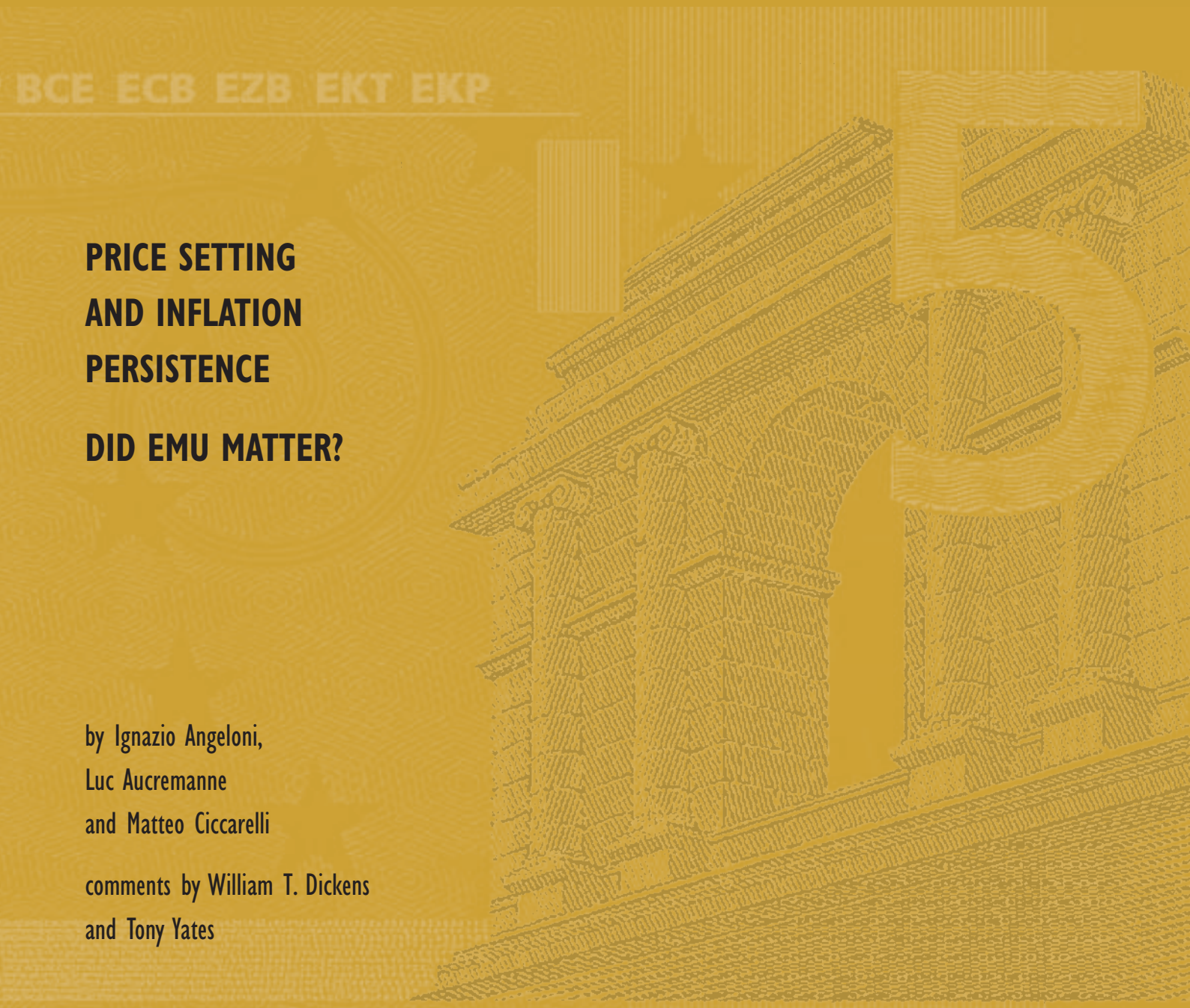
EUROPEAN CENTRAL BANK

PROCEEDINGS OF JUNE 2005 WORKSHOP ON WHAT EFFECTS IS EMU HAVING ON THE EURO AREA AND ITS MEMBER COUNTRIES?

WORKING PAPER SERIES
NO 597 / MARCH 2006



PRICE SETTING AND INFLATION PERSISTENCE

DID EMU MATTER?

by Ignazio Angeloni,
Luc Aucremanne
and Matteo Ciccarelli

comments by William T. Dickens
and Tony Yates

EUROPEAN CENTRAL BANK

WORKING PAPER SERIES
NO 597 / MARCH 2006

PROCEEDINGS OF JUNE 2005 WORKSHOP ON WHAT EFFECTS IS EMU HAVING ON THE EURO AREA AND ITS MEMBER COUNTRIES?

PRICE SETTING AND INFLATION PERSISTENCE

DID EMU MATTER? [1]

by Ignazio Angeloni [2],
Luc Aucremanne [3]
and Matteo Ciccarelli [4]

comments by William T. Dickens
and Tony Yates

In 2006 all ECB publications will feature a motif taken from the €5 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=887084

1 The views expressed here are personal and do not involve the ECB, the Eurosystem or the National Bank of Belgium. We are grateful to Ramón Adalid for research assistance, to Filippo Altissimo, Benoit Mojon, Paolo Zaffaroni, Laurent Bilke, Luis Álvarez and Marianne Collin for sharing with us their respective data sets on sectoral inflation and to Emmanuel Dhyne, Ignacio Hernando, Johannes Hoffmann, Hervé Le Bihan, Roberto Sabbatini and Fabio Rumler for providing us their results on the frequencies and the magnitudes of price adjustment in micro CPI data.
2 The Department of the Treasury, Italian Ministry of Economy and Finance, Via XX Settembre, 97, 00187 Rome, Italy; e-mail: ignazio.angeloni@tesoro.it
3 National Bank of Belgium, Boulevard de Berlaimont 14, B-1000 Brussels, Belgium; e-mail: luc.aucremanne@nbb.be
4 European Central Bank, Kaiserstrasse 29, 60311 Frankfurt am Main, Germany; e-mail: matteo.ciccarelli@ecb.int

PREFACE

On 16 and 17 June 2005, the ECB has hosted a Conference on "**What Effects is EMU Having on the Euro Area and its Member Countries?"** One and a half decade after the start of the European Economic and Monetary Union (EMU) and more than six years after the launch of the euro, the aim of the conference was to assess what can be learned about the impact of economic and monetary integration and how it has benefited the euro area and its member countries.

The conference brought together academics, central bankers and policy makers to discuss the existing empirical evidence on changes brought about, either directly or indirectly, by EMU and, in particular, the introduction of the euro in five main areas:

Area 1. Trade integration;
Area 2. Structural reforms in product and labour markets;
Area 3. Financial integration;
Area 4. Business cycles synchronisation and economic specialisation; and
Area 5. Inflation persistence and inflation differentials.

Lead presenters for each of the aforementioned areas had been asked to put together - and interpret - all the available information, flag any open questions, and also discuss the implications in their respective field of expertise. With the benefit of hindsight, lead presenters and discussants have also addressed some initial presumptions with the evidence that has accumulated thus far.

In order to exchange information and ideas on the above effects, and increase mutual awareness of ongoing work in the diverse areas, we deemed it useful to issue the five leading presentations, together with the accompanying discussions, in the ECB Working Paper Series.

Otmar Issing	Francesco Paolo Mongelli	Juan Luis Vega
Member of the Executive Board	Conference Organiser	Conference Organiser

Address
Kaiserstrasse 29
60311 Frankfurt am Main, Germany

Postal address
Postfach 16 03 19
60066 Frankfurt am Main, Germany

Telephone
+49 69 1344 0

Internet
http://www.ecb.int

Fax
+49 69 1344 6000

Telex
411 144 ecb d

ISSN 1561-0810 (print)
ISSN 1725-2806 (online)

CONTENTS

Abstract

Surprisingly it did not, or at least not directly. Using micro data on consumer prices and sectoral inflation rates from 6 euro area countries, spanning several years before and after the introduction of the euro, we look at whether EMU has altered the behaviour of retail price setting and/or inflation dynamics. We find no evidence that anything has changed around 1999 – if anything, persistence may have slightly increased. At the end of 2001 and in the beginning of 2002 (period surrounding the euro cash changeover) retail price adjustment frequencies, both up and down, increased substantially, while the magnitude of the price adjustment, also both up and down, was smaller than otherwise. However, both settled quickly back to the earlier patterns. On the contrary, we do find evidence of a decline in the persistence of the inflation process in the mid-1990s. This could be due to a structural change in private inflationary expectations due, at least in part, to policies linked to the preparation of EMU; however, this interpretation is weakened by the fact that a similar decline occurred also in the US.

JEL codes: E31, E42, E52

Key words: Price setting, Inflation persistence, Aggregate and Sectoral Inflation, EMU

Non-technical summary

The aim of this paper is to see whether Europe's Economic and Monetary Union (EMU) had any effect on the setting of consumer prices and on the dynamics of inflation (in particular on its persistence) in the countries involved. This question is especially important because EMU, beside the introduction of a new currency and the creation of a new central bank responsible for preparing and implementing the single monetary policy, has a related goal of reinforcing the EU single market by eliminating any differences in the units of account, hence making the price system more efficient and transparent. Clearly, nobody seriously expected price setting patterns in the euro area to change radically overnight just because of the euro. Theories and practical experience suggest that, over short time spans, prices are subject to a variety of forces (e.g. competition; efficient dissemination of information, etc.), which in turn could well themselves be influenced by EMU, through an indirect chain of effects. Also, structural changes in price formation could have occurred well before the birth of the euro, and yet be caused by it via expectation mechanisms or the preparatory policy process that paved the way to the euro.

Our work has its roots in an international research project involving the European Central Bank (ECB) and the 12 National Central banks (NCBs) belonging to the euro area (the Eurosystem Inflation Persistence Network, or IPN). The group has assembled and started to analyse a new data set including, together with a rich menu of aggregate and sectoral price indices for all euro area countries (mainly published data, though not always easy to put together on a comparable basis), individual price records underlying the compilation of consumer and producer price indices (unpublished and unused so far). This unprecedented data source is being used by the IPN to study a number of general questions concerning the rigidity of prices and the persistence of inflation in the euro area, as well as their causes and policy implications.

In order to answer the specific question epitomised by our title, we use some of those data, spanning from 1985Q1 to 2004Q4 and covering 6 countries (Spain, Germany, France, Italy, Belgium and Austria). The findings reveal that, perhaps surprisingly, EMU did not have visible effects on both price setting and inflation persistence, or at least not directly. Specifically, results can be summarised in two parts. First, we find no evidence of a change around 1999 – if anything, persistence may have slightly increased. At the end of 2001 and in the beginning of 2002 (period surrounding the euro cash changeover) retail price adjustment frequencies increased substantially, while the magnitude of the price adjustment was smaller than otherwise. Second, we do find evidence of a decline in the persistence of the inflation process in the mid-1990s, which could be due to a structural change in private inflationary expectations due, at least in part, to policies linked to the preparation of EMU. However, this interpretation is weakened by the fact that we find a similar decline occurred also in the US. The latter have experienced no currency reform in recent years, and therefore is a good control to see if something emerges for the Euro area in differential terms.

1. Introduction

The aim of this paper is to see whether Europe's Economic and Monetary Union (EMU) had any effect on the setting of consumer prices and on the dynamics of inflation in the countries involved. This question is important in several respects. EMU involved the introduction of a new currency, the euro, in 12 European countries, and the creation of a new central bank responsible for preparing and implementing the single monetary policy. While the determinants of this historically unprecedented reform are numerous and complex, there is no doubt that, at least for most participating countries, a main motivation for joining was the desire of being part of an area of monetary stability, after a quarter-century period of high and variable inflation. A related goal was to reinforce the EU single market by eliminating any differences in the units of account, hence making, also in this respect, the price system more efficient and transparent. All this suggests that a central objective behind the creation of the euro was, in one way or another, to change something in the way prices (and their aggregate change, namely inflation) are determined and move over time.

Clearly, nobody seriously expected price setting patterns in the euro area to change radically overnight just because of the euro. While most economists agree that in the long term inflation is a monetary phenomenon – in the sense that it can exist only if it is determined or at least tolerated by the monetary policy maker – over short time spans theories and practical experience suggest that prices (both individual and aggregate) are subject to a variety of forces. For example, the smooth functioning of product markets (e.g. no barriers to entry; price flexibility; efficient dissemination of information, etc) is a main determinant of relative and aggregate prices in the short run. The dynamics of input costs (wages, international prices) is another. These additional factors could well themselves be influenced by EMU, but the chain of effect in that case would probably not be direct nor immediate. Moreover, it must be remembered that most of today's EMU members had already attained a good degree of price stability in 1999 – in fact this was one of the "performance criteria" for joining. All this suggests that, on the one hand, to bring some light on our issue it is necessary to analyse pricing and inflation patterns over a prolonged time span, covering time before and after EMU, but also, on the other hand, that even doing so detecting causality between EMU and pricing patterns is not trivial. Structural changes in price formation could have occurred well before the birth of the euro, and yet be caused by it via expectation mechanisms or the preparatory policy process that paved the way to the euro. As Tobin noted before many

others, *post hoc* does not mean *propter hoc* in many economic relationships, nor does it in the one we investigate.

Until a few years ago, a serious empirical analysis of the micro-mechanics of price determination in Europe would have been impossible due to lack of data. Very recently, however, an international research project involving the European Central Bank (ECB) and the 12 National Central banks (NCBs) belonging to the euro area (the Eurosystem Inflation Persistence Network, or IPN) has assembled and started to analyse a new data set including, together with a rich menu of aggregate and sectoral price indices for all euro area countries (mainly published data, though not always easy to put together on a comparable basis), individual price records underlying the compilation of consumer and producer price indices (unpublished and unused so far). This unprecedented data source is being used by the IPN to study a number of general questions concerning the rigidity of prices and the persistence of inflation in the euro area, as well as their causes and policy implications (for preliminary results, see ECB, 2004). In this paper we use some of those data to answer the specific question epitomised by our title.

The paper is organised as follows. First, in section 2, we review a number of concepts from the recent literature to help us understand why one would expect a monetary reform such as EMU to affect price determination and inflation persistence at all. This reasoning will also help us identify testable hypotheses in which our main query (Has EMU mattered?) can be decomposed to make the empirical analysis easier. In section 3 we describe our data. In section 4 we examine the micro price data. Our micro data are used to decompose the inflation process in four components: frequency of price increases and decreases, and average size of price increases and decreases. In line with the approach adopted by the IPN, and unlike most of the earlier literature, we try to make inference informally from analysing the micro data in conjunction with the aggregate inflation series. In section 5 we turn to the evidence concerning aggregate and sectoral inflation dynamics. This is preceded by a short explanation of our statistical methodology. In short, in line with most recent literature we focus on a measure of persistence consisting of the sum of lagged effects in a univariate autoregressive process, and estimate this parameter using two alternative Bayesian methodologies, one that assumes the structural change dates are known, and one that does not. Finally, section 6 contains a discussion of the results and some tentative conclusions.

2. Why should EMU affect price setting or inflation persistence?

In this paper we will subsequently investigate the potential impact of EMU on price setting and on inflation persistence. Our thinking about the possible channels through which EMU can affect price setting or inflation persistence is structured by means of two simple equations, respectively equations (2) and (3) described in more detail below.

The first part of our empirical analysis, in section 4, looks for evidence of structural breaks in the frequency, sign and average size of price adjustments. We use data on individual price quotes, with sample coverage and composition standardized across countries and including for each country the same 50 product categories. We use, at the monthly level, frequencies of price continuations and changes, positive and negative, as well as the sign and average size of price increases and decreases. This amounts to breaking down inflation rates (national and sectoral) into components (frequency of positive price change; frequency of negative price change; each of them weighted by the average size of positive and negative price changes). To see how this accounting exercise works, consider the monthly inflation rate in period t for a particular product category j, for which P_j individual products are observed. At this elementary level of aggregation, all individual goods i = 1, …, P_j have equal weight $1/P_j$. The m-o-m inflation rate for this product category is then

$$\pi_{jt}^{m} = \frac{1}{P_j}\sum_{1}^{P_j}\pi_{ijt}^{m} \qquad (1)$$

where π_{ijt}^{m} is the single period difference in the log price of individual good i in product category j at time t. The above expression can be written as

$$\pi_{jt}^{m} = \frac{1}{P_j}\left[A_{jt}^{m}\overline{\pi_{jt}^{m+}} - B_{jt}^{m}\overline{\pi_{jt}^{m-}}\right] = F_{jt}^{m+}\overline{\pi_{jt}^{m+}} - F_{jt}^{m-}\overline{\pi_{jt}^{m-}} = F_{jt}^{m}\overline{\pi_{jt}^{m}} \qquad (2)$$

where A_{jt}^{m} is the number of price increases, B_{jt}^{m} is the number of price decreases, and $\overline{\pi_{jt}^{m+}}$ and $\overline{\pi_{jt}^{m-}}$ are respectively the average sizes, in absolute value, of price increases and price decreases, conditional on the fact an increase, respectively a decrease effectively takes place. The unconditional probabilities of price increases and price decreases are then given by the frequencies F_{jt}^{m+} and F_{jt}^{m-}. The sum of these two frequencies gives the overall frequency of price changes F_{jt}^{m}, while the unconditional probability of price continuations (no price

change), $1-F_{jt}^{m}$, is a measure of price stickiness or price rigidity for product category j. Finally, in equation (2), $\overline{\pi_{jt}^{m}}$ is the overall (weighted[5]) average of the size, in absolute value, of both price increases and price decreases, conditional on the fact a price change, regardless its sign, takes place.

From equation (2), one can start aggregating and eventually obtains similar expressions for the decomposition of inflation at different intermediate levels of aggregation, for instance for the main analytical components of inflation (unprocessed food, energy, processed food, non-energy industrial goods and services) or at the aggregate level (headline inflation or core inflation, here defined as the aggregate of processed food, non-energy industrial goods and services). Obviously, at these levels of aggregation, the CPI weights w_j of each product category j should be taken into account, both in the computation of the aggregate inflation rate, π_t^m, the aggregate frequencies of price adjustment (F_t^{m+}, F_t^{m-} and F_t^m) and the average magnitudes, in absolute value, of these adjustments ($\overline{\pi_t^{m+}}$, $\overline{\pi_t^{m-}}$ and $\overline{\pi_t^m}$).

Starting from equation (2), an increase in inflation can be associated, ceteris paribus, to an increase in the frequency or average size of price increases, or a decrease in the frequency or average size of price decreases. Mutatis mutandis, a similar decomposition is obtained for a decrease in inflation. History dependence of π_t^m, associated with persistence phenomena of various kinds, should be reflected in a corresponding history dependence of one or more of the above components. Conversely, changes in such components would not necessarily bring about changes in inflation or in its dynamic properties; for example, there could be simultaneous increases in frequency (or size) of both price increases and decreases, with no net effect on inflation.

Changes in the frequencies and size of price changes can be caused by a number of factors, some of which could potentially be associated with EMU. For example, enhanced competition or structural reforms in the retail sector, would likely reduce price rigidity (hence a fall in $1-F_t^m$, and a corresponding rise in F_t^{m+} and/or F_t^{m-}). According to the nature of the change, this could impact either on the lump-sum (menu) cost component of adjusting prices, or on the variable one (quadratic à-la-Rotemberg). In the latter case, there would be also a change in the average size of price changes. Another example would be a situation in which

[5] The shares of price increases and price decreases in the total number of price changes are the respective weights.

the increased market competition brings about a reduction of monopolistic-competitive elements in the market, and accordingly in the strategic interaction in setting prices. In this case one likely result would be a fall in the sign asymmetries that often characterise price setting in certain sectors, like services. One would see, as a result, a better balance between the frequency and the size of price increases and decreases.

The second part of our empirical analysis, in section 5, looks for evidence of structural breaks in inflation persistence. To start thinking about the basic elements driving the inflation process and the role EMU can play on persistence, it is convenient to refer to the standard "hybrid" neo-Keynesian inflation equation

$$\pi = \alpha_B \pi_{-1} + \alpha_F \pi^e_{+1} + \gamma x + \varepsilon \qquad (3)$$

Where π is consumer price inflation, π^e_{+1} is the current expectation of inflation next period. The hybrid nature of this model is reflected by the presence in the equation of both expectations of future inflation and lagged inflation, with coefficients summing to (something close to) unity[6]. The variable x is an exogenous driver of inflation. Authors have used different specifications for x, spanning from the more proximate determinants of the inflation process (such as labour costs or the firms' real marginal costs) or the more distant ones (like the output gap). One can also think of (1) as a reduced form, where x is as a proxy for monetary policy, once the aggregate demand equation has been substituted in. This is the formulation we think of here. Hence γ expresses the overall strength of the transmission mechanism running from monetary policy, over aggregate demand, to inflation. Therefore, γ is a complex function of different structural parameters in the economy: (i) it is negatively related to the degree of price stickiness, $1 - F_t^m$, as more nominal price rigidity makes prices less sensitive to variations in their drivers; (ii) it is negatively related to the degree of real rigidity, as the latter reduces the sensitivity of real marginal costs to the output gap or gives rise to countercyclical mark-ups which can (partly) offset the cyclicality of real marginal costs; (iii) it is positively related to the strength of the monetary transmission on the output gap.

In the context of model (3), Angeloni et al. (2004) distinguish three sources of frictions in the inflation process. There is first *intrinsic* inflation persistence, if α_B is non zero. Intrinsic inflation persistence is generated by the fact that inflation adjusts sluggishly to its long run

[6] An exposition of the microfoundations of this equation, with and without backward looking component, is contained e.g. in Woodford (2003).

equilibrium value, even though it is possible that its drivers (inflationary expectations and monetary policy, in model (3)) do not display any slow adjustment. A non zero α_B could be determined by the existence of informal indexation schemes, like for example a "rule of thumb" behaviour by price setters consisting in taking as a reference past inflation in determining price adjustments later on[7]. There could be, second, an "expectations driven" element in persistence, if inflationary expectations adjust sluggishly to the target determined by monetary policy. This type of persistence could be induced for example by an inefficient monetary policy or communication strategy, or by lack of credibility, as a result of which markets would take time to adjust expectations to what the central bank says or does. Thirdly, there can also be "extrinsic" inflation persistence, represented by sluggishness in x. A persistent dynamics of the monetary policy proxy in equation (3) could alternatively be due to lags in the transmission process, or to the policy rule itself, or both.

EMU may in principle have affected all three sources of persistence. Product market reforms aimed at strengthening competition and removing explicit or implicit indexation would presumably reduce the degree of *intrinsic* persistence. Reforms of this type have in fact been introduced in recent years in a number of countries, and it is not unconceivable that EMU may have been a triggering factor. Even in the absence of reforms, the introduction of a single numéraire across the area automatically increases competition because it facilitates systematic price comparisons across countries. Unlike the previous one, this effect on pricing practices could be very quick to materialise. Changes in the degree of intrinsic persistence induced by these types of factors could conceivably be different across sectors, because of uneven coverage or effectiveness of product market reforms across sectors.

As to persistence due to *expectations*, it is natural to think that the introduction of a new currency and a new central bank may have affected it. The ECB was endowed from the start with a degree of independence and statutory aversion to inflation greater that most constituent central banks. Moreover, even before it started to conduct policy it adopted, in October 1998, an explicit and quantified inflation objective and a formal monetary policy strategy, again unlike most of its predecessors. For these reasons it is legitimate to think that the dynamic characteristics of expected inflation may have changed quite suddenly, in most countries adopting the euro, as soon as the ECB assumed its monetary policy responsibilities. The likely direction of this change would be towards stronger anchorage to the ECB price stability norm and lower dependence of expected inflation on past inflation history.

[7] See e.g. Gali et al. (2004).

Finally, similar considerations apply to the last term of the right hand side of equation (3), namely, to *extrinsic* persistence. Quite obviously, both the monetary policy reaction function and the transmission of monetary policy are likely to have changed as a result of EMU, both maybe very rapidly. The policy "rule" followed by the ECB should presumably accommodate inflationary shocks less than the average behaviour of the constituent central banks in the pre-EMU years (though not so much so compared to the more recent period[8]). As to the transmission mechanism, Angeloni and Ehrmann (2003) have provided evidence suggesting an increase of the strength of monetary policy effects and a shortening of its lags.

Our empirical strategy is to estimate not (3) directly, but a reduced form including only lags of inflation itself. This approach is rather common in the recent empirical work on inflation dynamics[9]. The advantage is its simplicity and robustness; no proxies for the unobservables in equation (3) need to be found. The drawback is that the reduced form coefficients scramble together the deeper parameters identifying the three forms of persistence, so that separate identification of each of them becomes impossible. In practice, the estimating equation is[10]

$$\pi = \rho\pi_{-1} + \eta \qquad (4)$$

It is worth noting here that the omission of terms in (4) relative to (3) is likely to lead in many practical cases in an overestimate of the parameter of intrinsic persistence, ρ in equation (4), relative to the true intrinsic persistence value, which is α_B in equation (3). The overestimate is likely to be greater the larger is the (positive) dependence of π^e_{+1} and x, on the one hand, and lagged inflation, on the other[11]. The implications of this are relevant for our analysis. First, estimating (4), say for a country characterised by extrapolative inflationary expectations in a pre-EMU sample period, the coefficient attached to lagged inflation will tend to be high. Second, if the transition to the post-EMU period led to the reduction or elimination of an extrapolative element in inflationary expectations, as one

[8] There is evidence that the policy rules followed by the main continental European central banks converged during the 1990s; see Angeloni and Dedola (1999).

