EUROPEAN CENTRAL BANK

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EUROSYSTEM INFLATION PERSISTENCE NETWORK

HOW PERSISTENT IS DISAGGREGATE INFLATION?

AN ANALYSIS ACROSS EU15 COUNTRIES AND HICP SUB-INDICES

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In 2004 all publications will carry a motif taken from the €100 banknote.

This paper can be downloaded without charge from http://www.ecb.int or from the Social Science Research Network electronic library at http://ssrn.com/abstract_id=617808.

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The Eurosystem Inflation Persistence Network

This paper reflects research conducted within the Inflation Persistence Network (IPN), a team of Eurosystem economists undertaking joint research on inflation persistence in the euro area and in its member countries. The research of the IPN combines theoretical and empirical analyses using three data sources: individual consumer and producer prices; surveys on firms' price-setting practices; aggregated sectoral, national and area-wide price indices. Patterns, causes and policy implications of inflation persistence are addressed.

The IPN is chaired by Ignazio Angeloni; Stephen Cecchetti (Brandeis University), Jordi Galí (CREI, Universitat Pompeu Fabra) and Andrew Levin (Board of Governors of the Federal Reserve System) act as external consultants and Michael Ehrmann as Secretary.

The refereeing process is co-ordinated by a team composed of Vítor Gaspar (Chairman), Stephen Cecchetti, Silvia Fabiani, Jordi Galí, Andrew Levin, and Philip Vermeulen. The paper is released in order to make the results of IPN research generally available, in preliminary form, to encourage comments and suggestions prior to final publication. The views expressed in the paper are the author's own and do not necessarily reflect those of the Eurosystem.

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Abstract:

This paper analyses the degree of inflation persistence in the EU15, the euro area and each of its member states using disaggregate price indices from the Harmonised Index of Consumer Prices. Our results reveal substantial heterogeneity across countries and indices. The overall results, based on both parametric and non-parametric persistence measures, suggest a very moderate degree of median and mean inflation persistence. For most price indices we are able to reject the unit root hypothesis, as well as the notion of disaggregate inflation exhibiting a high degree of persistence. Durable goods and services tend to be relatively less persistent than other indices. Aggregation effects, both across indices and countries, tend to be present. We find structural breaks both owing to the change in the monetary regime and to the modified treatment of sales in the official HICP series. The latter tends to reduce the measured degree of inflation persistence.

Keywords: Inflation persistence, Mean reversion, Aggregation effect, Structural breaks
JEL Codes: E31, C21, C22, C14

Non-Technical Summary

For monetary authorities and central banks, it is important to know how sluggishly inflation returns to its long-run equilibrium level after a disturbance, in order to assess the short-term impact of monetary policy decisions. A vast literature has emerged analysing the degree of inflation persistence. One of the central issues is whether inflation persistence follows a unit root. Recent empirical evidence not only suggests that inflation has varied over time, but also that inflation is not an intrinsically persistent process.

Most of the available international evidence, however, focuses on aggregate inflation data, while using more disaggregated inflation data may prove a useful complement to identify the key drivers of aggregate inflation persistence. A disaggregate analysis may uncover inflation persistence differences and allow their categorisation according to sectors and/or to expenditure weights. This is the direction of research pursued in this paper. It provides a detailed analysis of the degree of inflation persistence in the European Union, the euro area and the 15 individual EU15 countries at the most disaggregate level of the Harmonised Index of Consumer Prices (HICP). This approach is motivated by the seemingly high degree of aggregate inflation persistence in the euro area during the last economic downturn and the theoretical finding that aggregate inflation persistence is predominantly driven by the most persistent disaggregate inflation components.

In total, we provide results for more than 1400 different officially published price indices in the period of January 1995 to December 2003. We use officially published data series from Eurostat and adopt a unified approach to exploit all the information available. These data are readily available, of good quality and to a large extent harmonised across EU15 countries. We employ two measures of inflation persistence and use both parametric and non-parametric approaches. The primary measure of inflation persistence is the sum of autoregressive (ΣAR) coefficients based on univariate estimations. As an auxiliary inflation persistence indicator, we use a non-parametric measure of mean reversion (γ).

Our results reveal substantial heterogeneity across countries and indices. Overall, the results suggest a very moderate degree of median and mean inflation persistence. For most price indices, we are not only able to reject the unit root hypothesis, but also the notion of disaggregate inflation exhibiting a high degree of persistence. For the 1,247 indices of the individual EU15 countries, 93 percent of the inflation persistence parameters based on the ΣAR coefficients are

estimated to be within the range of $-0.75 \leq \rho \leq 0.75$, while still almost 70 percent of the ρ estimates fall into the range of $0 \leq \rho \leq 0.75$. Similarly, an alternative measure of inflation persistence based on the mean reversion coefficient γ reveals a large degree of indices in the range of $0.3 \leq \gamma \leq 0.7$, within which the hypothesis of zero persistence is generally not rejected.

In addition, we find some support for an aggregation effect in the sense of aggregate inflation exhibiting a larger degree of inflation persistence than the weighted average of the disaggregate series. This "positive" aggregation effect is more prominent when measuring persistence by the ΣAR coefficients and when aggregating across countries, rather than indices. However, there is much heterogeneity, as these effects appear to be less systematic than those reported elsewhere.

As common practice these days, we also allow for a structural break in the series in order to avoid spuriously high inflation persistence estimates. On the one hand, we allow for an exogenous break at the start of EMU stage III. On the other hand, we analyse the effects of an important modification to the HICP data collection methodology, i.e. the inclusion of sales prices. This modification is shown to have a non-negligible impact on the time series properties of some disaggregate inflation series. For the indices affected by end-of-season sales, the measured degree of inflation persistence tends to be lower in the post-sales period. The structural break due to the modified sales treatment cannot be easily disentangled from an eventual break emanating from the introduction of a new monetary policy strategy and, implicitly, different inflation objectives at the start of EMU stage III. However, it seems, that the modified treatment of sales is by far the dominant source of a structural break, and should therefore receive appropriate attention in the analysis of the time series properties of disaggregate inflation series and the presence of eventual breaks.

With regard to individual indices, the results are generally as expected. *Seasonal food*, indices affected by sales and some services, such as a *passenger by air and accommodation services* exhibit low degrees of inflation persistence. At the other end of the spectrum, we have *gas*, *heat energy* and *telephone & telefax equipment*. In terms of categories, *durables* and indices affected by sales as well as *services* show less inflation persistence than *processed food & alcohol*, while *non-durables* and *energy* are not significantly different. The fact that services do not seem to be more persistent than other HICP categories runs counter to prior intuition.

I. INTRODUCTION

For monetary authorities and central banks, it is important to know how sluggishly inflation returns to its long-run equilibrium level after a disturbance, in order to assess the short-term impact of monetary policy decisions. A vast literature has emerged analysing the degree of inflation persistence.[1] One of the central issues is whether inflation persistence follows a unit root. Recent empirical evidence not only suggests inflation has varied over time, but also that inflation is not an intrinsically persistent process.

As Levin & Piger (2004) demonstrated recently, a high degree of apparent inflation persistence may be related to neglecting breaks in the mean inflation, which may reflect changes in central banks' inflation target over time. They show in a multi-country study that inflation persistence, as measured by the sum of autoregressive (ΣAR) coefficients, is well below unity for almost all inflation series and countries if the possibility of a structural break in the mean of the inflation series is taken into consideration and conclude that inflation persistence is not an intrinsic feature of industrial economies. Benati (2004) subsequently provided evidence for 20 OECD countries plus the euro area for the post WWII era. He allows for multiple structural breaks in the series and reports that persistence estimates are generally characterised by a significant amount of uncertainty – sometimes to the extent that it is often impossible to make strong statements of persistence for a specific series and/or sample period. For some countries and inflation series, inflation is all but persistent. He, too, concludes that high inflation persistence is not a robust feature of the data.

For the euro area and its individual member states, the empirical evidence points towards inflation persistence being remarkably invariable - despite the numerous changes in monetary policy regimes that took place – and in contrast to recent U.S. evidence (e.g. Cogley & Sargent, 2002). Marques (2004) reports that the euro area inflation persistence has been remarkably invariable, while the U.S. inflation shows persistence parameter instability when using conventional structural break tests. For both the U.S and the euro area, however, inflation persistence drops considerably when a time-varying mean of inflation is maintained. In addition, the parameter instability in the case of the U.S. inflation series vanishes. O'Reilly & Whelan (2004) also report a stable but relatively high level of inflation persistence in the euro area in the period between 1970 and 2002, despite allowing for endogenous structural breaks. Batini (2002) finds that inflation persistence in the euro area has only marginally varied over the last 30 years. She argues

[1] For a review see for example Levin & Piger (2004) or Benati (2004).

that this result is due to a statistical averaging effect, rather than aggregation. Nevertheless, she finds evidence for substantial differences across the major four euro area countries. Benigno & López-Salido (2002) also report a significant degree of cross-country heterogeneity, which may have implications for the optimal monetary policy.

The above-mentioned studies focus on aggregate inflation data, while using more disaggregated inflation data may prove a useful complement to identify the key drivers of aggregate inflation persistence. A disaggregate analysis may uncover inflation persistence differences and allow their categorisation according to sectors and/or to expenditure weights. This is the approach followed by Clark (2003) who presents results for more than 150 sub-indices of the U.S. consumer price index. He reports three main results; first, the average persistence of disaggregate inflation series is below the aggregate inflation persistence. Most of the disaggregate inflation series exhibit a low degree of inflation persistence, but those with a high degree of persistence tend to represent a higher fraction of consumer spending. Second, the overall level of inflation persistence seems to be similar across different sectors (durable goods, non-durable goods and services). Third, the estimated inflation persistence is lower in magnitude if a shift in mean inflation is taken into account.

This paper adds to this direction of research. It provides a detailed analysis of the degree of inflation persistence in the European Union, the euro area and the 15 individual EU15 countries at the most disaggregate level of the Harmonised Index of Consumer Prices (HICP). This approach is motivated by the seemingly high degree of aggregate inflation persistence in the euro area during the last economic downturn[2] and the theoretical finding that aggregate inflation persistence is predominantly driven by the most persistent disaggregate inflation components (e.g. Altissimo & Zaffaroni, 2003; Zaffaroni, 2004). In total, we provide results for more than 1400 different officially published price indices in the period of January 1995 to December 2003. We use officially published data series from Eurostat and adopt a unified approach to exploit all the information available. They are readily available, of good quality and to a large extent harmonised across EU15 countries. We aim to identify the main drivers of inflation persistence across countries and indices.

[2] See for example ECB president Jean-Claude Trichet's introductory statement at the press conference on 6 November 2003.

We employ two measures of inflation persistence and use both parametric and non-parametric approaches. The primary measure of inflation persistence is the ΣAR coefficients based on univariate estimations.[3] As an auxiliary inflation persistence indicator, we use a non-parametric measure of mean reversion proposed by Marques (2004). It provides a valuable robustness check, in particular in light of the short reference period considered. Our results reveal substantial heterogeneity across countries and indices. Overall, the results suggest a very moderate degree of median and mean inflation persistence. For most price indices, we are able to reject the unit root hypothesis as well as the notion of disaggregate inflation exhibiting a high degree of persistence. Durable goods and services tend to be relatively less persistent than other indices. In general, our results show some remarkable similarities to those provided by Clark (2003). Moreover, our results may also be seen in light of the challenge of finding an adequate structural interpretation for aggregate inflation persistence (see, for example, Bils & Klenow, 2002).

In addition, we find some support for an aggregation effect in the sense of aggregate inflation exhibiting a larger degree of inflation persistence than the weighted average of the disaggregate series. This "positive" aggregation effect is more prominent when measuring persistence by the ΣAR coefficients and when aggregating across countries, rather than indices. As common practice these days, we also allow for a structural break in the series in order to avoid spuriously high inflation persistence estimates. On the one hand, we allow for an exogenous break at the start of EMU stage III. On the other hand, we analyse the effects of an important modification to the HICP data collection methodology, i.e. the inclusion of sales prices. This modification is shown to have a non-negligible impact on the time series properties of some disaggregate inflation series. For the indices affected by end-of-season sales, the measured degree of inflation persistence tends to be lower in the post-sales period.

II. DATA, VARIABLES AND ESTIMATION METHODOLOGY

The underlying price index data are publicly available and taken from the Eurostat *New Cronos* database. The database comprises the HICP for the individual EU15 countries. Throughout the paper, the country abbreviations adopted by Eurostat will be used. These are: be-Belgium, dk-Denmark, de-Germany, gr-Greece, es-Spain, fr-France, ie-Ireland, it-Italy, lu-Luxembourg, nl-The Netherlands, at-Austria, pt-Portugal, sf-Finland, sv-Sweden and uk-The United Kingdom,

[3] We do not wish to engage in discussions about the pro and cons of different parametric indicators. A detailed discussion on different inflation persistence measures (based on impulse response function, the largest autoregressive root, the spectral density at frequency zero and the half life) can for example be found in Marques (2004).

plus EA - euro area and EU – European Union.[4] The data covers the period from January 1995 to December 2003. Our results are based on q-o-q inflation rates at quarterly frequency. While we also compute results for intermediate aggregations of the HICP, which will be used to analyse the presence of aggregation effects, we will concentrate the presentation on the 94 most disaggregated HICP sub-indices.

Data problems and other challenges

The disaggregate approach has the advantage of identifying the drivers of inflation persistence in the aggregate series. It also allows classifying countries and sectors into more or less persistent sub-groups, but the availability of data is poorer at the disaggregate level than for the full HICP.[5] In general, the publication of harmonised price indices at the disaggregate level dates back to January 1995 only. In addition, many national statistical institutes changed their methodology of compiling the HICP. An important change relates to the implementation of a European Commission regulation with regard to the treatment of price reductions in the national indices, in particular due to seasonal sales. Eventually, national statistical institutes adopted end-of-season sales prices at different points in time.

An alternative approach would be to account for seasonality by exploiting the sectoral nature of the database. This would probably reduce the need for splitting the sample, which is a relevant issue given the short time period under investigation.[6] However, such an approach would necessitate prior knowledge concerning the timing and duration of seasonal effects, as well as prior knowledge concerning the indices affected. As will become clear in one of the subsequent sections, correctly identifying the HICP-sub-indices that are affected by end-of-season sales is not evident - both in theory and in practice. Importantly, in the context of the present study, the impact of sales prices varies across member states depending not only on the nature, the date and duration of price reductions, but also on the exact timing of the HICP data collection periods within a single month.

Due to the vast number of estimations to be carried out, we adopt a unified approach. With regard to the univariate regressions, the chosen lag length is individually determined for each price index. We report least squares estimates and do not attempt to correct the downward bias

4 Throughout the paper the mention of EU is synonymous with EU15.

5 It cannot be excluded that differences in the measured inflation persistence across countries and sub-indices may also be affected by differences in the data collection practices of the respective National Statistical Institutes (e.g. by the number of price series from which an index is constructed).

6 We are grateful to the anonymous referee for pointing this out to us.

of the least squares coefficients in using median unbiased estimates (e.g. Andrews, 1993; Andrews & Chen, 1994). This is motivated by the predominant share of estimated coefficients residing in the range between 0.00 and 0.75, within which the bias is generally not considered to be particularly worrisome.[7]

Research Methodology

a. Univariate Estimations

The ΣAR coefficients are used as the primary measure of inflation persistence. For each HICP sub-index *i* and country *j* we estimate the following equation:

$$\pi_{i,j,t} = c_{i,j,t} + \sum_{k=1}^{K} \beta_{i,j,k} \pi_{i,j,t-k} + \sum_{l=2}^{4} D_{i,j,l} + \varepsilon_{i,j,t} \text{, with } \rho_{i,j} = \sum_{k=1}^{K^*} \beta_{i,j,k} \text{ ,}$$

where $\pi_{i,j,t}$ refers to the quarterly inflation rate in quarter *t* in the HICP sub-index *i* of country *j* and $\rho_{i,j}$ to the ΣAR autoregressive coefficients with K^* representing the optimal lag length according to the Schwarz (1978) criterion. The maximum allowed lag length (*K*) is 4 quarters. $D_{i,j,l}$ denote quarterly fixed effects to take account of seasonality. The associated t-statistics are based on heteroskedasticity consistent standard errors.

As Figure 1 shows, we find that for most indices a lag of one quarter is the predominant outcome according to the Schwarz criterion. For all countries and country aggregates the 1-quarter lag length is chosen in 50 or more percent of cases. We observe that the EU15 and the euro area figure at the lower end, while for countries such as Austria, the Netherlands and Germany, about 80 percent of the HICP sub-indices exhibit a lag length of one quarter.

Furthermore, we investigate the presence of a structural break in the inflation process with respect to the modified treatment of sales prices in the HICP and alternatively due to the dawn of EMU stage III. As the dates of the potential breaks are well-defined, there is no need for using procedures that test for structural breaks at unknown date. Additionally, the source of the overall structural breaks is explored by applying Wald-tests separately to the ΣAR coefficients and to the intercept.

[7] For some indices the estimation of an inflation persistence parameter was not possible. In general, this was either due to an insufficient number of observations or due to too little variation in the inflation series. The latter may for example be the case for HICP sub-indices, which are affected by administered pricing. These indices often only change once per year, meaning that due to the inclusion of quarterly dummies no estimation is possible.

b. Mean Reversion

We complement the analysis with a non-parametric measure of persistence, which explores the relationship between persistence and mean reversion. Following Marques (2004), we define $\gamma = 1 - n/T$ as an alternative measure of inflation persistence, where *n* reflects the number of times the inflation series crosses its mean during an interval with *T+1* observations. Given the short sample period under consideration, we assume the mean to be constant. The constant mean is defined as the average of the q-o-q inflation rate.[8] As shown by Marques (2004), a value of γ=0.5 indicates the absence of serial correlation, while values close to 0 and 1 indicate negative and positive autocorrelation, respectively. In theory, there should be close correspondence between the two inflation persistence indicators.

In our case, the use of a secondary indicator of inflation persistence serves three purposes. First, the concept of mean reversion is non-parametric in nature. Thus, the methodology is independent of the common assumptions underlying parametric estimation methods. Second, it represents a very intuitive way to analyse inflation persistence and allows us to obtain results even for those HICP sub-indices for which only few observations are available. Third, the secondary indicator provides a robustness check for the parametric estimates. In addition, this non-parametric measure has a couple benefits over the common inflation persistence estimate ρ.

First, it does not require the specification and estimation of a model and thus is expected to be robust against potential model misspecifications. Second, given its non-parametric nature it is also expected to be less sensitive to the presence of outliers in the data than for example the univariate estimates based on OLS. An additional property of the measure proposed by Marques (2004) is that the persistence of the whole sample period is approximately equivalent to a weighted average of persistence of two consecutive sub-periods.[9]

III. RESULTS BASED ON THE FULL SAMPLE

Inflation persistence based on ΣAR coefficients

First, we estimate the persistence of the different sub-indices without allowing for structural breaks. The results referring to these estimations will henceforth be referred to as "restricted" or "constrained". Analysing all most disaggregated HICP sub-indices separately for each coun-

[8] The assumption of a time varying mean approximated by Hodrick-Prescott filter with λ=1600 does not change the results in any substantial way.

[9] However, both parametric and non-parametric measures are affected by the uncertainty surrounding the measurement of the mean level of inflation (e.g. Dias & Marques, 2004).

try, returns the results for the constrained ΣAR coefficients summarised in Table 1.[10] The unweighted median and mean ρ across all countries and sub-indices are 0.16 and 0.22, respectively. Both the mean and the median are typically positive, with the exception of Finland, where the mean is negative. With the exception of France, the median is always larger than the mean, indicating that the distribution is typically right-skewed.

Table 1 presents the differences and similarities between countries' frequencies of inflation parameters to fall into certain ranges. Most of the countries have the highest parameter frequency in the range of 0.25 to 0.75. For the 1,247 indices of the individual EU15 countries, 93 percent of the inflation persistence parameters are within the range $-0.75 \leq \rho \leq 0.75$, while still almost 70 percent and over 50 percent of the ρ estimates fall into $0 \leq \rho \leq 0.75$ and $0 \leq \rho \leq 0.5$. Hence, at first sight, there seems little evidence of a large degree of inflation persistence in the EU15 countries. For a substantial number of all country index combinations, the estimated persistence ρ is negative, despite the inclusion of quarterly dummies. This may reflect the impact of end-of-season sales for different indices.

Particularly noteworthy is the position of the EU15 and euro area aggregates. With increasing inflation parameter values, their position descends relative to the individual countries. The 95th, 75th and 50th percentiles of the inflation persistence parameter are always larger for the euro area and the EU15 than for any other individual country. In other words, a larger fraction of EU15 and euro area sub-indices exhibit a larger inflation persistence as measured by the ΣAR coefficients than for other individual countries, which is suggestive of a country aggregation "effect" being at work. It is also apparent that, ceteris paribus, the degree of inflation persistence is lower in non-euro area countries than for the euro area countries. Both the sales and the aggregation issue will be discussed in more detail in the subsequent sections.

