelve level one sectors.

[17] See Bilke (2004) for related French evidence.

[18] For instance, as we see in Table A2 of the Appendix using the disaggregation level three data, IO1 is preferred in 59 out of 85 cases (69% of total cases), out of which in 45 cases the null is rejected at the 10% level (76% of preferred cases) leading to a rejection rate with IO1 as the preferred model of 52% (=69%*76%). Similar figures for IO2, AO as the preferred models are 18%, and 2%, respectively, leading to the overall rejection rate for disaggregation level three at the 10% significance level of 72% (=52%+18%+2%). This is the figure that we quote in the second row, final column of Table 4.

[19] The null hypothesis in the endogenous two-break unit root test of Lumsdaine and Papell (1997) assumes no structural breaks, while the alternative does not necessarily imply broken trend stationarity. Thus, rejecting the null may be interpreted as rejection of a unit root with no structural break, and not necessarily as rejection of a unit root *per se*.

[20] Table A3 in the Appendix presents the Lee and Strazicich (2003) results for all three levels of disaggregation.

[21] Lee and Strazicich (2003) point out that structural breaks under the unit root null can be interpreted as large permanent shocks or outliers.

[22] Our finding of inflation stationarity using a panel with sectoral inflation rates as cross-sectional units agrees with previous panel evidence that employed aggregate national inflation rates as cross-sectional units and assumed cross sectional independence (see among others, Culver and Papell, 1997).

[23] Imposing a common factor is not completely inappropriate since we would suspect that there are common macroeconomic shocks.