[9] See for example Levin and Piger (2004), Gadzinski and Orlandi (2004) or Corvoisier and Mojon (2004).

[10] In fact the equation we will use in section 5 is a multivariate autoregressive extension of (2), where the parameter of interest is the sum of the AR coefficients, as done e.g. by Gadzinski and Orlandi (2004) and others.

[11] This follows by a simple omitted variable argument. If the omitted variable is positively correlated with an included variable, the estimated coefficient on the latter tends to be biased upward, under assumption of orthogonality of the other variables.

could expect if EMU strengthened market confidence on price stability, one should observe a structural break in the estimated ρ across the two regimes, towards a lower value. Similar considerations apply, under plausible assumptions concerning the nature of the structural breaks, if the change is not in the expectations formation mechanism but in the monetary policy rule, or in the transmission mechanism. Thirdly and finally, suppose one conducts a battery of estimations and tests using prices across different sectors, countries and time periods, as we shall do in section 5. Then several cases may arise, that can provide some informal clues (not strict proofs) of what among the different forms of persistence may have changed. If the estimates of ρ differ significantly across sectors, then it maybe logical to suspect that the differences may be due to intrinsic persistence, since other factors (expectations, monetary policy) are probably common across all sectors in a given country[12] . By the same token, if one observes different changes in ρ across the two regimes in a given country, one may think they are more likely to stem from adjustments in the intrinsic component of persistence, whereas if they are roughly the same, macro factors such as expectations and monetary policy may be more relevant[13].

Whereas a change in the ρ parameter in equation (4) across regimes is unambiguous indication that one or more of the three sources of persistence has changed, the reverse is not true: persistence of more than one form could have changed and yet the reduced form parameter ρ remain the same, if the change in one form of persistence exactly compensates, by coincidence, the one of another. However, this possibility is unlikely to occur practically and we will disregard it in our empirical analysis.

Before concluding it must be mentioned that, apart from the possible effects of EMU on the frequencies, signs and sizes of price adjustment and on inflation persistence, EMU could also have led to price level convergence across countries and as such could have made a contribution to the better functioning of the single market. As will be described in the next section, part of our analysis is based on detailed micro price data for comparable goods in several countries, which in principle are very well suited to test price level convergence. However, we did not have direct access to these data, as they were obtained, within the

[12] A partial caveat in this argument regards monetary transmission, which has been shown to differ somewhat across sectors; see Dedola and Lippi (2005).

[13] In some cases this conclusion is clearly not warranted, namely when a sectoral inflation rate is directly driven by the cost of an imported input. Energy, as we shall see in section 5, is an example. The increase in persistence of euro area energy prices in the more recent years was clearly due to highly persistent oil shocks or an unusual sequence of shock realizations for which one particular direction was predominant.

context of the IPN, under strict confidentiality constraints by research teams in the NCBs. This made it impossible to merge the different national datasets and to compare price levels. As a result, we did not address this (interesting) question.

3. The data

The evidence on price setting, presented in section 4, is based on micro CPI data, for six European countries: Spain, Germany, France, Italy, Belgium and Austria. Due to confidentiality constraints, we did not have access to the raw databases and only obtained, from the IPN research teams in the NCB's, monthly data on the frequencies of price changes, the frequencies of price increases and the frequencies of price decreases, as well as on the average magnitudes, in absolute value, of these three types of price adjustment for each of these countries (see section 2 and equation (2) for the formal definitions of these concepts). We dispose of these data for a harmonised set of 50 product categories, except for Spain and Italy, for which we have only data at an intermediate level of aggregation (unprocessed and processed food, non-energy industrial goods and services for both Italy and Spain and energy for Italy only). For the 4 other countries, the 50 product categories are those that underlie the analysis of consumer price setting presented in Dhyne et al (2004), where a detailed description and motivation of the choice of this particular sample of goods and services is given. Further details on the original datasets underlying the results used below, can be found in the respective papers analysing consumer price setting at the level of each country in our dataset[14]. Each of the broad CPI categories at the intermediate level of aggregation that are available for Spain and Italy, are covered by the 50 products sample which is available for Germany, France, Belgium and Austria. Hence, for these countries this intermediate level of aggregation was constructed starting from the 50 product sample and using the corresponding CPI shares as weights. We also constructed data at the aggregate level, this is for the entire CPI, except for Spain as energy is missing, and for the core part of the CPI, i.e. the aggregate of processed food, non-energy industrial goods and services.

Whereas the cross-sectional dimension of our data is relatively well harmonised, there is more diversity in the time dimension. For Belgium and Spain, data are available since the beginning of 1994. While the available series include 2003 for Belgium, there are no Spanish data available after the end of 2001. The French data are available from August 1994 until

[14] Álvarez and Hernando (2004) for Spain; Hoffmann and Kurz-Kim (2004) for Germany; Baudry, Le Bihan, Sevestre and Tarrieu (2004) for France; Veronese, Fabiani, Gattulli and Sabbatini (2005) for Italy; Aucremanne and Dhyne (2004) for Belgium and Baumgartner, Glatzer, Rumler and Stiglbauer (2004) for Austria.

February 2003 and the Austrian and Italian data cover the period going from January 1996 to December 2003. Finally, the German dataset only starts in February 1998, but then covers all months until the end of 2003. As some of the Spanish data are only available at the quarterly frequency[15], all monthly series for the other countries have been transformed to quarterly data. All data have been seasonally adjusted, and, compatible with the available evidence surveyed in Dhyne et al. (2004), seasonal patterns appeared to be quite pronounced for the frequencies of price adjustment. Data were seasonally adjusted in the original frequency in which they were available, as this approach had the advantage that meaningful quarterly averages could be computed for some of the quarters for which not all the months are available (for instance, for the third quarter of 1994 in France and for the first quarter of 1998 in Germany). Using seasonally adjusted data, it was also possible to compute meaningful averages for some relevant sub periods, even if for some countries the data are not available for all of the quarters in a particular sub period.

Data availability and coverage of the euro area is summarised in Figure 1. Starting from the available national data, four aggregates are constructed as proxies for the euro area. A first aggregate intends to cover the earlier years and is therefore composed of Spain, France and Belgium only. This first aggregate, labelled Euro Area 1, is available from 1994-Q3 until the 2001-Q4. Its coverage is relatively low (approximately 35 p.c. of the euro area), as data availability is rather poor for the earlier years. On top of the three countries mentioned, a second aggregate, labelled Euro Area 2, comprises also Italy and Austria. It is available from 1996-Q1 until 2001-Q4 and covers somewhat more than 55 p.c. of the euro area. The aggregate Euro Area 3 comprises Germany and is therefore only available from 1998-Q1 onwards. In order to cover a sufficiently long time span (in practice until 2003-Q1), Spain was omitted from this aggregate, which covers 80 p.c. of the euro area. Finally, also France was dropped from the aggregate Euro Area 4 and therefore coverage of the latter is reduced to nearly 60 p.c. of the euro area, but data availability now lasts to the end of 2003. A fifth aggregate, taking on board the six countries, has been considered as well. While it has the advantage that it covers nearly 90 p.c. of the euro area, it is only available for a relatively short time span (from 1998-Q1 to 2001-Q4). As it turned out that the patterns, both in terms of frequencies and magnitudes of price adjustment, for this aggregate were very much in line with those for Euro Area 3, we do not consider this broader aggregate in an explicit way in the remainder of this paper. As will be shown in section 4, the patterns displayed by the four

[15] See Álvarez and Hernando (2004) on this.

aggregates during the period they are all available (5 years from 1996 to 2001) are relatively comparable. This tends to suggest that what is observed for the less broad aggregates during the earlier years or during the more recent years can be extrapolated, to some extent, to the broader aggregates and perhaps also to the entire euro area.

Starting from the available data, at the disaggregate level, for the frequencies and the magnitudes of price increases and price decreases, sectoral inflation rates were computed according to equation (2). These inflation rates were subsequently aggregated (at the intermediate and the overall level) for each country and were further aggregated, using the appropriate country weights, to form the four proxies of the euro area defined above. These constructed inflation rates based on the sample of 50 products were then compared with the corresponding aggregates based on published HICP inflation rates.

Not surprisingly, this match is far from perfect. Apart from the partial coverage of our sample (50 product categories only, compared to several hundreds in the HICP), some methodological particularities in the construction of the HICP are at work as well. For instance, equation (2) is only valid in case of geometric averaging of prices. In practice, the HICP not always uses geometric means at the elementary level of aggregation and they are very rarely used at higher levels of aggregation. Moreover, published inflation data are also weighted according to a regional weighting scheme within a particular country, whereas the approach embedded in equation (2) ignores this type of weighting. Finally, the micro datasets from which the frequencies and the magnitudes of price adjustment are derived are often those on which the national CPIs are based and not necessarily those underlying the HICPs.

These factors notwithstanding, Table 1 illustrates that the match between the constructed and the actual inflation rates is, generally speaking, quite good. The correlation between both inflation measures is relatively high for headline inflation and for unprocessed food and energy. For the core components, the match is still quite good, except for the services component for Euro Area 4. Tables 2 and 3 give, for each country and for the two euro area aggregates covering either the earlier or the most recent years (respectively Euro Area 1 and Euro Area 4), the average inflation rates during 4 sub periods which are judged to be relevant for the particular questions we address. The first three sub periods correspond to the three "regimes" which are consistently used in sections 4 and 5, whereas the fourth subperiod isolates, from the third one, the 4 quarters surrounding the euro cash changeover. While the level of both inflation measures differs quite substantially in some countries (published HICP inflation rates tend to be higher than our constructed inflation rates in France, Italy, Belgium

and Austria), the evolution over time in official inflation is relatively well captured by the constructed inflation rates for each of the countries considered. Overall, this evidence validates the sample of 50 products.

The sectoral time series used in section 5 consists of 552 seasonally adjusted q-o-q annualised inflation rates of CPI sub-indices from Germany, France, Italy, Spain, and Belgium, over the period 1985.1-2004.4. In this part of the analysis nearly 90 p.c. of the euro area is covered during the entire period considered. The data set extends the one used by Altissimo et al. (2004) and Bilke (2005) and therefore we refer to their papers to motivate the choice of the data, sample period and description of the data for Germany, France and Italy.
For Belgium and Spain, we have followed the same procedures in de-seasonalising and chaining as those described in Altissimo et al. Concretely, the data set contains sectoral CPI time series of 60 product categories for Belgium, based on the monthly national CPI series published by the Belgian National Statistical Institute. The original data refer to three different base years[16] and each original index was deseasonalised separately, in order to cope with (sometimes pronounced) changes in seasonality. Deseasonalised indices were, subsequently, chain-linked over the entire period and transformed to quarterly series, by averaging. The Belgian data are not affected by the phenomenon of seasonal sales, as the Belgian national CPI, as opposed to the HICP, does not take seasonal sales into account (see Aucremanne and Collin (2005) for more details on this subset of our data). The subset of Spanish sectoral inflation rates consists of 88 product categories, published by the Instituto Nacional de Estadística. The original data refer to three different base years.[17] As for Belgian data, original indices were was deseasonalised separately and subsequently chain-linked over the entire period and transformed to quarterly series, by averaging. The Spanish sectoral inflation data are affected by the introduction in the CPI of seasonal sales in 2002. The impact of this has however been removed appropriately, by using a specific deseasonalization for the most recent period.

[16] The index 1981=100 for the period 1984-1990; the index 1988=100 for the period 1991-1995; and the index 1996=100 for the period 1996-2004
[17] The index 1983=100 for the period 1985-1992; the index 1992=100 for the period 1993-2001; and the index 2001=100 for the period 2002-2004.

4. Evidence on the frequency, sign and size of price changes

4.1 Our summary statistics

This section examines to what extent EMU mattered for price setting practices in the euro area. The analysis is based on the available statistics described in the previous two sections: the frequencies of respectively price changes, price increases and price decreases and the magnitudes, in absolute value, of these three types of price adjustment. Figures 2 to 7 plot, for the 4 proxies of the euro area (defined in the previous section), quarterly time series of these six variables, both for two aggregate inflation measures (headline and core inflation) and for five intermediate aggregates (energy, unprocessed food, processed food, non-energy industrial goods and services). Similar statistics at the country level are presented in Tables 4 to 9, where data have been averaged over subperiods which ex ante seemed relevant for our analysis.

In this respect, we take the crucial dates of 1996 and 1998 seriously. Several arguments suggest that at these two dates (or dates very close to them) structural changes in market inflationary expectations linked to the anticipation of EMU may have occurred. Concerning the first, in both Italy and Spain, two countries for which participation in EMU was considered by market participants very uncertain at the time, key policy announcements were made in 1996 that suggested a shifting orientation towards early entry[18]. The other four countries considered (Germany, France, Austria and Belgium) were probably perceived by observers and public opinion as likely EMU founders from the start. For the second break, the timing is easy: the publication of the Commission and the Bundesbank convergence reports in the spring of 1998 was a clear official indication that all countries considered here (plus others) would certainly adopt the euro as of the subsequent year. Finally, partly based on already available evidence, we thought that price-setting practices could have been disturbed in the period surrounding the euro cash changeover in January 2002.

As a consequence, we have computed averages for respectively the period 1994-1995, the period 1996-1998, the period 1999-2003 (i.e. the EMU period, excluding, however, the two quarters before and the two quarters after the cash changeover) and, finally, the period going from 2001Q3 to 2002Q2 (cash changeover). The three last columns of Tables 4 to 9 then give, for the second, third and fourth subperiod, the difference with the preceding subperiod. A two-tailed test for small, unpaired samples on the significance of the difference in the

[18] Angeloni and Violi (1998) discuss these events in some detail.

mean of two subsequent periods was performed. In cases where the null hypothesis of no difference was rejected at the 95% level, the corresponding mean has a bold format. Tables 4 to 9 also summarise the available information for the two euro area proxies covering either the earlier or the most recent years (respectively Euro Area 1 and Euro Area 4) in a similar way.

4.2 Results

In what follows, we will focus on the question whether EMU has affected price setting and not insist on findings already discussed elsewhere. We refer in particular to Dhyne et al. (2004) for a thorough overview of the important findings on consumer price setting in the euro area. Let us just remind the most striking patterns in terms of price setting, which can be seen from Figures 2 to 7 and Tables 4 to 9. First of all, price adjustment appears to be lumpy. Prices are indeed adjusted relatively infrequently and when they are changed, the adjustment tends to be quite large (close to 10 % on average). There are no notable asymmetries when price increases and price decreases are considered separately, except for the services sector where price decreases are very rare. There are large sectoral differences in frequency, sign and size of price adjustment and cross-sectoral rankings are strikingly similar across the six economies considered. Energy and unprocessed food are the most flexible product categories, processed food occupies an intermediate position and non-energy industrial goods and services turn out to be the stickiest components of the CPI. There are some differences across countries as well, particularly in terms of the frequencies of price adjustment, but they tend to be smaller than the cross-sectoral differences and they can partly be explained by conditioning economic factors. These cross-country differences can be seen from Tables 4 to 9 and they explain the level differences for the different euro area proxies in Figures 2 to 7, as the country composition of these aggregates changes. Overall, these findings are very much in line with those of Bills and Klenow (2004) for the US, apart from the fact that prices tend to adjust less frequently in the euro area.

As to a possible EMU effect, examination of Figures 2 to 4 on the frequencies of respectively price changes, price increases and price decreases immediately learns that there are no clear pronounced breaks which temporarily or permanently shift the probability of price adjustment in a particular direction at the specific dates we had in mind initially (1996 and 1998). On the contrary, huge spikes are found in the frequencies of price adjustment in 2002Q1 and to some extent also in the quarters just before and after the cash changeover. Interestingly, these spikes are seen for both price increases and price decreases and this

symmetry is at odds with the general public's perception that prices predominantly went up as a result of the introduction of the euro. These spikes are clearly observed for most of the product categories considered, except for energy and to a lesser extent for processed food. The latter product category is also the only one where a notable asymmetry in the effect of the cash changeover is seen. While for these products the probability of price increases was not particularly affected in 2002Q1, the frequency of price increases temporarily jumped upward, as was the case for the other non-energetic components of the CPI. After the cash changeover, frequencies of price adjustment quickly settled back to the earlier patterns.

Tables 4 to 6 confirm this temporary impact of the cash changeover on price adjustment frequencies in a more formal way. For the Euro Area 4 proxy (the only one that incorporates the changeover period completely), the frequency of price adjustment is significantly higher during the period 2001Q3 to 2002Q2 for core inflation, for non-energy industrial goods and for services. A similar picture is seen when price increases and price decreases are considered separately, except for the fact that the higher probability of price decreases is no longer significantly different for services. Apart from Spain, where the sample period ends in 2001Q4 (!), frequencies of price adjustment, both up and down, are often found to be significantly higher during the period 2001Q3 to 2002Q2 at the level of the individual countries as well.

Turning to the magnitudes of price adjustments (Figures 5 to 7 and Tables 7 to 9), no pronounced shifts are detected at the crucial dates 1996 and 1998. Here too there is, however, some evidence of a cash changeover effect. The magnitudes of the price adjustments are indeed somewhat smaller than usual, particularly for the components processed food and non-energy industrial goods. For these product categories it can be seen in the tables that the size of the price changes for the Euro Area 4 proxy is significantly smaller during the period 2001Q3 to 2002Q2. The effect of the changeover on the sizes of price adjustment is more pronounced for price decreases than for price increases. Similar patterns are observed at the level of 5 individual countries (Germany, France, Italy, Belgium and Austria), while for Spain the sample period does not cover the changeover period entirely.

Not detecting a visible impact of EMU on price setting does not imply, however, that the frequencies of price adjustment have not changed during the sample period considered. These changes seem, however, more related to either aggregate or product-specific inflation developments and are not directly related to EMU. For instance, the frequency of price changes for energy is significantly higher in the post 1998 period, as, starting from mid-1999

onwards, oil price shocks were more important than during the period 1994-1998 for euro area inflation. Another example is the frequency of price changes (particularly the frequency of price increases - Figure 3) for both headline and core inflation, which seem to co-move somewhat with the corresponding inflation concept. These are interesting observations on their own, as they can have important implications for the choice of the underlying price setting model used in micro-founded macro models of the business cycle. Purely time-dependent models, in which the timing of price adjustment is completely exogenously given, would imply that the frequency of price adjustment is stable over time. Variability in inflation would then only affect the size of the price adjustments. State-dependent models, in which the timing of the price adjustment is conditioned by the state of the economy, would imply that the frequency of price adjustment varies over time, together with economic conditions. In that event, both the frequencies and the sizes of price adjustment can vary over time. Based on these arguments, Klenow and Kryvtsov (2005) present a decomposition of the variance of inflation in a state-dependent and a time-dependent component, and find that the latter (incorporating only the impact of the variability in the sizes) largely dominates in the US. Although such a type of analysis is clearly beyond the scope of this paper, the available (graphical) evidence in Figures 2 to 7 suggests that in the euro area the frequencies of price adjustment display more variability over business cycle frequencies than the sizes. This is particularly so for the frequency of price increases. We leave further investigation of this issue for future research.

Finally, it is interesting to observe that the low inflation environment brought about by EMU did not lead to a greater reluctance to decrease prices. The comparison between the second and the first subperiod is in this respect very relevant, as in the 3 countries for which this comparison is possible (Spain, France and Belgium) measured HICP inflation was lower in the period 1996-1999 than in the period 1994-1995. In the case of Spain the difference between both periods is significant and this holds also for the Euro Area 1 aggregate (Table 3). The downward move in the inflation series that we have constructed from the micro data is even more pronounced and for some series also significant in the case of France and Belgium (Table 2). For this Euro Area 1 aggregate, the decrease in inflation during the run-up to EMU has been accompanied by a mildly downward movement in the frequency of price increases and by a mildly upward trend in the frequency of price decreases. From Tables 5 and 6, it can be seen that the differences in the frequencies of respectively upward and downward price adjustment between the period 1996-1998 and 1994-1995 are

statistically significant for core inflation and some of its components, both for the Euro Area 1 aggregate and for Spain and France. Observing these effects on the probabilities to observe price increases and price decreases respectively, is the normal pattern one would expect in the case of no specific downward rigidities. In case such rigidities would prevail, one would only expect a decrease in the frequency of price increases and, as a result, a more pronounced drop in the overall frequency. This would then imply that the low inflationary environment hampers the normal adjustment of relative prices in the economy and this distortion would give rise to negative long-run effects on output and employment. Apparently, this is not what happened in EMU. Aucremanne et al. (2002) also found a tendency towards more symmetry in the distribution of price changes as aggregate inflation decelerated, on the basis of Belgian sectoral inflation data.

5. Evidence on inflation dynamics

5.1 The statistical model

As emerged from the recent works on inflation persistence, a good estimation of the latter takes into account the fact that the inflation process can be characterized by non-linearities which may reflect changing structure over time.
On the other hand, the consideration of heterogeneity across countries and sectors in more disaggregated data helps in describing persistence in a more proper way.

For these reasons the class of model we consider here for each sector allows for the dynamics to differ over time. Specifically, focusing on a univariate p^{th} autoregressive representation, we write:

$$\pi_t = \alpha_{0t} + \alpha_{1t}\pi_{t-1} + \cdots + \alpha_{pt}\pi_{t-p} + \varepsilon_t, \qquad (5)$$

where, for $i=1,...,p$, the coefficients of the linear AR representation are assumed to be time varying.
In the following we estimate two time-varying specifications. In the first one, the form of the time variation is simply based on an AR dynamics which differs across sub-periods, or "regimes", where the latter are defined exogenously based on our prior hypothesis on a

possible EMU effect. The most general model we consider in this class of discrete changes is a three-regime which are assumed to change at fixed dates. In particular, we have:

$$\pi_t = \begin{cases} \alpha_{01} + \alpha_{11}\pi_{t-1} + \cdots + \alpha_{p1}\pi_{t-p} + \varepsilon_t & t < t_0 \\ \alpha_{02} + \alpha_{12}\pi_{t-1} + \cdots + \alpha_{p2}\pi_{t-p} + \varepsilon_t & t_0 \le t < t_1 \\ \alpha_{03} + \alpha_{13}\pi_{t-1} + \cdots + \alpha_{p3}\pi_{t-p} + \varepsilon_t & t \ge t_1 \end{cases} \qquad (6)$$

In the second model specification, we allow the parameters in (5) to continuously vary over time. We assume, as it is customarily done (e.g. Pivetta-Reis, 2004), that coefficients evolve according to a random walk:

$$\alpha_{it+1} = \alpha_{it} + \eta_{it+1} \qquad (7)$$

We assume ε_t to be i.i.d $N\left(0, h_t\sigma^2\right)$ and η_{it} to be i.i.d. $N\left(0, \lambda_i\sigma^2\right)$ where ε_t, η_{is} and η_{jr} are independent of one another for all s,t,r,i and j. Heteroscedasticity is captured by h_t in both models.

This specification is quite standard in the literature (Koop, 2003; Koop and Potter, 2001) and has the advantage of capturing permanent or transitory changes in the dynamics of inflation process of the types that EMU might have introduced.

Note in particular that the evidence of variation over time in the parameters, or of structural instability, is easy to check by testing $\lambda_i = 0$. In fact if the vector $\lambda = \left(\lambda_0, ..., \lambda_p\right)'$ is equal to zero, equation (5) reduces to a simple linear AR model.

Both specification (5) and (6) can be encompassed in the following convenient state space form:

$$\begin{aligned} \pi_t &= X_t'\alpha_t + G_t u_t \qquad t = 1, 2, ..., T \\ \alpha_{t+1} &= M_t\alpha_t + H_t u_t \qquad t = 0, 1, ..., T \end{aligned} \qquad (8)$$

Here $\alpha_0 = 0$, and $u_t = (\varepsilon_t \ \eta_t)'$ are i.i.d $N\left(0, \sigma^2 I_{p+1}\right)$. The specification (6) is simply obtained as a special case by assuming $M_t = I$, $H_t = 0$ and splitting the sample in three. The specification (5) is also easily obtained assuming:

$G_t = \left[\sqrt{h_t}, 0_p'\right]$, $H_t = \left[0_p, A\right]$

with A such that the variance-covariance matrix of $\eta_t = (\eta_{1t}, ..., \eta_{1t})'$ is $\Sigma = \sigma^2 \Lambda = \sigma^2 AA'$, with

$$\Lambda = \begin{pmatrix} \lambda_0 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & \lambda_p \end{pmatrix}$$

The model in state space form is relatively easy to estimate. Model (6) is simply estimated with dummy variables, while for the general version of model (5) the simulation smoother of deJong and Shepard (1995) is used, as described in Koop (2003, Ch. 8)

The considered (time-varying) measure of persistence is the sum of the coefficients in the autoregressive process and is defined as $\rho_t = \sum_{i=1}^{p} \alpha_{it}$. This measure is estimated for all sectors and countries, along with a measure of uncertainty associated with the persistence (to check its significance) and with the associated λ_i (to check its structure instability).