One of the key questions in the context of inflation persistence is whether the inflation process follows a unit root. We therefore subject the estimated ρ coefficients to an ADF test, based on $(\rho_{i,k,t-1}) / \text{s.e.}_{i,k,t}$ (see Table 2).[11] For all indices considered, the unit root hypothesis is rejected

[10] Detailed tables with results are available from the authors upon request.
[11] Here we are only concerned with $\rho<1$ and ignore the fact that some estimates return $\rho<-1$. This is the case for about 30 estimated ΣAR coefficients.

for 4 out of 5 sub-indices at the 10 percent level or better. At the 5 percent level of confidence, this share is still 74 percent, while for 6 out of 10 indices we are able to reject the unit root hypothesis at the 1 percent level of confidence. These rejection frequencies are not only very similar to those reported by Clark (2003) for the U.S, but also provide strong evidence against unit roots for the majority of indices. As the persistence of aggregate inflation is determined primarily by the properties of its most persistent components, aggregate inflation may nevertheless be characterised by substantial persistence.

Inflation Persistence Based on Mean Reversion

Table 3 presents the summary results with regard to the mean reversion coefficient γ and illustrates that, for most countries, the mean and median values of γ are relatively close to the theoretically expected value of 0.5 under the assumption of no serial correlation. The density functions nevertheless suggest that inflation persistence is relevant across both individual countries and the country aggregates, as a fraction of index country combinations reveals a degree of mean reversion at either side of the scale. For the euro area aggregate, about 25 percent of the indices exhibit a mean reversion coefficient γ of at least 0.67.

The degree of persistence differs substantially across countries. As a rough approximation, the hypothesis of zero persistence may be rejected in one out of 6 cases in Finland, whereas in Greece the corresponding share is 45 percent.[12] In general, we observe a rather low frequency of rejection for non-euro area countries (about 20 percent or less). Within the euro area, a comparably low rejection frequency may only be observed for smaller countries (e.g. Belgium, Ireland, Austria, Portugal and Finland). The rejection frequency is generally higher for larger euro area countries (in particular Germany and Italy).

[12] As shown by Marques (2004), the critical values of the mean reversion coefficient γ may be derived according to the following property $((\gamma - 0.5)/(0.5/\sqrt{T})) \dot{\cap} N(0;1)$, where T+1 is the number of observations. Assuming a number of 30 observations, the hypothesis of zero serial correlation is not rejected (at the 5% level of significance) for values of γ within the approximate interval of $0.3 < \gamma \leq 0.7$.

How do these results compare to those obtained by univariate estimation techniques? We analyse to what extent the estimated ΣAR coefficients and the mean reversion indicator γ are correlated (or not). As Dias & Robalo Marques (2004) have shown, there is a monotonic relationship between γ and ρ if the data is generated by an AR(1) process, while for higher order processes this relationship breaks down. As most of our ρ estimates refer to AR(1) processes, we would expect that an approximate monotonic relationship exists between the two indicators. The correlation coefficient between ρ and γ is 0.42 (see Figure 2).[13] In particular, for a given value of the mean reversion parameter γ, we obtain a wide range of the estimated ΣAR coefficients ρ. For example, for frequently mean-reverting indices (i.e. $\gamma = 0$), we find ρ parameters ranging from -2.10 to +0.55. In addition, for $\gamma = 0.5$ (i.e. the expected value for zero-mean white noise processes) we observe estimated ΣAR coefficients ρ ranging from –2.51 to +1.50. The median and mean of ρ are 0.04 and -0.01. Finally, for infrequently mean-reverting indices (i.e. γ close to 1) we find rather large ρ's.

Aggregation effects

The results in the previous section suggest that most disaggregate inflation series are characterised by a low to moderate degree of persistence. However, the estimated parameters vary substantially across indices, and in addition, some indices seem to exhibit unit roots. These results are particularly relevant as heterogeneity in the persistence across stationary disaggregate inflation series may imply a non-stationary inflation process at the aggregate level (e.g. Granger, 1980; Chambers, 1998). Hence, this may imply that the aggregate inflation process is characterised by substantial persistence, in particular as the persistence of aggregate series is primarily determined by the properties of its most persistent components (e.g. Altissimo & Zaffaroni, 2003; Zaffaroni, 2004).

In this section, we analyse to what extent inflation persistence is affected by simple aggregation. Clark (2003) has shown for U.S. data that persistence of aggregate inflation series is typically larger than the weighted persistence of the disaggregate inflation series ("positive aggregation effect" hereafter) and that the differences in persistence between the aggregate series and the weighted persistence of the disaggregate series increase with the level of disaggregation. Table 4 presents the results for different disaggregation levels. We use both the euro area HICP weights for all countries and the respective national HICP weights to see whether this funda-

[13] The correlation coefficient increases to 0.63, however, if we restrict the correlation analysis to indices estimated with an AR(1) process and residing within $\rho \in [-1; 1]$.

mentally changes the results. As this is not the case, we focus on presenting the results using the euro area weights for all countries.

For the ΣAR coefficients ρ, the results seem to support the presence of an aggregation effect. Aggregating from level 1 (comprises max. 12 different sub-indices) to the full HICP (level 0), we are able to detect a positive aggregation effect for 10 out of 17 countries. Aggregating from level 2 (comprises max. 39 sub-indices) to the full HICP (level 0), a positive aggregation effect is discernible for 12 out of 17 countries, while aggregating from the lowest level of aggregation 3 (comprises max. 94 sub-indices) to the full HICP (level 0) returns a positive aggregation effect for 11 out of 17 countries. With regard to the mean reversion coefficient γ, the results are less supportive. Only if we aggregate from level 2 to level 0 is a positive aggregation effect detectable for more than 50 percent of the countries. In contrast to Clark (2003), these results do not tend to suggest, however, that the aggregation effect becomes larger as the level of disaggregation is increased (see Table 5 for more details).

We also investigated the effect of aggregation from levels 3 to level 2 and 1 and from level 2 to level 1. For the ΣAR coefficients ρ, the above results are also valid for intermediate aggregates. The simple sum over countries and indices for each aggregation method always shows a positive aggregation effect in excess of the 50 percent mark. For the mean reversion coefficient γ, this is only the case when aggregating from level 3 to level 2. In the other cases, the persistence of more aggregate series is more often smaller than the weighted persistence of the more disaggregated series.

In Table 6, we analyse the presence of a country rather than an index aggregation effect. In other words, are the EU15 and euro area aggregates more persistent than the simple weighting of the disaggregate persistence of the individual countries would suggest? Again, the results with regard to the ΣAR coefficients ρ suggest the presence of a positive country aggregation effect. This is the case irrespective of the level of aggregation in question. For the mean reversion coefficient, this is the case at the level of the full HICP. At the first level of disaggregation, a positive country aggregation effect is present for only 2 out of 12 indices, while at levels 2 and

3, the share exceeds 50 percent. Similar to the results presented with regard to aggregation across indices, the results based on γ are not as supportive as those based on the ΣAR coefficients.

Clark (2003) also demonstrated for the U.S. that the weighted median, the weighted average and the weighted 75 percentile are typically larger than their non-weighted counterparts. The corresponding statistics are given in Table 7 and Table 8 for each individual country and for the EU15 and for the euro area for the lowest level of aggregation. They are supportive to the findings by Clark (2003). With regard to the ΣAR coefficients, for all countries except Denmark, the weighted 75 percentile is larger than the non-weighted 75 percentile. Moreover, for all countries except for Portugal, two out of the three weighted statistics are larger in magnitude than the non-weighted counterparts. For the mean reversion coefficient γ, the latter is the case for the EU15, Belgium, Germany, Greece, Ireland and Austria. Hence, the evidence in favour of a "positive" weighting effect is less strong when referring to the mean reversion coefficient.

Overall, aggregation in many cases leads to a higher degree of measured inflation persistence. This applies to both aggregations across countries and across indices. However, the size and the direction of the aggregation effect do not seem to be as clear-cut as those reported in Clark (2003).

IV. STRUCTURAL BREAKS

As discussed by Perron (1990) and implemented by Levin & Piger (2004) and Batini (2002) and others, the restriction of not allowing structural breaks may result in misleadingly high inflation parameter estimates. While the above reported summary statistics indicate only a moderate degree of inflation persistence if any at all, hereafter, we nevertheless allow for structural breaks in the series. This is motivated by two major innovations during the time period under investigation; the implementation of further harmonisation rules for the HICP indices across EU15 countries in recent years and the dawn of EMU stage III at the beginning of 1999.

a. A different treatment of sales: A methodological change resulting in structural breaks?

The implementation of further harmonisation rules for the HICP indices across countries has led to methodological changes in some countries in recent years. Prices of selected goods (such as clothing and footwear, furnishings, household equipment and durables) are typically affected by end-of season sales in January/February and July/August/September depending on the country in question. In most of the EU15 countries' national statistics institutes (i.e. Denmark, United Kingdom, Greece, France, Netherlands, Austria, Portugal, Finland, Sweden), the national statistics institutes included sales prices into the HICP already in 1995. Over the years, more and more countries followed suit. In Germany and Portugal, sales prices are included from 1998 onwards, in Ireland and Luxembourg from 1999 onwards and in Belgium from 2000. In January 2001, Italy and Spain were the last two countries to include sales into their HICP price collection.[14]

Figure 3 illustrates the quarterly inflation rates of the HICP sub-index "*cp0311 clothing materials*" for the euro area, Italy, Belgium and Luxembourg. The modified treatment of sales prices is not only clearly visible, but the time series properties change fundamentally too. Importantly, these methodological changes also affect the figure for the euro area aggregate. The variance of the series is larger after the methodological change. Importantly, when taking into account sales prices, inflation oscillates around its mean without necessarily approaching it. Not taking account of these changes may distort the estimated ΣAR coefficients, as the inclusion of sales prices may, due to oscillating behaviour, imply that the lagged inflation coefficients cancel out. Hence, inferring the degree of inflation persistence from estimated ΣAR coefficients may be misleading, in particular for indices showing strong oscillations in the inflation series. The poor signalling properties of the ΣAR coefficients in these cases have also been acknowledged by Andrews & Chen (1994).

Among the 94 HICP sub-indices considered, we would a priori expect 25 indices to be affected by end-of season sales. These potentially affected HICP sub-indices refer mainly to the aggregates of "*cp03 Clothing and footwear*", "*cp05 Furnishings, household equipment and routine maintenance of the house*", "*cp09 Recreation and culture*" and "*cp123 Personal effects n.e.c.*"

[14] The official date may be 12 months later. However, the indices of the previous 12 months had been revised in order to avoid distortions in the inflation rates. For more details see ECB (2002).

with the exception of services, such as "*cp0314 Cleaning, repair and hire of clothing*" or "*cp0923 Maintenance and repair of other major durables for recreation and culture*". The selected indices are presented in Table 9 and reflect a combined weight of 21.872 percent in the euro area HICP for 2002.

As we do not know whether the a priori identified indices are correctly identified, we split the sample of each sub-index at the respective date and estimate the sub-samples separately. The obtained estimates will be referred to as "unrestricted" or "unconstrained" estimates. The countries having adopted the sales prices from the outset will not be examined. For the EU15 and euro area, we chose to use the break date of 2001Q1, as by then all countries had adopted the HICP methodology revision. Thereafter, we assess with a Chow structural break test whether an overall structural break is present in the data. We expect to receive confirmation of a structural break for HICP sub-indices being substantially affected by end-of-season sales.[15]

Figure 4 shows a clear leftward shift in the frequency distribution for the countries of Spain and Italy following the inclusion of sales prices. This shift is, albeit to a lesser extent, also visible at the aggregate EU15 and at the euro area level. Comparing Table 10 with Table 1 we observe for all countries that adopted the HICP revision except Belgium that the median of the post sales sample is below the median of the restricted estimations. In essence, this indicates that the HICP methodology revision induced negative serial correlation into the inflation series and induced lower ΣAR estimates.

How does the different treatment of sales prices impact on the mean reversion indicator γ? As shown by the upper panels in Figure 6, the fraction of indices with a high frequency of mean-crossings (i.e. γ close to 0) is larger when taking account of sales prices. For the individual

[15] Obviously, structural breaks may also emanate for other reasons. Moreover, the impact of the introduction of sales prices into the HICP and the inception of EMU stage III may superimpose. In Ireland and Luxembourg for example, the dates of the implementation of the modified treatment of sales and the EMU stage III coincide, while for other countries these dates may only differ by 4 or 8 quarters.

countries concerned, the share of indices with a mean reversion γ smaller than 0.1 rises from an average of 3.3 percent prior to the revision to 7.8 percent after the revision. This change is particularly strong in the case of Luxembourg and Italy for which the share rises from 0 to 12 percent and from 2 to 9 percent, respectively. In addition, the fraction of indices with infrequent mean crossings diminishes with the modified treatment of sales prices, thereby implying a leftward shift in the cumulative density function at lower levels of the mean reversion coefficient γ. This holds, in particular, for Italy where the share of indices with γ larger than 0.9 decreases from 8 to 1 percent.

The lower panels in Figure 6 illustrate the implications of the different treatment of sales prices for the hypothesis of zero persistence. With the exception of Italy, the frequency of indices with large deviations from 0.5 increases, thus, implying a higher rejection probability of the null of zero persistence (ceteris paribus).

In the following, the Chow test is used to investigate the presence of an overall structural break in the inflation series.[16] Additionally, in order to explore the source of the structural break, we use a Wald-test on the ΣAR coefficients and the intercept. Lastly, we also provide a one-sided F-test on the standard deviations of the sub-samples prior to and after the HICP revision date for the respective country. In each case, we distinguish between indices that we consider, a priori, to be (un-)affected by the HICP revision. The results are summarised in Table 11. As a critical rejection value, we use the 5 percent level of confidence.

For both the EU15 and the euro area, we are able to reject the hypothesis of no overall structural break in about two out of three indices. The corresponding shares for Spain and Italy are 71 and 57 percent. For sales indices, we generally find larger rejection frequencies than for non-sales indices. This is valid with the exception of the euro area. In the case of Spain, the rejection frequency is larger than 95 percent for sales indices, while the corresponding share for non-sales indices remains comparatively low at 59 percent. For Belgium and Luxembourg re-

[16] Figure 5 presents the distribution of the inflation persistence parameter ρ conditional on a structural break. The distribution is very similar to that presented in Figure 4.

spectively, the rejection frequencies are almost twice and more than two ½ times as high for sales indices than for non-sales indices. Thus, these results provide strong support for the notion that the HICP methodology revision affected the overall time series properties of some inflation series.

In the predominant number of cases, the structural breaks are due to differences in the variances in the two sub-samples. The rejection frequency is much lower for the two Wald-tests than for the Chow test. This is the case for all countries for which the test could be computed. In case of the euro area, only 9 percent of the indices show a structural break for the ΣAR coefficients. The corresponding share for a break in the intercept is very similar at 12 percent.

There are noteworthy differences between the different sets of indices. For the EU15 aggregate and the countries of Spain, Italy and Luxembourg, the hypothesis of equal ΣAR coefficients is more frequently rejected for sales indices than for non-sales indices. In Belgium and the euro area aggregate, the opposite is the case. With regard to the hypothesis of equal intercepts, a similar pattern holds. The hypothesis can be rejected more frequently for the sales indices. This is the case for all countries and country aggregates analysed in this table. In the case of the EU15 aggregate, the rejection frequency is up to 7 times higher for sales indices. The one-sided F-test reveals additionally that the introduction of sales prices into the HICP coincides with increased standard deviations in the inflation series. With the exception of Ireland, this is the case for all other countries considered and country aggregates. All in all, these results suggest that the sales are one driving factor for structural breaks in the respective inflation series.

Table 12 synthesises the implications of the HICP methodology revision with respect to the estimated inflation persistence. For each index, if the Null of no structural break is not rejected, then we use the inflation persistence estimate ρ of the regression referring to the full sample. If the Null is rejected at the 5 percent level or better, the different ρ estimates relate to the respective sub-samples. With the exception of Belgium, the median and mean level of ρ decreases with the introduction of sales prices. In the case of Luxembourg, both the level and the volatility ρ decrease. The trends towards less persistent, but more volatile ρ estimates extend to both the euro area and the EU15.

b. Structural breaks due to EMU?

In contrast to the introduction of sales into the HICP by national statistical institutes, the inception of Stage III constitutes a general shift towards a new monetary regime potentially affecting the full set of price indices in all euro area countries. Similar to the modified treatment of sales prices, we allow for both a break in the intercept and the ΣAR coefficients. The sample split date is 1999Q1. Conveniently, this date is almost in the middle of our sample period.

Figure 7 below presents, for each country, three different distributions for the inflation persistence parameter ρ. The distribution is based on the most disaggregated sub-HICP indices. The first distribution reflects the results of the ΣAR coefficients in a restricted regression, assuming the absence of a structural break in the inflation series. These were already presented in a more aggregate form in Table 1. The second and third set of distributions present the inflation parameters estimated for the respective sub-samples.

Figure 7 shows that firstly, not allowing for structural changes may have consequences for the estimated inflation persistence. Secondly, the change in the monetary regime does not impact on ρ in a uniform direction. As presented in Table 13, in Belgium, Germany, Ireland and the Netherlands, we observe an increase in both the mean and the median level of ρ. In Greece, Spain, Italy, Luxembourg, Portugal, Austria and Finland, both the mean and the median level of ρ shrink after Stage III. Inconclusive signals are observed for the non-euro area countries Denmark and Sweden.

Similar to the autoregressive coefficients, the shift in the monetary regime seems to have affected the mean crossing in a heterogeneous way. In Figure 9, we compare the cumulative distribution of the frequency of mean crossings across countries. First, comparing the results with Figure 6, we observe a degree of similarity for the countries for which we analysed the inclusion of sales prices into the HICP. For Belgium, the figures look very similar, due to a mere difference of 4 quarters between the two sample split dates. In Luxembourg, the figures are in fact identical as the two sample split dates coincide. In the cases of Spain and Italy, the cumulative distribution of mean crossings shifts to the right, i.e. towards lower levels of the mean reversion

coefficient γ. This pattern was already observed in the analysis of sales. The remaining countries do not show any clear-cut changes in the cumulative distribution.

In order to analyse the implications of EMU Stage III on the Null of zero persistence, Figure 10 illustrates the distribution of deviations of the mean reversion coefficient γ from 0.5. The most important changes may be observed for Spain, Italy and Austria with a larger share of smaller deviations from 0.5. To a lesser extent, a similar tendency may be observed for Portugal, Finland and Sweden. These results are indicative of a lower degree of inflation persistence after 1999Q1.

We have contrasted the results between the pre-EMU and the post-EMU period, but have not yet addressed the significance of structural breaks.[17] As done for sales, we computed different structural break tests. Table 14 presents the results of the Chow and the Wald-tests. Overall, for 56 percent of the indices, the structural break statistic is significant at the 10% level or better. For about 41 percent, this is the case at the 5% level or better, while still almost 20 percent of all indices show a break at the 1% level of significance. Hence, these results are a strong indication that structural breaks are present in the inflation series. Ranked according to the frequency at the 5 percent level of confidence, the Netherlands, Luxembourg, Greece and Italy show a frequency of structural breaks close to 50 percent, the opposite being the case for Germany. Hence, it seems that there is no pattern that immediately distinguishes high inflation countries prior to EMU stage III from low inflation countries. However, we need to bear in mind that the effect of the HICP revision is not explicitly considered here. As previously mentioned, these two effects are likely to superimpose each other.

In order to investigate the source of the overall structural break, we use Wald-tests. Table 15 presents the frequency distributions for different significance levels for both significantly dif-

[17] Figure 8 presents the distribution of the inflation persistence parameter ρ conditional on a structural break. The distribution is very similar to that presented in Figure 7.

ferent intercepts and ΣAR coefficients. For the EU15 and the euro area, the structural differences emanate in about one in ten cases from differences in the ΣAR coefficients and in about one in ten cases from differences in the intercept. There is no clear pattern with regard to the driving force of the structural breaks across countries. For countries such as Germany, Spain, the Netherlands and Austria, the break in the ΣAR coefficients seems to be a much more frequent source of structural breaks, while for countries, such as Greece, Luxembourg, Finland and Sweden, it is the intercept.

Figure 11 summarises the origin of structural breaks. Eight possible cases are distinguished. For example, it may be the case that the overall structural break test suggests the presence of a break, while the separate Wald-tests return significant differences in both the ΣAR coefficients and the intercept, or only one of the two, or neither. Similarly, it may be the case that one of the Wald-tests is significant, while the overall structural break test does not indicate the presence of a structural break. Firstly, we note that the three cases where either one or both Wald-tests indicate differences in the ΣAR coefficients or the intercept, while the absence of an overall structural break is not rejected remain very rare. This is true for all countries and country aggregates.

Secondly, for most countries and country aggregates, both the overall structural break test, combined with either significant Wald-tests for differences in the ΣAR coefficients and/or the intercept at the 5 percent level or better, emerges in less than one out of five indices, with exceptions being Italy and Spain. Thirdly, Figure 11 displays the frequencies of no breaks, be it as overall structural break or as break in a single parameter. For all countries, this is the case in 40+ percent of the indices. Fourthly, we see that a large share of the indices show a structural break, while neither the ΣAR coefficients nor the intercept are significantly different from each other.

Table 16 above reports the summary statistics relative to the inflation parameter ρ taking account of the evidence for an overall structural break indicated by the Chow test at the 5 percent

level of significance or better. For most countries, the differences obtained are of rather small magnitude, the exceptions being Belgium and the Netherlands (both indicating an increase in the mean and the median level of ρ) as well as Spain and Luxembourg (both displaying a decline in the mean and the median level of ρ). These findings by and large support the results obtained when comparing across sub-samples, regardless of the evidence on structural breaks (Table 13). In addition, the estimates obtained for both sub-samples are in general rather close to those obtained for the restricted estimation. The ρ estimates for the restricted model, however, are not necessarily within the interval given by the estimates for the two sub-samples.

c. Panel data regressions

In order to get a clearer picture about the significance of the differences in inflation persistence across countries, we use a simple fixed effects panel regression (the fixed effects being the individual sub-indices) with robust standard errors to explore which countries and indices show more persistence than others. We regress the previously obtained inflation persistence measures on country dummy variables. Table 17 reports the results of these regressions. In order to avoid the results being driven by outliers, we decided to remove all indices outside $|\rho|>1$. All coefficients are relative to the EU15 aggregate.

In summary, the following results appear with regard to the inflation persistence coefficient ρ: First, all individual countries except Germany display lower coefficient estimates than the EU15 and the euro area aggregate. In the post sales period, Germany is the only country with a higher degree of persistence than the EU15 and euro area. As mentioned previously, this is suggestive of an aggregation effect at work. The differences to the EU15 are significant (in decreasing order) for Luxembourg, Finland, the United Kingdom, Sweden, Austria, Denmark, Greece and Belgium.

Second, for the EU15 large differences between the pre-EMU and post-EMU sample are not discernible. Spain changes from insignificantly larger inflation persistence before the EMU to significantly less inflation persistence after the EMU. An opposite, albeit insignificant, tendency seems to be prevalent for Germany. All other individual countries remain below the EU15 both prior to and following the EMU.

Third, the HICP methodology revision to include sales prices reduces the inflation persistence estimate for the EU15 from 0.33 prior to the revision to 0.21 after revision. Belgium was relatively less persistent prior to the inclusion of sales, but is not longer so afterwards. Noticeable changes occur in the case of Spain and Italy, both of which have a relatively lower average degree of inflation persistence after the inclusion of sales prices. Previously, ρ was on average significantly larger for Italy than the EU15. The results presented in column "ρ (fs new)" are not very different from those using the estimated ρ coefficients from the restricted regressions. This is our preferred summary though, as it the results take into account the recent inclusion of sales price for all countries.

With regard to the mean reversion coefficient γ, the following results appear: First and in contrast to the results with regard to the inflation persistence indicator ρ, the individual countries, with the exception of the United Kingdom, tend to have a higher mean reversion coefficient than the EU15. The difference in the coefficient size is significant for the countries of Belgium, Germany, Spain, Italy, the Netherlands, Austria and Portugal. The estimated coefficient for the EU15 is very close to the 0.5, i.e. the theoretically expected value for a zero-mean white noise process. This means that the average degree of positive serial correlation is higher than for the EU15 aggregate.

With regard to the inclusion of sales prices, we observe that the countries of Spain, Italy and Luxembourg, which showed a significantly larger average degree inflation persistence prior to the sales, do not do so afterwards. However, for Portugal, the opposite is the case.

In summary, both measures of inflation persistence seem to be reasonably closely linked to each other. The correlation between ρ and γ is 0.57, while the rank correlation is 0.52. Two main results emerge, which seem to be fairly robust to the choice of the sample period as well as the choice of the inflation persistence measure. First, Germany appears to have a higher degree of inflation persistence than other countries and the two country aggregates. Second, the degree of inflation persistence in the United Kingdom seems to be relatively small compared to other countries and the two country aggregates. Nonetheless, the obtained levels of inflation persistence are generally quite low.

V. COMPARING RESULTS ACROSS HICP SUB-INDICES

a. Basic descriptions

Finally, we investigate differences in persistence across indices. Do some indices and/or countries reveal a systematically higher/lower degree of inflation persistence than others? To answer the question of typical differences across indices, Figure 12 and Figure 13 summarise for all HICP sub-indices the distribution of persistence indicators across countries following the introduction of sales and illustrate that the cross-index differences are not robust to the choice of the persistence indicator.[18]

Firstly, with regard to the ΣAR coefficients, the following results seem to emerge. At the lower end of the spectrum, we find the indices "*cp0116 fruits*" and "*cp0117 vegetables*", as well as the indices within the category "*cp03 clothing & footwear*" some indices within "*cp09 recreation & culture*", notably "*cp09 equipment for sport & camping*", "*cp0933 garden plants & flowers*" and "*cp096 package holidays*". This is expected. The former indices are largely affected by seasonality of harvesting, while the latter correspond to the indices that we singled out as being affected by the end of season sales. The indices "*cp0722 passenger transport by air*" and "*cp0734 passenger transport by sea and inland waterway*" also figure among those indices displaying the least degree of positive autocorrelation in the inflation series. These indices can also be thought of as being affected by seasonality. While airplane tickets may be changed daily, ferry prices are largely influenced by holiday seasons. Two other indices stand out; "*cp112 accommodation services*" and "*cp126 financial services*", two services indices for which we also find negative medians.

With regard to the indices displaying a large degree of positive autocorrelation (with a median ρ larger than 0.4), we find the indices "*cp0112 meat*", "*cp041 actual rentals for housing*", "*cp082 telephone and telefax equipment*", "*cp0911 equipment for reception, recording and reproduction*", "*cp09 photographic and cinematographic equipment*" and "*cp0931 games, toys and hobbies*" Secondly, with regard to the frequency of mean crossings, a very large fraction of outcomes for 1-γ is between 0.3 and 0.5. This implies a certain skewness in favour of positive

[18] The range of indicator values considered within these figures has been truncated so as to exclude extreme county-index combinations (i.e., cases of instability in particular). In addition, the lower (upper) end of the bars corresponds to the 25 (75) percentile. The asterisk reflects the median level of the indicator in question.

autocorrelation in the inflation processes. Indices for which we obtain a value inferior to 0.5 for γ are by and large indices subject to sales (e.g., "*cp0131 clothing materials*", "*cp0312 garments*", "*cp0313 other articles and clothing accessories*", "*cp032 footwear including repair*", "*cp0512 carpets and other floor coverings*", "*cp052 household textiles*", "*cp0932 equipment for sport, camping and open air recreation*" as well as "*cp1232 other personal effects*"). In addition, these indices display relatively large cross-country differences, as can be inferred from the difference between the 25 and 75 percentile. Large median values for γ are observed for "*cp0452 gas*" and "*cp081 postal services*".

b. Panel Data Regression

Table 18 below reports the results with regard to the sub-indices. The indices are ranked according to the γ persistence indicator in the last column "γ (fs new)". The close relationship between the ΣAR coefficients and the mean reversion coefficient γ becomes apparent. The correlation coefficient for the columns "ρ (fs)" and "γ (fs)" is about 66 percent, and 48 percent for the columns "ρ (fs new)" and "γ (fs new)".

By and large, our expectations are supported with respect to the indices displaying a low degree of positive serial correlation. These are the indices belonging to perishable products, i.e. "*cp016 fruits*" and "*cp017 vegetables*", energy products, such as "*cp0453 liquid fuels*" or "*cp0722 fuel and lubricants for personal transport equipment*" and the category of "*cp03 clothing and footwear*", which are generally found to be affected by modified treatment of sales, i.e. "*cp032 garments*", "*cp0313 other articles of clothing*". The impact of the inclusion of sales prices also becomes evident when assessing the changes in ranks before and after the sales inclusion (see Table 19). 80 percent of the 25 identified indices have a lower mean reversion coefficient γ in the post- sales period, while this is the case for just 56 percent of the 25 indices for the inflation persistence indicator *ρ*. Positive surprises are related to some services such as "*cp 0733 passenger transport by air*" or "*cp0734 passenger transport by sea and inland waterway*", which also display signs of negative serial correlation. Other surprises include indices, which we would expect to display more inflation persistence due to their association with a high degree of nominal price rigidities (e.g. "*cp081 postal services*"). At the other extreme, we find "*cp0455 heat energy*" to be among the indices displaying a higher degree of inflation persistence.

Categorising the HICP sub-indices into different sectors helps us to identify those categories with higher degrees of inflation persistence.[19] For example, it is commonly perceived that *services* represents a sector with a high degree of inflation persistence, partly due to the high degree of nominal price rigidities. Clark (2003), however, reports no material differences of different sectors. Our results presented in Table 21, however, show some significant differences. The results indicate, regardless of the chosen inflation persistence indicator, that *services* and *durables* are typically less persistent than *food*.

In contrast, *energy* and *non-durables* show no significant differences to *food*. These results hold by and large for both persistence indicators. As with *fish & seafoods*, *fruit* and *vegetables* are among those indices with the lowest degree of positive serial correlation, these results must be entirely due to the *processed food incl. alcohol* items within this category. The inclusion of a dummy variable for sales indices reduces the coefficient size of *durables* and leads to their insignificance when using the inflation persistence indicator ρ. This is not unexpected, as there is a large overlap between these two categories.[20]

VI. SUMMING UP

This paper analyses the degree of persistence of inflation in the European Union across 94 HICP sub-indices and 17 countries or country aggregates. The results indicate substantial heterogeneity across countries and indices, and a very moderate median and mean inflation persistence at the disaggregate level. In addition, for most price indices we are able to reject the unit root hypothesis. For the 1,247 indices of the individual EU15 countries, 93 percent of the inflation persistence parameters based on the ΣAR coefficients are estimated to be within the range of $-0.75 \leq \rho \leq 0.75$, while still almost 70 percent of the ρ estimates fall into the range of $0 \leq \rho \leq 0.75$. Similarly, an alternative measure of inflation persistence based on the mean reversion coefficient γ reveals a large degree of indices in the range of $0.3 \leq \gamma \leq 0.7$, within which the hypothesis of zero persistence is generally not rejected.

[19] This is in line with the results by Barsky et *al.* (2003) who report that durables goods prices may be very flexible in the sense that the respond faster to monetary shocks.

[20] Details about the sub-indices and their respective categories are presented in Table 20.

The results also provide some support for the presence of "positive" aggregation effects, both across indices and individual euro area countries, in the sense that the aggregate inflation exhibits a larger degree of inflation persistence than the weighted average of the disaggregate series. In general, this is effect is more apparent, when measuring persistence by the ΣAR coefficients and when aggregating across countries, rather than indices. However, there is much heterogeneity, as these effects appear to be less systematic than those reported elsewhere.

We show that structural breaks are present, which are either associated with EMU stage III or the modified treatment of sales in the HICP. The modified treatment of sale prices in the HICP changes the time series properties of the indices concerned, and results in negative serial correlations for numerous indices. The oscillation of the inflation series affects both ΣAR coefficients and the mean reversion coefficient γ. Hence, for the indices concerned we typically find a lower inflation persistence estimate after the inclusion of sales prices into the HICP. This effect is found to be extremely relevant, as even indices at the aggregate level, such as the EU15 and the euro area, are affected.

The structural break due to the modified sales treatment cannot be easily disentangled from an eventual break emanating from the introduction of a new monetary policy strategy and inflation objectives at the start of EMU stage III in January 1999. However, it seems that the modified treatment of sales is by far the dominant source of a structural break, and should therefore receive appropriate attention in the analysis of the time series properties of disaggregate inflation series and the presence of eventual breaks.

With regard to individual indices, the results are generally as expected. *Seasonal food*, indices affected by sales and some services, such as a *passenger by air and accommodation services* exhibit low degrees of inflation persistence. At the other end of the spectrum, we have *gas, heat energy* and *telephone & telefax equipment*. In terms of categories, *durables* and indices affected by sales as well as *services* show less inflation persistence than *processed food & alcohol*, while *non-durables* and *energy* are not significantly different. The fact that services do not seem to be more persistent than other HICP categories runs counter to prior intuition.

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TABLES AND FIGURES

Figure 1: Optimal lag length in quarters, per country, restricted model

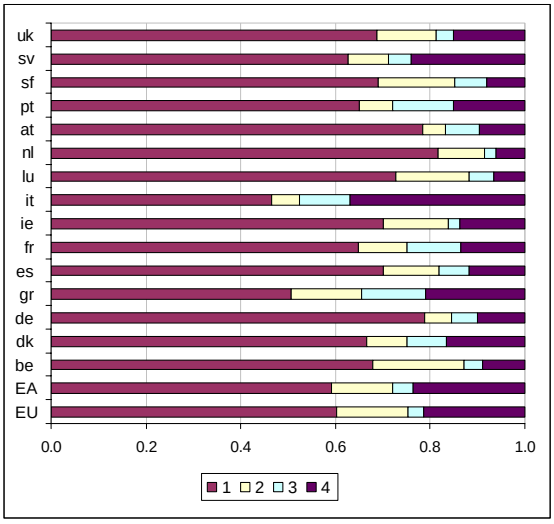


Table 1: Summary statistics of inflation persistence parameter ρ per country, restricted model

Country code	Country	# Indices	Average	Std.dev.	5%ile	25%ile	50%ile	75%ile	95%ile
EU15	European Union 15	93	0.27	0.34	-0.29	0.02	0.30	0.54	0.74
EA	Euro Area	93	0.30	0.42	-0.45	0.12	0.40	0.59	0.76
be	Belgium	78	0.15	0.41	-0.56	-0.09	0.26	0.44	0.68
dk	Denmark	84	0.01	0.58	-1.02	-0.08	0.16	0.29	0.55
de	Germany	90	0.29	0.39	-0.33	0.14	0.34	0.53	0.73
gr	Greece	81	0.11	0.46	-0.76	-0.06	0.17	0.44	0.72
es	Spain	77	0.18	0.51	-0.71	0.01	0.27	0.49	0.74
fr	France	88	0.29	0.69	-0.54	0.08	0.28	0.54	0.83
ie	Ireland	87	0.23	0.31	-0.33	0.12	0.25	0.42	0.65
it	Italy	84	0.22	0.49	-0.71	0.05	0.34	0.54	0.72
lu	Luxembourg	77	0.03	0.41	-0.81	-0.12	0.09	0.27	0.64
nl	Netherlands	82	0.18	0.42	-0.60	0.00	0.27	0.44	0.68
at	Austria	83	0.04	0.58	-0.73	-0.08	0.18	0.33	0.51
pt	Portugal	86	0.22	0.36	-0.40	0.02	0.32	0.45	0.68
sf	Finland	87	-0.05	0.54	-1.20	-0.11	0.08	0.23	0.50
sv	Sweden	83	0.09	0.32	-0.47	-0.11	0.10	0.29	0.61
uk	United Kingdom	80	0.02	0.49	-0.85	-0.14	0.11	0.31	0.53
	All	1433	0.16	0.48	-0.69	-0.03	0.22	0.44	0.70

Note: The estimated parameters are taken at face value and are not treated as zeros in case of statistical insignificance. Only the most disaggregated sub-indices are included.

Table 2: Unit root test, per country and significance level, in %, restricted model

Level of Significance	EU15	EA	be	dk	de	gr	es	fr	ie	It	lu	nl	at	pt	sf	sv	uk	All
P-value<0.1	75.3	72.0	70.5	79.8	73.3	80.2	84.4	67.0	77.0	84.5	87.0	80.5	89.2	84.9	90.8	89.2	86.3	80.5
P-value<0.05	71.0	61.3	65.4	70.2	71.1	72.8	75.3	55.7	72.4	76.2	83.1	75.6	85.5	80.2	83.9	85.5	77.5	74.1
P-value<0.01	53.8	46.2	53.8	52.4	60.0	61.7	57.1	40.9	55.2	61.9	72.7	61.0	73.5	57.0	73.6	80.7	65.0	60.2

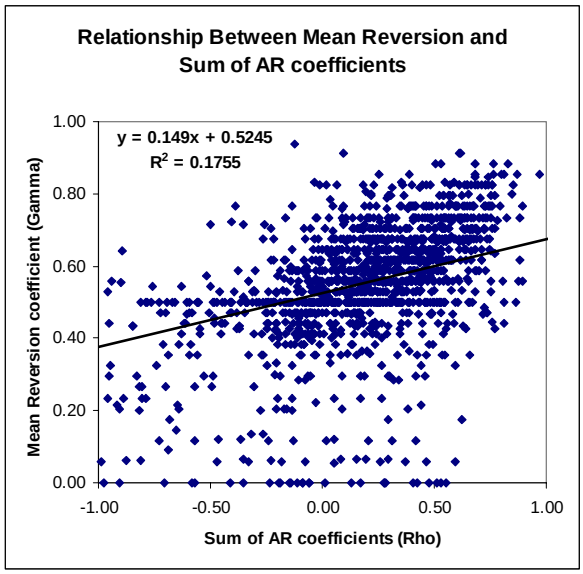
Note: The critical values are calculated according to MacKinnon (1991) and not adjusted for varying lag lengths.

Table 3: Summary statistics of mean reversion coefficient γ, per country

Country code	Country	# Indices	Average	Std.dev.	5%ile	25%ile	50%ile	75%ile	95%ile
EU15	European Union 15	94	0.52	0.20	0.06	0.50	0.56	0.65	0.78
EA	Euro Area	94	0.56	0.19	0.14	0.50	0.56	0.68	0.83
be	Belgium	88	0.57	0.14	0.35	0.50	0.56	0.68	0.79
dk	Denmark	92	0.51	0.17	0.18	0.43	0.50	0.64	0.74
de	Germany	93	0.63	0.12	0.44	0.56	0.62	0.71	0.79
gr	Greece	88	0.53	0.25	0.00	0.50	0.56	0.72	0.83
es	Spain	83	0.58	0.12	0.44	0.50	0.56	0.68	0.79
fr	France	92	0.55	0.18	0.10	0.50	0.57	0.65	0.80
ie	Ireland	92	0.55	0.18	0.09	0.50	0.59	0.65	0.76
it	Italy	88	0.62	0.15	0.36	0.53	0.64	0.74	0.82
lu	Luxembourg	92	0.55	0.18	0.23	0.41	0.59	0.68	0.82
nl	Netherlands	89	0.56	0.15	0.29	0.50	0.57	0.65	0.76
at	Austria	91	0.56	0.15	0.32	0.50	0.59	0.64	0.75
pt	Portugal	88	0.57	0.12	0.37	0.50	0.56	0.65	0.75
sf	Finland	92	0.51	0.15	0.29	0.44	0.53	0.59	0.72
sv	Sweden	88	0.55	0.15	0.30	0.47	0.56	0.65	0.74
uk	United Kingdom	83	0.46	0.18	0.07	0.43	0.50	0.57	0.67
	All	1527	0.55	0.17	0.21	0.50	0.56	0.67	0.79

Note: Only the most disaggregated sub-indices are included.

Figure 2: The relationship between mean reversion coefficient γ and ΣAR coefficients



Note: The figure is restricted to values of $\rho \in [-1; 1]$.

Table 4: Aggregation effects, for different levels of aggregation

Aggregation From level x → y	ΣAR EA Weights	In %	ΣAR National Weights	In %	γ EA Weights	In %	γ National Weights	In %
1 → 0	10/17	58.8	10/15	66.7	5/17	29.4	4/17	23.5
2 → 1	81/151	53.6	79/151	52.3	56/170	32.9	7/170	45.3
3 → 2	198/349	56.7	188/345	54.5	205/425	48.2	217/416	52.2
2 → 0	12/17	70.6	10/17	58.8	14/17	82.4	11/17	64.7
3 → 0	11/17	64.7	11/17	64.7	4/17	23.5	3/17	17.6
2 → 1	102/185	55.1	101/185	54.6	67/187	35.8	62/187	33.2

Note: The table shows the fraction (number) of indices for which the estimated persistence of the more aggregate series is larger than the weighted persistence of the disaggregate series. Both the HICP weights for the euro area and the national HICP weights refer to the year 2002.

Table 5: Difference in weighted persistence estimates, according to level of aggregation

Aggr. Level	EU15	EA	be	dk	de	gr	es	Fr	ie	it	lu	nl	at	pt	sf	sv	uk
ΣAR																	
0	0.40	-0.14	-0.33	0.21	-0.16	0.51	-0.50	0.49	0.38	0.23	-0.17	0.28	0.43	0.31	0.07	0.06	0.32
Using EA HICP weights																	
1	0.32	0.26	-0.05	0.11	0.11	0.06	0.04	0.17	0.31	0.28	0.20	0.19	0.12	0.15	-0.01	0.14	0.14
2	0.31	0.25	0.13	0.06	0.26	0.12	0.16	0.14	0.19	0.08	0.04	0.19	0.10	0.19	-0.05	0.08	0.01
3	0.35	0.31	0.15	0.08	0.28	0.16	0.16	0.29	0.25	0.16	0.13	0.20	0.12	0.22	-0.07	0.17	0.14
Using National HICP weights																	
1	0.32	0.26	-0.05	0.13	0.10	0.12	0.05	0.20	0.30	0.25	0.17	0.17	0.08	0.13	0.03	0.13	0.19
2	0.31	0.25	0.16	0.08	0.24	0.25	0.21	0.20	0.23	-0.03	0.07	0.17	0.12	0.34	0.03	0.06	0.15
3	0.35	0.31	0.15	0.08	0.29	0.18	0.19	0.32	0.20	0.05	0.11	0.18	0.08	0.26	0.01	0.18	0.16
γ																	
0	0.41	0.47	0.44	0.38	0.38	0.06	0.35	0.41	0.62	0.47	0.62	0.32	0.56	0.56	0.47	0.18	0.12
Using EA HICP weights																	
1	0.42	0.48	0.53	0.47	0.51	0.40	0.53	0.47	0.53	0.57	0.55	0.45	0.52	0.53	0.47	0.50	0.44
2	0.43	0.46	0.49	0.39	0.52	0.42	0.42	0.45	0.42	0.49	0.46	0.43	0.45	0.45	0.41	0.41	0.34
3	0.53	0.56	0.58	0.48	0.64	0.52	0.53	0.55	0.53	0.61	0.55	0.52	0.55	0.54	0.50	0.51	0.43
Using National HICP weights																	
1	0.42	0.48	0.52	0.48	0.52	0.40	0.53	0.48	0.53	0.55	0.54	0.44	0.50	0.53	0.48	0.51	0.45
2	0.43	0.46	0.52	0.47	0.48	0.50	0.38	0.50	0.54	0.54	0.47	0.415	0.48	0.63	0.50	0.40	0.37
3	0.53	0.56	0.59	0.50	0.65	0.48	0.55	0.57	0.54	0.60	0.55	0.54	0.55	0.57	0.52	0.53	0.46

Note: HICP weights for euro area in 2002. National HICP weights in 2002. Sum of weights vary across countries and aggregation levels, as estimates were not possible for all indices.