The first time-varying model is a simple version of the general model above, which takes the crucial dates of 1996 and 1998 seriously and imposes dummy variables to check whether the persistence parameter has changed after 1996Q1 or after 1998Q3 (see section 4.1, for a motivation of these dates).The model with dummy variables is therefore the following:

$$\pi_t = \left(\alpha_0 + \gamma_0^1 D_{1,t} + \gamma_0^2 D_{2,t}\right) + \left(\alpha_1 + \gamma_1^1 D_{1,t} + \gamma_1^2 D_{2,t}\right)\pi_{t-1} + \cdots + \left(\alpha_p + \gamma_p^1 D_{1,t} + \gamma_p^2 D_{2,t}\right)\pi_{t-p} + \varepsilon_t$$

As usual, we re-arrange the model to obtain the Augmented Dickey-Fuller regression:

$$\pi_t = \left(\alpha_0 + \gamma_0^1 D_{1,t} + \gamma_0^2 D_{2,t}\right) + \left(\rho + \gamma^1 D_{1,t} + \gamma^2 D_{2,t}\right)\pi_{t-1} + \sum_{j=1}^{p-1}\left(\varphi_j + \beta_j^1 D_{1,t} + \beta_j^2 D_{2,t}\right)\Delta\pi_{t-j} + \varepsilon_t \qquad (9)$$

where

$\rho = \sum_{i=1}^{p} \alpha_i$,

$\gamma^s = \sum_{i=1}^{p} \gamma_i^s \quad (s = 1, 2)$,

$\varphi_j = -\sum_{i=j+1}^{p} \alpha_i$,

$\beta_j^s = -\sum_{i=j+1}^{p} \gamma_i^s \quad s = 1,2$

Here $D_{s,t}$ is a dummy variable that takes value 1 as of 1996:1($s=1$) or 1998:3 ($s=2$).

The persistence parameter is therefore $\left(\rho + \gamma^1 D_{1,t} + \gamma^2 D_{2,t}\right)$. For a preliminary check of an effect of EMU on the persistence it is enough to check whether γ^s is different from zero. Concretely, we allow for a change in persistence due to the announcement of the EMU $\left(\gamma^1\right)$ and to a further possible change due to the effective implementation of the new regime $\left(\gamma^2\right)$. A positive value of these values would point in favour of an increase in persistence (possibly) due to EMU. A negative value would on the contrary be evidence of a decrease in persistence (possibly) due to EMU. The net effect would be given by the sum of $\left(\gamma^1 + \gamma^2\right)$.

The analysis is performed on each sector of the countries under analysis. Notice that in the specification above γ_0^s controls for a possible break in the mean of inflation due to the same reason and is needed to avoid a spurious result on γ^s, while the β_j^s's control for the fact that the change in persistence can be due to changes in any of the autoregressive parameters and not just in the first one. In other words, we consider changes in all the dynamics and not just in the first autoregressive lag.

The model is estimated allowing for time-heteroskedasticity in the data. The lag length has been optimally chosen for each sector using Schwarz criterion. Estimation is Bayesian, meaning that a prior distribution has been combined with the likelihood, and that results are based on features of interest of the posterior distribution. The chosen prior is however very loose so that results are practically centred on classical estimates. For all results, the reported features of the posterior distribution are the mean (or median) and the 68% Highest Posterior Density Interval (HPDI). The latter is also used to check the significance of the parameters of interest or other simple linear restrictions.

5.2 Results

The estimation results of the model with dummies are reported in Tables 10 and 11. The former shows tests of constancy of the parameter ρ of equation (6), for each of the two dates separately, i.e., using each of the two dummies at once. The latter reports the same results for the whole model (9). In both tables results are presented aggregated and disaggregated for the 5 countries and for 5 economic sectors (processed food; unprocessed food; non energy industry; energy; services).

It is immediately clear from the aggregate results, and for most of the disaggregated ones of Table 10a, that there is evidence of a downward break in the persistence parameter in 1996Q1. Considering all sectors and all countries together (552 product items), ρ declines from .58 to .45. The 68% confidence interval for γ (equivalent to ± one standard deviation under normality) does not include the zero. There are sizeable differences across sectors, however. The sharpest decline occurs in industry and services. For energy, there is actually an increase (by .12).

The country breakdown reveals that the largest drop occurred in Germany and France – countries already characterised by a relatively low inflation level. The smallest took place in Italy. An informal look at the data also seems to suggest that there is more similarity across countries than across sectors (within and across countries), both for the levels of ρ before and after the break date and for γ. This would suggest that differences in the degrees of inflation persistence at the disaggregated level are more likely to be linked to sector-specific structural factors, than to nation-specific macroeconomic ones (see also Altissimo et al. on the comparison across sectors and countries of inflation persistence).

Table 10b reports results like the preceding ones, but assuming instead a break date at 1998Q3. All results are confirmed, and in fact strengthened. The estimates of inflation persistence before and after EMU are comparable to the previous ones, and the decline at the break date is somewhat larger.

Based on Tables 10a and 10b it is not possible to ascertain whether both assumed break dates are indeed significant. To check that, we need to encompass both dates; we do this in Table 11. It is immediately apparent from the table that while the earlier date remains significant (in

fact it becomes more significant) the second is not. In fact there is even an increase in the estimated degree of inflation persistence after 1998Q3 (parameter γ_2). Hence, the results from Table 10b were probably spurious. Otherwise most results of the earlier tables are confirmed, insofar as it relates to the first break point. Again, differences in inflation persistence seem to be mainly sector-specific, not country-specific. For instance, formal tests on the mean could not reject the equality of γ_1 in Germany and France on the one hand, and in Italy, Belgium and Spain on the other hand, whereas similar tests lead to all rejections across sectors. The evidence for γ_2 is more mixed across countries and sectors.

It is interesting to note that most of the reductions in inflation persistence between the pre-1996 and the post-mid-1998 periods are concentrated in the services sector; particularly strong gains can be observed in Germany, France and Spain.

There are two "puzzles" emerging from table 11. First, there seems to have been, in the post-1998 period, an increase in the degree of inflation persistence in the euro area. Food (both processed and unprocessed) seems to be responsible for this. Second, looking instead at the changes between the pre-1996 and the post-mid-1998 periods, persistence has decreased everywhere except in the energy compartment, where a sharp increase in persistence occurs after 1996. Something specific to food and energy prices could be at work here. As a matter of fact, these sectors were often singled out as sources of inflationary shocks in recent years. It is also important to remember that, as discussed in the previous section, our reduced form estimates lump together intrinsic and extrinsic components of persistence (and also the part due to expectations). One explanation then could be that the increase in persistence we observe in these sectors has nothing to do with how prices are formed in the euro area, but is due instead to the characteristics of the shocks, which may have been more persistent than in the past or displayed an unusual sequence of realisations for which one particular direction (upward in these cases) was predominant (see also footnote 10 on page 9).

To put these findings in a better perspective, we illustrate now the results of the pure time-varying coefficient model, Eq. (4).

The first important result is reported in Table 12, which contains the posterior mean and standard deviations for λ_1. They indicate that a substantial amount of parameter variation occurs in the ρ coefficient both across sectors and across countries, and therefore that there is enough evidence of structural instability over the sample 1985-2004. This finding allows us to answer positively to the question: Has inflation persistence changed over the sample under

consideration? The next question is to see whether this departure from stability reflects a change in structure due to EMU or it is related to some nonlinearities endogenously generated, for instance, by the same behaviour of the inflation process, which has proved to be largely common not only to EMU countries but also to other OECD countries (e.g. Rogoff, 2003; Ciccarelli and Mojon, 2005).

Figure 8 shows the time profile of our time-varying measure of persistence, in the aggregate and for all sectors. The figure reports the 68% HPDI (dotted external lines), the posterior mean (solid line) and the posterior median (dashed line) of our measure of persistence. Besides providing a clearer view on the dynamics of inflation persistence over the last 20 years, overall the figure confirms what previously reported by just looking at two single dates (Table 11). A discrete amount of time-variation is present for most sectors, as argued from Table 12. A gradual decline in the pre-EMU years is quite evident from the picture; there is also some visual support for a break in 1996, given by the fact that most lines show a steeper decline in that year. It is also clear that something happened after 1999 bringing inflation persistence partially back up. For energy the increase occurs earlier, confirming what was seen in Table 11.

The subsequent Figures, 9 to 13, try to shed some light on the link between inflation persistence, inflation levels, and inflationary expectations. The question we have in mind is twofold: Do expectations have anything to do with persistence? Does persistence have anything to do with actual inflation, and if so what is the causal relation?

Figure 9 plots inflation expectations and persistence together, in the aggregate and at national level. Clearly, the increase in persistence we noted is accompanied by an increase of inflationary expectations. This reasoning reminds of Levin and Piger (2004) and others, who have attributed inflation persistence to monetary policy regimes and to the associated expectations formation. If one computes cross-correlations between the two variables (Figure 10), one sees that expectations predominantly tend to *lead* persistence, rather than the opposite. As to the relation between persistence and actual inflation (Figures 11 and 12), this is also rather strong (correlation coefficient mainly above .5, except for Belgium). The evidence for actual inflation predominantly leading persistence (as was the case for expectations) is weak. An interesting contrast emerges from Figure 13, where we plot together the dynamic correlation coefficients of actual and expected inflation with persistence: in relative terms at least, it seems that expectations tend to lead persistence, and the latter tends to lead inflation.

The findings discussed until now point out that inflation persistence has shown a downward tendency in the run-up to EMU and stabilization after 1999, and that these tendencies are strongly related to both current and expected inflation. Are these results a distinguishing feature of EMU countries? To answer this question we attempt a comparison between the Euro area and the United States. The latter have experienced no currency reform in recent years, and therefore it is a good control to see if something emerges for the Euro area in differential terms. Data for US are already aggregated at the level of 4 main sectors (Food, Energy, Service and Housing) and two broad categories (all items and Core inflation). Clearly the different aggregation with respect to the European data might make a difference *per se* in measuring persistence (e.g. Altissimo et al. 2004), but at least it gives us a reasonable term of comparison.

Results are shown in Tables 13-14, which report the same information as Tables 10-11, and Figures 14-16, which plot the time-varying measure of persistence.

Two initial broad results are worth emphasizing. First, our persistence estimate is generally more volatile for the US than it is for the euro area: While we have no specific explanation for this evidence, it could reveal the existence in the euro area of more deep-rooted persistence factors in the inflation process, or it can just be the effect of a different aggregation, as mentioned above. Second, and perhaps more importantly for our purpose, in the US, as in the euro area, persistence tends to decline before 1998 and to rise afterwards. Actually the rise in the US seems stronger and more lasting. Figure 14 plots the time varying persistence for the main US sectors. Both the figure and the Tables 13-14, seem to confirm that the behaviour of US persistence is qualitatively very similar to the one of the euro area for most sectors. In particular, the persistence in the energy sector increases in the period 1996-1999, whereas in the services sector it constantly declines over the entire sample. These results are put in a better perspective in Figure 15, where US persistence for 5 aggregates is reported (solid line) together with the 68% HPDI of the correspondent euro area sectors (dashed lines). Apart from very few exceptions, limited to concrete time periods, the estimate of the US persistence lies entirely in the euro area bands, confirming the idea that results for US sectors are not very dissimilar from the results obtained for the euro area. Finally, Figure 16 allows another direct visual testing of the difference between the persistence of overall inflation among euro area countries, and the US, at different dates. The dashed lines are the 68% HPDI for the euro area as obtained from the aggregation of results from the 552 products. Solid-coloured lines are the persistence of all countries under analysis. A few

comments are worth making. Belgium and France are both below the German level of persistence for most of the sample. Italy's persistence level is comparable to Germany's, but at the end of the sample it clearly rises above it. Spain has a significantly higher persistence level throughout. Finally, in the US the increase at the end of the sample brings inflation persistence at a much higher level than Germany. It seems natural to associate this increase with the increase that has taken place in US core inflation in recent years, in an environment of continuing monetary policy accommodation. However, at this stage this is simply a conjecture that would warrant further investigation to be confirmed or refuted.

6. Discussion of overall results and conclusions

The aim of this paper is to see whether Europe's Economic and Monetary Union (EMU) had any effect on the setting of consumer prices and on the dynamics of inflation in the countries involved. One can think of different channels through which the creation of EMU can affect price setting and inflation persistence.

First of all, EMU has led to a more competitive environment, not only because the single numeraire enhances price transparency and price comparison across countries, but also because EMU may have been a triggering factor for product market reforms aimed at strengthening competition. As to price setting, this more competitive environment could have led to (i) more price level convergence in the euro area, (ii) more price flexibility and (iii) a fall in the sign asymmetries that characterise price setting in some sectors. As to inflation persistence, increased competition can have led to a stronger incentive to set prices in a fully optimal, forward looking way and to rely less on explicit or implicit indexation, thereby reducing so-called intrinsic inflation persistence, i.e. the persistence in the inflation process beyond that in expectations and in the drivers of inflation.

Second, the creation of EMU has had an important impact on the conduct of monetary policy. The ECB's clear mandate for maintaining price stability, the existence of an explicit and quantified inflation objective and the elaboration of a formal monetary policy strategy presumably have led towards a stronger anchorage of inflation expectations and a lower dependence on past inflation history. This could have reduced the persistence due to expectations. On top of that, EMU may have affected the monetary reaction function and the transmission mechanism of monetary policy and this can have had an impact on so-called extrinsic inflation persistence, i.e. the persistence in the drivers. We consider monetary policy

indeed as the main, ultimate driver of inflation. Finally, in the run-up to the new regime, inflation declined substantially and it was subsequently stabilised at low levels compatible with the monetary policy strategy of the Eurosystem. As a result of this, it could be the case that specific downward rigidities have become a more visible aspect of price setting, as they bite more in a low inflation environment. As to inflation persistence, the decrease in long-run inflation should be appropriately taken into account in order to avoid spuriously high persistence estimates.

As nobody seriously expects radical overnight changes as a result of the creation of EMU in 1999, we study, a relatively long period before and after 1999 and adopt two partially overlapping approaches, both for price setting and for inflation persistence. According to the first approach, we look for discrete breaks at two crucial dates in the run-up to EMU (1996 and 1998), while the second approach allows for a smoother and more continuous process of change.

As to price setting, we were not able to address the issue of price level convergence as we did not have micro price levels at our disposal, but only micro based measures of the frequencies and magnitudes of price adjustment. While our results show that time variation in the frequency of price adjustment is relatively important, this seems to be mainly the result of aggregate or sectoral inflation developments at business cycle frequencies and, therefore, not related to EMU, at least not directly. In particular we did not find evidence of pronounced breaks in the frequencies and magnitudes of price adjustment in 1996 and in 1998. On the contrary, at the end of 2001 and in the beginning of 2002 (period surrounding the cash changeover) retail price adjustment frequencies, both up and down, increased substantially, while the magnitude of the price adjustment, also both up and down, was smaller than otherwise. However, both settled quickly back to the earlier patterns. The significant decrease of inflation during the run-up to EMU was accompanied by a moderate reduction of the frequency of price increases and a mild upward trend in the frequency of price decreases. The latter observation is not supportive for the existence of pronounced downward rigidities in pricing and therefore suggest that the low inflation environment of EMU is not hampering the smooth adjustment of relative prices.

As to inflation persistence, there is no evidence of a change around 1999 - if anything, persistence may have slightly increased. On the contrary, we do find evidence of a decline in the persistence of the inflation process in the mid-1990s and the results of the two approaches adopted (discrete breaks versus a pure time-varying coefficient model with smooth changes)

are both relatively in line in this respect. In particular, according to the pure time-varying approach, a substantial amount of parameter instability was found over the sample 1985-2004. A gradual decline in persistence in the pre-EMU years is quite evident from this approach and there is some support for a more pronounced decline in 1996, corroborating the evidence for a discrete break at that point in time in the first approach. According to the time-varying approach, the reduction in persistence is relatively homogenous, both across sectors and across countries. Therefore, the change is probably attributable to macro-economic factors such as expectations or monetary policy and, as a consequence, it is presumably expectations based or extrinsic persistence, rather than intrinsic persistence that was falling. Moreover, the decrease in persistence seems to be preceded, in a systematic manner, by a decrease in inflation expectations, putting even more weight on expectations based persistence as the most important driving factor.

This evidence could be supportive for a decrease of inflation persistence induced by a structural change in private inflationary expectations due, at least in part, to policies linked to the preparation of EMU. This interpretation is, however, weakened by the fact that a similar decline occurred also in the US. Indeed, in the US, as in the euro area, persistence tends to decline before 1998 and to rise afterwards and, apart from very few exceptions, the estimate of US persistence tends to lie entirely in the euro area confidence bands of the corresponding inflation series.

Figure 1 – Availability of micro price data and weights for the different Euro Area aggregates used