Table 6: Country aggregation effects

At Aggregation Level	ΣAR Fraction of indices	In %	γ Fraction of indices	In %
0	1/1	100.0	1/1	100.0
1	10/11	90.9	2/12	33.3
2	21/29	72.4	20/39	51.3
3	46/58	79.3	54/94	57.4

Note: The table shows the fraction (number) of indices for which the estimated persistence of the more aggregate series is larger than the weighted persistence of the disaggregate series. The respective national countries weights refer are relative to the euro area in 2002.

Table 7: Weighted persistence (ΣAR) estimates at the lowest level of disaggregation

	EU	EA	be	dk	de	gr	es	fr	ie	it	lu	nl	at	pt	sf	sv	uk
# Indices	93	93	78	84	90	81	77	88	87	84	77	82	83	86	87	83	80
Minimum	-0.77	-1.33	-1.06	-2.88	-1.85	-1.68	-2.44	-1.61	-1.30	-2.12	-0.90	-1.62	-3.96	-1.16	-2.12	-0.72	-2.51
Maximum	0.88	0.97	0.80	0.88	1.01	0.81	0.88	5.14	0.89	0.85	0.81	1.14	0.58	0.76	0.77	0.72	0.82
25 Percentile	0.02	0.12	-0.09	-0.08	0.14	-0.06	0.01	0.08	0.12	0.05	-0.12	0.00	-0.08	0.02	-0.11	-0.11	-0.14
Median	0.30	0.40	0.26	0.16	0.34	0.17	0.27	0.28	0.25	0.34	0.09	0.27	0.18	0.32	0.08	0.10	0.11
75 Percentile	0.54	0.59	0.44	0.29	0.53	0.44	0.49	0.54	0.42	0.54	0.27	0.44	0.33	0.45	0.23	0.29	0.31
Average	0.27	0.30	0.15	0.01	0.29	0.11	0.18	0.29	0.23	0.22	0.03	0.18	0.04	0.22	-0.05	0.09	0.02
Std.dev	0.34	0.42	0.41	0.58	0.39	0.46	0.51	0.69	0.31	0.49	0.41	0.42	0.58	0.36	0.54	0.32	0.49
Weighted 25 %ile	0.16	0.10	0.03	-0.08	0.18	0.00	-0.02	0.09	0.13	0.06	-0.07	-0.07	-0.09	0.00	-0.04	-0.08	-0.02
Weighted Median	0.40	0.46	0.26	0.16	0.34	0.20	0.33	0.35	0.22	0.39	0.19	0.24	0.21	0.28	0.15	0.22	0.18
Weighted 75 %ile	0.57	0.64	0.54	0.29	0.60	0.49	0.58	0.55	0.42	0.60	0.47	0.44	0.36	0.49	0.29	0.44	0.41
Weighted Average	0.35	0.31	0.15	0.08	0.28	0.16	0.16	0.29	0.25	0.16	0.13	0.20	0.12	0.22	-0.07	0.17	0.14
Cum. Weight	992.2	992.2	927.8	950.4	987.3	933.4	898.1	977.3	947.8	965.3	914.6	861.0	963.6	961.8	971.5	922.3	927.7
Evidence of weighted statistics > unweighted statistics																	
Average	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes
Median	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes
75 %ile	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Aggr. persistence	0.40	-0.14	-0.33	0.21	-0.16	0.51	-0.50	0.49	0.38	0.23	-0.17	0.28	0.43	0.31	0.07	0.06	0.32
% persis.<agg. persis.	57.0%	12.9%	14.1%	61.9%	10.0%	81.5%	9.1%	72.7%	67.8%	40.5%	22.1%	53.7%	86.7%	48.8%	48.3%	45.8%	75.0%
Correl(persist., weight	0.19	0.02	0.01	0.11	-0.02	0.09	-0.03	0.00	0.06	-0.11	0.21	0.03	0.13	-0.01	-0.04	0.22	0.22

Note: All results use HICP weights for euro area in 2002. Sum of weights vary across countries and aggregation levels, as estimates were not possible for all indices.

Table 8: Weighted persistence (γ) estimates at the lowest level of disaggregation

	EU	EA	be	dk	de	gr	es	fr	ie	it	lu	nl	at	pt	sf	sv	uk
# Indices	94	94	88	92	93	88	83	92	92	88	92	89	91	88	92	88	83
Minimum	0.00	0.00	0.14	0.00	0.24	0.00	0.29	0.00	0.00	0.18	0.21	0.00	0.00	0.18	0.00	0.00	0.00
Maximum	0.82	0.88	0.88	0.91	0.91	0.94	0.85	0.83	0.88	0.91	1.00	0.83	0.97	0.82	0.81	0.83	0.77
25 Percentile	0.50	0.50	0.50	0.43	0.56	0.50	0.50	0.50	0.50	0.53	0.41	0.50	0.50	0.50	0.44	0.47	0.43
Median	0.56	0.56	0.56	0.50	0.62	0.56	0.56	0.57	0.59	0.64	0.59	0.57	0.59	0.56	0.53	0.56	0.50
75 Percentile	0.65	0.68	0.68	0.64	0.71	0.72	0.68	0.65	0.65	0.74	0.68	0.65	0.64	0.65	0.59	0.65	0.57
Average	0.52	0.56	0.57	0.51	0.63	0.53	0.58	0.55	0.55	0.62	0.55	0.56	0.56	0.57	0.51	0.55	0.46
Std.dev	0.20	0.19	0.14	0.17	0.12	0.25	0.12	0.18	0.18	0.15	0.18	0.15	0.15	0.12	0.15	0.15	0.18
Weighted 25 %ile	0.50	0.50	0.50	0.41	0.56	0.52	0.50	0.50	0.50	0.53	0.44	0.47	0.50	0.50	0.44	0.50	0.43
Weighted Median	0.57	0.56	0.57	0.50	0.65	0.58	0.56	0.57	0.56	0.63	0.59	0.56	0.62	0.56	0.53	0.59	0.50
Weighted 75 %ile	0.68	0.68	0.71	0.62	0.76	0.70	0.65	0.70	0.65	0.76	0.68	0.71	0.65	0.68	0.59	0.62	0.53
Weighted Average	0.53	0.56	0.59	0.48	0.64	0.53	0.56	0.55	0.54	0.62	0.55	0.54	0.55	0.56	0.50	0.53	0.45
Cum. Weight	998.9	998.9	984.1	996.3	998.9	979.7	943.0	996.3	974.7	982.8	992.9	963.0	996.8	970.5	996.3	960.9	947.1
Evidence of weighted statistics > unweighted statistics																	
Average	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No	No	No	No	No	No	No	No	No
Median	Yes	No	Yes	No	Yes	Yes	No	Yes	No	No	No	No	Yes	No	No	Yes	No
75 %ile	Yes	No	Yes	No	Yes	No	No	Yes	No	Yes	No	Yes	Yes	Yes	No	No	No
Aggr. persistence	0.41	0.47	0.44	0.38	0.38	0.06	0.35	0.41	0.62	0.47	0.62	0.32	0.56	0.56	0.47	0.18	0.12
% persis.<agg. persis.	17.0%	17.0%	11.4%	14.1%	3.2%	8.0%	3.6%	12.0%	60.9%	10.2%	54.3%	6.7%	40.7%	40.9%	30.4%	2.3%	8.4%
Correl(persis., weight)	0.04	0.01	0.13	-0.15	0.11	0.01	-0.12	0.02	-0.04	-0.02	-0.02	-0.11	-0.04	-0.06	-0.06	-0.08	-0.06

Note: All results use HICP weights for euro area in 2002. Sum of weights vary across countries and aggregation levels, as estimates were not possible for all indices.

Figure 3: The effect of the HICP methodological revision

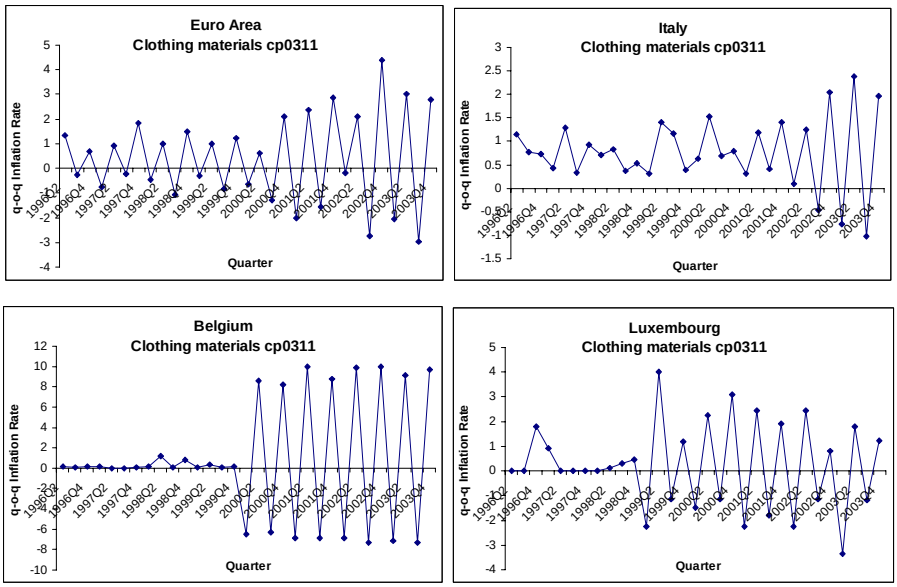
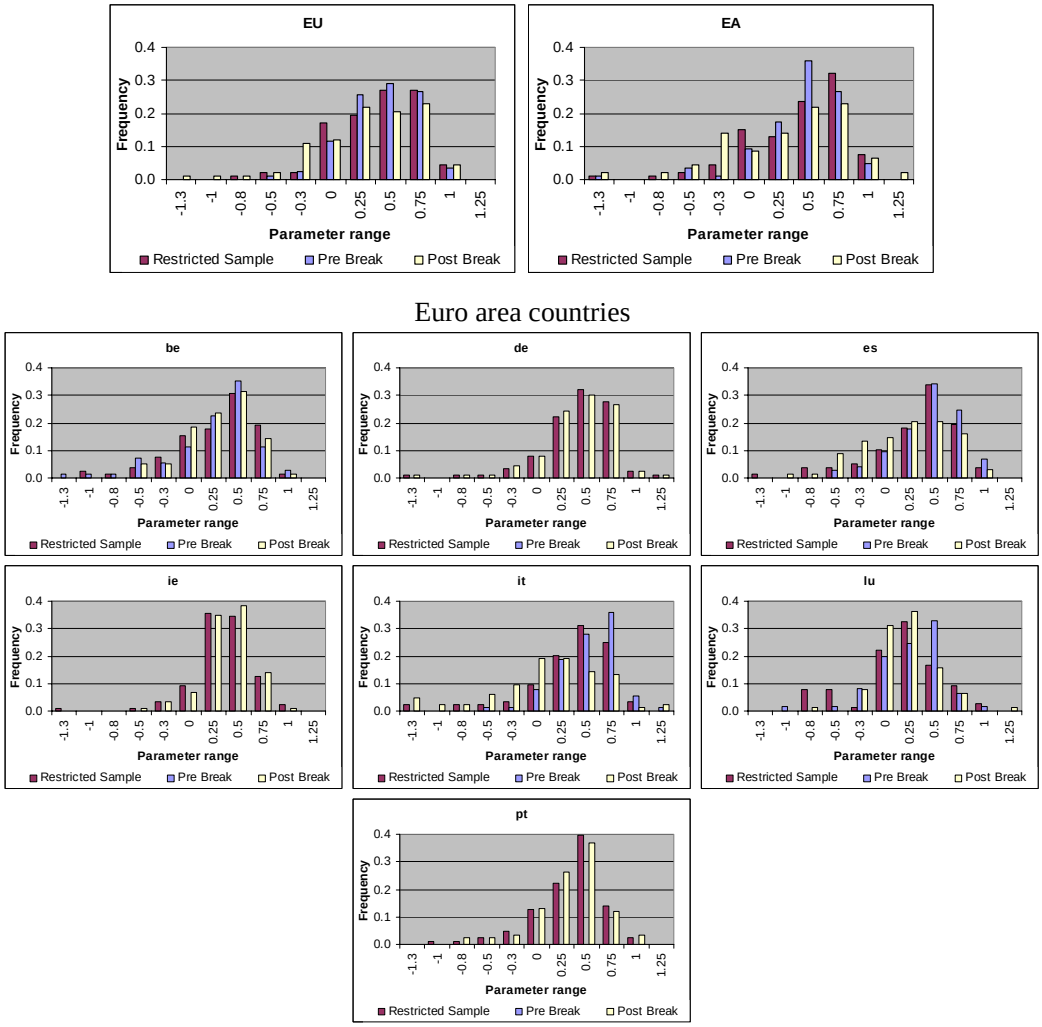


Table 9: Description of indices considered being affected by the modified treatment of sales

HICP Description	HICP weight
cp0311 Clothing materials	0.33
cp0312 Garments	56.4
cp0313 Other articles of clothing & clothing accessories	2.29
cp032 Footwear including repair	16.21
cp0511 Furniture & furnishings	28.36
cp0512 Carpets & other floor coverings	2.83
cp052 Household textiles	6.45
cp0531_532 Major househ. appl. whether elec. or not & small elec. househ. appl.	10.73
cp054 Glassware, tableware & household utensils	6.14
cp055 Tools & equipment for house & garden	4.57
cp0561 Non-durable household goods	10.19
cp0911 Equipment for the reception, recording & reproduction of sound & pictures	6.17
cp0912 Photographic & cinematographic equipment & optical instruments	1.75
cp0913 Information processing equipment	4.18
cp0914 Recording media	4.28
cp0921_922 Major durables for in- & outdoor recreation incl. musical instruments	2.62
cp0931 Games, toys and hobbies	4.31
cp0932 Equipment for sport, camping and open-air recreation	2.8
cp0933 Gardens, plants and flowers	6.24
cp0934_935 Pets and related products; veterinary and other services for pets	4.8
cp0951 Books	6.71
cp0953_954 Miscellaneous printed matter; stationery and drawing materials	3.22
cp096 Package holidays	15.52
cp1231 Jewellery, clocks and watches	5.5
cp1232 Other personal effects	6.12
Total	**218.72**

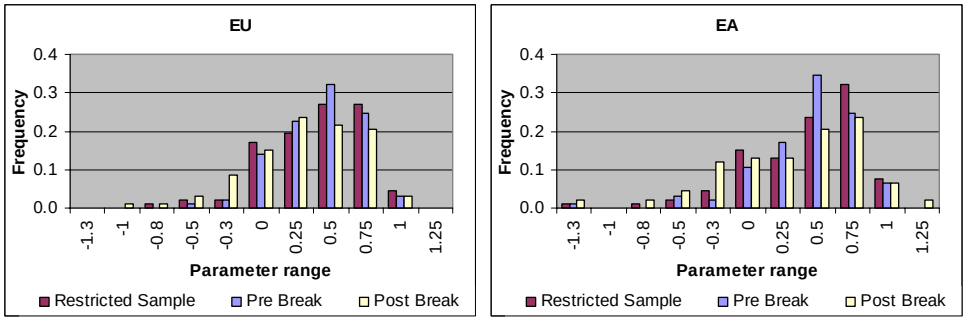
Note: Weights based on euro area in 2002

Figure 4: Distribution of inflation parameter ρ prior and after the HICP methodology revision

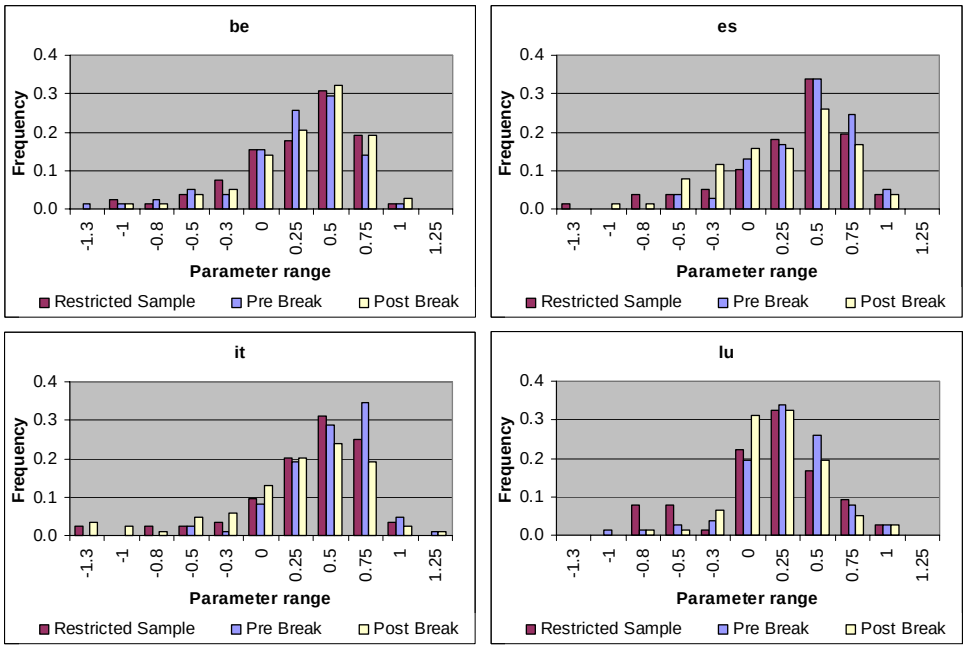


Note: The graphs show the distribution of the restricted model, the unrestricted model (sub-period prior and after the structural break) **regardless of whether the Chow break point test is significant or not**. The countries not shown, i.e. Greece, France, The Netherlands, Austria, Finland, Denmark, Sweden, and The United Kingdom adopted sales prices from the outset, and thus are not included in the figure.

Figure 5: Distribution of inflation parameter ρ prior and after the HICP methodology revision



Euro area countries



Note: The graphs show the distribution of the restricted model, the unrestricted model (sub-period prior and after the structural break). **In cases where no overall structural break was found the parameter estimates of the restricted model are assumed to hold for the unrestricted model.**

This Figure presents the differences in the distribution between the two sub-periods conditional on the presence of a structural break.

Table 10: Descriptive statistics of inflation persistence parameter ρ per country, for post HICP revision period

Country code	Country	# Indices	Average	Std.dev.	5%ile	25%ile	50%ile	75%ile	95%ile
EU15	European Union 15	92	0.21	0.50	-0.54	-0.02	0.25	0.55	0.79
EA	Euro Area	92	0.19	0.58	-0.68	-0.10	0.29	0.55	0.93
be	Belgium	76	0.18	0.33	-0.47	-0.02	0.23	0.41	0.62
dk	Denmark								
de	Germany	90	0.28	0.40	-0.38	0.11	0.34	0.55	0.71
gr	Greece								
es	Spain	68	0.07	0.45	-0.64	-0.26	0.15	0.43	0.64
fr	France								
ie	Ireland	86	0.26	0.27	-0.22	0.14	0.27	0.40	0.70
it	Italy	83	0.05	0.81	-1.24	-0.26	0.05	0.38	1.09
lu	Luxembourg	77	0.08	0.29	-0.32	-0.10	0.05	0.24	0.54
nl	Netherlands								
at	Austria								
pt	Portugal	84	0.21	0.35	-0.41	0.05	0.29	0.44	0.65
sf	Finland								
sv	Sweden								
uk	United Kingdom								
	All								

Note: The estimated parameters are taken at face value and are not treated as zeros in case of statistical insignificance.

Figure 6: Distribution of mean reversion indicator γ prior and after the HICP revision

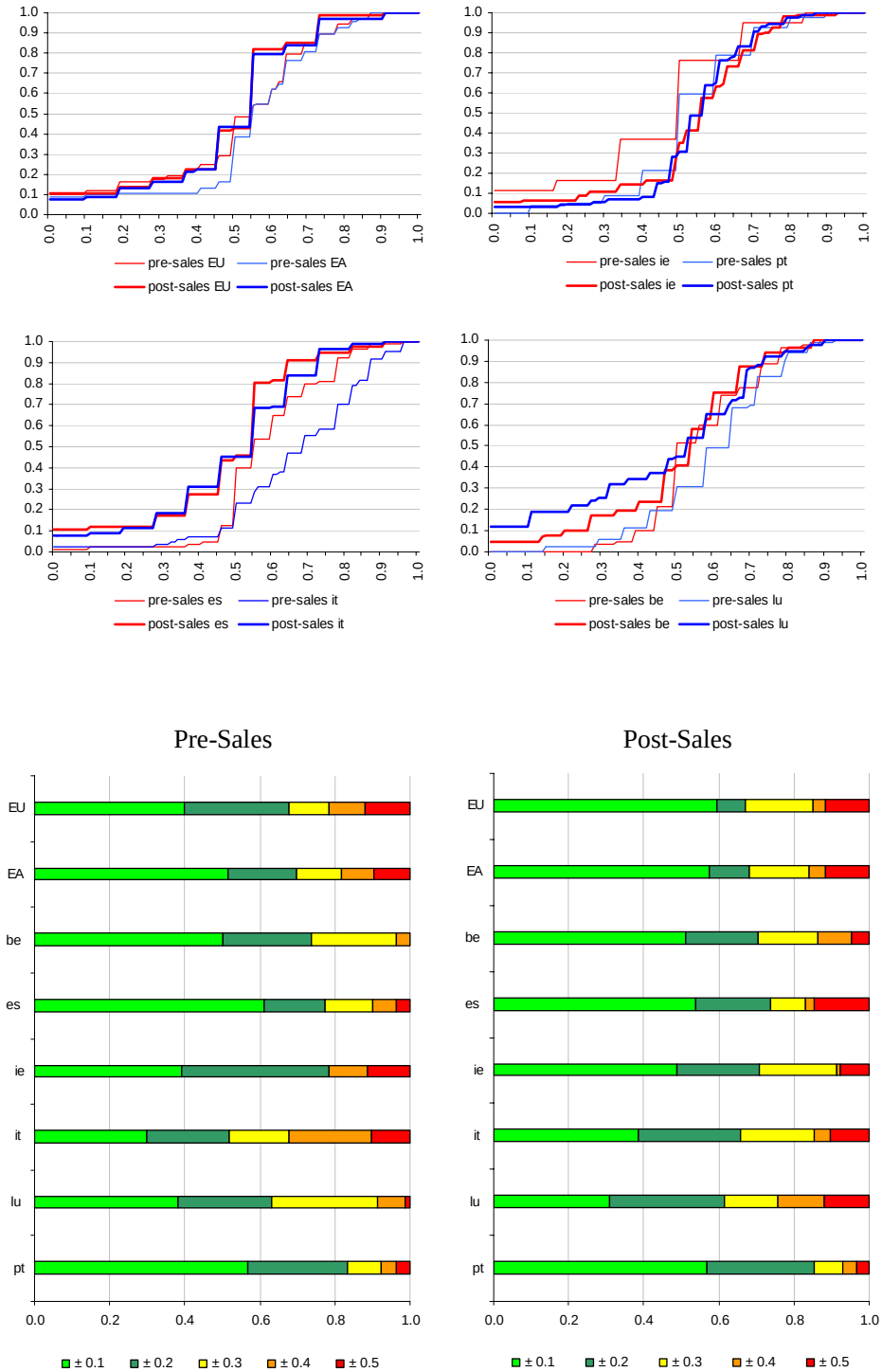


Table 11: Frequency of structural breaks, per country, in percent

	EU15	EA	be	dk	de	gr	Es	fr	ie	it	lu	nl	at	pt	sf	Sv	uk
Break Date	**2001**	**2001**	**2000**		**1998**		**2001**		**1999**	**2001**	**1999**			**1998**			
Chow Break point test																	
All Indices	65.1	64.0	45.6				70.8			57.3	49.2						
Sales Indices	72.0	60.0	65.2				95.2			68.0	78.3						
Non-sales indices	62.3	65.6	35.6				59.1			52.0	31.6						
Wald-test on Change in ΣAR coefficients																	
All Indices	9.3	10.5	11.4				20.0			21.3	4.9						
Sales Indices	16.0	4.0	4.0				33.3			28.0	8.7						
Non-sales indices	6.6	13.1	15.6				13.6			18.0	2.6						
Wald-test on Change in intercept																	
All Indices	16.3	11.6	10.6				15.6			20.0	30.5						
Sales Indices	40.0	24.0	23.8				35.0			32.0	52.4						
Non-sales indices	6.6	6.6	4.4				6.8			14.0	18.4						
One-sided non-param. F-test: Std. dev S_2 (post-break) > Std. dev. S_1 (pre break): $F(n_1/(n_1\text{-}1))\ S_1^2 / ((n_2/(n_2\text{-}1)\ S_2^2)\ , n_1\text{-}1, n_2\text{-}1)$																	
All Indices	19.8	33.7	38.7		39.1		36.2		38.0	17.1	58.0			21.5			
Sales Indices	32.0	48.0	40.0		60.0		66.7		32.0	32.0	68.0			30.4			
Non-sales indices	14.8	27.9	38.0		30.6		22.9		40.7	10.5	53.6			17.9			

Note: A break is identified with a p-value ≤ 0.05.

Table 12: Statistics of inflation persistence parameter ρ per country, unrestricted model

Pre-sales

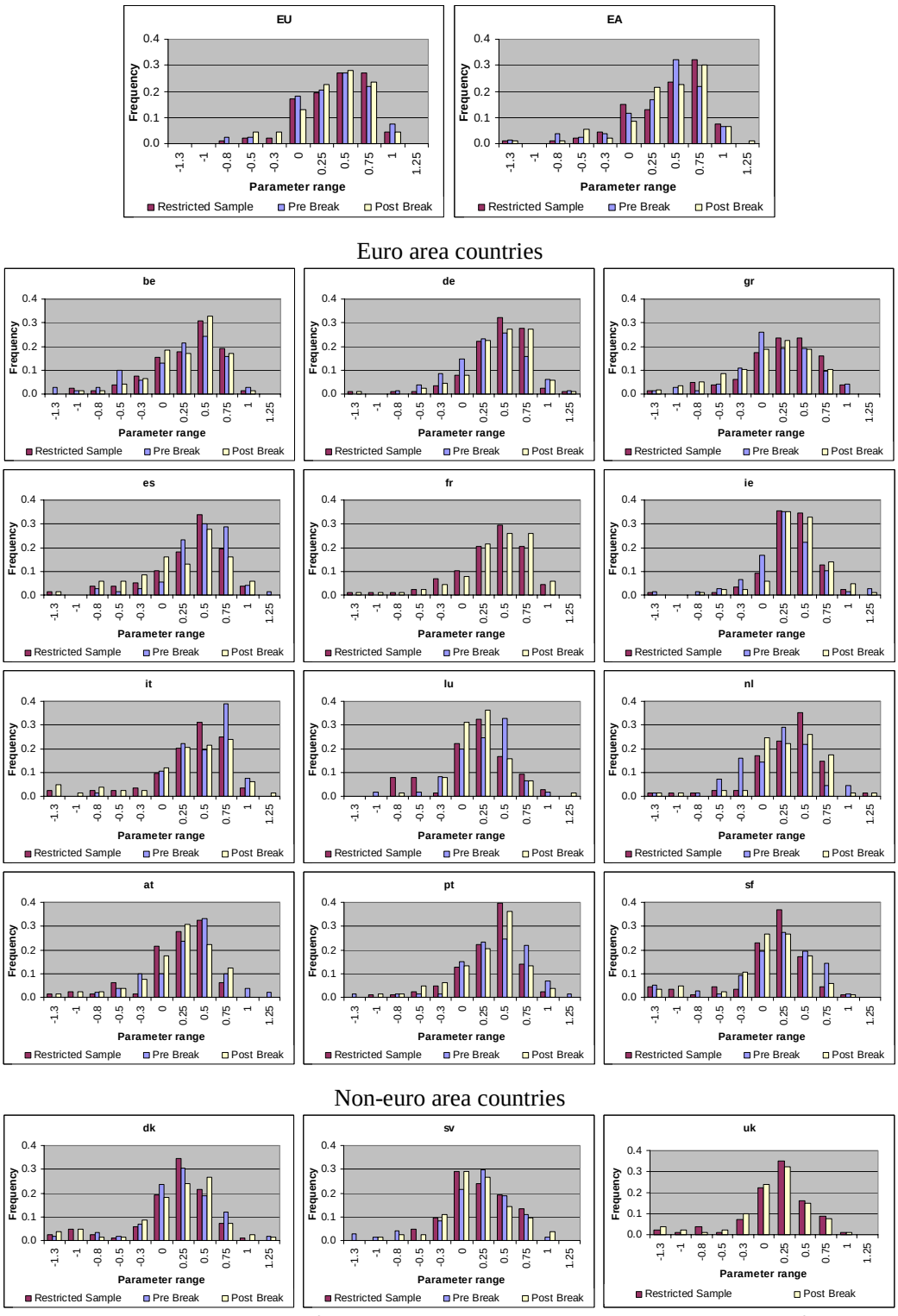
Country code	Country	# Indices	Average	Std.dev.	5%ile	25%ile	50%ile	75%ile	95%ile
EU15	European Union 15	93	0.31	0.30	-0.18	0.13	0.33	0.54	0.73
EA	Euro Area	93	0.32	0.37	-0.28	0.16	0.37	0.57	0.77
be	Belgium	78	0.11	0.42	-0.74	-0.05	0.20	0.39	0.65
dk	Denmark	84	0.01	0.58	-1.02	-0.08	0.16	0.29	0.55
de	Germany	90	0.29	0.39	-0.33	0.14	0.34	0.53	0.73
gr	Greece	81	0.11	0.46	-0.76	-0.06	0.17	0.44	0.72
es	Spain	77	0.30	0.34	-0.46	0.14	0.36	0.56	0.75
fr	France	88	0.29	0.69	-0.54	0.08	0.28	0.54	0.83
ie	Ireland	87	0.23	0.31	-0.33	0.12	0.25	0.42	0.65
it	Italy	84	0.36	0.32	-0.19	0.17	0.43	0.61	0.75
lu	Luxembourg	77	0.15	0.36	-0.43	-0.03	0.16	0.34	0.64
nl	Netherlands	82	0.18	0.42	-0.60	0.00	0.27	0.44	0.68
at	Austria	83	0.04	0.58	-0.73	-0.08	0.18	0.33	0.51
pt	Portugal	86	0.22	0.36	-0.40	0.02	0.32	0.45	0.68
sf	Finland	87	-0.05	0.54	-1.20	-0.11	0.08	0.23	0.50
sv	Sweden	83	0.09	0.32	-0.47	-0.11	0.10	0.29	0.61
uk	United Kingdom	80	0.02	0.49	-0.85	-0.14	0.11	0.31	0.53
	All	1433	0.18	0.46	-0.58	-0.01	0.24	0.44	0.70

Post-sales

Country code	Country	# Indices	Average	Std.dev.	5%ile	25%ile	50%ile	75%ile	95%ile
EU15	European Union 15	93	0.22	0.45	-0.54	-0.01	0.23	0.51	0.75
EA	Euro Area	93	0.21	0.52	-0.67	-0.09	0.29	0.55	0.92
be	Belgium	78	0.20	0.38	-0.56	-0.02	0.27	0.44	0.68
dk	Denmark	84	0.01	0.58	-1.02	-0.08	0.16	0.29	0.55
de	Germany	90	0.29	0.39	-0.33	0.14	0.34	0.53	0.73
gr	Greece	81	0.11	0.46	-0.76	-0.06	0.17	0.44	0.72
es	Spain	77	0.12	0.45	-0.62	-0.23	0.21	0.46	0.74
fr	France	88	0.29	0.69	-0.54	0.08	0.28	0.54	0.83
ie	Ireland	87	0.23	0.31	-0.33	0.12	0.25	0.42	0.65
it	Italy	84	0.14	0.69	-1.16	-0.18	0.23	0.50	0.75
lu	Luxembourg	77	0.08	0.30	-0.35	-0.08	0.07	0.27	0.58
nl	Netherlands	82	0.18	0.42	-0.60	0.00	0.27	0.44	0.68
at	Austria	83	0.04	0.58	-0.73	-0.08	0.18	0.33	0.51
pt	Portugal	86	0.22	0.36	-0.40	0.02	0.32	0.45	0.68
sf	Finland	87	-0.05	0.54	-1.20	-0.11	0.08	0.23	0.50
sv	Sweden	83	0.09	0.32	-0.47	-0.11	0.10	0.29	0.61
uk	United Kingdom	80	0.02	0.49	-0.85	-0.14	0.11	0.31	0.53
	All	1433	0.14	0.49	-0.65	-0.05	0.21	0.43	0.70

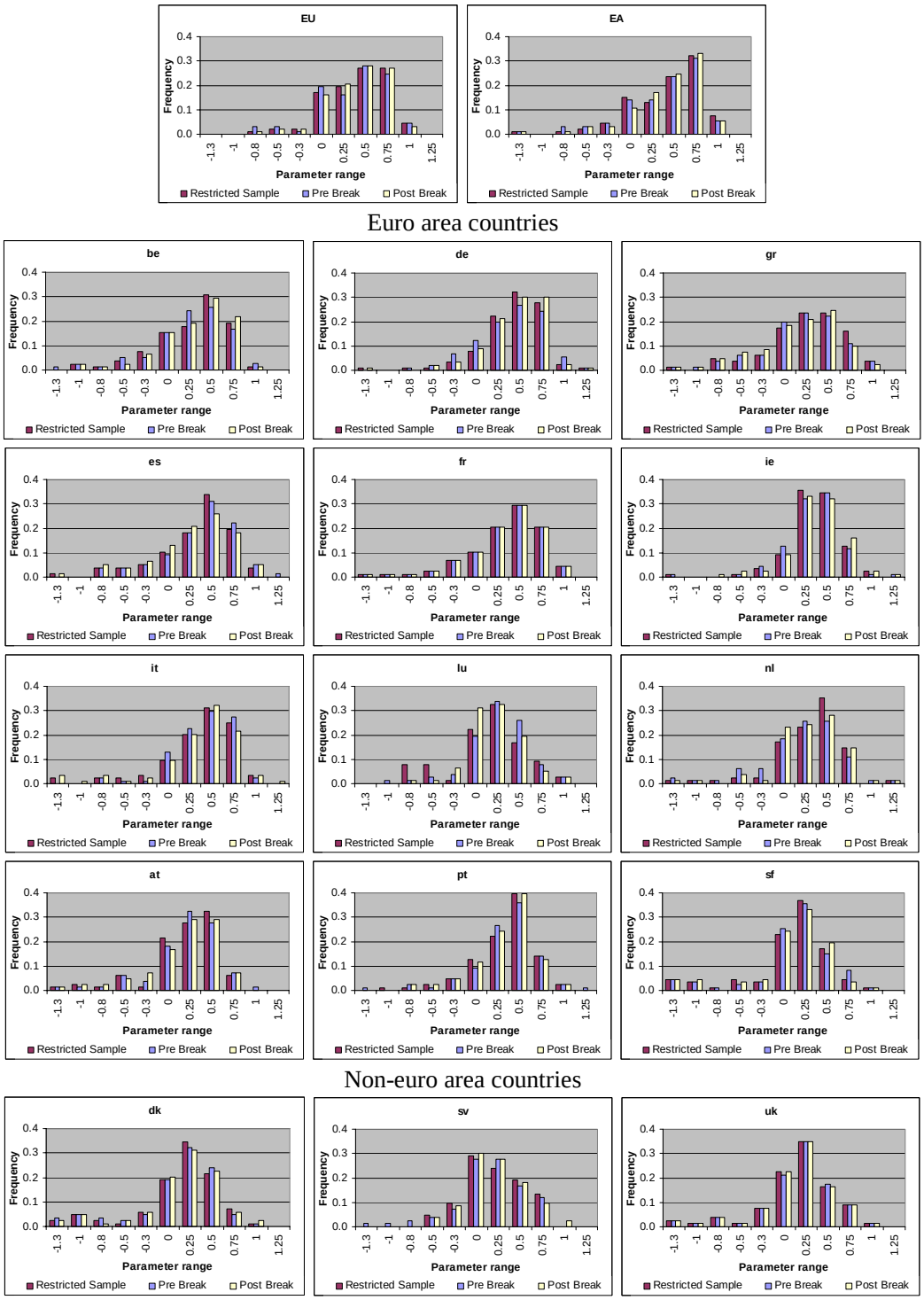
Note: Only the most disaggregated sub-indices are considered. The estimated parameters are taken at face value and are not treated as zeros in case of statistical insignificance. **The summary statistics are based on the unrestricted model. In cases where no overall structural break was found, the parameter estimates of the restricted model are assumed to hold. The values for France and the UK are identical as due to data limitations no structural break tests could be performed.**

Figure 7: Distribution of inflation parameter ρ before and after EMU break



Note: The graphs show the distribution of the restricted model, the unrestricted model (sub-period prior and after the structural EMU break) **regardless of whether the Chow break point test is significant or not**. For France and The United Kingdom, the separate estimation of the pre EMU period was not possible due to the lack of a sufficient number of observations.

Figure 8: Distribution of inflation parameter ρ before and after EMU break



Note: The graphs show the distribution of the restricted model, the unrestricted model (sub-period prior and after the structural break). **In cases where no overall structural break was found the parameter estimates of the restricted model are assumed to hold for the unrestricted model.**

This Figure presents the differences in the distribution between the two sub-periods conditional on the presence of a structural break.

Table 13: Summary statistics of inflation persistence parameter ρ per country

Pre EMU sub-sample

Country code	Country	# Indices	Average	Std.dev.	5%ile	25%ile	50%ile	75%ile	95%ile
EU15	European Union 15	78	0.26	0.37	-0.28	0.02	0.30	0.57	0.78
EA	Euro Area	78	0.24	0.47	-0.75	0.07	0.36	0.56	0.77
be	Belgium	70	0.08	0.52	-0.78	-0.17	0.16	0.44	0.72
dk	Denmark	59	0.10	0.45	-0.56	-0.12	0.10	0.33	0.69
de	Germany	82	0.21	0.39	-0.49	-0.03	0.24	0.49	0.80
gr	Greece	73	0.06	0.59	-0.70	-0.11	0.05	0.35	0.76
es	Spain	73	0.32	0.36	-0.41	0.14	0.32	0.58	0.75
fr	France								
ie	Ireland	77	0.13	0.41	-0.45	-0.03	0.13	0.36	0.71
it	Italy	67	0.37	0.34	-0.12	0.10	0.46	0.63	0.76
lu	Luxembourg	61	0.18	0.40	-0.33	-0.06	0.21	0.40	0.60
nl	Netherlands	69	0.03	0.41	-0.56	-0.26	0.07	0.30	0.62
at	Austria	51	0.21	0.41	-0.50	0.01	0.27	0.42	0.84
pt	Portugal	73	0.44	1.45	-0.18	0.01	0.31	0.53	0.83
sf	Finland	77	0.03	0.51	-0.93	-0.15	0.09	0.36	0.63
sv	Sweden	74	0.06	0.47	-0.78	-0.10	0.08	0.30	0.67
uk	United Kingdom								
	All	1062	0.18	0.58	-0.60	-0.04	0.20	0.46	0.76