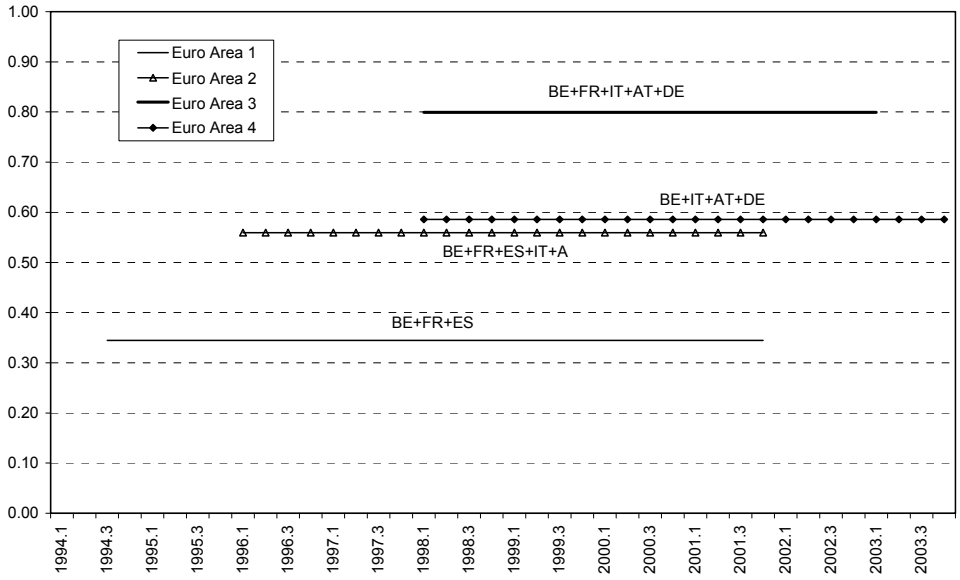


Figure 2 - Frequency of price changes

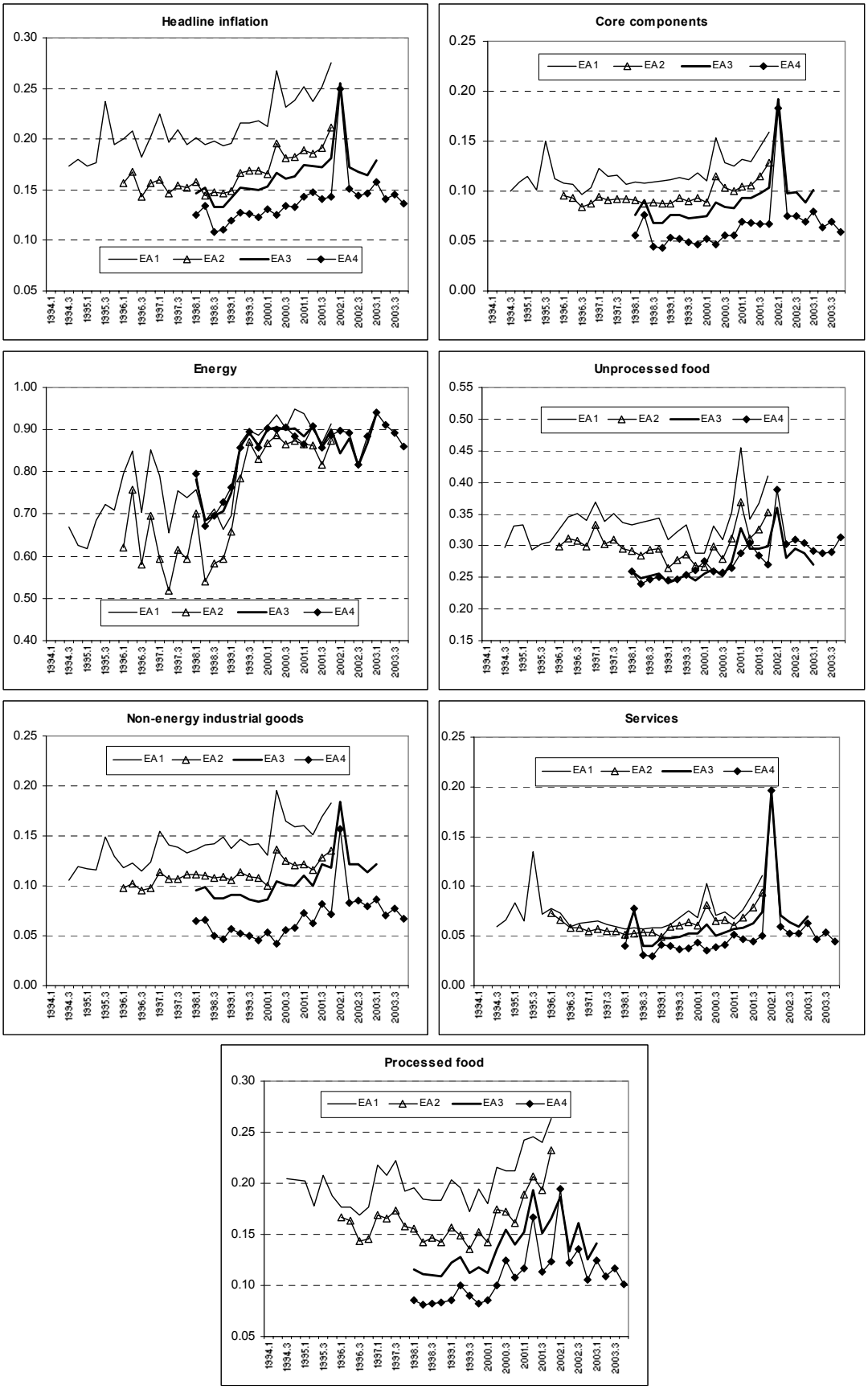


Figure 3 - Frequency of price increases

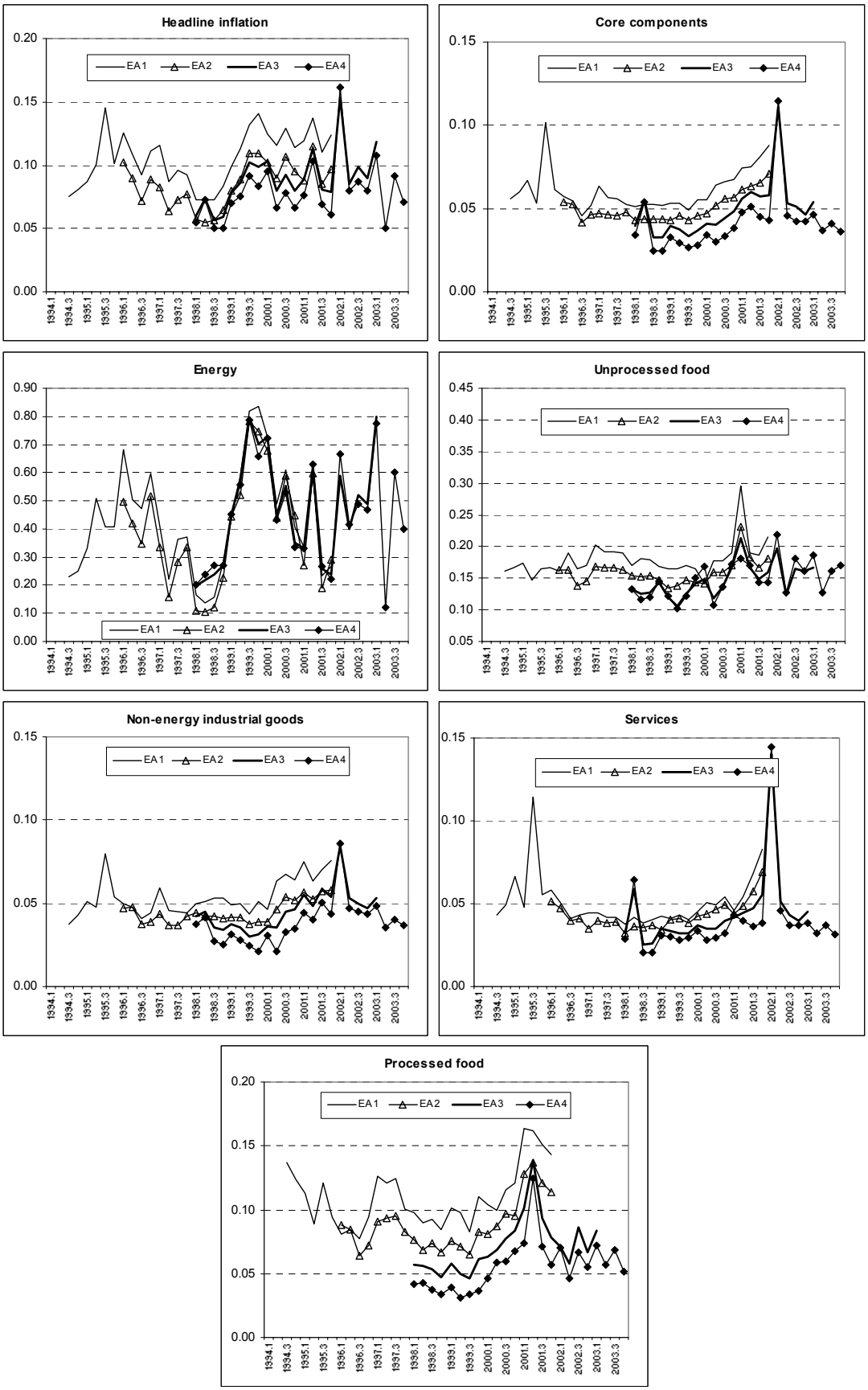


Figure 4 - Frequency of price decreases

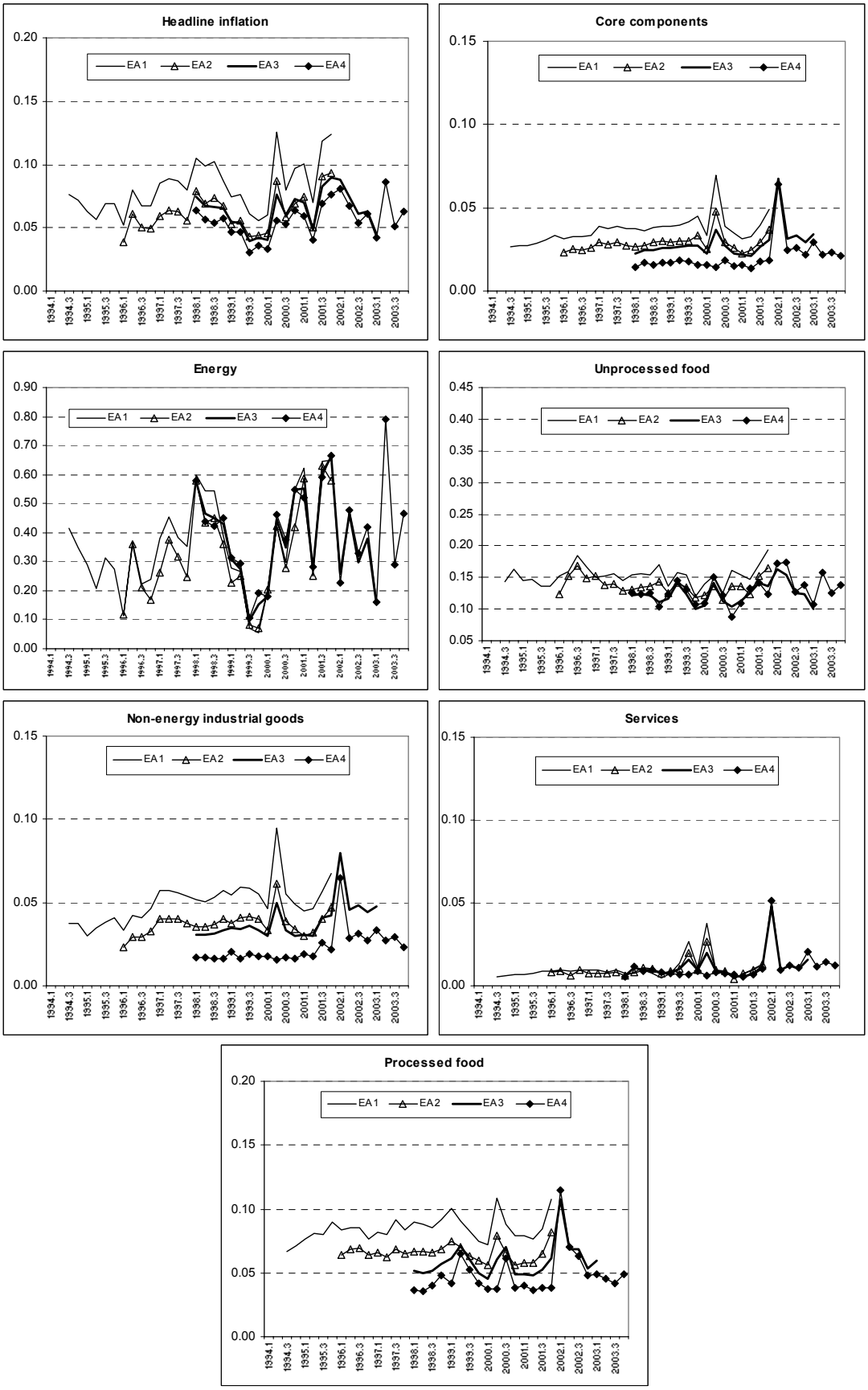


Figure 5 - Size of price changes

Figure 6 - Size of price increases

Figure 7 - Size of price decreases, in absolute value

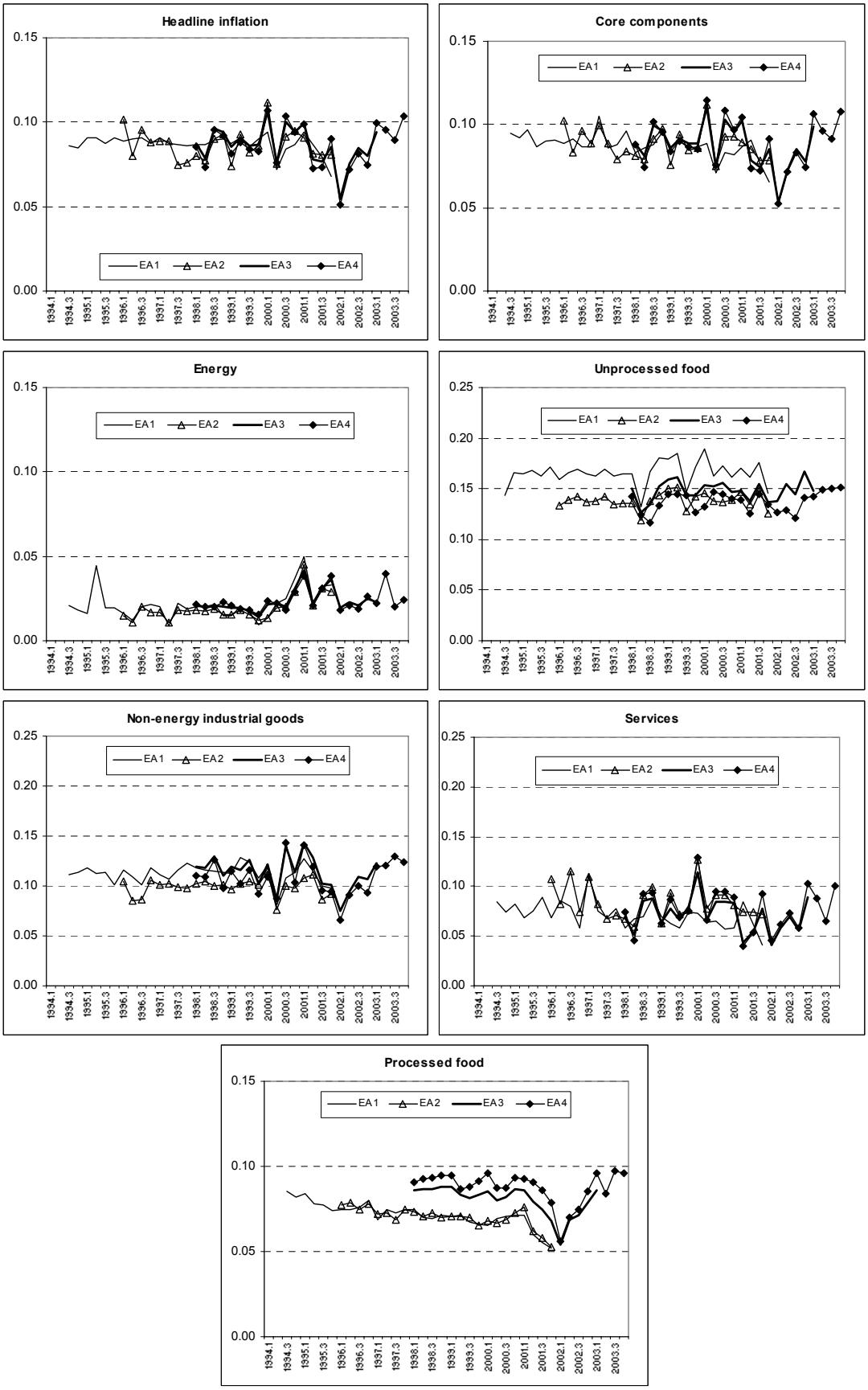


Figure 8 - Time-varying persistence measure

EMU Sectors

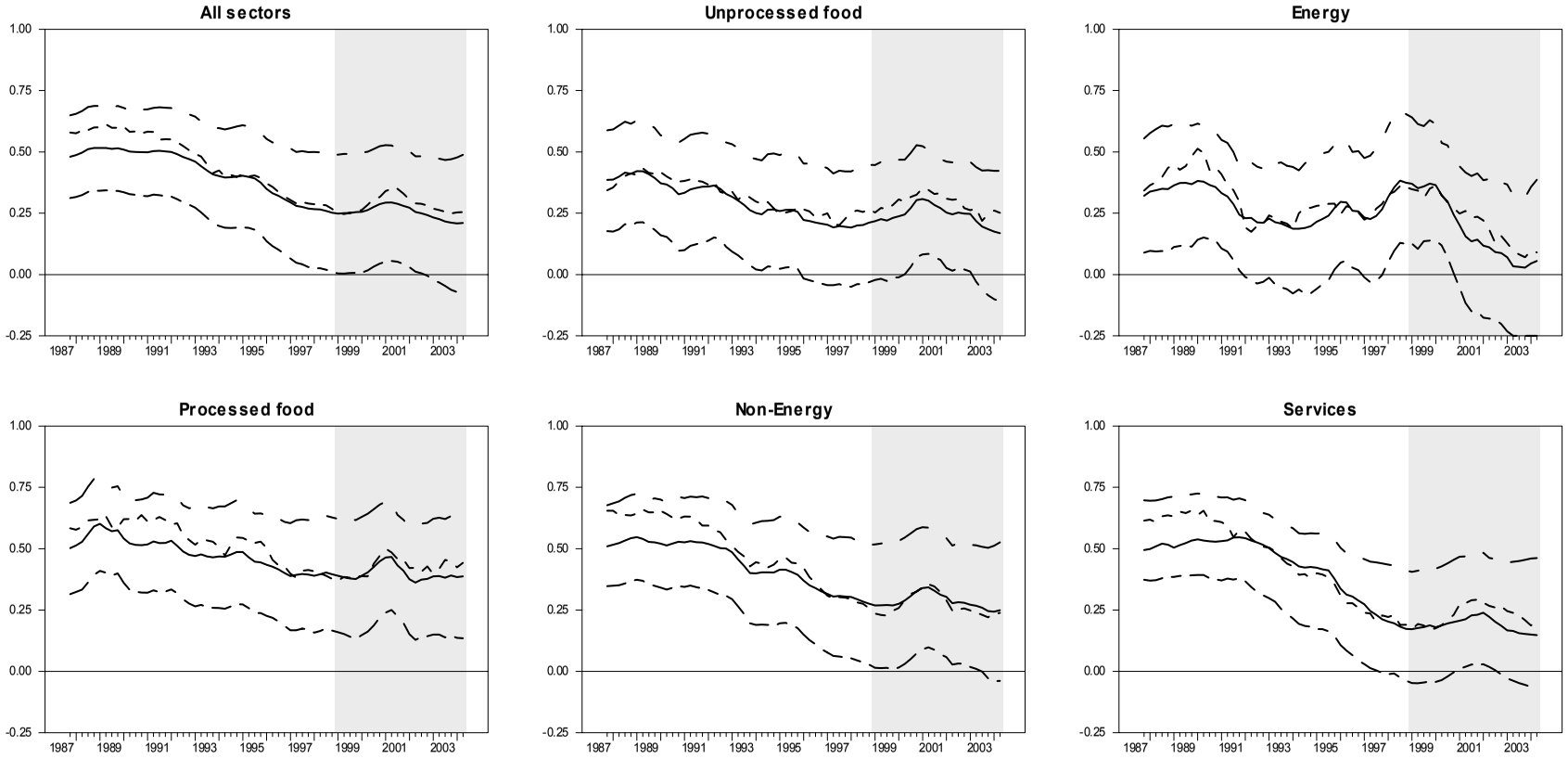


Figure 9 - Inflation Persistence and Expectations in EMU countries

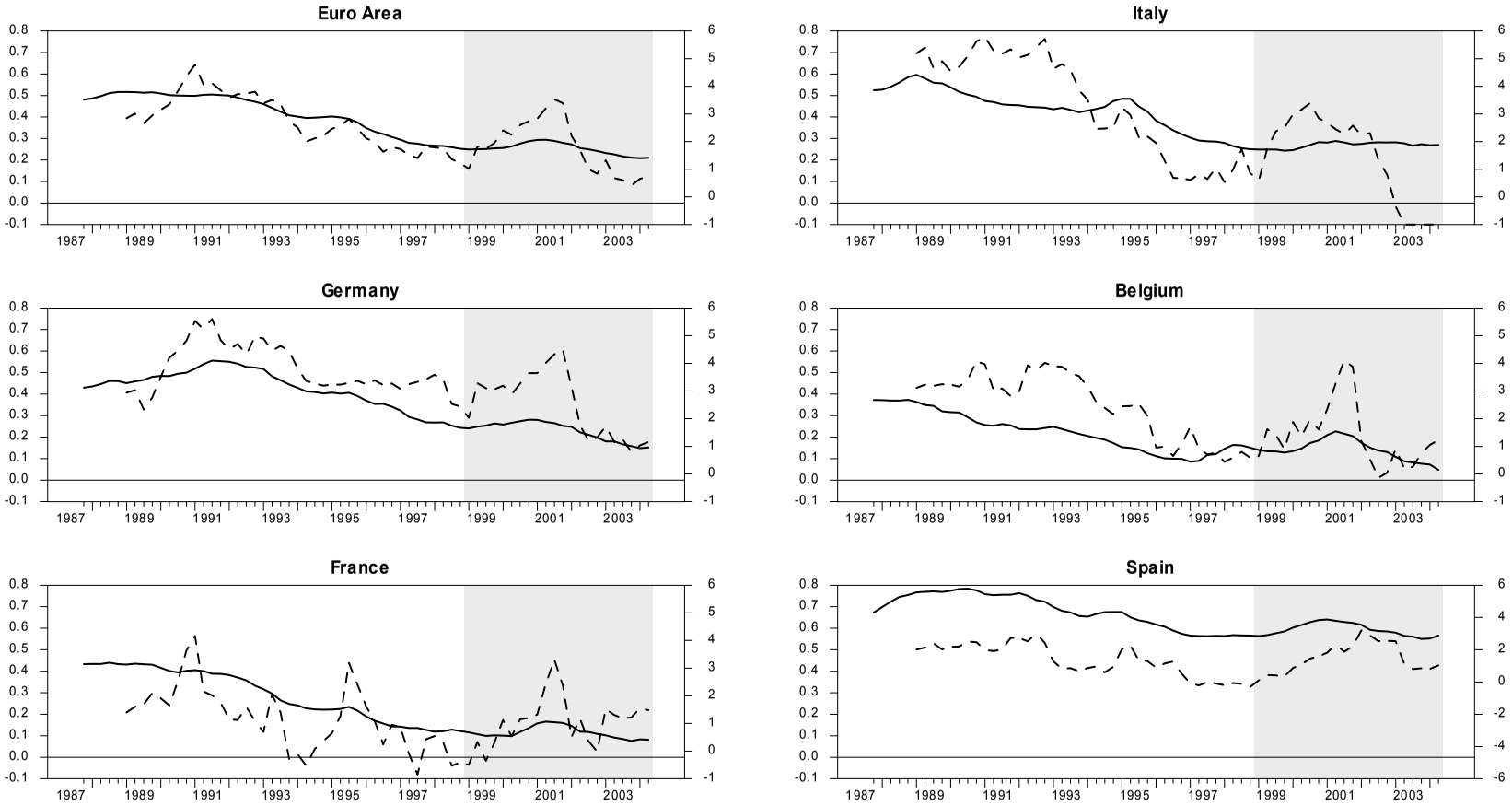


Figure 10 - Inflation expectations and inflation persistence

Cross-correlation

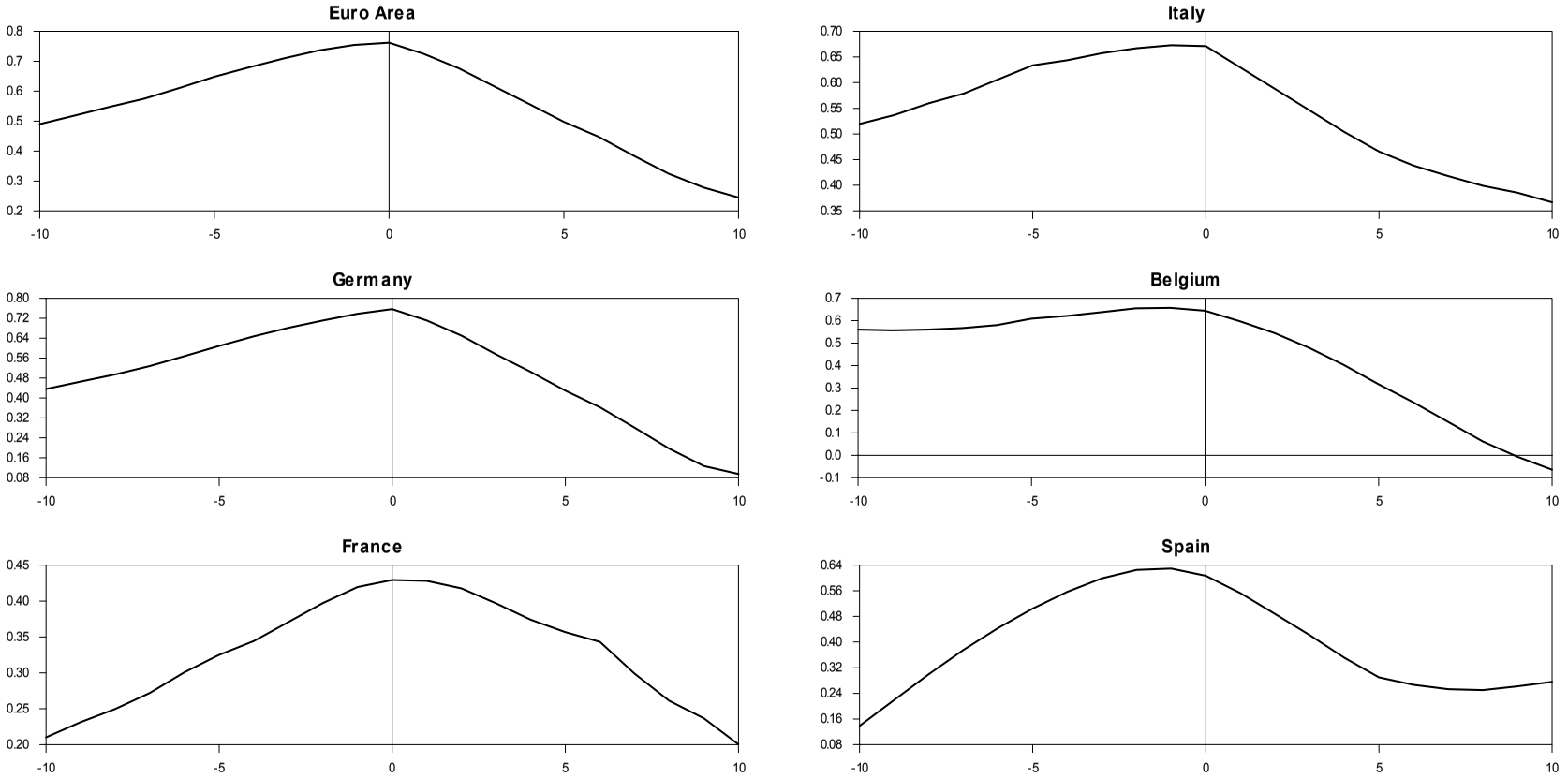


Figure 11 - Current inflation and inflation persistence in EMU countries

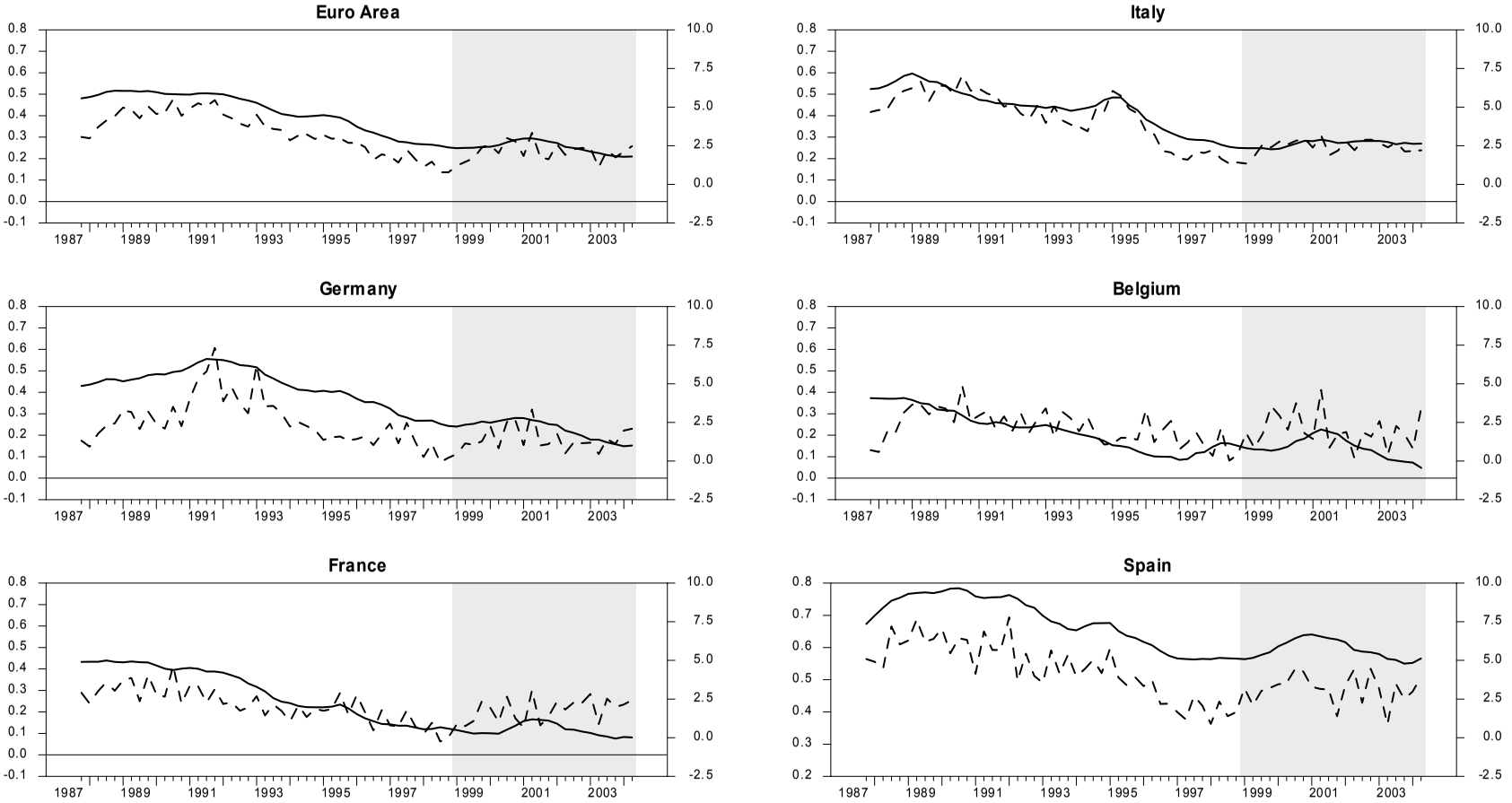


Figure 12 - Current Inflation and inflation persistence

Cross-correlation

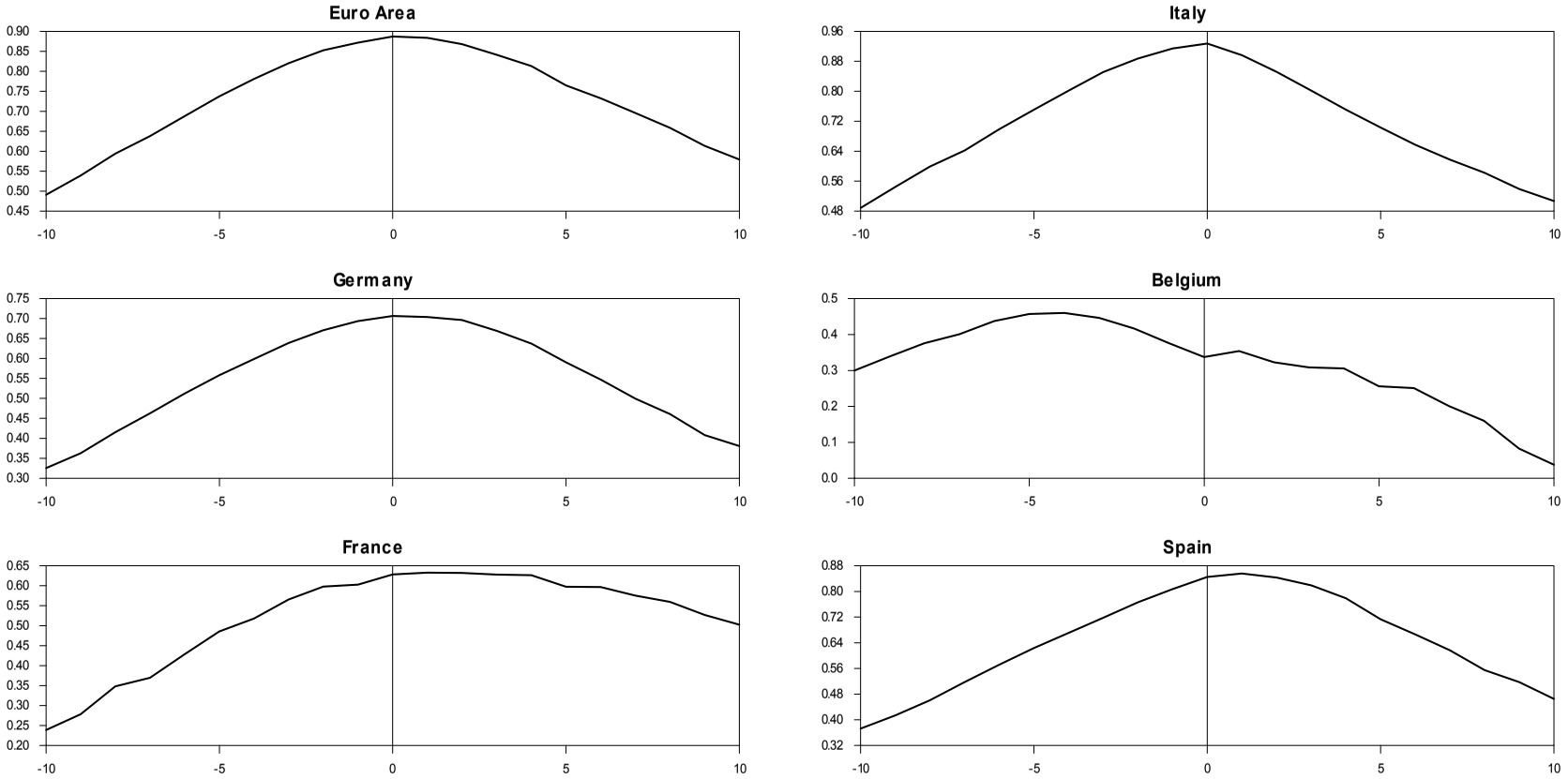


Figure 13 - Inflation (current and expected) and inflation persistence

Cross-correlation

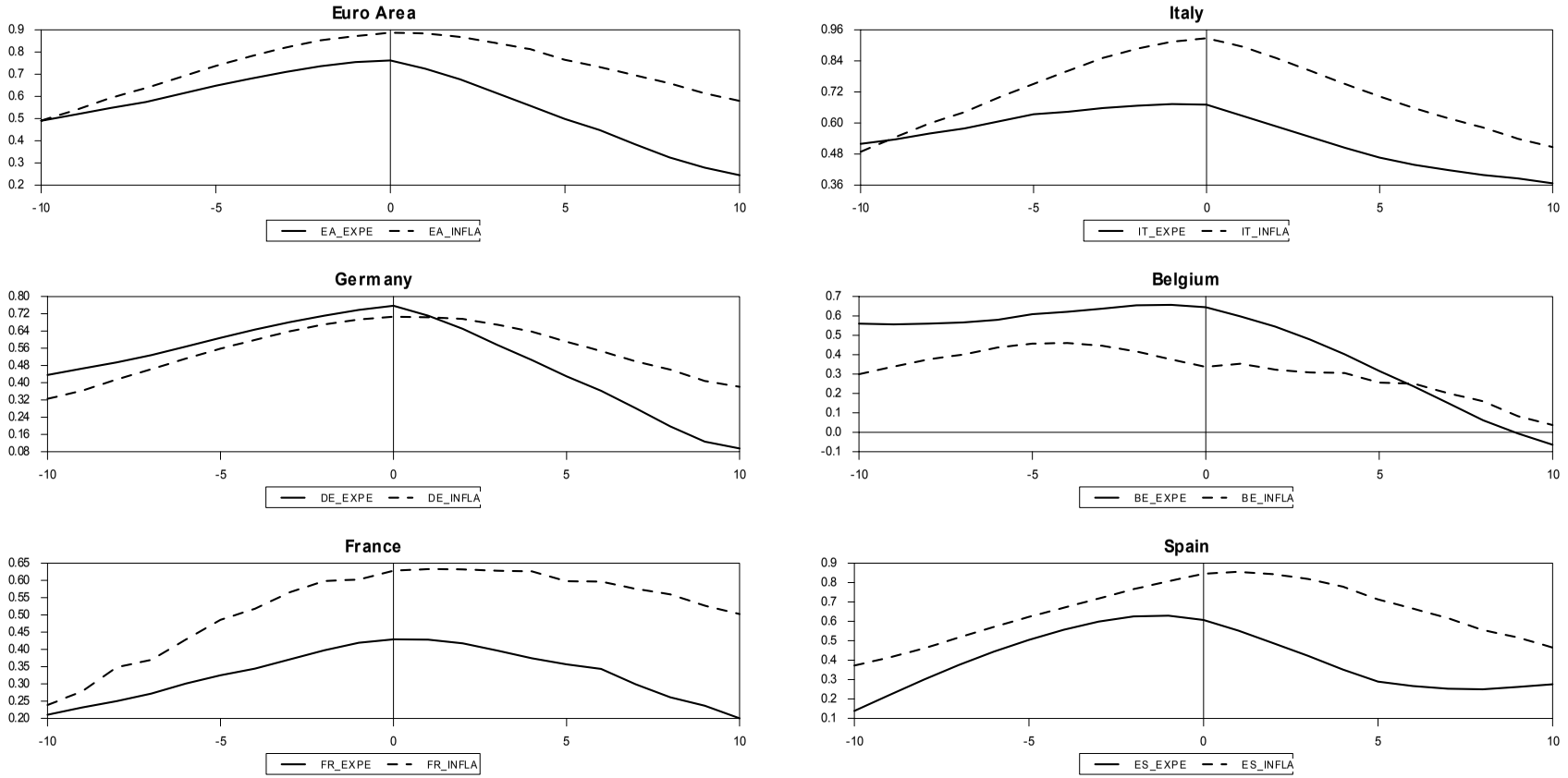


Figure 14 - Time-varying persistence measure

US sectors

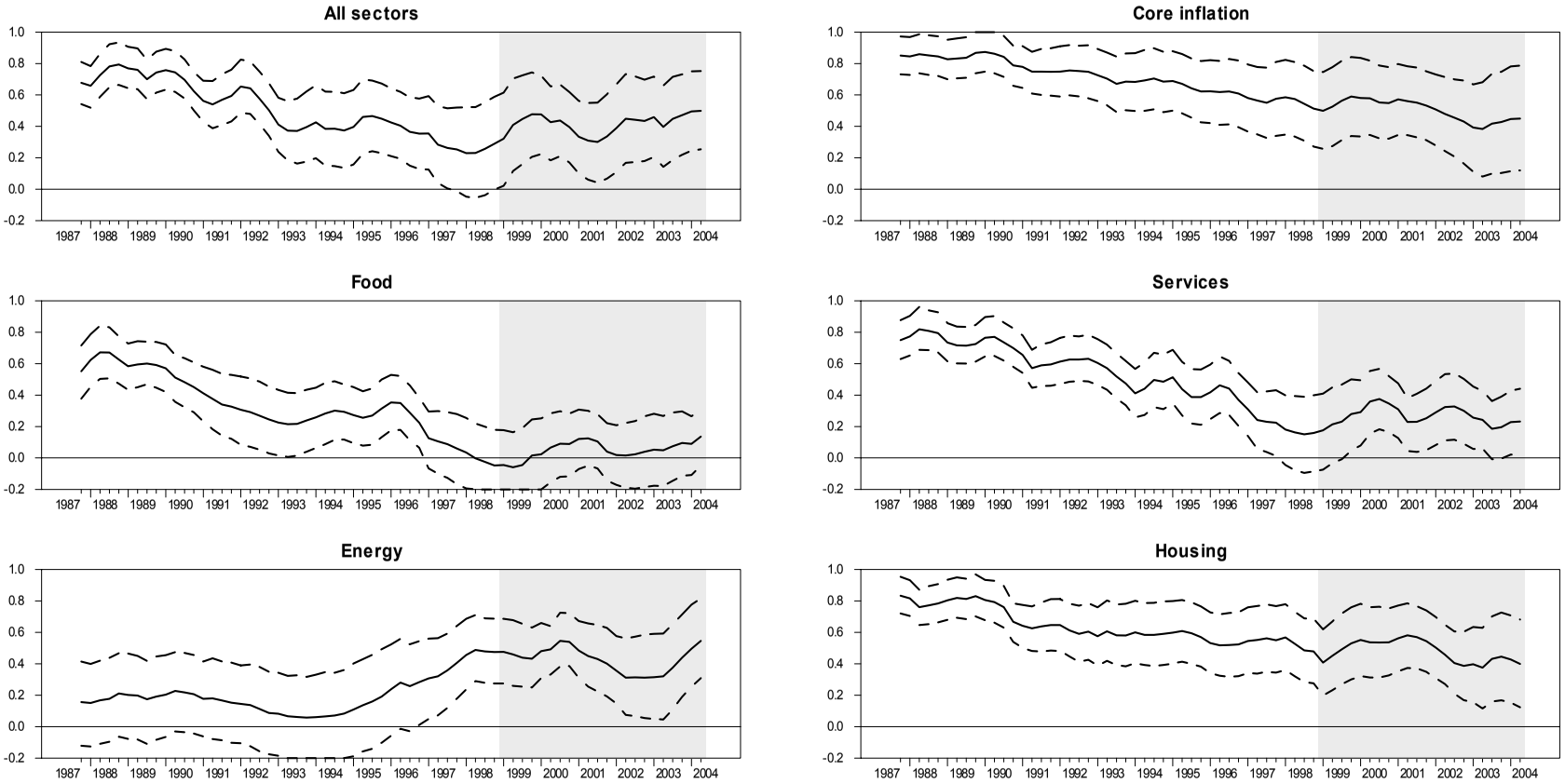


Figure 15 - Time-varying persistence measure

EMU and US sectors

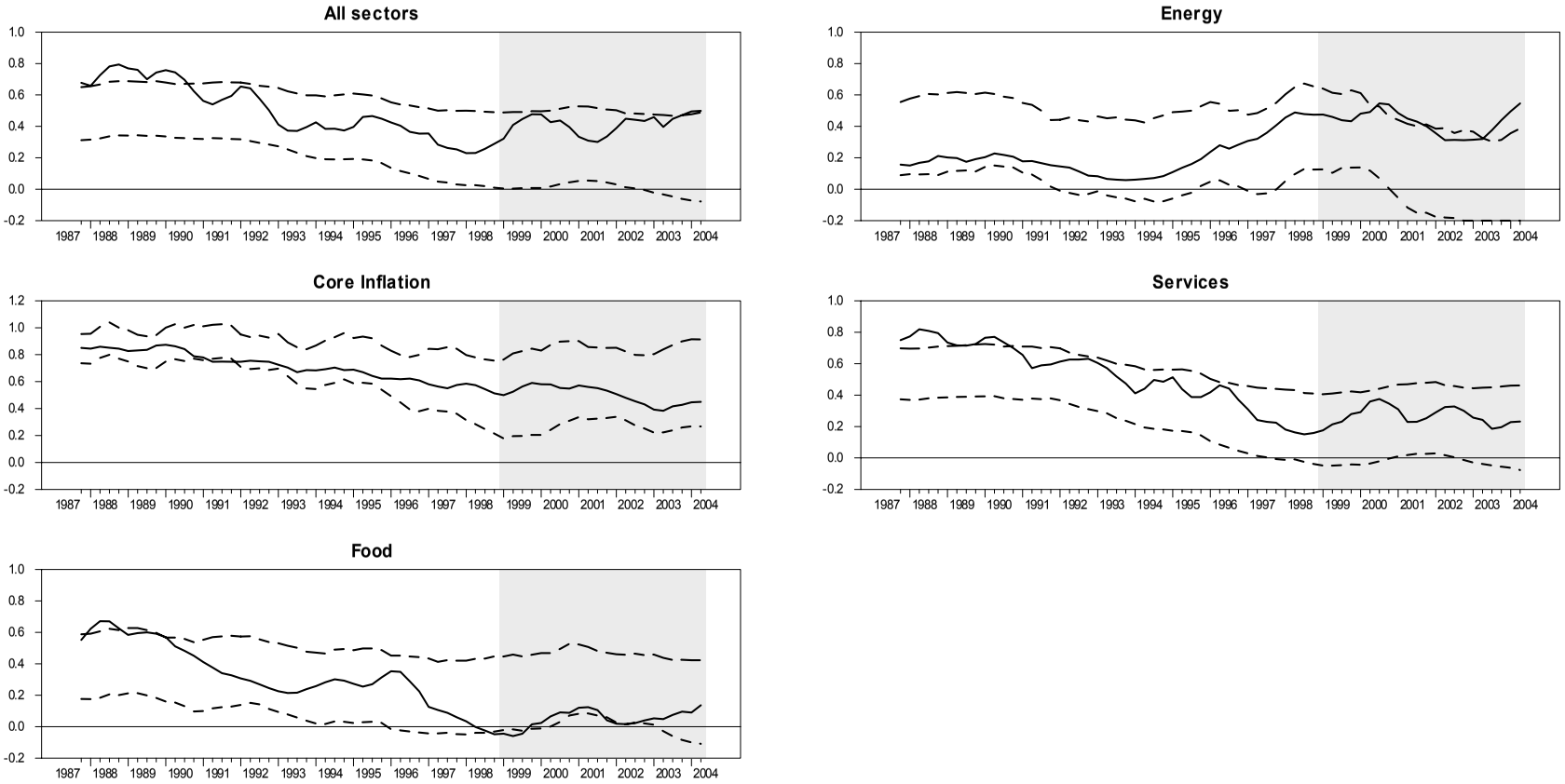


Figure 16 - Time-varying persistence

Aggregate. All countries

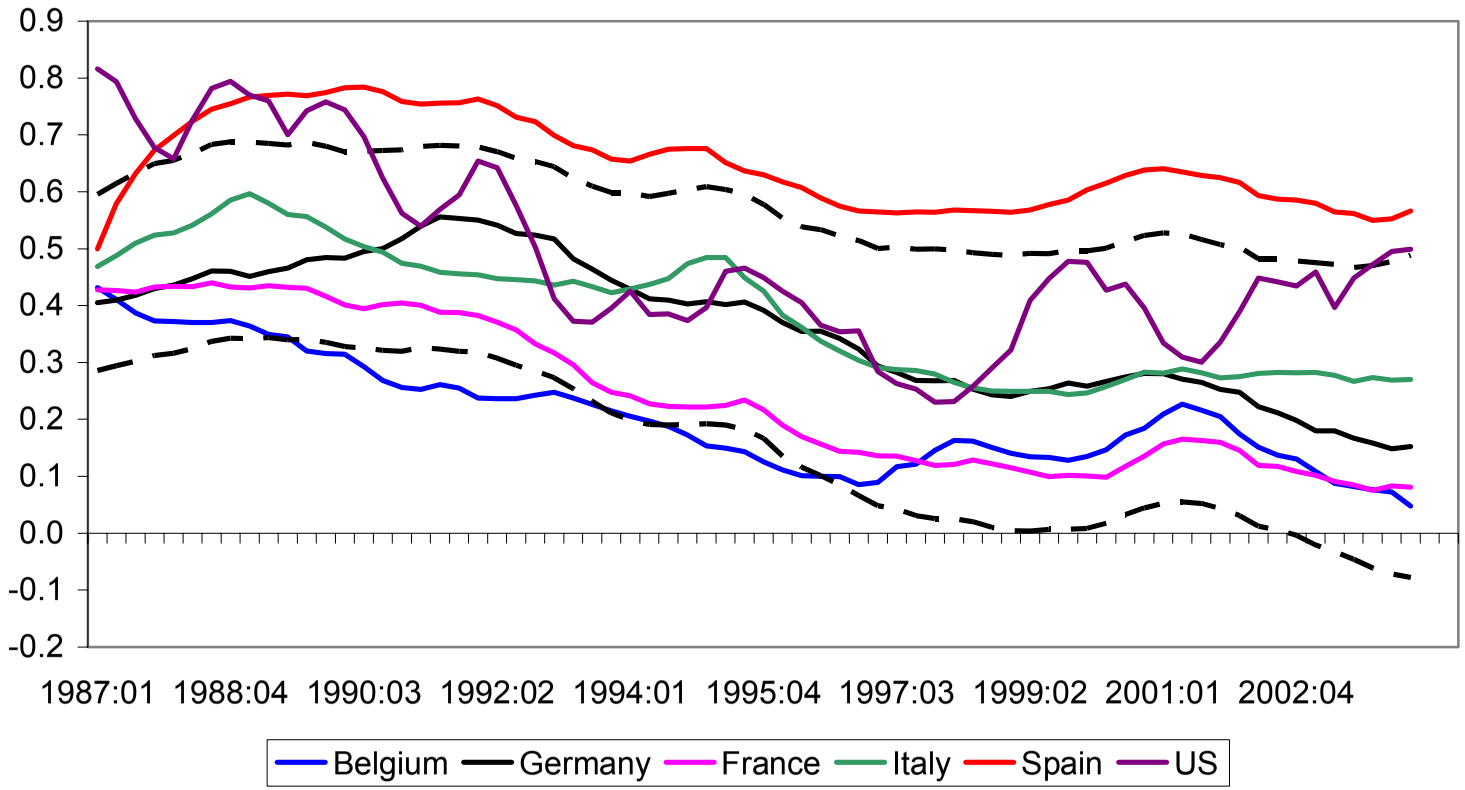


Table 1 - Correlation between inflation based on sample and HICP inflation

	Euro Area 1 (1994-3 to 2001-4)	**Euro Area 2** (1996-1 to 2001-4)	**Euro Area 3** (1998-1 to 2001-4)	**Euro Area 4** (1998-1 to 2003-4)
T	0.82	0.89	0.83	0.68
C	0.69	0.64	0.59	0.48
UPF	0.63	0.71	0.82	0.78
EN	0.97	0.95	0.95	0.93
PF	0.43	0.68	0.65	0.68
NEIG	0.49	0.45	0.43	0.49
Serv	0.59	0.58	0.45	0.26

Table 2 - Inflation calculated on the basis of 50 common products

		Period 1994-1 to 1995-4	Period 1996-1 to 1998-4	Period 1999-1 to 2003-4, excluding 2001-3 to 2002-2	Period 2001-3 to 2002-2	Delta - second subperiod	Delta - third subperiod	Delta - fourth subperiod
		(1)	(2)	(3)	(4)	(2)-(1)	(3)-(2)	(4)-(3)
Spain	Total							
(94/01 - 01/12)	Core	0.041	0.021	0.028	0.036	**-0.020**	**0.007**	0.008
	UNP	0.049	0.014	0.070	0.035	-0.035	0.056	-0.036
	EN							
	PF	0.028	0.002	0.012	0.060	**-0.027**	0.011	0.048
	NEIG	0.030	0.014	0.019	0.026	**-0.016**	0.005	0.007
	SER	0.054	0.032	0.040	0.042	**-0.022**	**0.008**	0.003
Germany	Total		0.004	0.016	0.011		0.012	-0.005
(98/02 - 04/01)	Core		0.009	0.007	0.024		-0.003	**0.017**
	UNP		0.007	0.029	-0.106		0.022	-0.135
	EN		-0.053	0.109	-0.056		0.161	**-0.165**
	PF		-0.007	0.005	-0.003		0.012	-0.008
	NEIG		0.004	-0.001	0.012		-0.005	**0.013**
	SER		0.016	0.012	0.038		-0.005	**0.026**
France	Total	0.009	-0.010	-0.001	-0.015	**-0.019**	0.009	-0.014
(94/08 - 03/02)	Core	0.010	-0.014	-0.017	-0.007	**-0.024**	-0.003	0.010
	UNP	-0.006	0.001	0.019	0.002	0.007	0.018	-0.018
	EN	0.020	0.009	0.125	-0.099	-0.011	0.116	-0.225
	PF	0.055	0.003	0.009	0.006	**-0.051**	0.006	-0.003
	NEIG	-0.030	-0.053	-0.066	-0.062	**-0.023**	-0.013	0.004
	SER	0.027	0.013	0.014	0.034	**-0.015**	0.001	**0.020**
Italy	Total		0.016	0.024	0.024		**0.008**	0.001
(96/02 - 03/12)	Core		0.019	0.022	0.029		0.003	0.008
	UNP		-0.007	0.021	0.019		**0.028**	-0.001
	EN		-0.007	0.055	-0.042		0.062	**-0.097**
	PF		0.013	0.019	0.024		0.006	0.005
	NEIG		0.017	0.015	0.022		-0.002	0.007
	SER		0.022	0.028	0.038		0.006	0.010
Belgium	Total	-0.011	-0.012	0.013	0.004	0.000	0.024	-0.009
(94/01 - 03/12)	Core	0.010	0.000	0.009	0.023	**-0.009**	**0.008**	**0.014**
	UNP	-0.149	-0.097	-0.029	-0.020	0.053	0.068	0.009
	EN	-0.027	-0.016	0.083	-0.106	0.012	0.098	-0.189
	PF	0.003	-0.023	-0.015	0.011	-0.026	0.009	0.025
	NEIG	-0.001	-0.006	0.002	0.006	**-0.005**	**0.008**	0.004
	SER	0.024	0.020	0.028	0.049	-0.005	**0.008**	**0.021**
Austria	Total		0.004	0.006	-0.018		0.002	**-0.024**
(96/02 - 03/12)	Core		0.004	-0.001	-0.007		-0.004	-0.006
	UNP		0.043	0.030	-0.138		-0.013	-0.168
	EN		-0.015	0.067	-0.077		0.082	**-0.144**
	PF		0.003	-0.006	-0.016		-0.010	-0.010
	NEIG		-0.008	-0.021	-0.024		-0.013	-0.003
	SER		0.016	0.023	0.014		0.007	-0.010
Euro Area 1	Total	0.005	-0.010	-0.002	-0.015	**-0.015**	0.009	-0.013
(1994-3 to 2001-4	Core	0.041	0.021	0.028	0.038	**-0.020**	0.007	**0.010**
	UNP	-0.008	-0.006	0.019	-0.001	0.002	0.025	-0.020
	EN	0.007	0.006	0.102	-0.191	-0.001	0.097	-0.294
	PF	0.049	0.000	0.005	0.030	**-0.049**	0.005	0.025
	NEIG	-0.011	-0.030	-0.034	-0.023	**-0.019**	-0.004	0.011
	SER	0.034	0.019	0.021	0.041	**-0.015**	0.002	0.020
Euro Area 4	Total		0.003	0.018	0.014		0.015	-0.004
(1998-1 to 2003-4	Core		-0.016	0.083	-0.106		0.098	-0.189
	UNP		-0.009	0.023	-0.063		0.032	-0.086
	EN		-0.052	0.088	-0.056		0.141	-0.144
	PF		-0.007	0.007	0.005		0.014	**-0.002**
	NEIG		0.005	0.003	0.013		-0.002	0.010
	SER		0.015	0.018	0.037		0.003	**0.019**