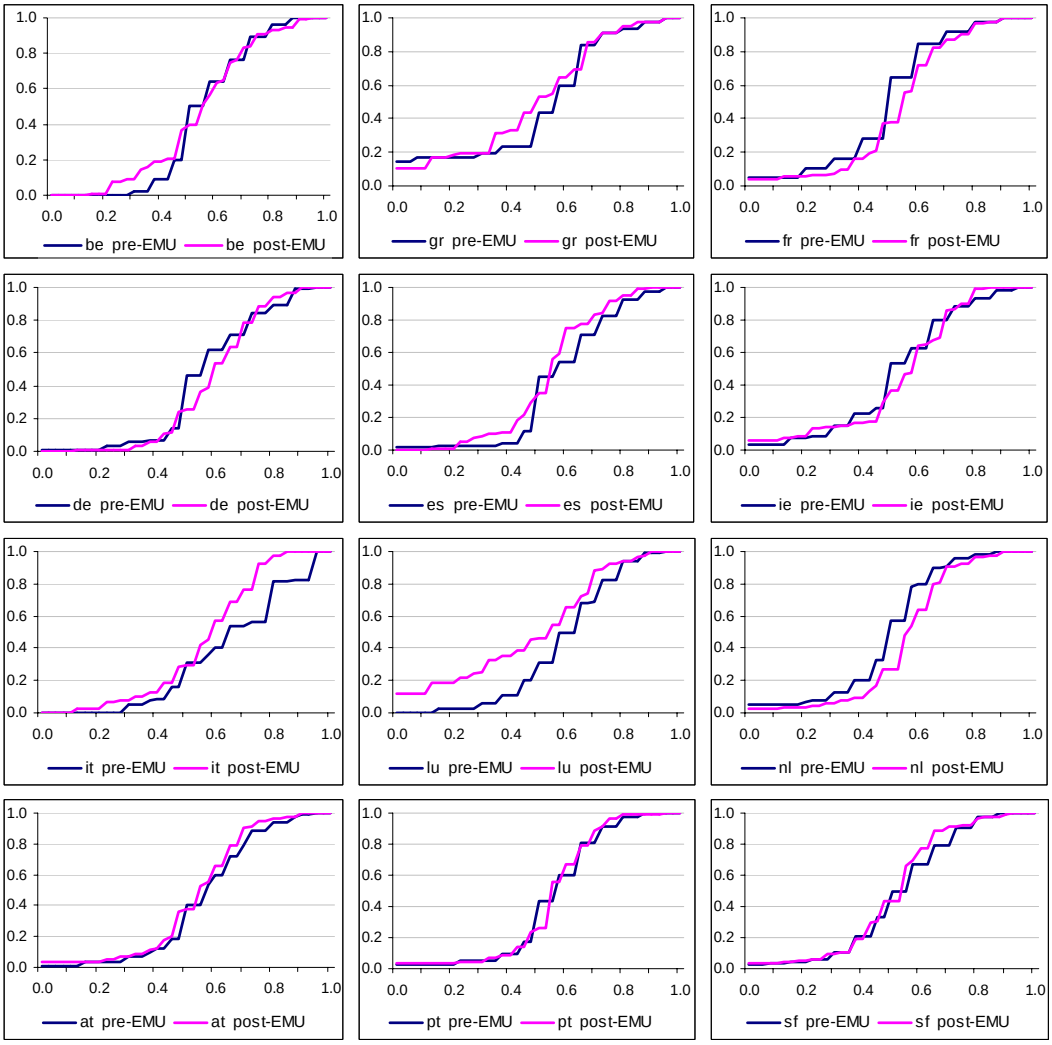
Post EMU sub-sample

Country code	Country	# Indices	Average	Std.dev.	5%ile	25%ile	50%ile	75%ile	95%ile
EU15	European Union 15	93	0.26	0.36	-0.47	0.03	0.32	0.52	0.74
EA	Euro Area	93	0.29	0.43	-0.57	0.10	0.37	0.57	0.77
be	Belgium	76	0.16	0.37	-0.56	-0.03	0.27	0.46	0.60
dk	Denmark	83	0.09	0.94	-1.12	-0.11	0.18	0.35	0.64
de	Germany	88	0.30	0.40	-0.42	0.11	0.39	0.59	0.76
gr	Greece	58	-0.08	0.52	-0.86	-0.40	0.02	0.30	0.55
es	Spain	69	0.10	0.55	-0.85	-0.12	0.23	0.48	0.77
fr	France	88	0.33	0.70	-0.51	0.07	0.32	0.56	0.83
ie	Ireland	85	0.27	0.33	-0.36	0.10	0.29	0.41	0.80
it	Italy	83	0.16	0.63	-1.03	-0.02	0.29	0.57	0.81
lu	Luxembourg	77	0.08	0.29	-0.32	-0.10	0.05	0.24	0.54
nl	Netherlands	81	0.16	0.44	-0.42	-0.06	0.24	0.45	0.63
at	Austria	81	0.02	0.59	-0.80	-0.10	0.13	0.31	0.60
pt	Portugal	83	0.19	0.39	-0.67	-0.03	0.27	0.45	0.63
sf	Finland	86	-0.04	0.56	-1.18	-0.23	0.03	0.25	0.53
sv	Sweden	83	0.06	0.39	-0.55	-0.17	0.04	0.30	0.68
uk	United Kingdom	80	-0.02	0.51	-1.06	-0.13	0.07	0.23	0.58
	All	1387	0.15	0.53	-0.71	-0.06	0.21	0.45	0.71

Note: The estimated parameters are taken at face value and are not treated as zeros in case of statistical insignificance.

Figure 9: Distribution of mean reversion coefficient γ before and after EMU

Euro area countries



Non-euro area countries

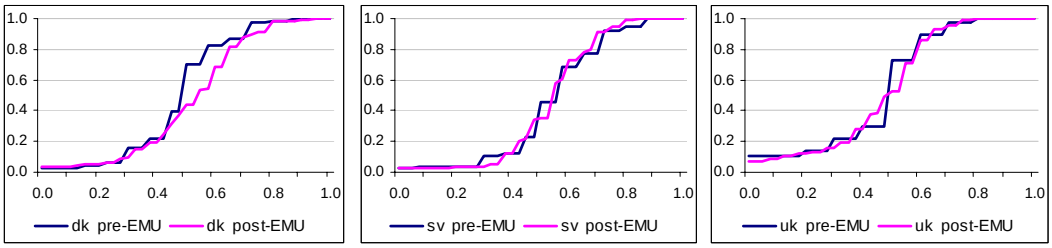


Figure 10: Distribution of deviations of γ from 0.5 before and after EMU break

Pre-EMU *Post-EMU*

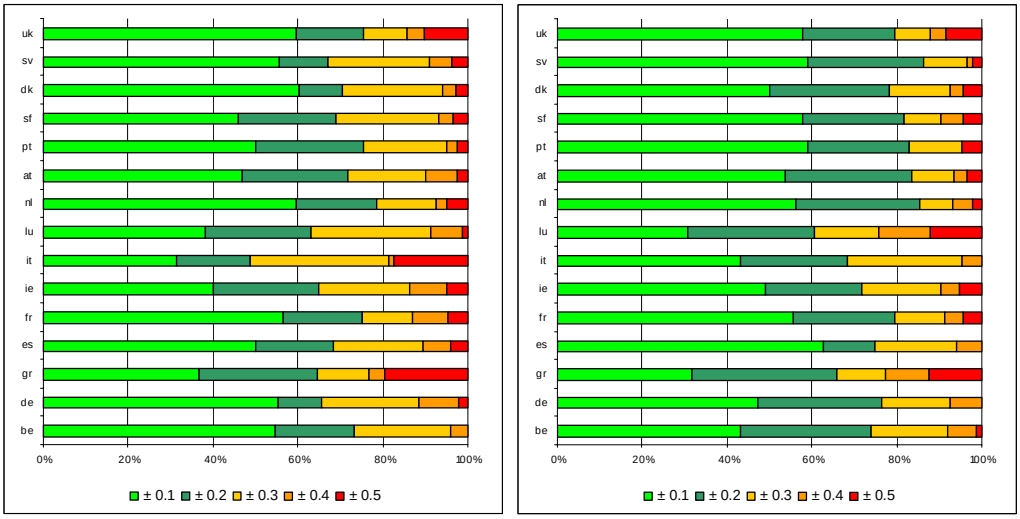


Table 14: Frequency of structural break, per country and significance level, in percent

Level of Significance	EU15	EA	be	dk	de	gr	es	fr	ie	it	lu	nl	at	pt	sf	sv	uk	All
P-value<0.1	52.6	48.7	55.7	49.2	42.7	68.6	57.6		59.2	67.2	57.4	69.6	60.8	51.4	52.6	55.4		56.0
P-value<0.05	39.7	38.5	35.7	37.3	31.7	49.0	40.9		38.2	47.8	49.2	49.3	37.3	42.9	36.8	44.6		41.0
P-value<0.01	16.7	12.8	15.7	15.3	18.3	27.5	16.7		17.1	23.9	36.1	31.9	11.8	22.9	18.4	17.6		20.0

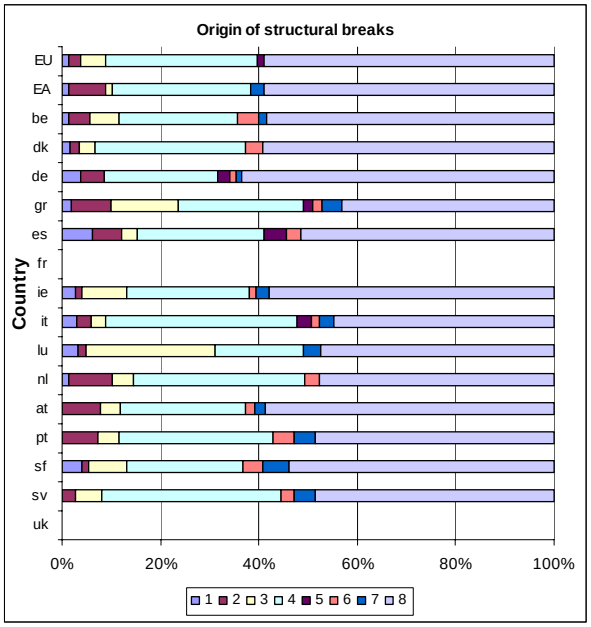
Note: The estimated parameters are taken at face value and are not treated as zeros in case of statistical insignificance.

Table 15: Frequency of structural breaks in the ΣAR coefficients and the intercept, per country and significance level, in percent

Level of Significance	EU15	EA	be	dk	de	gr	es	fr	ie	it	lu	nl	at	pt	sf	sv	uk	All
Σ AR coefficients																		
P-value<0.1	11.5	9.0	17.1	10.2	15.9	23.5	30.3		10.5	13.4	9.8	21.7	15.7	18.8	15.8	9.5		15.3
P-value<0.05	5.1	9.0	10.0	6.8	12.2	13.7	19.7		5.3	10.4	4.9	13.0	9.8	10.1	9.2	5.4		9.5
P-value<0.01	2.6	3.8	2.9	5.1	4.9	5.9	13.6		1.3	6.0	1.6	4.3	5.9	4.3	5.3	1.4		4.5
Intercept																		
P-value<0.1	10.3	7.7	17.1	15.3	11.0	31.4	21.2		19.7	17.9	37.3	10.1	9.8	12.9	25.0	20.3		17.3
P-value<0.05	7.7	5.1	8.6	5.1	7.3	21.6	13.6		14.5	11.9	30.5	5.8	5.9	8.6	17.1	9.5		11.2
P-value<0.01	2.6	1.3	2.9	1.7	2.4	5.9	6.1		3.9	3.0	22.0	2.9	0.0	1.4	10.5	2.7		4.5

Note: These structural breaks in the ΣAR coefficients and the intercept reported are irrespective of whether the overall F-statistic of the structural break test is significant.

Figure 11: The origin of structural breaks



Legend: p-values conditions to be met

Legend	Break test	Wald-test	
	Overall	ΣAR coeff.	Intercept
1	<0.05	<0.05	<0.05
2	<0.05	<0.05	>0.05
3	<0.05	>0.05	<0.05
4	<0.05	>0.05	>0.05
5	>0.05	<0.05	<0.05
6	>0.05	<0.05	>0.05
7	>0.05	>0.05	<0.05
8	>0.05	>0.05	>0.05

Table 16: Statistics of inflation persistence parameter ρ per country, unrestricted model

Pre EMU sample

Country code	Country	# Indices	Average	Std.dev.	5%ile	25%ile	50%ile	75%ile	95%ile
EU15	European Union 15	93	0.24	0.39	-0.57	-0.01	0.30	0.54	0.74
EA	Euro Area	93	0.25	0.47	-0.72	-0.01	0.38	0.57	0.75
be	Belgium	78	0.13	0.44	-0.72	-0.09	0.20	0.43	0.73
dk	Denmark	84	-0.03	0.62	-1.12	-0.12	0.16	0.29	0.52
de	Germany	90	0.28	0.37	-0.40	0.08	0.32	0.54	0.75
gr	Greece	81	0.07	0.57	-0.76	-0.09	0.09	0.34	0.72
es	Spain	77	0.25	0.43	-0.56	0.07	0.31	0.57	0.76
fr	France	88	0.29	0.69	-0.54	0.08	0.28	0.54	0.83
ie	Ireland	87	0.21	0.35	-0.38	0.08	0.24	0.40	0.66
it	Italy	84	0.28	0.36	-0.23	0.06	0.33	0.55	0.69
lu	Luxembourg	77	0.15	0.36	-0.43	-0.03	0.16	0.34	0.64
nl	Netherlands	82	0.08	0.47	-0.65	-0.13	0.14	0.43	0.61
at	Austria	83	0.06	0.57	-0.69	-0.05	0.16	0.34	0.53
pt	Portugal	86	0.36	1.35	-0.40	0.05	0.31	0.45	0.72
sf	Finland	87	-0.02	0.53	-1.20	-0.11	0.07	0.24	0.60
sv	Sweden	83	0.04	0.39	-0.71	-0.13	0.10	0.27	0.64
uk	United Kingdom	80	0.02	0.49	-0.85	-0.14	0.11	0.31	0.53
	All	1433	0.16	0.58	-0.70	-0.04	0.21	0.44	0.71

Post EMU sample

Country code	Country	# Indices	Average	Std.dev.	5%ile	25%ile	50%ile	75%ile	95%ile
EU15	European Union 15	93	0.28	0.34	-0.29	0.02	0.31	0.54	0.73
EA	Euro Area	93	0.30	0.42	-0.49	0.12	0.39	0.59	0.75
be	Belgium	78	0.18	0.40	-0.56	-0.03	0.27	0.47	0.70
dk	Denmark	84	0.09	0.92	-1.02	-0.09	0.17	0.31	0.63
de	Germany	90	0.30	0.38	-0.33	0.13	0.37	0.54	0.73
gr	Greece	81	0.01	0.49	-0.76	-0.22	0.05	0.34	0.61
es	Spain	77	0.14	0.53	-0.83	-0.06	0.25	0.48	0.75
fr	France	88	0.29	0.69	-0.54	0.08	0.28	0.54	0.83
ie	Ireland	87	0.26	0.32	-0.35	0.10	0.27	0.43	0.66
it	Italy	84	0.20	0.56	-0.92	0.06	0.34	0.51	0.72
lu	Luxembourg	77	0.08	0.30	-0.35	-0.08	0.07	0.27	0.58
nl	Netherlands	82	0.16	0.41	-0.60	-0.02	0.21	0.44	0.63
at	Austria	83	0.02	0.58	-0.79	-0.11	0.14	0.33	0.53
pt	Portugal	86	0.22	0.34	-0.40	0.04	0.29	0.45	0.61
sf	Finland	87	-0.03	0.57	-1.20	-0.13	0.08	0.25	0.52
sv	Sweden	83	0.10	0.33	-0.42	-0.13	0.11	0.30	0.64
uk	United Kingdom	80	0.02	0.49	-0.85	-0.14	0.11	0.31	0.53
	All	1433	0.16	0.51	-0.65	-0.04	0.22	0.44	0.69

Note: Only the most disaggregated sub-indices are considered. The estimated parameters are taken at face value and are not treated as zeros in case of statistical insignificance. **The summary statistics are based on the unrestricted model. In cases where no overall structural break was found, the parameter estimates of the restricted model are assumed to hold. The estimates for France and the UK are identical, as no break test could be performed.**

Table 17: Panel data results for different persistence estimates

Country	ρ (fs)	ρ (pre emu)	ρ (post emu)	ρ (pre sales)	ρ (post sales)	ρ (fs new)	γ (fs)	γ (pre emu)	γ (post emu)	γ (pre sales)	γ (post sales)	γ (fs new)
EU15	0.27 ***	0.27 ***	0.27 ***	0.33 ***	0.21 ***	0.21 ***	0.52 ***	0.52 ***	0.50 ***	0.51 ***	0.47 ***	0.47 ***
EA	0.04	0.01	0.04	0.01	0.01	0.00	0.04 **	0.03	0.03	0.04 *	0.01	0.01
be	-0.10 **	-0.14 **	-0.09 **	-0.17 ***	-0.03	-0.03	0.05 **	0.05 **	0.05 **	0.05 **	0.04 *	0.04 *
dk	-0.14 ***	-0.15 **	-0.12 **			-0.08	-0.02	-0.04	0.02			0.04 *
de	0.04	-0.06	0.06		0.09 **	0.09 **	0.10 ***	0.06 ***	0.11 ***	0.06 **	0.14 ***	0.14 ***
gr	-0.14 ***	-0.18 ***	-0.27 ***			-0.07	0.01	-0.02	-0.02			0.06 **
es	-0.05	0.04	-0.15 ***	-0.01	-0.14 **	-0.13 **	0.06 ***	0.08 ***	0.06 ***	0.08 ***	0.00	0.00
fr	-0.01		0.03			0.05	0.02	-0.02	0.03 *			0.07 ***
ie	-0.02	-0.14 ***	-0.01		0.06	0.06	0.03	0.01	0.04 *	-0.08 ***	0.07 ***	0.07 ***
it	0.00	0.11 **	0.00	0.07 **	-0.15 ***	-0.15 ***	0.10 ***	0.15 ***	0.08 ***	0.16 ***	0.01	0.01
lu	-0.24 ***	-0.13 **	-0.20 ***	-0.18 ***	-0.14 ***	-0.14 ***	0.03	0.08 ***	-0.03	0.08 ***	-0.01	0.00
nl	-0.06	-0.22 ***	-0.08 *			0.00	0.04 **	-0.02	0.06 ***			0.10 ***
at	-0.16 ***	-0.10 *	-0.17 ***			-0.09 **	0.04 **	0.05 **	0.04 *			0.09 ***
pt	-0.03	0.02	-0.05		0.00	0.01	0.05 ***	0.04 *	0.06 ***	0.02	0.08 ***	0.08 ***
sf	-0.20 ***	-0.17 ***	-0.21 ***			-0.13 ***	-0.01	0.01	0.00			0.04 **
sv	-0.17 ***	-0.15 ***	-0.18 ***			-0.11 **	0.03	0.03	0.04 *			0.08 ***
uk	-0.18 ***		-0.19 ***			-0.11 **	-0.06 ***	-0.06 **	-0.05 **			0.00

Note: (fs) stands for full sample and refers to the estimated coefficients from the restricted regressions (i.e. without allowing for structural breaks). (fs new) uses the inflation persistence estimates of ρ and the mean reversion coefficient of γ for the period after the HICP methodology revision for those countries which adopted sales prices during the observation period (EU15, EA-12, be, de, es, ie, it, lu, pt) and the full number of observations for the remaining countries.
All coefficients relative to the EU15 aggregate. Estimates are within estimates (sub-indices absorbed) with robust standard errors. ***,**,* denote significance at the 1%, 5%, 10% level, respectively.

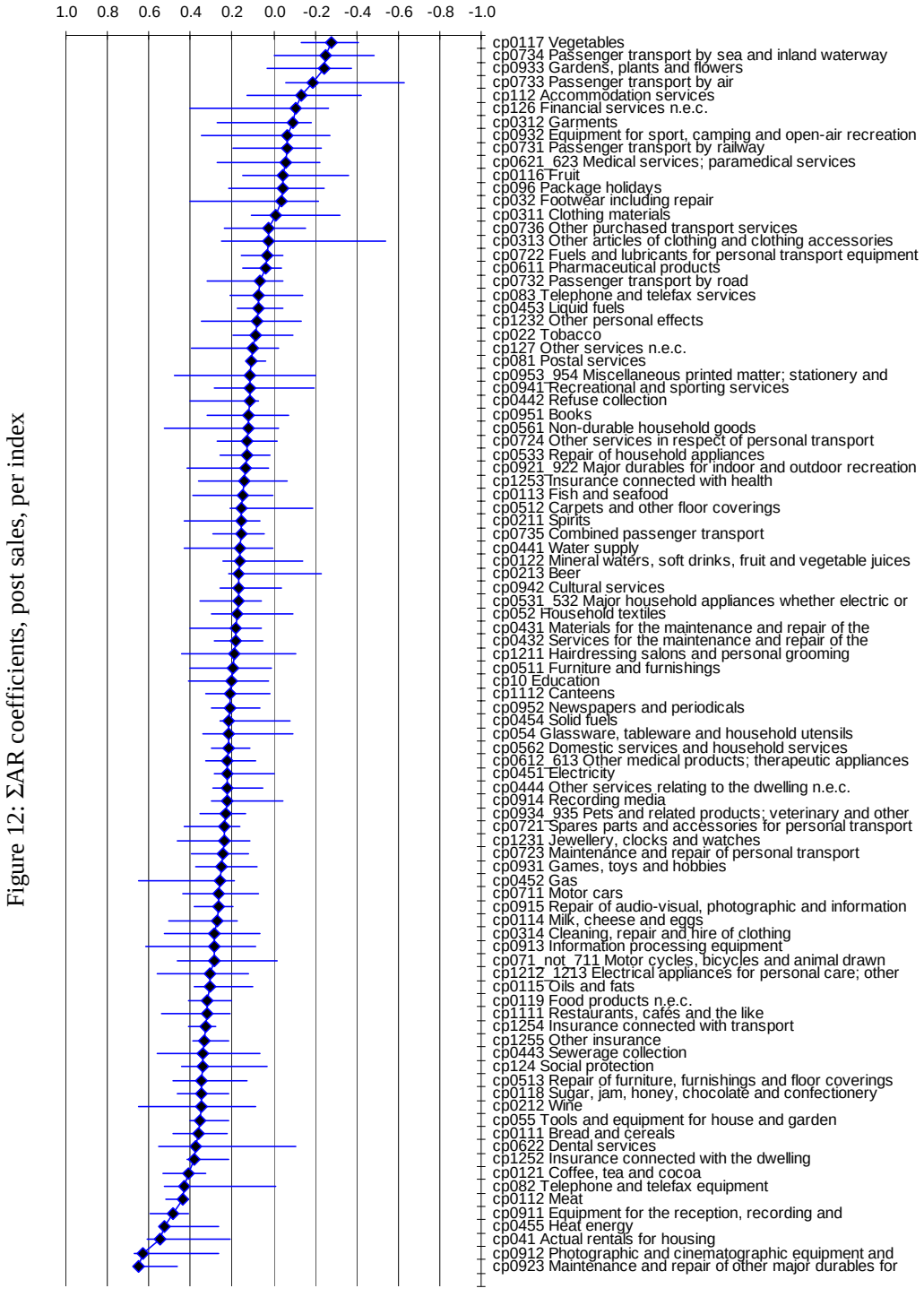


Figure 12: ΣAR coefficients, post sales, per index

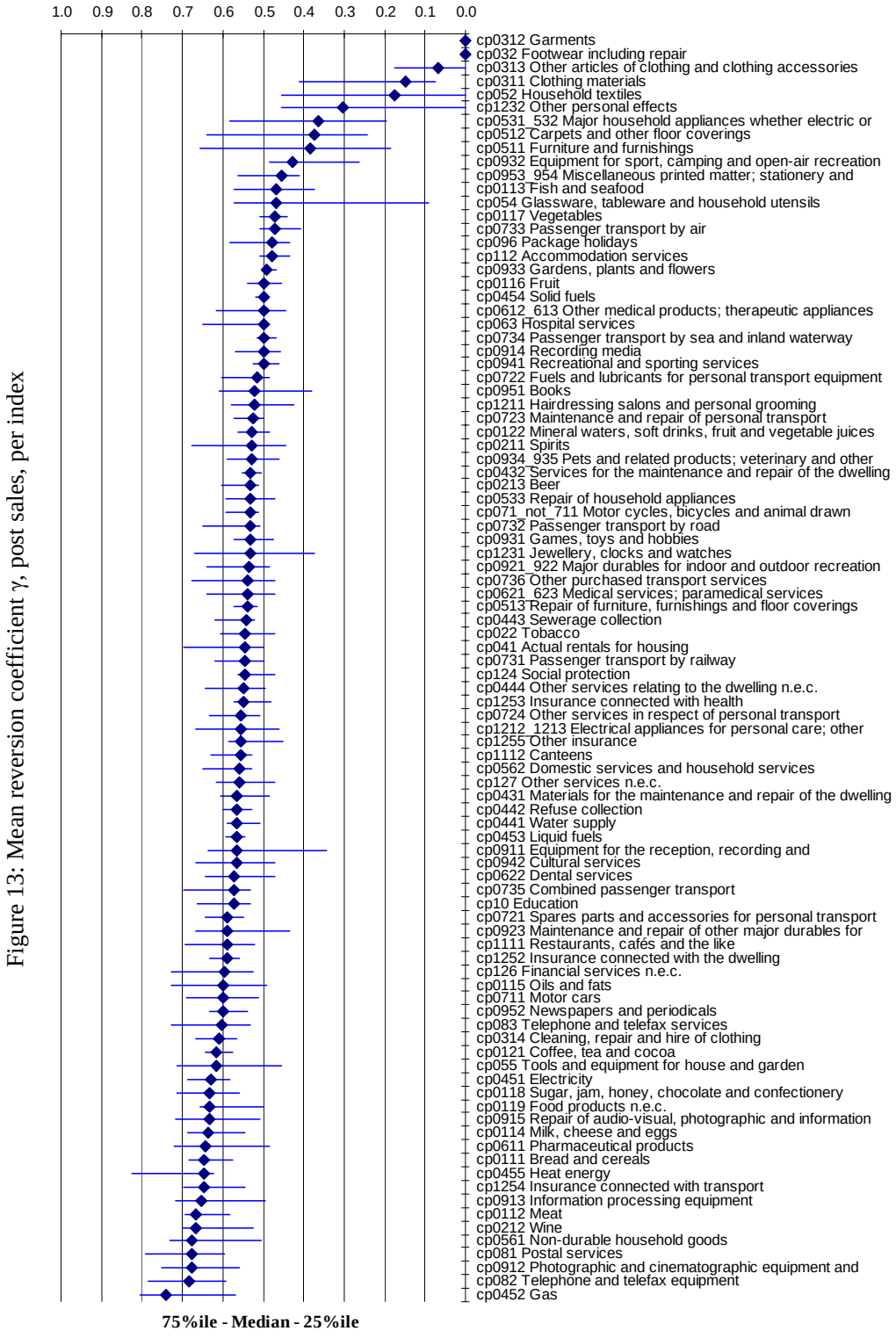

1.0 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0.0
cp0312 Garments
cp032 Footwear including repair
cp0313 Other articles of clothing and clothing accessories
cp0311 Clothing materials
cp052 Household textiles
cp1232 Other personal effects
cp0531_532 Major household appliances whether electric or
cp0512 Carpets and other floor coverings
cp0511 Furniture and furnishings
cp0932 Equipment for sport, camping and open-air recreation
cp0953_954 Miscellaneous printed matter; stationery and
cp0113 Fish and seafood
cp054 Glassware, tableware and household utensils
cp0117 Vegetables
cp0733 Passenger transport by air
cp096 Package holidays
cp112 Accommodation services
cp0933 Gardens, plants and flowers
cp0116 Fruit
cp0454 Solid fuels
cp0612_613 Other medical products; therapeutic appliances
cp063 Hospital services
cp0734 Passenger transport by sea and inland waterway
cp0914 Recording media
cp0941 Recreational and sporting services
cp0722 Fuels and lubricants for personal transport equipment
cp0951 Books
cp1211 Hairdressing salons and personal grooming
cp0723 Maintenance and repair of personal transport
cp0122 Mineral waters, soft drinks, fruit and vegetable juices
cp0211 Spirits
cp0934_935 Pets and related products; veterinary and other
cp0432 Services for the maintenance and repair of the dwelling
cp0213 Beer
cp0533 Repair of household appliances
cp071_not_711 Motor cycles, bicycles and animal drawn
cp0732 Passenger transport by road
cp0931 Games, toys and hobbies
cp1231 Jewellery, clocks and watches
cp0921_922 Major durables for indoor and outdoor recreation
cp0736 Other purchased transport services
cp0621_623 Medical services; paramedical services
cp0513 Repair of furniture, furnishings and floor coverings
cp0443 Sewerage collection
cp022 Tobacco
cp041 Actual rentals for housing
cp0731 Passenger transport by railway
cp124 Social protection
cp0444 Other services relating to the dwelling n.e.c.
cp1253 Insurance connected with health
cp0724 Other services in respect of personal transport
cp1212_1213 Electrical appliances for personal care; other
cp1255 Other insurance
cp1112 Canteens
cp0562 Domestic services and household services
cp127 Other services n.e.c.
cp0431 Materials for the maintenance and repair of the dwelling
cp0442 Refuse collection
cp0441 Water supply
cp0453 Liquid fuels
cp0911 Equipment for the reception, recording and
cp0942 Cultural services
cp0622 Dental services
cp0735 Combined passenger transport
cp10 Education
cp0721 Spares parts and accessories for personal transport
cp0923 Maintenance and repair of other major durables for
cp1111 Restaurants, cafés and the like
cp1252 Insurance connected with the dwelling
cp126 Financial services n.e.c.
cp0115 Oils and fats
cp0711 Motor cars
cp0952 Newspapers and periodicals
cp083 Telephone and telefax services
cp0314 Cleaning, repair and hire of clothing
cp0121 Coffee, tea and cocoa
cp055 Tools and equipment for house and garden
cp0451 Electricity
cp0118 Sugar, jam, honey, chocolate and confectionery
cp0119 Food products n.e.c.
cp0915 Repair of audio-visual, photographic and information
cp0114 Milk, cheese and eggs
cp0611 Pharmaceutical products
cp0111 Bread and cereals
cp0455 Heat energy
cp1254 Insurance connected with transport
cp0913 Information processing equipment
cp0112 Meat
cp0212 Wine
cp0561 Non-durable household goods
cp081 Postal services
cp0912 Photographic and cinematographic equipment and
cp082 Telephone and telefax equipment
cp0452 Gas
Figure 13: Mean reversion coefficient γ, post sales, per index
75%ile - Median - 25%ile

Table 18: Panel data estimates: Index fixed effects

Index	ρ (fs)	ρ (pre emu)	ρ (post emu)	ρ (pre sales)	ρ (post sales)	ρ (fs new)	γ (fs)	γ (pre emu)	γ (post emu)	γ (pre sales)	γ (post sales)	γ (fs new)
cp0312 Garments	-0.14 ***	0.11	-0.14 ***	0.15	-0.01 ***	0.01 ***	0.08 ***	0.09 ***	0.03 ***	0.18 ***	-0.02 ***	-0.04 ***
cp032 Footwear incl. repair	-0.03 ***	0.19	0.03 ***	0.20	0.15 *	0.09 ***	0.08 ***	0.10 ***	0.03 ***	0.16 ***	0.00 ***	-0.02 ***
cp0313 Other articles of clothing & clothing acc	-0.17 ***	0.25	-0.16 ***	0.27	0.00 ***	-0.09 ***	0.20 ***	0.26 ***	0.12 ***	0.39	0.04 ***	0.06 ***
cp0311 Clothing materials	-0.13 ***	0.14	-0.10 ***	0.20	-0.11 ***	-0.11 ***	0.29 ***	0.33 ***	0.25 ***	0.35 *	0.09 ***	0.17 ***
cp052 Household textiles	0.08 ***	0.27	0.12 ***	0.42	0.11 ***	0.12 ***	0.31 ***	0.33 ***	0.22 ***	0.37 **	0.07 ***	0.18 ***
cp1232 Other personal effects	0.10 ***	0.18	0.21 ***	0.19 *	0.13 **	0.14 ***	0.33 ***	0.41 **	0.27 ***	0.52	0.14 ***	0.21 ***
cp054 Glassware, tableware & household utens	0.18 ***	0.23	0.20 ***	0.43	0.24 *	0.16 **	0.38 ***	0.41 **	0.32 ***	0.38 *	0.15 ***	0.27 ***
cp0932 equip. for sport, camping & open-air rec	0.10 ***	0.32	0.18 ***	0.22	0.23	0.09 ***	0.37 ***	0.40 **	0.32 ***	0.39	0.27 ***	0.29 ***
cp0512 Carpets & other floor coverings	0.19 ***	0.29	0.15 ***	0.41	0.05 **	0.07 ***	0.41 ***	0.41 **	0.38 ***	0.46	0.33 ***	0.33 ***
cp0511 Furniture & furnishings	0.29 ***	0.37	0.27 **	0.29	0.32	0.29	0.43 ***	0.49	0.34 ***	0.48	0.27 ***	0.33 ***
cp0531_532 Major household appl. whether ele	0.33 **	0.33	0.22 ***	0.40	0.28	0.28 *	0.46 ***	0.45	0.35 ***	0.52	0.30 ***	0.33 ***
cp0113 Fish & seafood	0.30 ***	0.39	0.25 ***	0.20	0.28	0.27 *	0.42 ***	0.46	0.42 ***	0.34 ***	0.35 ***	0.37 ***
cp0733 Passenger trans. by air	-0.31 ***	-0.11 ***	-0.27 ***	-0.50 ***	-0.18 ***	-0.23 ***	0.43 ***	0.46 *	0.41 ***	0.47	0.45 ***	0.41 ***
cp112 Accommodation services	-0.05 ***	-0.18 ***	-0.10 ***	-0.09 ***	-0.16 ***	-0.09 ***	0.44 ***	0.44 **	0.44 ***	0.43 *	0.44 ***	0.42 ***
cp0117 Vegetables	-0.12 ***	0.00 ***	-0.19 ***	0.05 ***	-0.19 ***	-0.23 ***	0.47 ***	0.46 *	0.44 ***	0.44	0.41 ***	0.42 ***
cp0953_954 Miscellaneous printed matter; stati	0.31 **	0.28	0.29 **	0.53 *	0.37	0.22 *	0.51 ***	0.55	0.46 ***	0.63	0.41 ***	0.42 ***
cp1231 Jewellery, clocks & watches	0.45	0.37	0.42	0.54 *	0.33	0.32	0.56 **	0.58	0.47 **	0.59	0.39 ***	0.43 ***
cp0734 Passenger trans. by sea & inl& waterwa	-0.21 ***	-0.18 ***	-0.06 ***	-0.27 ***	-0.06 ***	-0.20 ***	0.47 ***	0.47 *	0.47 ***	0.45	0.43 ***	0.43 ***
cp1255 Other insurance	0.43		0.42		0.31	0.31	0.45 ***		0.46 ***	-0.02 ***	0.45 ***	0.44 ***
cp0951 Books	0.25 ***	0.30	0.32 **	0.49	0.21 *	0.18 **	0.52 ***	0.56	0.49 *	0.58	0.42 ***	0.44 ***
cp124 Social protection	0.24 *		0.24 **		0.13	0.23	0.45 ***		0.45 ***	0.18 ***	0.43 ***	0.44 ***
cp0933 Gardens, plants & flowers	-0.08 ***	0.10 ***	-0.08 ***	0.31	-0.25 ***	-0.20 ***	0.47 ***	0.42 **	0.45 ***	0.44 *	0.46 ***	0.44 ***
cp096 Package holidays	0.00 ***	-0.12 ***	0.11 ***	-0.07 **	-0.02 ***	0.02 ***	0.44 ***	0.36 ***	0.45 ***	0.27 ***	0.41 ***	0.44 ***
cp0116 Fruit	0.02 ***	0.00 ***	0.21 ***	0.01 **	0.16 **	-0.01 ***	0.46 ***	0.45 *	0.49 *	0.49	0.55 *	0.44 ***
cp1211 Hairdressing salons & personal groomir	0.28 ***	0.22	0.27 ***	0.39	0.30	0.22 *	0.49 ***	0.48	0.48 **	0.49	0.48 ***	0.44 ***
cp0722 Fuels & lubricants for personal trans. ec	0.18 ***	0.26	0.19 ***	0.44	-0.07 ***	0.05 ***	0.52 ***	0.51	0.51 **	0.52	0.41 ***	0.45 ***
cp0941 Recreational & sporting services	0.29 ***	0.37	0.24 ***	0.33	-0.16 ***	-0.03 ***	0.49 ***	0.51	0.48 ***	0.55	0.49 **	0.45 ***
cp0513 Repair of furniture, furnishings & floor c	0.37 *	0.32	0.36 *	0.52 **	0.21	0.27	0.49 ***	0.51	0.47 **	0.53	0.47 **	0.46 ***
cp0723 Maintenance & repair of personal trans.	0.43	0.34	0.44	0.53	0.33	0.28	0.53 ***	0.53	0.50 **	0.59	0.45 ***	0.46 ***
cp0921_922 Major durables for indoor & outdoc	0.32 ***	0.33	0.27 ***	0.31	0.00 ***	0.16 **	0.57 **	0.56	0.51 *	0.54	0.40 ***	0.46 ***
cp1253 Insurance connected with health	0.21 ***		0.20 ***		0.15 **	0.17 **	0.49 ***		0.49 ***	0.29 *	0.48 ***	0.46 ***
cp0122 Mineral waters, soft drinks, fruit & veget	0.33 ***	0.32	0.27 ***	0.46	0.16 **	0.15 ***	0.53 ***	0.55	0.52	0.58	0.49 ***	0.47 ***
cp0911 equip. for the reception, recording & rep	0.52	0.38	0.66 *	0.47	0.58	0.50	0.53 **	0.55	0.53	0.62	0.47 **	0.47 **
cp0454 Solid fuels	0.24 ***	0.13	0.19 ***	-0.08 **	-0.10 ***	0.13 **	0.51 ***	0.53	0.49 **	0.46	0.46 ***	0.48 ***
cp063 Hospital services							0.50 ***		0.50 *		0.51 *	0.48 ***
cp0431 Materials for the maintenance & repair c	0.31 ***	0.29	0.33 **	0.45	0.36	0.27 *	0.55 ***	0.57	0.48 **	0.59	0.44 ***	0.48 ***
cp0914 Recording media	0.24 ***	0.26	0.15 ***	0.38	0.16 **	0.17 ***	0.56 **	0.49	0.51	0.58	0.47 ***	0.48 ***
cp0612_613 Other medical products; therapeut	0.27 ***	-0.01	0.27 ***	-0.01 ***	0.17 **	0.20 ***	0.51 ***	0.54	0.50 **	0.37	0.51 **	0.48 ***
cp0621_623 Medical services; paramedical sen	0.12 ***		0.14 ***		0.04 **	0.10 ***	0.50 ***		0.50 *	0.05 ***	0.53 **	0.48 ***
cp0931 Games, toys & hobbies	0.38 **	0.43	0.35 **	0.40	0.32	0.32	0.54 ***	0.54	0.52	0.55	0.46 ***	0.48 ***
cp0562 Domestic services & household service	0.25 ***	0.33	0.23 ***	0.14 **	0.12 **	0.18 **	0.54 ***	0.51	0.51 *	0.47	0.44 ***	0.48 ***
cp0444 Other services relating to the dwelling n	0.12 ***	0.16	0.10 ***	-0.10 ***	0.17	0.21 *	0.52 ***	0.50	0.44 **	0.50	0.44 ***	0.49 ***
cp055 Tools & equip. for house & garden	0.36 **	0.30	0.37 *	0.51	0.25	0.25	0.57 **	0.54	0.53	0.50	0.42 **	0.49 **
cp0735 Combined passenger trans.	0.26 ***	0.08 **	0.25 ***	0.27	0.01 *	0.06 ***	0.53 ***	0.53	0.50	0.50	0.46 **	0.49 **
cp0533 Repair of household appl.	0.19 ***	0.16	0.27 ***	0.34	0.29	0.16 ***	0.52 ***	0.52	0.51 **	0.50	0.52 ***	0.49 ***
cp127 Other services n.e.c.	0.36 **	0.40	0.27 ***	0.49 *	0.26	0.26 *	0.52 ***	0.57	0.51 *	0.56	0.56 **	0.49 ***
cp0731 Passenger trans. by railway	-0.07 ***	-0.39 ***	-0.02 ***	-0.41 ***	-0.07 ***	-0.08 ***	0.51 ***	0.48	0.53	0.44 *	0.50 ***	0.49 ***
cp022 Tobacco	0.14 ***	0.20	0.14 ***	0.17 **	0.05 ***	0.09 ***	0.53 ***	0.54	0.50 **	0.52	0.47 ***	0.49 ***
cp0923 Maintenance & repair of other major du	0.64	0.40	0.32 **	0.78 ***	0.24	0.33	0.51 **	0.50	0.52	0.55	0.58	0.50
cp0432 Services for the maintenance & repair o	0.22 ***	0.18	0.17 ***	0.21	0.20 *	0.15 *	0.55 ***	0.57	0.54	0.58	0.51 ***	0.50 ***
cp0934_935 Pets & related products; veterinary	0.42	0.36	0.39	0.23	0.34	0.34	0.57 **	0.49	0.56	0.40 *	0.50 ***	0.50 ***
cp1112 Canteens	0.28 ***	0.28	0.24 ***	0.45	0.04 ***	0.18 ***	0.54 ***	0.56	0.49 ***	0.53	0.50 ***	0.50 ***
cp0443 Sewerage collection	0.33 **	0.44	0.02 ***	0.13 ***	0.31	0.28	0.52 ***	0.52	0.53	0.50	0.54 **	0.51 ***
cp0213 Beer	0.23 ***	0.07 **	0.28 *	0.06 *	-0.02 ***	0.10 ***	0.56 ***	0.56	0.52 *	0.54	0.51 ***	0.51 ***
cp0736 Other purchased trans. services	0.08 ***	0.24	0.18 ***	-0.01 ***	0.31	0.20 **	0.58	0.62	0.51	0.62	0.47 ***	0.51 **
cp0622 Dental services	0.26 *		0.28 *		0.29	0.25	0.52 ***		0.52	0.43 *	0.57	0.51 **
cp1212_1213 Electrical appl. for personal care;	0.50	0.41	0.40	0.59 ***	0.47	0.40	0.57 **	0.60	0.50 *	0.59	0.50 **	0.51 **
cp0211 Spirits	0.36 *	0.36	0.35 *	0.38	0.25 *	0.26 *	0.55 **	0.55	0.55	0.53	0.46 ***	0.51 **
cp0732 Passenger trans. by road	0.24 ***	0.28	0.25 ***	0.45	0.19 **	0.14 ***	0.56 ***	0.55	0.53	0.59	0.56 *	0.51 ***
cp0441 Water supply	0.35 **	0.37	0.17 ***	0.33	0.21	0.21 **	0.54 ***	0.50	0.53	0.48	0.52 **	0.52 ***
cp1252 Insurance connected with the dwelling	0.41	0.35	0.32 **	0.27	0.39	0.34	0.60	0.61	0.54	0.62	0.46 **	0.52 **
cp126 Financial services n.e.c.	0.08 ***	-0.04 **	0.12 ***	-0.05 ***	-0.05 ***	0.03 ***	0.59	0.59	0.53	0.57	0.52 **	0.52 **
cp0711 Motor cars	0.33 ***	0.21	0.41	0.43	0.15 *	0.21 **	0.56 ***	0.52	0.57	0.52	0.56 *	0.52 ***
cp0453 Liquid fuels	0.19 ***	0.40	0.14 ***	0.58 **	-0.07 ***	0.02 ***	0.55 ***	0.58	0.52	0.54	0.52 **	0.52 ***
cp041 Actual rentals for housing	0.62	0.48	0.57	0.42	0.50	0.51	0.61	0.54	0.53	0.63	0.52 **	0.52 **
cp0121 Coffee, tea & cocoa	0.56	0.62 ***	0.48	0.59 **	0.35	0.44	0.62	0.70 ***	0.58	0.68 **	0.51 **	0.53 **
cp0952 Newspapers & periodicals	0.32 ***	0.24	0.38 **	0.29	0.45	0.32	0.57 ***	0.57	0.56	0.55	0.56 **	0.53 ***
cp0942 Cultural services	0.17 ***	0.12 ***	0.22 ***	0.09 ***	0.35	0.21 **	0.56 **	0.51	0.52	0.48	0.57 **	0.53 **
cp0724 Other services in respect of personal tra	0.21 ***	0.13 *	0.18 ***	0.09 ***	0.13 **	0.14 ***	0.57 **	0.51	0.56	0.50	0.53 **	0.53 **
cp071_not_711 Motor cycles, bicycles & animal	0.48	0.46 *	0.44	0.49	0.10 **	0.23 *	0.62	0.59	0.59	0.62	0.49 ***	0.53 **
cp0119 Food products n.e.c.	0.42	0.28	0.42	0.22	0.44	0.40	0.59 **	0.50	0.58	0.44	0.54 **	0.54 **
cp0442 Refuse collection	0.35 ***	0.15	0.15 ***	0.46	0.32	0.26 *	0.55 ***	0.58	0.55	0.51	0.56	0.54 **
cp10 Education	0.30 **	0.27	0.26 ***	0.25	0.12 **	0.24 *	0.54 ***	0.52	0.55	0.49	0.54 **	0.54 **
cp083 Telephone & telefax services	0.27 ***	0.46	0.27 ***	0.35	0.28	0.19 **	0.59	0.56	0.59	0.59	0.59	0.55
cp0611 Pharmaceutical products	0.12 ***	0.29	0.12 ***	0.43	0.03 ***	0.08 ***	0.59	0.57	0.58	0.43	0.56 *	0.55
cp1111 Restaurants, cafés & the like	0.52	0.19	0.49	0.39	0.44	0.42	0.62	0.51	0.61	0.47	0.56	0.56
cp0561 Non-durable household goods	0.42	0.28	0.36 *	0.42	0.33	0.33	0.65	0.69 ***	0.56	0.63	0.51 *	0.56
cp0451 Electricity	0.24 ***	0.07 ***	0.22 ***	0.16	0.11 ***	0.23 **	0.59 *	0.59	0.58	0.54	0.56	0.56
cp0721 Spares parts & accessories for persona	0.44	0.40	0.42	0.50	0.18 **	0.27 *	0.60 *	0.56	0.56	0.58	0.56	0.56
cp0212 Wine	0.49	0.52 **	0.48	0.42	0.38	0.40	0.61	0.61	0.59	0.69 **	0.56	0.56
cp0314 Cleaning, repair & hire of clothing	0.38 *	0.37	0.34 **	0.50	0.29	0.32	0.59 **	0.55	0.61	0.56	0.61	0.57
cp0118 Sugar, jam, honey, chocolate & confect	0.46	0.26	0.54	0.24	0.49	0.42	0.63	0.53	0.63	0.54	0.58	0.57
cp0913 Information process. equip.	0.52	0.47	0.46	0.68 ***	0.40	0.38	0.64	0.61	0.59	0.64	0.63	0.57
cp0912 Photographic & cinematographic equip.	0.58	0.50 **	0.66	0.46	0.73 **	0.54	0.59	0.58	0.61	0.53	0.65	0.57
cp0115 Oils & fats	0.42	0.50 *	0.32 *	0.56	0.38	0.30	0.62	0.65	0.61	0.66	0.65	0.58
cp0915 Repair of audio-visual, photographic & i	0.34 ***	0.34	0.31 ***	0.31	0.28	0.28 *	0.57 **	0.57	0.58	0.50	0.60	0.58
cp0114 Milk, cheese & eggs	0.47	0.27	0.52	0.59 ***	0.38	0.37	0.63	0.59	0.59	0.56	0.60	0.58
cp1254 Insurance connected with trans.	0.45	0.00 *	0.46	0.38	0.36	0.41	0.62	0.56	0.60	0.48	0.63	0.60
cp081 Postal services	0.24 ***	0.35	0.21 ***	0.45	-0.08 ***	0.06 ***	0.66	0.64	0.61	0.65	0.58	0.60
cp0112 Meat	0.56	0.48 *	0.59	0.60 **	0.54	0.53	0.61	0.59	0.63	0.59	0.65	0.61
cp0111 Bread & cereals	0.53 ***	0.31 ***	0.54 ***	0.36 ***	0.44 ***	0.42 ***	0.65 ***	0.55 ***	0.59 ***	0.55 ***	0.66 ***	0.62 ***
cp0452 Gas	0.43	0.43	0.40	0.54	0.40	0.40	0.68	0.64	0.67 *	0.67	0.63	0.63
cp082 Telephone & telefax equip.	0.44	0.36	0.33	0.39	0.26	0.34	0.64	0.60	0.61	0.65	0.68	0.64
cp0455 Heat energy	0.56	0.33	0.59	0.63 ***	0.46	0.49	0.69	0.73 ***	0.72 **	0.71 **	0.67	0.65