Table 3 - HICP Inflation based on complete basket

		Period 1994-1 to 1995-4	Period 1996-1 to 1998-4	Period 1999-1 to 2003-4, excluding 2001-3 to 2002-2	Period 2001-3 to 2002-2	Delta - second subperiod	Delta - third subperiod	Delta - fourth subperiod
		(1)	(2)	(3)	(4)	(2)-(1)	(3)-(2)	(4)-(3)
Spain	Total							
(94/01 - 01/12)	Core	0.041	0.021	0.028	0.036	**-0.020**	**0.007**	0.008
	UNP	0.049	0.014	0.070	0.035	-0.035	0.056	-0.036
	EN							
	PF	0.028	0.002	0.012	0.060	**-0.027**	0.011	**0.048**
	NEIG	0.030	0.014	0.019	0.026	**-0.016**	0.005	0.007
	SER	0.054	0.032	0.040	0.042	**-0.022**	**0.008**	0.003
Germany	Total		0.003	0.016	0.008		0.013	-0.007
(98/02 - 04/01)	Core		0.003	0.008	0.015		0.005	0.007
	UNP		-0.008	0.022	-0.037		0.030	**-0.059**
	EN		-0.036	0.080	-0.028		0.116	**-0.108**
	PF		0.016	0.012	0.022		-0.003	0.009
	NEIG		0.008	-0.002	0.005		**-0.010**	0.007
	SER		-0.004	0.014	0.021		0.019	0.007
France	Total	0.017	0.011	0.020	0.015	-0.007	0.009	-0.005
(94/08 - 03/02)	Core	0.019	0.011	0.012	0.022	-0.008	0.002	0.009
	UNP	0.005	0.018	0.038	0.011	0.012	0.021	-0.027
	EN	0.015	0.003	0.071	-0.054	-0.012	**0.067**	**-0.125**
	PF	0.030	0.018	0.030	0.034	-0.013	**0.012**	0.004
	NEIG	0.006	0.003	0.004	0.009	-0.003	0.001	0.005
	SER	0.028	0.015	0.013	0.028	**-0.013**	-0.001	0.015
Italy	Total		0.020	0.026	0.022		0.005	-0.004
(96/02 - 03/12)	Core		0.023	0.022	0.026		-0.001	0.004
	UNP		0.013	0.036	0.041		**0.023**	0.005
	EN		-0.005	0.051	-0.049		**0.056**	**-0.100**
	PF		0.015	0.023	0.020		0.008	-0.003
	NEIG		0.019	0.017	0.022		-0.001	0.004
	SER		0.030	0.026	0.033		-0.004	**0.006**
Belgium	Total	0.016	0.012	0.023	0.008	-0.004	0.011	-0.015
(94/01 - 03/12)	Core	0.018	0.013	0.016	0.022	-0.006	0.003	0.006
	UNP	0.008	0.019	0.029	-0.004	0.011	0.010	-0.033
	EN	0.006	0.002	0.065	-0.083	-0.004	0.063	**-0.148**
	PF	0.017	0.014	0.017	0.017	-0.002	0.003	0.000
	NEIG	0.012	0.006	0.011	0.016	-0.006	0.005	0.005
	SER	0.027	0.020	0.020	0.028	-0.007	0.001	0.007
Austria	Total		0.009	0.018	0.015		0.009	-0.003
(96/02 - 03/12)	Core		0.010	0.014	0.022		0.005	0.008
	UNP		0.015	0.041	-0.018		0.026	**-0.059**
	EN		0.001	0.047	-0.053		0.045	**-0.099**
	PF		0.010	0.015	0.015		0.006	0.000
	NEIG		-0.003	0.006	0.010		0.008	0.004
	SER		0.021	0.020	0.035		-0.001	**0.015**
Euro Area 1	Total	0.016	0.011	0.018	0.009	**-0.005**	0.007	-0.009
(1994-3 to 2001-4	Core	0.045	0.023	0.027	0.041	**-0.022**	0.004	0.014
	UNP	0.017	0.019	0.043	0.002	0.002	0.025	-0.041
	EN	0.010	0.003	0.064	-0.101	-0.007	**0.060**	**-0.165**
	PF	0.037	0.015	0.023	0.040	**-0.021**	0.008	**0.017**
	NEIG	0.014	0.007	0.008	0.020	**-0.007**	0.001	0.012
	SER	0.033	0.021	0.017	0.031	**-0.012**	-0.004	0.013
Euro Area 4	Total		0.011	0.018	0.009		0.007	-0.009
(1998-1 to 2003-4	Core		0.014	0.015	0.028		0.001	0.013
	UNP		0.019	0.043	0.002		0.025	-0.041
	EN		0.003	0.064	-0.101		0.060	-0.165
	PF		0.015	0.023	0.040		0.008	0.017
	NEIG		0.007	0.008	0.020		0.001	0.012
	SER		0.021	0.017	0.031		-0.004	0.013

Table 4 - Frequency of price changes

		Period 1994-1 to 1995-4	Period 1996-1 to 1998-4	Period 1999-1 to 2003-4, excluding 2001 3 to 2002-2	Period 2001-3 to 2002-2	Delta - second subperiod	Delta - third subperiod	Delta - fourth subperiod
		(1)	(2)	(3)	(4)	(2)-(1)	(3)-(2)	(4)-(3)
Spain	Total							
(94/01 - 01/12)	Core	0.082	0.069	0.071	0.079	**-0.013**	0.002	0.008
	UNP	0.508	0.493	0.489	0.498	**-0.015**	-0.004	0.009
	EN							
	PF	0.177	0.178	0.181	0.220	0.001	0.002	**0.039**
	NEIG	0.079	0.068	0.066	0.069	**-0.012**	-0.002	0.004
	SER	0.066	0.050	0.056	0.063	**-0.017**	**0.007**	0.007
Germany	Total		0.130	0.137	0.183		0.007	**0.045**
(98/02 - 04/01)	Core		0.052	0.055	0.103		0.002	**0.048**
	UNP		0.258	0.290	0.329		**0.032**	**0.039**
	EN		0.872	0.916	0.933		**0.043**	0.018
	PF		0.071	0.104	0.127		**0.033**	**0.024**
	NEIG		0.054	0.064	0.113		0.009	**0.049**
	SER		0.047	0.038	0.091		-0.009	0.054
France	Total	0.196	0.205	0.233	0.262	0.009	**0.027**	**0.029**
(94/08 - 03/02)	Core	0.136	0.133	0.155	0.190	-0.003	**0.021**	**0.036**
	UNP	0.227	0.279	0.260	0.300	**0.052**	-0.019	**0.040**
	EN	0.687	0.747	0.874	0.834	**0.060**	**0.128**	-0.040
	PF	0.205	0.196	0.217	0.216	-0.009	**0.021**	-0.001
	NEIG	0.153	0.177	0.209	0.241	**0.024**	**0.032**	**0.032**
	SER	0.096	0.074	0.086	0.138	**-0.022**	**0.012**	**0.052**
Italy	Total		0.090	0.119	0.140		**0.029**	**0.021**
(96/02 - 03/12)	Core		0.058	0.064	0.086		0.006	**0.022**
	UNP		0.194	0.211	0.235		**0.017**	**0.024**
	EN		0.440	0.819	0.815		**0.379**	-0.005
	PF		0.095	0.096	0.132		0.002	0.036
	NEIG		0.060	0.062	0.077		0.002	0.014
	SER		0.046	0.056	0.081		**0.010**	0.025
Belgium	Total	0.164	0.174	0.196	0.218	0.010	**0.022**	**0.022**
(94/01 - 03/12)	Core	0.082	0.073	0.076	0.106	-0.010	0.004	**0.029**
	UNP	0.301	0.327	0.346	0.347	**0.026**	**0.019**	0.002
	EN	0.611	0.741	0.895	0.887	**0.130**	**0.154**	-0.008
	PF	0.202	0.190	0.190	0.209	-0.012	0.000	0.019
	NEIG	0.063	0.058	0.061	0.090	-0.006	0.004	**0.029**
	SER	0.045	0.031	0.037	0.071	-0.013	0.006	**0.034**
Austria	Total		0.131	0.154	0.178		**0.024**	**0.023**
(96/02 - 03/12)	Core		0.070	0.082	0.108		**0.012**	**0.026**
	UNP		0.489	0.476	0.544		-0.013	**0.068**
	EN		0.622	0.798	0.765		**0.177**	-0.034
	PF		0.125	0.150	0.207		**0.026**	**0.056**
	NEIG		0.060	0.065	0.077		0.005	0.012
	SER		0.061	0.076	0.105		**0.015**	**0.029**
Euro Area 1	Total	0.189	0.201	0.229	0.263	**0.011**	**0.028**	0.035
(1994-3 to 2001-4)	Core	0.114	0.109	0.123	0.152	-0.005	**0.014**	**0.028**
	UNP	0.311	0.343	0.333	0.388	**0.032**	-0.010	0.055
	EN	0.672	0.746	0.888	0.892	**0.074**	0.142	0.003
	PF	0.198	0.191	0.207	0.252	-0.007	0.017	0.044
	NEIG	0.123	0.135	0.153	0.176	**0.012**	**0.018**	0.023
	SER	0.080	0.063	0.072	0.102	**-0.017**	0.010	**0.030**
Euro Area 4	Total		0.120	0.136	0.171		**0.017**	0.035
(1998-1 to 2003-4)	Core		0.109	0.123	0.152		0.014	**0.028**
	UNP		0.249	0.278	0.312		0.029	0.033
	EN		0.724	0.878	0.884		**0.154**	0.006
	PF		0.083	0.109	0.138		**0.026**	0.029
	NEIG		0.057	0.063	0.098		0.006	**0.035**
	SER		0.045	0.045	0.087		0.000	**0.042**

Table 5 - Frequency of price increases

		Period 1994-1 to 1995-4	Period 1996-1 to 1998-4	Period 1999-1 to 2003-4, excluding 2001-3 to 2002-2	Period 2001-3 to 2002-2	Delta - second subperiod	Delta - third subperiod	Delta - fourth subperiod
		(1)	(2)	(3)	(4)	(2)-(1)	(3)-(2)	(4)-(3)
Spain	Total							
(94/01 - 01/12)	Core	0.064	0.050	0.053	0.062	**-0.014**	0.003	0.008
	UNP	0.272	0.255	0.269	0.254	-0.017	0.014	-0.014
	EN							
	PF	0.110	0.096	0.105	0.153	**-0.015**	0.009	0.048
	NEIG	0.062	0.049	0.048	0.055	**-0.013**	-0.001	0.006
	SER	0.059	0.042	0.049	0.053	-0.016	**0.006**	0.004
Germany	Total		0.068	0.081	0.103		0.013	0.022
(98/02 - 04/01)	Core		0.037	0.034	0.066		-0.002	**0.032**
	UNP		0.131	0.155	0.162		0.024	0.006
	EN		0.360	0.524	0.446		0.164	-0.078
	PF		0.034	0.054	0.055		**0.021**	0.000
	NEIG		0.036	0.037	0.066		0.001	**0.030**
	SER		0.038	0.028	0.069		-0.010	0.041
France	Total	0.104	0.095	0.125	0.118	-0.008	**0.030**	-0.007
(94/08 - 03/02)	Core	0.071	0.057	0.067	0.092	**-0.014**	**0.010**	**0.024**
	UNP	0.118	0.149	0.144	0.155	**0.031**	-0.004	0.011
	EN	0.378	0.368	0.599	0.308	-0.010	**0.231**	**-0.291**
	PF	0.112	0.098	0.122	0.114	-0.014	**0.024**	-0.008
	NEIG	0.051	0.052	0.064	0.079	0.000	**0.013**	**0.015**
	SER	0.072	0.047	0.050	0.093	-0.025	0.003	**0.044**
Italy	Total		0.046	0.072	0.074		**0.027**	0.002
(96/02 - 03/12)	Core		0.032	0.039	0.052		**0.006**	**0.014**
	UNP		0.094	0.118	0.127		**0.024**	0.009
	EN		0.189	0.507	0.338		**0.318**	**-0.169**
	PF		0.046	0.056	0.058		0.010	0.001
	NEIG		0.030	0.031	0.042		0.001	**0.011**
	SER		0.030	0.040	0.060		**0.010**	**0.020**
Belgium	Total	0.091	0.087	0.114	0.103	-0.004	**0.027**	-0.011
(94/01 - 03/12)	Core	0.055	0.044	0.048	0.071	-0.011	0.004	**0.023**
	UNP	0.157	0.171	0.193	0.189	0.014	**0.022**	-0.005
	EN	0.313	0.338	0.546	0.288	0.025	**0.209**	**-0.259**
	PF	0.115	0.101	0.100	0.111	-0.014	-0.001	0.011
	NEIG	0.040	0.032	0.037	0.058	-0.008	0.005	**0.022**
	SER	0.043	0.030	0.035	0.064	-0.013	0.005	0.030
Austria	Total		0.069	0.092	0.085		**0.024**	-0.007
(96/02 - 03/12)	Core		0.043	0.051	0.062		**0.007**	0.011
	UNP		0.256	0.252	0.264		-0.004	0.012
	EN		0.248	0.476	0.255		**0.228**	**-0.221**
	PF		0.065	0.075	0.093		0.010	**0.018**
	NEIG		0.033	0.037	0.041		0.005	0.003
	SER		0.047	0.056	0.072		0.009	**0.016**
Euro Area 1	Total	0.099	0.094	0.122	0.117	-0.004	**0.028**	-0.005
(1994-3 to 2001-4	Core	0.067	0.054	0.061	0.084	**-0.013**	**0.007**	**0.023**
	UNP	0.163	0.180	0.184	0.201	**0.017**	0.003	0.017
	EN	0.355	0.364	0.584	0.251	0.008	**0.220**	**-0.333**
	PF	0.113	0.098	0.116	0.147	**-0.015**	0.018	**0.031**
	NEIG	0.052	0.049	0.057	0.073	-0.003	**0.009**	0.016
	SER	0.063	0.044	0.047	0.076	**-0.019**	0.003	**0.029**
Euro Area 4	Total		0.057	0.081	0.093		**0.024**	0.012
(1998-1 to 2003-4	Core		0.054	0.061	0.084		0.007	**0.023**
	UNP		0.128	0.151	0.158		0.023	0.007
	EN		0.245	0.518	0.392		**0.273**	-0.126
	PF		0.039	0.059	0.061		0.020	0.002
	NEIG		0.033	0.035	0.057		0.002	**0.022**
	SER		0.034	0.034	0.066		0.000	**0.033**

Table 6 - Frequency of price decreases

		Period 1994-1 to 1995-4	Period 1996-1 to 1998-4	Period 1999-1 to 2003-4, excluding 2001-3 to 2002-2	Period 2001-3 to 2002-2	Delta - second subperiod	Delta - third subperiod	Delta - fourth subperiod
		(1)	(2)	(3)	(4)	(2)-(1)	(3)-(2)	(4)-(3)
Spain	Total							
(94/01 - 01/12)	Core	0.017	0.019	0.018	0.017	**0.002**	-0.001	-0.001
	UNP	0.235	0.238	0.220	0.242	0.002	**-0.017**	0.022
	EN							
	PF	0.067	0.082	0.076	0.069	**0.016**	-0.007	-0.007
	NEIG	0.018	0.019	0.017	0.015	0.001	-0.001	-0.003
	SER	0.008	0.007	0.007	0.010	-0.001	0.000	0.003
Germany	Total		0.062	0.057	0.080		-0.006	**0.023**
(98/02 - 04/01)	Core		0.016	0.020	0.036		0.005	**0.016**
	UNP		0.127	0.134	0.167		0.008	**0.032**
	EN		0.512	0.391	0.487		-0.121	0.096
	PF		0.037	0.050	0.073		**0.013**	**0.023**
	NEIG		0.019	0.027	0.047		**0.009**	**0.020**
	SER		0.009	0.010	0.022		0.001	0.012
France	Total	0.067	0.084	0.078	0.112	**0.017**	-0.005	**0.034**
(94/08 - 03/02)	Core	0.035	0.045	0.052	0.061	**0.010**	0.007	**0.009**
	UNP	0.105	0.124	0.107	0.139	**0.019**	**-0.016**	**0.032**
	EN	0.302	0.378	0.277	0.524	0.077	-0.101	**0.247**
	PF	0.080	0.086	0.086	0.092	0.006	0.000	0.007
	NEIG	0.047	0.068	0.082	0.098	**0.021**	**0.014**	**0.016**
	SER	0.008	0.011	0.016	0.019	**0.003**	0.005	0.004
Italy	Total		0.030	0.035	0.051		0.005	**0.016**
(96/02 - 03/12)	Core		0.011	0.012	0.018		0.002	**0.006**
	UNP		0.095	0.088	0.104		-0.007	0.016
	EN		0.239	0.305	0.470		0.066	**0.164**
	PF		0.032	0.028	0.036		-0.004	0.008
	NEIG		0.008	0.010	0.015		**0.002**	**0.004**
	SER		0.006	0.010	0.016		**0.003**	**0.006**
Belgium	Total	0.067	0.080	0.074	0.106	0.013	-0.006	**0.032**
(94/01 - 03/12)	Core	0.027	0.028	0.029	0.035	0.001	0.000	**0.007**
	UNP	0.144	0.156	0.152	0.159	0.012	-0.004	0.007
	EN	0.298	0.404	0.352	0.596	0.105	-0.051	**0.244**
	PF	0.088	0.089	0.090	0.098	0.002	0.001	0.008
	NEIG	0.024	0.026	0.025	0.032	0.002	-0.001	**0.007**
	SER	0.001	0.001	0.002	0.007	0.000	0.001	**0.005**
Austria	Total		0.062	0.063	0.092		0.001	**0.029**
(96/02 - 03/12)	Core		0.026	0.031	0.046		**0.005**	**0.015**
	UNP		0.232	0.225	0.280		-0.008	**0.055**
	EN		0.372	0.323	0.510		-0.050	**0.187**
	PF		0.060	0.075	0.114		**0.015**	**0.039**
	NEIG		0.027	0.028	0.036		0.001	0.008
	SER		0.014	0.020	0.033		0.006	0.013
Euro Area 1	Total	0.068	0.083	0.080	0.121	**0.016**	-0.003	**0.041**
(1994-3 to 2001-4	Core	0.029	0.036	0.041	0.044	**0.007**	0.004	0.004
	UNP	0.145	0.158	0.144	0.181	**0.013**	**-0.014**	**0.037**
	EN	0.308	0.382	0.303	0.648	0.074	-0.079	**0.345**
	PF	0.077	0.085	0.085	0.096	**0.008**	0.000	0.011
	NEIG	0.036	0.050	0.057	0.062	**0.013**	0.007	0.006
	SER	0.007	0.009	0.013	0.012	**0.002**	0.004	-0.001
Euro Area 4	Total		0.058	0.051	0.073		-0.007	**0.022**
(1998-1 to 2003-4	Core		0.036	0.041	0.044		0.004	**0.004**
	UNP		0.120	0.126	0.152		0.006	**0.027**
	EN		0.473	0.358	0.490		-0.115	0.132
	PF		0.040	0.047	0.065		0.006	0.018
	NEIG		0.017	0.022	0.035		0.005	**0.013**
	SER		0.009	0.010	0.019		0.001	0.010

Table 7 - Size of price changes

		Period 1994-1 to 1995-4	Period 1996-1 to 1998-4	Period 1999-1 to 2003-4, excluding 2001·3 to 2002-2	Period 2001-3 to 2002-2	Delta - second subperiod	Delta - third subperiod	Delta - fourth subperiod
		(1)	(2)	(3)	(4)	(2)-(1)	(3)-(2)	(4)-(3)
Spain	Total							
(94/01 - 01/12)	Core	0.083	0.075	0.075	0.086	**-0.008**	0.000	0.011
	UNP	0.152	0.145	0.151	0.152	**-0.007**	0.006	**0.001**
	EN							
	PF	0.080	0.070	0.071	0.059	**-0.010**	0.001	**-0.013**
	NEIG	0.073	0.065	0.065	0.061	**-0.008**	-0.001	-0.004
	SER	0.093	0.086	0.086	0.118	**-0.007**	0.000	0.031
Germany	Total		0.094	0.096	0.084		0.002	**-0.012**
(98/02 - 04/01)	Core		0.097	0.098	0.085		0.001	**-0.013**
	UNP		0.158	0.164	0.154		0.006	-0.010
	EN		0.024	0.038	0.038		**0.014**	0.001
	PF		0.105	0.104	0.089		-0.001	**-0.015**
	NEIG		0.116	0.129	0.096		0.013	**-0.033**
	SER		0.084	0.079	0.078		-0.005	-0.002
France	Total	0.083	0.092	0.092	0.078	**0.009**	0.000	**-0.014**
(94/08 - 03/02)	Core	0.082	0.093	0.090	0.074	**0.011**	-0.003	**-0.016**
	UNP	0.160	0.161	0.170	0.158	0.002	**0.008**	-0.012
	EN	0.017	0.020	0.032	0.032	**0.003**	**0.012**	-0.001
	PF	0.073	0.066	0.053	0.046	**-0.007**	-0.013	**-0.007**
	NEIG	0.114	0.133	0.133	0.107	**0.018**	0.000	**-0.025**
	SER	0.059	0.070	0.068	0.057	**0.010**	-0.001	**-0.011**
Italy	Total		0.079	0.074	0.069		-0.005	-0.005
(96/02 - 03/12)	Core		0.082	0.076	0.069		**-0.007**	-0.007
	UNP		0.076	0.075	0.082		-0.001	0.006
	EN		0.014	0.021	0.020		**0.007**	-0.001
	PF		0.064	0.056	0.048		**-0.009**	**-0.007**
	NEIG		0.072	0.062	0.057		**-0.009**	-0.006
	SER		0.096	0.094	0.084		-0.002	-0.010
Belgium	Total	0.058	0.058	0.068	0.061	0.000	**0.009**	**-0.006**
(94/01 - 03/12)	Core	0.059	0.058	0.067	0.057	-0.002	**0.009**	**-0.010**
	UNP	0.112	0.124	0.135	0.147	0.013	**0.011**	0.012
	EN	0.024	0.023	0.034	0.034	-0.001	**0.011**	0.000
	PF	0.070	0.061	0.062	0.063	-0.009	0.001	0.000
	NEIG	0.049	0.049	0.066	0.049	0.001	**0.016**	**-0.017**
	SER	0.066	0.065	0.071	0.064	-0.001	0.006	-0.007
Austria	Total		0.090	0.096	0.092		**0.006**	-0.004
(96/02 - 03/12)	Core		0.092	0.096	0.090		0.005	**-0.006**
	UNP		0.199	0.218	0.241		**0.019**	0.024
	EN		0.022	0.037	0.042		**0.015**	0.004
	PF		0.142	0.149	0.115		**0.007**	**-0.034**
	NEIG		0.111	0.117	0.122		0.007	0.005
	SER		0.056	0.058	0.051		0.002	**-0.008**
Euro Area 1	Total	0.080	0.087	0.087	0.078	**0.008**	0.000	-0.010
(1994-3 to 2001-4	Core	0.080	0.084	0.083	0.076	**0.005**	-0.001	-0.007
	UNP	0.152	0.153	0.157	0.149	0.001	0.004	-0.008
	EN	0.018	0.020	0.033	0.034	0.002	**0.012**	0.001
	PF	0.076	0.067	0.059	0.048	**-0.009**	**-0.008**	**-0.010**
	NEIG	0.096	0.105	0.106	0.095	**0.009**	0.000	-0.011
	SER	0.069	0.074	0.074	0.070	**0.005**	0.000	-0.003
Euro Area 4	Total		0.086	0.088	0.078		0.002	-0.009
(1998-1 to 2003-4	Core		0.084	0.083	0.076		-0.001	-0.007
	UNP		0.128	0.139	0.134		0.011	-0.004
	EN		0.021	0.032	0.033		**0.012**	**0.000**
	PF		0.090	0.088	0.076		-0.001	**-0.013**
	NEIG		0.098	0.103	0.082		0.006	**-0.021**
	SER		0.084	0.082	0.077		-0.002	-0.005

Table 8 - Size of price increases

		Period 1994-1 to 1995-4	Period 1996-1 to 1998-4	Period 1999-1 to 2003-4, excluding 2001-3 to 2002-2	Period 2001-3 to 2002-2	Delta - second subperiod	Delta - third subperiod	Delta - fourth subperiod
		(1)	(2)	(3)	(4)	(2)-(1)	(3)-(2)	(4)-(3)
Spain	Total							
(94/01 - 01/12)	Core	0.079	0.070	0.071	0.085	**-0.009**	0.002	0.014
	UNP	0.144	0.137	0.145	0.151	**-0.007**	**0.008**	0.005
	EN							
	PF	0.075	0.066	0.066	0.055	**-0.009**	0.000	-0.011
	NEIG	0.066	0.058	0.061	0.058	**-0.008**	0.003	-0.002
	SER	0.092	0.083	0.084	0.120	**-0.010**	0.001	0.037
Germany	Total		0.081	0.084	0.078		0.003	-0.005
(98/02 - 04/01)	Core		0.083	0.085	0.081		0.002	-0.004
	UNP		0.147	0.152	0.132		0.005	**-0.020**
	EN		0.020	0.032	0.026		**0.012**	**-0.006**
	PF		0.100	0.104	0.094		0.004	**-0.010**
	NEIG		0.097	0.108	0.090		0.011	**-0.017**
	SER		0.071	0.067	0.072		-0.004	0.005
France	Total	0.072	0.081	0.079	0.068	**0.009**	-0.002	**-0.011**
(94/08 - 03/02)	Core	0.069	0.080	0.076	0.064	**0.011**	-0.004	**-0.012**
	UNP	0.152	0.153	0.156	0.144	0.001	0.003	-0.012
	EN	0.015	0.017	0.029	0.023	0.002	**0.011**	**-0.005**
	PF	0.070	0.062	0.047	0.043	**-0.009**	**-0.015**	-0.003
	NEIG	0.089	0.114	0.108	0.092	**0.025**	-0.006	**-0.016**
	SER	0.053	0.059	0.061	0.050	**0.006**	0.001	**-0.011**
Italy	Total		0.075	0.069	0.066		**-0.006**	-0.003
(96/02 - 03/12)	Core		0.079	0.072	0.068		**-0.007**	-0.004
	UNP		0.072	0.072	0.078		0.000	0.006
	EN		0.015	0.019	0.018		**0.004**	-0.001
	PF		0.065	0.055	0.054		**-0.010**	-0.001
	NEIG		0.070	0.061	0.059		**-0.009**	-0.003
	SER		0.091	0.086	0.080		-0.005	-0.006
Belgium	Total	0.042	0.043	0.062	0.058	0.000	**0.019**	-0.004
(94/01 - 03/12)	Core	0.046	0.045	0.063	0.056	-0.001	**0.018**	**-0.006**
	UNP	0.066	0.077	0.106	0.129	0.010	**0.029**	**0.023**
	EN	0.010	0.012	0.038	0.022	0.002	**0.026**	**-0.016**
	PF	0.043	0.037	0.052	0.063	**-0.006**	**0.015**	**0.011**
	NEIG	0.035	0.033	0.061	0.046	-0.002	**0.029**	**-0.016**
	SER	0.060	0.062	0.069	0.066	0.002	**0.007**	-0.004
Austria	Total		0.075	0.080	0.073		0.005	**-0.007**
(96/02 - 03/12)	Core		0.075	0.079	0.070		0.004	**-0.009**
	UNP		0.187	0.208	0.219		**0.021**	0.012
	EN		0.024	0.032	0.037		**0.009**	0.005
	PF		0.134	0.144	0.119		0.009	**-0.025**
	NEIG		0.082	0.082	0.074		0.000	-0.008
	SER		0.049	0.054	0.050		0.005	-0.004
Euro Area 1	Total	0.068	0.076	0.074	0.069	**0.008**	-0.002	-0.005
(1994-3 to 2001-4	Core	0.069	0.073	0.071	0.070	**0.004**	-0.002	-0.002
	UNP	0.141	0.141	0.142	0.140	0.000	0.002	-0.003
	EN	0.014	0.017	0.027	0.021	0.002	**0.011**	-0.006
	PF	0.069	0.060	0.051	0.047	**-0.009**	**-0.009**	-0.004
	NEIG	0.077	0.090	0.087	0.084	**0.013**	-0.003	-0.003
	SER	0.064	0.066	0.067	0.066	0.002	0.001	-0.001
Euro Area 4	Total		0.075	0.077	0.073		0.002	-0.005
(1998-1 to 2003-4	Core		0.073	0.071	0.070		-0.002	-0.002
	UNP		0.119	0.127	0.119		0.008	-0.007
	EN		0.019	0.029	0.024		0.010	-0.005
	PF		0.085	0.087	0.081		0.003	**-0.007**
	NEIG		0.084	0.089	0.077		0.005	**-0.012**
	SER		0.074	0.072	0.073		-0.001	0.000