Note: (fs) stands for full sample and refers to the estimated coefficients from the restricted regressions (i.e. without allowing for structural breaks). (fs new) uses the inflation persistence estimates of ρ and the mean reversion coefficient of γ for the period after the HICP methodology revision for those countries which adopted sales prices during the observation period (EU15, EA-12, be, de, es, ie, it, lu, pt) and the full number of observations for the remaining countries.

Estimation methodology: Fixed effects estimates with robust standard errors. Overall constant is "*cp0111 bread and cereals*" for the EU15 aggregate. Coefficients given in **absolute** terms, while significance level is **relative** to "*cp0111 bread and cereals*" Indices are ranked according to last column. Indices shaded in grey are considered affected by the sales revision.

Table 19: Panel data estimates: Implied index rankings

Index	ρ (fs)	ρ (pre emu)	ρ (post emu)	ρ (pre sales)	ρ (post sales)	ρ (fs new)	γ (fs)	γ (pre emu)	γ (post emu)	γ (pre sales)	γ (post sales)	γ (fs new)
cp0312 Garments	4	15	4	18	16	11	1	1	1	4	1	1
cp032 Footwear incl. repair	10	26	11	23	33	22	2	2	2	3	2	2
cp0313 Other articles of clothing & clothing acce	3	33	3	32	17	6	3	3	3	14	3	3
cp0311 Clothing materials	5	19	6	22	6	5	4	5	5	9	5	4
cp052 Household textiles	14	37	14	56	26	25	5	4	4	11	4	5
cp1232 Other personal effects	16	23	34	21	30	28	6	9	6	48	6	6
cp054 Glassware, tableware & household utensil	24	30	30	58	48	32	8	10	8	12	7	7
cp0932 equip. for sport, camping & open-air recr	17	53	25	27	47	21	7	7	7	13	8	8
cp0512 Carpets & other floor coverings	26	47	20	52	24	18	9	8	11	24	11	9
cp0511 Furniture & furnishings	47	69	46	34	67	66	12	21	9	31	9	10
cp0531_532 Major household appl. whether elec	57	55	37	50	55	63	17	14	10	47	10	11
cp0113 Fish & seafood	49	71	42	24	57	60	10	17	13	8	12	12
cp0733 Passenger trans. by air	1	5	1	1	3	2	11	15	12	26	27	13
cp112 Accommodation services	9	3	5	5	5	7	14	12	14	18	24	14
cp0117 Vegetables	6	10	2	12	2	1	20	16	15	19	17	15
cp0953_954 Miscellaneous printed matter; statio	50	42	56	77	76	47	31	48	20	83	15	16
cp1231 Jewellery, clocks & watches	77	68	76	79	70	69	55	68	22	72	13	17
cp0734 Passenger trans. by sea & inl& waterway	2	2	8	3	12	3	19	18	24	23	22	18
cp1255 Other insurance	74		78		62	68	15		21	1	28	19
cp0951 Books	38	48	58	69	45	38	33	55	32	69	19	20
cp124 Social protection	36		39		31	49	16		19	5	21	21
cp0933 Gardens, plants & flowers	7	14	7	37	1	4	21	11	18	22	34	22
cp096 Package holidays	11	4	13	7	15	13	13	6	17	6	16	23
cp0116 Fruit	12	8	33	11	37	10	18	13	30	33	66	24
cp1211 Hairdressing salons & personal grooming	44	29	47	49	61	48	24	19	27	34	42	25
cp0722 Fuels & lubricants for personal trans. equ	23	36	28	60	11	15	39	30	40	45	17	26
cp0941 Recreational & sporting services	46	67	40	40	4	9	22	28	25	60	45	27
cp0513 Repair of furniture, furnishings & floor co	64	51	67	75	46	59	25	31	23	50	36	28
cp0723 Maintenance & repair of personal trans. e	72	58	79	76	69	65	41	41	36	74	29	29
cp0921_922 Major durables for indoor & outdoor	52	56	48	36	18	34	67	57	44	56	14	30
cp1253 Insurance connected with health	28		31		35	36	23		28	7	41	31
cp0122 Mineral waters, soft drinks, fruit & vegeta	56	52	50	65	36	30	42	54	53	67	43	32
cp0911 equip. for the reception, recording & repr	84	70	93	68	92	90	42	53	57	81	38	33
cp0454 Solid fuels	34	18	29	6	7	26	28	40	31	25	33	34
cp063 Hospital services							26		33		50	35
cp0431 Materials for the maintenance & repair of	51	45	62	61	75	58	51	67	25	72	25	36
cp0914 Recording media	37	35	21	45	38	35	60	23	45	68	37	37
cp0612_613 Other medical products; therapeutic	43	7	51	10	39	42	32	44	35	10	55	38
cp0621_623 Medical services; paramedical servi	20		18		22	23	27		38	2	61	39
cp0931 Games, toys & hobbies	65	77	66	51	66	72	45	43	49	62	31	40
cp0562 Domestic services & household services	39	57	38	17	28	37	46	29	45	26	26	41
cp0444 Other services relating to the dwelling n.e	18	22	12	4	40	45	37	24	16	39	23	42
cp055 Tools & equip. for house & garden	62	49	69	74	51	53	61	45	60	36	20	43
cp0735 Combined passenger trans.	41	13	43	33	19	16	40	42	34	42	34	44
cp0533 Repair of household appl.	25	21	49	41	60	33	35	36	41	36	57	45
cp127 Other services n.e.c.	63	73	52	71	53	56	38	63	41	64	69	46
cp0731 Passenger trans. by railway	8	1	9	2	9	8	29	20	59	20	47	47
cp022 Tobacco	21	27	19	20	23	20	42	47	39	46	40	48
cp0923 Maintenance & repair of other major dura	93	75	61	88	49	74	30	25	51	59	79	49
cp0432 Services for the maintenance & repair of	30	24	23	25	43	31	50	64	63	71	51	50
cp0934_935 Pets & related products; veterinary a	71	64	71	28	71	76	63	22	70	15	46	51
cp1112 Canteens	45	41	41	64	21	39	48	56	29	52	49	52
cp0443 Sewerage collection	54	79	10	16	63	64	34	35	54	38	65	53
cp0213 Beer	31	12	54	13	14	24	57	60	50	55	53	54
cp0736 Other purchased trans. services	15	31	27	9	64	41	68	82	43	80	39	55
cp0622 Dental services	40		55		59	54	35		48	16	78	56
cp1212_1213 Electrical appl. for personal care; c	83	76	72	84	88	83	64	77	37	75	47	57
cp0211 Spirits	61	63	65	46	50	57	51	51	64	51	31	58
cp0732 Passenger trans. by road	33	44	44	62	42	27	56	49	55	77	67	59
cp0441 Water supply	59	65	24	39	44	43	48	27	61	32	58	60
cp1252 Insurance connected with the dwelling	67	61	59	31	80	75	77	81	62	82	30	61
cp126 Financial services n.e.c.	13	6	15	8	13	14	70	76	58	66	56	62
cp0711 Motor cars	55	28	74	59	34	44	57	38	72	44	71	63
cp0453 Liquid fuels	27	74	17	81	10	12	54	71	52	57	60	64
cp041 Actual rentals for housing	92	84	89	54	90	91	78	46	56	84	59	65
cp0121 Coffee, tea & cocoa	90	88	83	82	73	88	81	87	75	91	52	66
cp0952 Newspapers & periodicals	53	32	70	35	86	71	62	62	67	60	72	67
cp0942 Cultural services	22	16	36	14	72	46	59	32	47	30	77	68
cp0724 Other services in respect of personal trar	29	17	26	15	32	29	64	34	68	41	62	69
cp071_not_711 Motor cycles, bicycles & animal d	81	81	80	70	25	51	84	73	82	79	44	70
cp0119 Food products n.e.c.	70	43	77	26	84	82	69	26	77	21	63	71
cp0442 Refuse collection	60	20	22	67	65	55	53	69	65	43	68	72
cp10 Education	48	39	45	30	29	52	47	37	66	35	64	73
cp083 Telephone & telefax services	42	80	53	42	56	40	73	58	80	78	82	74
cp0611 Pharmaceutical products	19	46	16	57	20	19	71	66	73	17	73	75
cp1111 Restaurants, cafés & the like	85	25	85	47	83	86	81	33	86	28	70	76
cp0561 Non-durable household goods	68	40	68	53	68	73	91	86	71	85	54	77
cp0451 Electricity	32	11	35	19	27	50	74	73	74	53	75	78
cp0721 Spares parts & accessories for personal	75	72	75	72	41	61	76	61	69	69	73	79
cp0212 Wine	82	87	84	55	78	80	79	79	78	92	76	80
cp0314 Cleaning, repair & hire of clothing	66	66	64	73	58	70	72	50	85	63	85	81
cp0118 Sugar, jam, honey, chocolate & confectic	79	34	88	29	89	85	87	39	91	54	80	82
cp0913 Information process. equip.	86	82	81	87	81	79	88	80	81	86	87	83
cp0912 Photographic & cinematographic equip. a	91	85	92	66	93	93	75	70	89	49	89	84
cp0115 Oils & fats	69	86	60	80	79	67	83	85	89	89	91	85
cp0915 Repair of audio-visual, photographic & in	58	59	57	38	54	62	66	65	75	40	83	86
cp0114 Milk, cheese & eggs	80	38	86	83	77	78	86	75	82	65	84	87
cp1254 Insurance connected with trans.	78	9	82	44	74	84	85	59	84	29	86	88
cp081 Postal services	35	60	32	63	8	17	92	83	88	88	81	89
cp0112 Meat	89	83	91	85	91	92	79	72	92	76	90	90
cp0111 Bread & cereals	87	50	87	43	85	87	90	52	79	58	92	91
cp0452 Gas	73	78	73	78	82	81	93	84	93	90	88	92
cp082 Telephone & telefax equip.	76	62	63	48	52	77	89	78	87	87	94	93
cp0455 Heat energy	88	54	90	86	87	89	94	88	94	93	93	94

Note: Indices are ranked in ascending order according to last column.

Table 20: Sector categorisation of sub-indices

Description	Weight 2002	sales	food	services	durables	non-durables	energy
cp0111 Bread & cereals	25.28		1				
cp0112 Meat	39.92		1				
cp0113 Fish & seafood	11.25		1				
cp0114 Milk, cheese & eggs	22.69		1				
cp0115 Oils & fats	5.5		1				
cp0116 Fruit	11.49		1				
cp0117 Vegetables	15.57		1				
cp0118 Sugar, jam, honey, chocolate & confectionery	9.7		1				
cp0119 Food products n.e.c.	3.75		1				
cp0121 Coffee, tea & cocoa	4.18		1				
cp0122 Mineral waters, soft drinks, fruit & vegetable juices	8.77		1				
cp0211 Spirits	3.29		1				
cp0212 Wine	6.95		1				
cp0213 Beer	5.68		1				
cp022 Tobacco	22.41		1				
cp0311 Clothing materials	0.33	1			1		
cp0312 Garments	56.4	1			1		
cp0313 Other articles of clothing & clothing accessories	2.29	1			1		
cp0314 Cleaning, repair & hire of clothing	1.88			1			
cp032 Footwear incl. repair	16.21	1			1		
cp041 Actual rentals for housing	64.98			1			
cp0431 Materials for the maintenance & repair of the dwelling	6.19					1	
cp0432 Services for the maintenance & repair of the dwelling	9.32			1			
cp0441 Water supply	8.01					1	
cp0442 Refuse collection	5.45			1			
cp0443 Sewerage collection	4.71			1			
cp0444 Other services relating to the dwelling n.e.c.	7.11			1			
cp0451 Electricity	20.12						1
cp0452 Gas	14.24						1
cp0453 Liquid fuels	6.12						1
cp0454 Solid fuels	0.78						1
cp0455 Heat energy	4.83						1
cp0511 Furniture & furnishings	28.36	1			1		
cp0512 Carpets & other floor coverings	2.83	1			1		
cp0513 Repair of furniture, furnishings & floor coverings	1.13			1			
cp052 Household textiles	6.45	1			1		
cp0531_532 Major household appl. whether electric or not & small electric h	10.73	1			1		
cp0533 Repair of household appl.	1.48			1			
cp054 Glassware, tableware & household utensils	6.14	1			1		
cp055 Tools & equip. for house & garden	4.57	1			1		
cp0561 Non-durable household goods	10.19	1				1	
cp0562 Domestic services & household services	8.43			1			
cp0611 Pharmaceutical products	11.84					1	
cp0612_613 Other medical products; therapeutic appl. & equip.	5.19					1	
cp0621_623 Medical services; paramedical services	9.22			1			
cp0622 Dental services	6.4			1			
cp063 Hospital services	6.7			1			
cp071_not_711 Motor cycles, bicycles & animal drawn vehicles	3.91				1		
cp0711 Motor cars	45.28				1		
cp0721 Spares parts & accessories for personal trans. equip.	10.11				1		
cp0722 Fuels & lubricants for personal trans. equip.	35.13						1
cp0723 Maintenance & repair of personal trans. equip.	24.72			1			
cp0724 Other services in respect of personal trans. equip.	10.03			1			
cp0731 Passenger trans. by railway	4.15			1			
cp0732 Passenger trans. by road	5.12			1			
cp0733 Passenger trans. by air	5.3			1			
cp0734 Passenger trans. by sea & inl& waterway	0.96			1			
cp0735 Combined passenger trans.	5.43			1			
cp0736 Other purchased trans. services	0.68			1			
cp081 Postal services	1.98			1			
cp082 Telephone & telefax equip.	2.97			1			
cp083 Telephone & telefax services	21.24			1			
cp0911 equip. for the reception, recording & reproduction of sound & picture	6.17	1			1		
cp0912 Photographic & cinematographic equip. & optical instr.	1.75	1			1		
cp0913 Information process. equip.	4.18	1			1		
cp0914 Recording media	4.28	1			1		
cp0915 Repair of audio-visual, photographic & information process. equip.	1.01			1			
cp0921_922 Major durables for indoor & outdoor recreation incl. musical ins	2.62	1			1		
cp0923 Maintenance & repair of other major durables for recreation & culture	0.04			1			
cp0931 Games, toys & hobbies	4.31	1			1		
cp0932 equip. for sport, camping & open-air recreation	2.8	1			1		
cp0933 Gardens, plants & flowers	6.24	1				1	
cp0934_935 Pets & related products; veterinary & other services for pets	4.8	1				1	
cp0941 Recreational & sporting services	10.11			1			
cp0942 Cultural services	14.62			1			
cp0951 Books	6.71	1			1		
cp0952 Newspapers & periodicals	10.03					1	
cp0953_954 Miscellaneous printed matter; stationery & drawing materials	3.22	1				1	
cp096 Package holidays	15.52	1		1			
cp10 Education	9.61			1			
cp1111 Restaurants, cafés & the like	66.6			1			
cp1112 Canteens	7.89			1			
cp112 Accommodation services	17.32			1			
cp1211 Hairdressing salons & personal grooming establishments	10.81			1			
cp1212_1213 Electrical appl. for personal care; other appl., articles & product	15.1					1	
cp1231 Jewellery, clocks & watches	5.5	1			1		
cp1232 Other personal effects	6.12	1			1		
cp124 Social protection	8.31			1			
cp1252 Insurance connected with the dwelling	2.28			1			
cp1253 Insurance connected with health	5.58			1			
cp1254 Insurance connected with trans.	7.04			1			
cp1255 Other insurance	2.56			1			
cp126 Financial services n.e.c.	5.03			1			
cp127 Other services n.e.c.	8.67			1			

Table 21: Panel data estimates: Sector differences

Country	ρ (fs)	ρ (fs)	ρ (fs new)	ρ (fs new)	γ (fs)	γ (fs)	γ (fs new)	γ (fs new)
sales		-0.14 ***		-0.07 *		-0.09 ***		-0.12 ***
food	0.27 ***	0.27 ***	0.22 ***	0.22 ***	0.60 ***	0.60 ***	0.57 ***	0.57 ***
services	-0.11 ***	-0.10 ***	-0.08 ***	-0.08 ***	-0.03 ***	-0.03 ***	-0.02 *	-0.01
durables	-0.10 ***	0.02	-0.06 **	0.00	-0.12 ***	-0.04 **	-0.17 ***	-0.07 ***
non-durables	-0.05	0.01	-0.04	-0.01	-0.01	0.03 **	-0.02	0.02 *
energy	-0.07 *	-0.07 *	-0.07	-0.07	0.02	0.02	0.02	0.02

Note: Fixed effects regression (country effects absorbed). All coefficients are relative to food. ***,**,* denote significance at the 1%, 5%, and 10% level, respectively.

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