Table 9 - Size of price decreases

		Period 1994-1 to 1995-4	Period 1996-1 to 1998-4	Period 1999-1 to 2003-4, excluding 2001·3 to 2002-2	Period 2001-3 to 2002-2	Delta - second subperiod	Delta - third subperiod	Delta - fourth subperiod
		(1)	(2)	(3)	(4)	(2)-(1)	(3)-(2)	(4)-(3)
Spain	Total							
(94/01 - 01/12)	Core	0.097	0.099	0.085	0.084	0.002	-0.014	0.000
	UNP	0.150	0.143	0.151	0.152	**-0.007**	0.009	0.001
	EN							
	PF	0.087	0.075	0.078	0.062	**-0.012**	0.003	-0.016
	NEIG	0.090	0.089	0.077	0.065	-0.002	-0.012	-0.012
	SER	0.106	0.114	0.093	0.106	0.008	-0.021	0.013
Germany	Total		0.094	0.097	0.075		0.003	**-0.022**
(98/02 - 04/01)	Core		0.098	0.101	0.076		0.003	**-0.025**
	UNP		0.152	0.167	0.152		0.014	-0.015
	EN		0.024	0.026	0.030		0.001	0.004
	PF		0.109	0.106	0.088		-0.003	**-0.018**
	NEIG		0.137	0.144	0.107		0.007	**-0.038**
	SER		0.072	0.074	0.054		0.002	**-0.020**
France	Total	0.093	0.095	0.094	0.076	0.002	-0.001	**-0.018**
(94/08 - 03/02)	Core	0.093	0.095	0.091	0.069	0.001	-0.004	**-0.021**
	UNP	0.172	0.175	0.188	0.178	0.003	0.013	-0.010
	EN	0.015	0.018	0.024	0.029	**0.003**	**0.006**	**0.006**
	PF	0.073	0.071	0.063	0.049	-0.002	**-0.008**	**-0.014**
	NEIG	0.133	0.136	0.138	0.110	0.004	0.002	**-0.028**
	SER	0.069	0.069	0.062	0.044	0.000	-0.007	**-0.018**
Italy	Total		0.084	0.083	0.069		0.000	-0.014
(96/02 - 03/12)	Core		0.089	0.088	0.071		-0.001	-0.017
	UNP		0.077	0.077	0.080		0.001	0.003
	EN		0.014	0.017	0.019		0.003	0.003
	PF		0.063	0.056	0.040		**-0.007**	**-0.016**
	NEIG		0.072	0.068	0.054		-0.003	-0.015
	SER		0.111	0.115	0.097		0.004	-0.018
Belgium	Total	0.059	0.050	0.054	0.046	-0.009	0.004	-0.009
(94/01 - 03/12)	Core	0.051	0.043	0.046	0.037	-0.008	0.003	-0.010
	UNP	0.144	0.151	0.155	0.149	0.007	0.004	-0.005
	EN	0.052	0.020	0.034	0.026	-0.032	0.014	-0.007
	PF	0.088	0.079	0.071	0.064	-0.008	-0.008	-0.007
	NEIG	0.050	0.050	0.061	0.047	0.000	0.011	**-0.014**
	SER	0.034	0.018	0.018	0.011	-0.017	0.000	-0.006
Austria	Total		0.077	0.082	0.079		0.006	-0.003
(96/02 - 03/12)	Core		0.077	0.081	0.076		0.005	-0.006
	UNP		0.193	0.212	0.235		0.019	**0.023**
	EN		0.021	0.029	0.037		**0.008**	**0.008**
	PF		0.141	0.144	0.112		0.003	**-0.032**
	NEIG		0.101	0.113	0.116		0.012	0.003
	SER		0.032	0.030	0.024		-0.002	-0.005
Euro Area 1	Total	0.089	0.088	0.087	0.074	0.000	-0.001	**-0.013**
(1994-3 to 2001-4	Core	0.092	0.090	0.085	0.071	-0.002	-0.005	**-0.014**
	UNP	0.163	0.164	0.170	0.161	0.001	0.006	-0.009
	EN	0.023	0.018	0.023	0.033	**-0.005**	0.005	0.010
	PF	0.080	0.073	0.068	0.054	**-0.007**	**-0.005**	**-0.015**
	NEIG	0.112	0.114	0.114	0.099	0.002	0.000	-0.015
	SER	0.079	0.076	0.067	0.051	-0.004	-0.009	-0.016
Euro Area 4	Total		0.087	0.089	0.072		0.003	**-0.018**
(1998-1 to 2003-4	Core		0.090	0.085	0.071		-0.005	**-0.014**
	UNP		0.129	0.140	0.134		0.011	-0.006
	EN		0.021	0.024	0.027		0.002	0.003
	PF		0.093	0.090	0.073		-0.003	**-0.017**
	NEIG		0.111	0.114	0.087		0.003	**-0.027**
	SER		0.076	0.081	0.063		0.005	-0.018

Table 10a. Persistence in EMU sectors. Dt = 1 as of 1996:1

	sample	ρ	68% hpdi		γ	68% hpdi		ρ+γ
ALL SECTORS	552	**0.58**	0.53	0.64	**-0.13**	-0.23	-0.04	**0.45**
A	97	**0.59**	0.54	0.63	**0.00**	-0.07	0.08	**0.59**
B	62	**0.51**	0.45	0.57	**-0.10**	-0.19	0.00	**0.41**
C	200	**0.62**	0.57	0.68	**-0.16**	-0.26	-0.06	**0.46**
D	22	**0.32**	0.24	0.38	**0.12**	0.01	0.23	**0.44**
E	171	**0.60**	0.54	0.67	**-0.21**	-0.31	-0.11	**0.40**
GERMANY	87	**0.63**	0.57	0.69	**-0.19**	-0.29	-0.10	**0.44**
A	10	**0.73**	0.68	0.77	**-0.10**	-0.18	-0.03	**0.62**
B	4	**0.56**	0.51	0.62	**-0.21**	-0.31	-0.10	**0.36**
C	30	**0.64**	0.58	0.70	**-0.09**	-0.19	0.00	**0.54**
D	4	**0.21**	0.14	0.25	**0.17**	0.07	0.27	**0.38**
E	39	**0.67**	0.59	0.73	**-0.29**	-0.39	-0.19	**0.38**
FRANCE	147	**0.53**	0.47	0.59	**-0.19**	-0.29	-0.08	**0.35**
A	12	**0.41**	0.35	0.48	**-0.12**	-0.21	-0.03	**0.29**
B	27	**0.57**	0.51	0.62	**-0.13**	-0.22	-0.04	**0.44**
C	60	**0.57**	0.50	0.62	**-0.31**	-0.43	-0.19	**0.25**
D	7	**0.27**	0.17	0.37	**0.22**	0.09	0.35	**0.49**
E	41	**0.59**	0.53	0.64	**-0.21**	-0.31	-0.11	**0.38**
ITALY	170	**0.51**	0.46	0.56	**-0.05**	-0.15	0.05	**0.46**
A	43	**0.54**	0.50	0.58	**0.11**	0.04	0.18	**0.65**
B	11	**0.43**	0.36	0.49	**-0.06**	-0.15	0.03	**0.37**
C	65	**0.55**	0.50	0.61	**-0.15**	-0.25	-0.05	**0.41**
D	3	**0.29**	0.22	0.33	**0.22**	0.10	0.34	**0.51**
E	48	**0.43**	0.38	0.50	**-0.07**	-0.19	0.05	**0.37**
BELGIUM	60	**0.46**	0.40	0.53	**-0.09**	-0.20	0.02	**0.38**
A	10	**0.35**	0.28	0.41	**-0.14**	-0.25	-0.03	**0.21**
B	6	**0.48**	0.41	0.57	**-0.25**	-0.37	-0.14	**0.23**
C	18	**0.63**	0.57	0.68	**-0.15**	-0.27	-0.03	**0.48**
D	5	**0.37**	0.30	0.45	**-0.01**	-0.12	0.11	**0.36**
E	21	**0.40**	0.34	0.45	**0.00**	-0.11	0.09	**0.40**
SPAIN	88	**0.73**	0.69	0.77	**-0.04**	-0.12	0.03	**0.69**
A	22	**0.74**	0.70	0.78	**0.02**	-0.04	0.08	**0.76**
B	14	**0.44**	0.38	0.50	**0.04**	-0.06	0.13	**0.48**
C	27	**0.83**	0.80	0.86	**-0.05**	-0.11	0.01	**0.78**
D	3	**0.73**	0.68	0.78	**-0.21**	-0.29	-0.13	**0.52**
E	22	**0.77**	0.73	0.81	**-0.10**	-0.19	-0.01	**0.67**

Note: A = Processed food
B = Unprocessed food
C = Non-energy ind. goods
D = Energy goods
E = Services

Table 10b. Persistence in EMU sectors. Dt = 1 as of 1998:3

	sample	ρ	68% hpdi		γ	68% hpdi		ρ+γ
ALL SECTORS	552	**0.61**	0.57	0.66	**-0.20**	-0.32	-0.07	**0.42**
A	97	**0.62**	0.59	0.67	**-0.02**	-0.11	0.07	**0.61**
B	62	**0.49**	0.44	0.54	**-0.03**	-0.13	0.07	**0.46**
C	200	**0.66**	0.62	0.70	**-0.22**	-0.34	-0.10	**0.44**
D	22	**0.45**	0.36	0.54	**-0.03**	-0.16	0.09	**0.42**
E	171	**0.63**	0.58	0.67	**-0.30**	-0.44	-0.17	**0.33**
GERMANY	87	**0.65**	0.60	0.70	**-0.30**	-0.43	-0.17	**0.36**
A	10	**0.73**	0.69	0.78	**-0.13**	-0.21	-0.04	**0.61**
B	4	**0.48**	0.42	0.54	**0.04**	-0.06	0.14	**0.52**
C	30	**0.65**	0.61	0.70	**-0.11**	-0.21	-0.01	**0.55**
D	4	**0.47**	0.34	0.60	**-0.16**	-0.29	-0.03	**0.32**
E	39	**0.67**	0.62	0.72	**-0.45**	-0.61	-0.30	**0.22**
FRANCE	147	**0.56**	0.51	0.61	**-0.23**	-0.35	-0.11	**0.33**
A	12	**0.38**	0.32	0.44	**-0.07**	-0.17	0.03	**0.31**
B	27	**0.54**	0.49	0.58	**-0.05**	-0.15	0.05	**0.49**
C	60	**0.61**	0.56	0.66	**-0.41**	-0.55	-0.26	**0.20**
D	7	**0.35**	0.28	0.44	**0.14**	0.01	0.28	**0.50**
E	41	**0.62**	0.57	0.66	**-0.25**	-0.36	-0.14	**0.37**
ITALY	170	**0.55**	0.51	0.59	**-0.06**	-0.18	0.07	**0.49**
A	43	**0.62**	0.59	0.66	**0.10**	0.01	0.19	**0.72**
B	11	**0.46**	0.41	0.51	**-0.09**	-0.19	0.01	**0.37**
C	65	**0.60**	0.55	0.64	**-0.21**	-0.37	-0.07	**0.39**
D	3	**0.28**	0.24	0.31	**0.30**	0.21	0.38	**0.58**
E	48	**0.45**	0.41	0.50	**0.00**	-0.13	0.13	**0.45**
BELGIUM	60	**0.50**	0.45	0.55	**-0.11**	-0.23	0.02	**0.39**
A	10	**0.38**	0.32	0.44	**-0.20**	-0.32	-0.09	**0.18**
B	6	**0.44**	0.38	0.51	**-0.18**	-0.31	-0.06	**0.26**
C	18	**0.67**	0.63	0.71	**-0.24**	-0.39	-0.09	**0.43**
D	5	**0.39**	0.32	0.46	**-0.03**	-0.14	0.09	**0.36**
E	21	**0.45**	0.40	0.50	**0.03**	-0.08	0.15	**0.48**
SPAIN	88	**0.77**	0.74	0.80	**-0.14**	-0.23	-0.06	**0.63**
A	22	**0.78**	0.75	0.81	**-0.09**	-0.16	-0.01	**0.69**
B	14	**0.47**	0.42	0.52	**0.01**	-0.09	0.12	**0.48**
C	27	**0.87**	0.84	0.89	**-0.10**	-0.18	-0.03	**0.76**
D	3	**0.76**	0.72	0.80	**-0.32**	-0.42	-0.23	**0.44**
E	22	**0.85**	0.82	0.88	**-0.33**	-0.45	-0.22	**0.51**

Note: A = Processed food
B = Unprocessed food
C = Non-energy ind. goods
D = Energy goods
E = Services

Table 11. Persistence in EMU sectors. Two dummies.

	sample	ρ	68% hpdi		γ_1	68% hpdi		γ_2	68% hpdi		$\gamma_1+\gamma_2$	$\rho+\gamma_1+\gamma_2$
ALL SECTORS	552	**0.58**	0.53	0.64	**-0.30**	-0.49	-0.11	**0.13**	-0.09	0.35	**-0.17**	**0.41**
A	97	**0.58**	0.54	0.63	**-0.20**	-0.37	-0.03	**0.22**	0.04	0.41	**0.02**	**0.61**
B	62	**0.51**	0.45	0.57	**-0.42**	-0.61	-0.24	**0.37**	0.18	0.57	**-0.05**	**0.46**
C	200	**0.62**	0.57	0.68	**-0.29**	-0.50	-0.07	**0.10**	-0.15	0.34	**-0.19**	**0.43**
D	22	**0.32**	0.25	0.39	**0.20**	-0.01	0.40	**-0.10**	-0.31	0.11	**0.09**	**0.41**
E	171	**0.61**	0.55	0.67	**-0.39**	-0.58	-0.22	**0.10**	-0.12	0.31	**-0.30**	**0.31**
GERMANY	87	**0.64**	0.58	0.70	**-0.35**	-0.55	-0.15	**0.06**	-0.17	0.28	**-0.29**	**0.35**
A	10	**0.72**	0.68	0.77	**-0.33**	-0.63	-0.05	**0.21**	-0.08	0.52	**-0.12**	**0.61**
B	4	**0.56**	0.50	0.62	**-0.69**	-0.88	-0.51	**0.64**	0.45	0.86	**-0.04**	**0.52**
C	30	**0.64**	0.58	0.70	**-0.31**	-0.59	-0.05	**0.23**	-0.04	0.50	**-0.09**	**0.55**
D	4	**0.21**	0.15	0.25	**0.38**	0.24	0.53	**-0.29**	-0.43	-0.15	**0.09**	**0.31**
E	39	**0.68**	0.61	0.74	**-0.42**	-0.58	-0.26	**-0.06**	-0.27	0.14	**-0.48**	**0.20**
FRANCE	147	**0.53**	0.47	0.59	**-0.35**	-0.57	-0.13	**0.14**	-0.09	0.38	**-0.21**	**0.33**
A	12	**0.42**	0.35	0.48	**-0.17**	-0.34	-0.01	**0.06**	-0.11	0.24	**-0.11**	**0.31**
B	27	**0.56**	0.51	0.62	**-0.59**	-0.78	-0.41	**0.51**	0.31	0.71	**-0.08**	**0.48**
C	60	**0.56**	0.50	0.62	**-0.36**	-0.58	-0.13	**-0.02**	-0.27	0.24	**-0.38**	**0.19**
D	7	**0.28**	0.18	0.37	**0.23**	-0.04	0.48	**0.00**	-0.26	0.27	**0.22**	**0.50**
E	41	**0.59**	0.53	0.64	**-0.45**	-0.66	-0.22	**0.22**	-0.01	0.45	**-0.22**	**0.36**
ITALY	170	**0.50**	0.45	0.56	**-0.23**	-0.37	-0.08	**0.15**	0.03	0.39	**-0.08**	**0.42**
A	43	**0.54**	0.50	0.58	**-0.09**	-0.20	0.03	**0.28**	0.14	0.41	**0.19**	**0.73**
B	11	**0.43**	0.36	0.49	**-0.17**	-0.32	-0.03	**0.12**	-0.03	0.27	**-0.06**	**0.37**
C	65	**0.55**	0.50	0.61	**-0.27**	-0.40	-0.11	**0.08**	-0.12	0.27	**-0.18**	**0.37**
D	3	**0.29**	0.23	0.33	**-0.01**	-0.17	0.12	**0.30**	0.17	0.47	**0.30**	**0.59**
E	48	**0.43**	0.38	0.49	**-0.32**	-0.51	-0.15	**0.33**	0.13	0.54	**0.01**	**0.44**
BELGIUM	60	**0.46**	0.40	0.53	**-0.23**	-0.47	0.01	**0.16**	-0.10	0.41	**-0.07**	**0.39**
A	10	**0.35**	0.28	0.42	**-0.19**	-0.39	0.02	**0.01**	-0.20	0.22	**-0.18**	**0.18**
B	6	**0.49**	0.41	0.57	**-0.28**	-0.46	-0.10	**0.04**	-0.15	0.22	**-0.24**	**0.24**
C	18	**0.63**	0.58	0.68	**-0.11**	-0.41	0.17	**-0.08**	-0.40	0.23	**-0.20**	**0.43**
D	5	**0.37**	0.30	0.45	**-0.08**	-0.37	0.21	**0.07**	-0.23	0.37	**-0.01**	**0.37**
E	21	**0.39**	0.34	0.45	**-0.36**	-0.57	-0.15	**0.45**	0.22	0.68	**0.09**	**0.48**
SPAIN	88	**0.73**	0.69	0.76	**-0.24**	-0.44	-0.03	**0.13**	-0.09	0.34	**-0.11**	**0.62**
A	22	**0.74**	0.70	0.77	**-0.34**	-0.51	-0.18	**0.30**	0.13	0.48	**-0.05**	**0.69**
B	14	**0.44**	0.39	0.50	**-0.16**	-0.38	0.05	**0.19**	-0.03	0.41	**0.03**	**0.47**
C	27	**0.83**	0.80	0.86	**-0.21**	-0.43	0.01	**0.14**	-0.10	0.37	**-0.07**	**0.76**
D	3	**0.74**	0.69	0.78	**-0.13**	-0.33	0.07	**-0.17**	-0.38	0.04	**-0.29**	**0.44**
E	22	**0.76**	0.72	0.81	**-0.28**	-0.47	-0.09	**0.00**	-0.21	0.21	**-0.27**	**0.49**

Note: A = Processed food
B = Unprocessed food
C = Non-energy ind. goods
D = Energy goods
E = Services

Table 12. Structural instability

		sample	λ	σ_λ
ALL SECTORS		552	0.626	0.204
	A	97	0.655	0.223
	B	62	0.646	0.214
	C	200	0.619	0.202
	D	22	0.657	0.217
	E	171	0.611	0.196
GERMANY		87	0.612	0.194
	A	10	0.707	0.247
	B	4	0.732	0.255
	C	30	0.597	0.187
	D	4	0.605	0.190
	E	39	0.595	0.184
FRANCE		147	0.662	0.227
	A	12	0.673	0.232
	B	27	0.645	0.220
	C	60	0.653	0.220
	D	7	0.680	0.228
	E	41	0.668	0.233
ITALY		170	0.605	0.194
	A	43	0.650	0.224
	B	11	0.660	0.222
	C	65	0.593	0.184
	D	3	0.585	0.183
	E	48	0.574	0.175
BELGIUM		60	0.604	0.192
	A	10	0.609	0.192
	B	6	0.563	0.164
	C	18	0.599	0.194
	D	5	0.642	0.208
	E	21	0.606	0.194
SPAIN		88	0.639	0.216
	A	22	0.597	0.192
	B	14	0.587	0.180
	C	27	0.661	0.236
	D	3	0.785	0.284
	E	22	0.639	0.214

Note: A = Processed food
B = Unprocessed food
C = Non-energy ind. goods
D = Energy goods
E = Services

Table 13a. Persistence in US sectors. Dt = 1 as of 1996:1

	ρ	68% hpdi		γ	68% hpdi		ρ+γ
all items	**0.66**	0.60	0.71	**-0.03**	-0.16	0.10	**0.63**
food and beverages	**0.55**	0.50	0.60	**-0.26**	-0.36	-0.16	**0.29**
energy	**0.03**	-0.06	0.15	**0.53**	0.39	0.65	**0.56**
all items less food and energy	**0.83**	0.79	0.87	**-0.10**	-0.17	-0.02	**0.73**
service	**0.64**	0.58	0.71	**-0.29**	-0.38	-0.20	**0.35**
housing	**0.84**	0.80	0.88	**-0.35**	-0.44	-0.26	**0.49**
median	**0.65**	0.59	0.71	**-0.18**	-0.27	-0.09	**0.53**
average	**0.59**	0.53	0.65	**-0.08**	-0.19	0.02	**0.51**

Table 13b. Persistence in US sectors. Dt = 1 as of 1998:3

	ρ	68% hpdi		γ	68% hpdi		ρ+γ
all items	**0.79**	0.74	0.83	**-0.18**	-0.31	-0.05	**0.61**
food and beverages	**0.50**	0.45	0.55	**-0.24**	-0.36	-0.12	**0.26**
energy	**0.15**	0.07	0.24	**0.36**	0.25	0.47	**0.51**
all items less food and energy	**0.92**	0.89	0.95	**-0.28**	-0.38	-0.19	**0.64**
service	**0.84**	0.79	0.89	**-0.50**	-0.59	-0.42	**0.34**
housing	**0.88**	0.85	0.92	**-0.36**	-0.45	-0.26	**0.53**
median	**0.81**	0.77	0.86	**-0.26**	-0.37	-0.15	**0.52**
average	**0.68**	0.63	0.73	**-0.20**	-0.31	-0.09	**0.48**

Table 14. Persistence in US sectors. Two dummies

	ρ	68% hpdi		γ_1	68% hpdi		γ_2	68% hpdi		$\gamma_1+\gamma_2$
all items	**0.65**	0.59	0.71	**-0.17**	-0.44	0.10	**0.09**	-0.17	0.35	**-0.07**
food and beverages	**0.55**	0.50	0.60	**-0.28**	-0.46	-0.10	**-0.02**	-0.22	0.18	**-0.30**
energy	**0.04**	-0.05	0.16	**0.41**	0.15	0.69	**0.21**	-0.06	0.47	**0.62**
all items less food and energy	**0.83**	0.78	0.87	**-0.24**	-0.46	-0.01	**-0.01**	-0.24	0.23	**-0.25**
service	**0.65**	0.59	0.72	**-0.16**	-0.38	0.06	**-0.24**	-0.46	-0.02	**-0.40**
housing	**0.85**	0.81	0.89	**-0.40**	-0.67	-0.13	**0.05**	-0.22	0.34	**-0.35**
median	**0.65**	0.59	0.71	**-0.20**	-0.45	0.02	**0.02**	-0.22	0.28	**-0.18**
average	**0.60**	0.54	0.66	**-0.14**	-0.38	0.10	**0.01**	-0.23	0.26	**-0.12**

References

Altissimo, F., B. Mojon and P. Zaffaroni (2004), "Fast micro and slow macro: can aggregation explain the persistence of inflation?", IPN conference.[20]

Álvarez L. and I. Hernando (2004), "Price setting behaviour in Spain. Stylized facts using consumer price micro data", *ECB WPS 416,* November.

Angeloni, I. and L. Dedola (1999) "From the ERM to the euro: new evidence on economic and policy convergence among EU countries", *ECB WPS 4*, May.

Angeloni, I. and M. Ehrmann (2003) "Monetary transmission in the Euro area: early evidence", *Economic Policy n. 37,* October.

Angeloni, I., L. Aucremanne, M. Ehrmann, J. Gali, A. Levin and F. Smets (2004), "Inflation persistence in the euro area: preliminary summary of findings", IPN conference.

Angeloni, I. and R. Violi (1997), "Long-term interest rate convergence in Europe and the probability of EMU", *Banca d'Italia, Temi di Discussione No. 322*.

Aucremanne, L., Brys, G., Hubert, M., Rousseeuw, P. and Struyf, A. (2002), "Inflation, relative prices and nominal rigidities", National Bank of Belgium Working Paper Series, n. 20.

Aucremanne, L. and E. Dhyne (2004), "How frequently do price change? Evidence based on the micro data underlying the Belgian CPI", *ECB WPS 331,* April.

Aucremanne, L. and M. Collin (2005), "Has inflation persistence changed over time? Evidence from aggregate and sectoral Belgian CPI data", National Bank of Belgium, mimeo.

Baudry, L., H. Le Bihan, P. Sevestre and S. Tarrieu (2004), "Price rigidity. Evidence from the French micro CPI data", *ECB WPS 384,* August.

Baumgartner, J., E. Glatzer, F. Rumler, A. Stiglbauer (2004), "How frequently do consumer prices change in Austria? Evidence from micro CPI data", IPN conference.

Bilke, L. (2005), "Break in the mean and persistence of inflation: a sectoral analysis of French CPI", *ECB WPS 463,* March.

Bils, M. and P. Klenow (2004), "Some evidence on the importance of sticky prices", *Journal of Political Economy 112*, pp 947-985.

Ciccarelli, M. and B. Mojon (2004), "Global inflation", *ECB WPS 537*, October.

Corvoisier, S. and B. Mojon (2005), "Breaks in the mean of inflation: how they happen and what to do with them", *ECB WPS 451*, March.

Dedola, L. and F. Lippi (2005), "The monetary transmission mechanism: evidence from the industries of five OECD countries", *European Economic Review,* 49:1543-1569.

[20] All paper presented at the IPN conference are available at http://www.ecb.int/events/conferences/html/inflationpersistence.en.html

DeJong P. and N. Shephard (1995), The simulation smoother for time series models, Biometrika, 82:339-350.

ECB (2004), Proceedings of the Conference "Inflation Persistence in the Euro Area", http://www.ecb.int/events/conferences/html/inflationpersistence.en.html.

Gadzinski, G. and F. Orlandi (2004), "Inflation persistence in the European Union, the euro area, and the United States", *ECB WPS 414,* November.

Gali, J., J.D. López-Salido, and J. Vallés (2004), "Rule of Thumb Consumers and the Design of Interest Rate Rules", *Journal of Money, Credit, and Banking*, vol. 36, no. 4, 739-764.

Hoffman J. and J. Kurz-Kim (2004), "Consumer price adjustment under the microscope: Germany in a period of low inflation", IPN conference.

Klenow, P. J. and O. Kryvtsov (2005), "State-dependent or Time-dependent Pricing: Does it Matter for Recent US Inflation?", *NBER Working Paper Series*, n. 11043, January.

Koop G. (2003), "Bayesian Econometrics", John Wiley, London.

Koop G. and S. Potter (2001), "Are apparent findings of nonlinearity due to structural instability in economic time series?", *Econometric Journal*, 4:37-55.

Levin, A. and J. Piger (2004), "Is inflation persistence intrinsic in industrial economies?", *ECB WPS 334,* April.

Lünnemann, P. and T. Mathä (2005), "Regulated and services' prices and inflation persistence", *ECB WPS 466,* April.

Lünnemann, P. and T. Mathä (2004), "How persistent is disaggregate inflation? An analysis across EU 15 countries and HICP sub-indices", *ECB WPS 415,* November.

Mankiw, G. and R. Reis (2002), "Sticky information versus sticky prices: a proposal to replace the new Keynesian Phillips Curve", *Quarterly Journal of Economics 117*, pp 1295-1328.

Rogoff, K. (2003), "Globalization and Global Disinflation", IMF mimeo.

Veronese, G., S. Fabiani, A. Gattulli, and R. Sabbatini (2005), "Consumer price behaviour in Italy: evidence from micro CPI data", *ECB WPS 449,* March.

Woodford, M. (2003), "Interest and Prices: Foundations of a Theory of Monetary Policy", Princeton University Press.

Comments on "Price Setting and Inflation Persistence: Did EMU Matter?

William T. Dickens
The Brookings Institution

I have three goals in my comments on this paper: 1. to heap praise on the authors of this paper and the organizers of the IPN, 2. to offer some comments on the methods and results from the paper, and 3. to present some preliminary results from the International Wage Flexibility Project – a sister project to the IPN that has also been generously supported by the ECB that I have been asked to discuss by the conference organizers.

The authors of this paper and the organizers of the IPN project are to be congratulated for having taken on and mastered a huge and difficult task. There is much to be learned by careful comparative study of the behavior of different economies. But, before we can conduct such studies there are a number of hurdles that must be crossed. Similar data from different countries must be found. Since methods of data collection almost always differ to some degree, the process of investigating similarities and differences across countries must be cognizant of this and the analysis must be adapted accordingly. The people best equipped to understand these differences are those from the country who work with the data, but coordinating a dozen or more country teams to execute a common protocol and then to aggregate the results in a useful way is a Herculean task. The contribution of the IPN goes beyond the results of this and its other studies. They are also showing the way for what I believe will be a very fruitful approach to cross-national research.

Angeloni et al. provide two types of evidence with the aim of determining whether EMU has changed price setting behavior. They provide a number of reasons to think that it might, but their data seem equivocal. They first look at the frequency and magnitude of price adjustments and find that neither has changed much over time except for a sharp increase in number of adjustments immediately after currency conversion. They thus conclude that EMU had no effects. They then estimate statistical models of the inflation process to measure the persistence of inflation. They find a notable decline in the persistence of inflation in the period leading up to monetary union, but they find a similar decline in data for the United States and conclude that this suggests something other than EMU might have been responsible for the decline.

With respect to the frequency and magnitude of price changes, do we really know that no change means no effect? Presumably we care not so much about the frequency of price changes, per se, as the process by which price changes take place. In particular, central bankers want to know how quickly a price shock is likely to propagate in different environments. To answer that question the authors would have to estimate a model of price changes. One could imagine that the authors could use their data to generate an estimate of the cost of price adjustment, or some similar structural parameter, and it is entirely possible that we would see changes in that parameter even if there are no changes in the frequency or magnitude of price adjustment.

I suspect that this might be the case because inflation during this period was declining. All else held equal, I would expect the frequency of price changes to decline as

the rate of inflation declined. The fact that it didn't suggests the possibility that EMU may have reduced the cost of price changes or made product markets more competitive making failure to adjust more costly. At the very least, I would like to have seen the authors construct estimates of the frequency of price changes at different points in time controlling for the rate of inflation. These might tell a very different picture from the results presented here.

I am not at all surprised that the authors find decreasing inflation persistence for both the US and the EU. In our 2000 paper, Akerlof, Perry and I proposed that wage and price setters tend to ignore inflation in price setting at low rates of inflation and presented evidence of this for the US. Ours is only one of several models of the formation and use of inflationary expectations that suggest that when inflation is low, price setting should become less responsive to recent shocks. Since both the US and EU have had low and stable inflation for the last decade, I would expect inflation persistence to weaken.

But this doesn't mean that the EMU shouldn't get some of the credit for the decline in persistence in the EU. In the US, the stabilization of inflation at low rates has followed the development of a consensus that the maintenance of low and stable rates of inflation should be a primary goal of monetary policy that should not be sacrificed for short term gains in the level of economic activity. In Europe, that same consensus has been embodied in the charter and operating rules of the ECB. I doubt that all the countries of the EMU would have seen as rapid and large a reduction in persistence in a different, less credible, institutional framework.

Although I think I know why the reduction in persistence took place and would have expected it to happen, I would still like to see the authors do more with this data. The reduced form specifications that they estimate do not allow us to determine the reasons for the decline in persistence. They don't, for example, give us any reason to believe that the decline in persistence will, itself, be persistent. There are trade-offs in estimating more structural models of the inflation process. We might have less confidence in the specification or the identification strategies. However, I would view these drawbacks as a small price to pay for the possibility of some further insight into the source of the change. I suspect that they would find that the decline in persistence could be attributed to a decline in the role of expectations of future price inflation in determining price changes, but it would be interesting to know that.

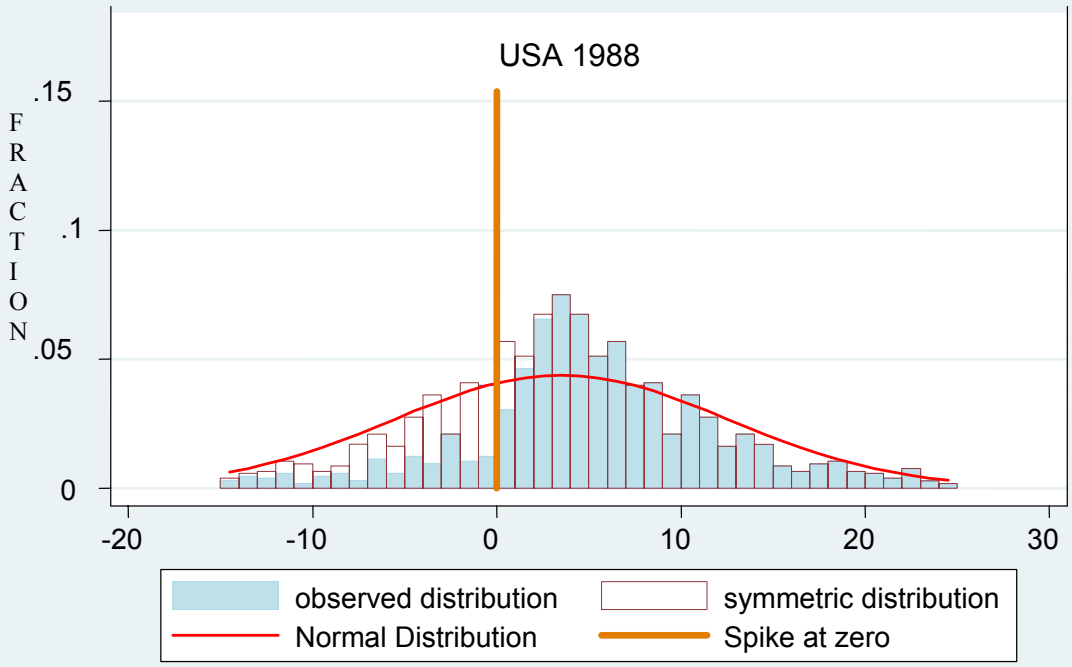
The International Wage Flexibility Project is a sister project of the IPN using much the same approach to cross national research. Teams in thirteen countries, coordinated by a core group of researchers, have gathered and analyzed micro data on wage changes over a period of thirty years. My interest in this project stems from work I did on applying the Akerlof, Dickens and Perry (1996, 2000) model to Europe that I presented at a previous ECB conference (Dickens 2001). I had hoped that an interaction between Europe's more restrictive labor market policies and the long-run effects of downward nominal wage rigidity on unemployment, that my co-authors and I had identified for the US, might explain persistent high unemployment in Europe. But, while the ADP model fits very well for the US and Canada, I found that it gave mostly nonsensical results for the European countries for which I estimated it. At the same time that I was doing this work, other authors were finding less evidence of downward nominal wage rigidity in some seemingly very high quality data outside the US (Smith

2000, Nichol and Quintini 2003). Commentators on a seminar I gave at the ECB suggested that wage rigidity in Europe was much more likely to be real than nominal and that this might explain the failure of the ADP model. They also told me about an effort to look at micro data on wage changes in several different countries that Erica Groshen was getting underway. After contacting and having some preliminary discussions with Erica, she asked me if I wanted to co-direct the project and I agreed to do it.

But how could micro data on wage changes tell us anything about the relative importance of real vs. nominal rigidity? At our first conference for project participants, we had each country plot graphs of percentage wage changes and some very interesting patterns emerged. Figure 1a below shows a typical wage change distribution for the United States. It shows the very typical

Figure 1a: Wage Change Distribution

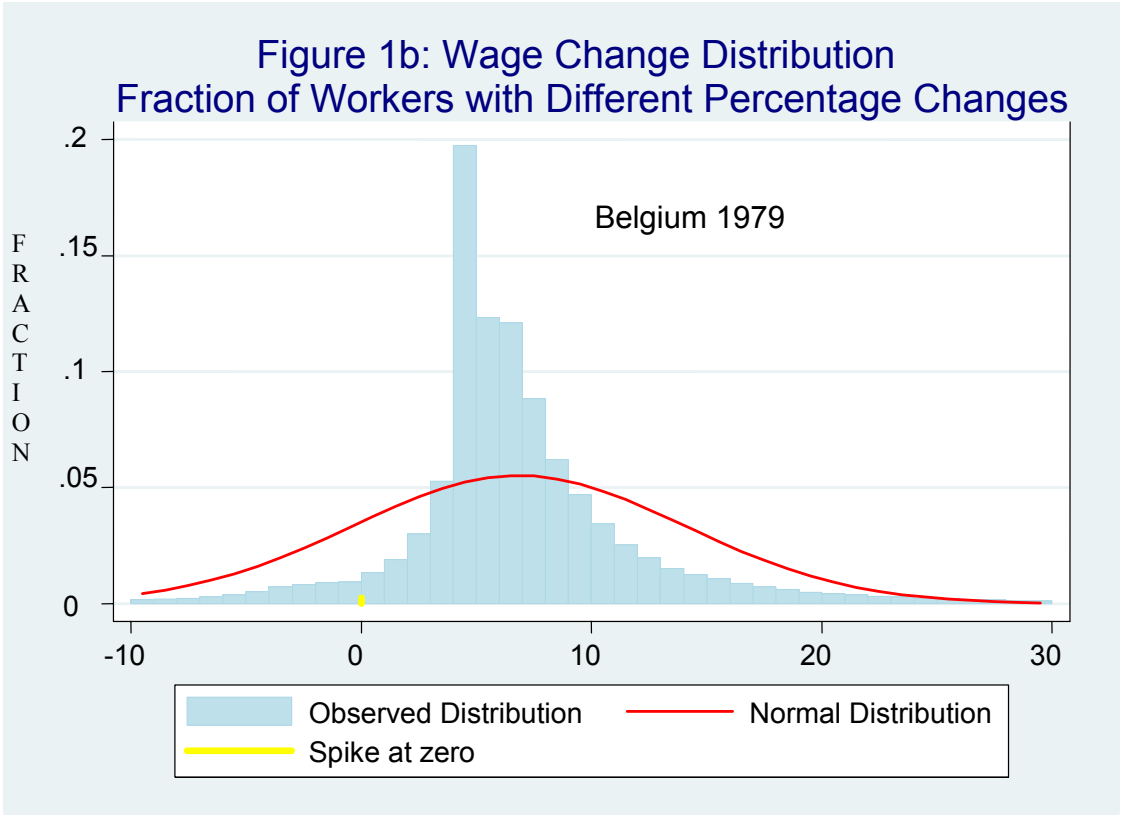
Fraction of Workers with Different Percentage Changes



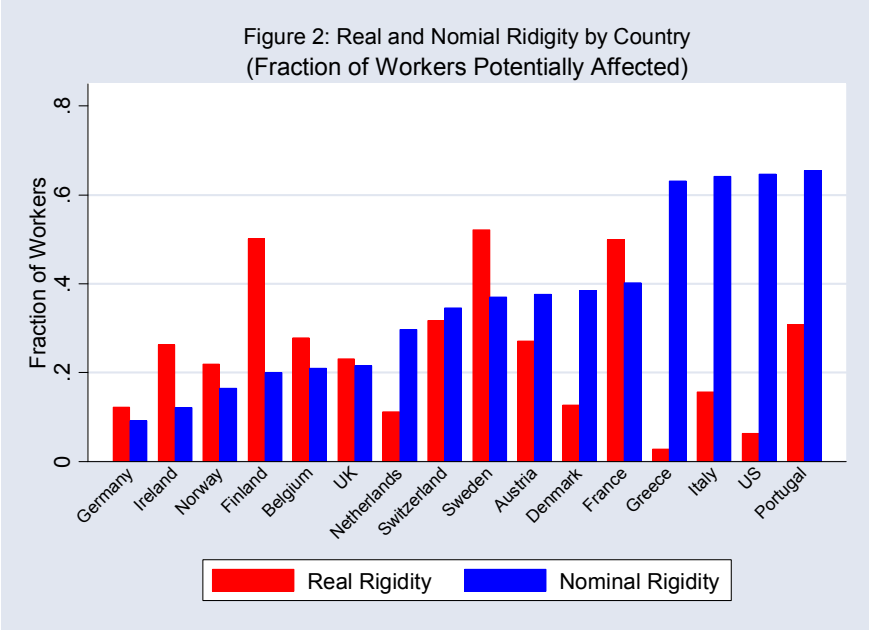
pattern of a noticeable spike at zero and a reduced concentration of observations below zero relative to a reflection of the upper tail of the distribution. Figure 1b tells a different story. This is the distribution for Belgium in 1979. There is a spike in this distribution but unlike the US it is not at zero, rather it is in the range of 5 to 6% -- about the rate of inflation in Belgium in that year. Again we see that observations that are piled up at the spike seem to be missing from the lower tail of the distribution. If figure 1a shows signs of downward nominal wage rigidity, then figure 1b shows signs of downward real wage rigidity.

The characteristics of these two distributions suggest a way of measuring the extent of downward nominal and downward real wage rigidity across countries. If we fit a model of the wage change distribution that allows for downward nominal and

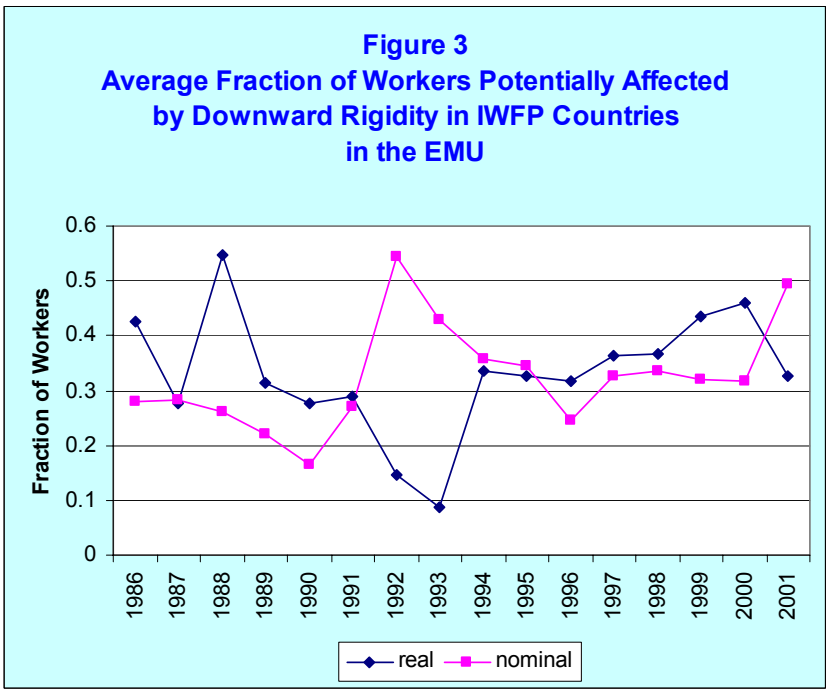
downward real wage rigidity to move observations from the lower tail to zero and/or a spike in the vicinity of the expected rate of inflation, parameters reflecting the fraction of workers subject to each type of rigidity can be viewed as measures of the importance of each type of rigidity in the country during that year. We can use this information to investigate the causes and consequences of both types of rigidity.



Dickens and Goette (2005) describe the methodology of this project in detail and Dickens et al. (2005) describe some of the first results of the project. One primary finding is that there are considerable differences across countries in the importance of different types of rigidity. Figure 2 shows the fraction of workers in each country that we estimate are potentially subject to each type of rigidity. This is our estimate of the fraction of workers who would receive a nominal or real wage freeze if their wage change, in the absence of downward rigidity, would have been less than zero (nominal rigidity) or less than the expected rate of inflation (real rigidity). Although only a fraction of workers who are potentially affected by rigidity will face a wage freeze in any year, we estimate that a 1 percentage point increase in nominal wages due to either type of rigidity is associated with greater than a one percentage point increase in unemployment. According to our estimates real and nominal rigidity together raised wages by almost 1.5% in EMU countries in our study in 2000.



Has EMU had any impact on wage rigidity? Figure 3 graphs the average levels of the fraction of the workforce that is at risk for downward nominal or downward real wage rigidity. These estimates are made for EMU member countries among the IWFP study participants. The figure shows values for each year from 1986 through 2001. As the figure shows, there is no evidence that EMU has had any impact on either real or nominal rigidity. Values for non-EMU countries in our study are similar in showing no time trend during this period.



References

Akerlof, George A., William T. Dickens, and George L. Perry (1996). "The Macroeconomics of Low Inflation." *Brookings Papers on Economic Activity 1*, 1-75.

Akerlof, George A., William T. Dickens, and George L. Perry (2000). "Near-Rational Wage and Price Setting and the Long-Run Phillips Curve." *Brookings Papers on Economic Activity 1*, 1-60.

Dickens, William T. (2001). "Comment on Charles Wyplosz, Do We Know How Low Inflation Should Be?" in Alicia G. Herrero, Vitor Gaspar, Lex Hoogduin, Julian Morgan, and Bernhard Winkler eds. *Why Price Stability? Proceedings of the Frist ECB Central Banking Conference, November 2000, Frankfurt Germany* ECB: Frankfurt.

Dickens, William T. and Lorenz Goette, "Estimating Wage Rigidity for the International Wage Flexibility Project," IWFP working paper, September, http://www.brookings.edu/es/research/projects/iwfp.htm .

Dickens, William T. Lorenz Goette, Erica L. Groshen, Steinar Holden, Julian Messina, Mark E. Schweitzer, Jarkko Turunen, and Melanie Ward (2005). "The Interaction of Labor Markets and Inflation: Analysis of Micro Data from the International Wage Flexibility Project," IWFP working paper, September, http://www.brookings.edu/es/research/projects/iwfp.htm .

Nickell, Stephen J. and Glenda Quintini (2003). "Nominal Wage Rigidity and the Rate of Inflation." *The Economic Journal 113*, 762-781.

Smith, J.C. (2000). "Nominal Wage Rigidity in the United Kingdom," *Economic Journal* 110(462): C176-C195.

Discussion of 'Price-setting and inflation persistence: did EMU matter?' by Angeloni *et al*

Tony Yates[1] (Bank of England)

Introduction:

The paper uses data on individual goods prices and price aggregates to investigate whether EMU affected price-setting and the time-series properties of inflation. They conclude that it hasn't. There is some affect of the EMU cash changeover on the frequency of price changes. The paper is refreshingly objective in assessing the impact of EMU, authored as it is by members of staff of an institution that owes its existence to EMU itself.

The authors are careful to note some severe problems that they confront in testing for an EMU effect on price-setting and inflation dynamics.

- That there are many other things changing in the study area that could have affected price-setting: notably, the deepening of the single market; price level convergence as poor countries catch up with richer ones. I'd add to this list the spread of online purchasing and market research.
- And that the impact of EMU could have been felt before EMU itself, via the entry criteria had on monetary policies before EMU officially took place.

The task of the discussant is particularly difficult in this case, since often the authors act as their own discussants. I hope that the following comments do justice to this really interesting paper.

Comments:

No general equilibrium model of the benefits of not having multiple currencies

First, that we do not have a complete theory of what it is EMU would have done to price-setting. It is therefore very hard to interpret either the statistics on price changes, or the inflation dynamics equations, since we do not know what we would expect.

There is the contention that the removal of multiple currency units will make it easier for market participants to make price-comparisons, and thereby make goods markets more 'competitive'. That EMU will reduce the barriers to trade, and thereby contribute to the same. As noted by Engel and Rogers (2004), this relies on there being either some kind of money illusion, or some kind of cost of calculating currency conversions.

Both of these represent quite stark departures from the models of price-setting that have become work-horses in the New Keynesian literature. We don't know what kind of micro-data on price-setting they would generate, relative to the models we know

[1] With thanks to Laura Piscitelli, Richard Harrison and Jan Vlieghe, whose work I draw on in my comments.

about. And we don't know what kind of Phillips Curves they would generate, and, as a result, how their presence would affect the reduced form of inflation in general equilibrium.

I'm afraid that this is not a very constructive comment, since I doubt that such a model would be feasible to build. But I think it is important to bear in mind when trying to draw conclusions from the paper.

More direct ways of assessing the presence of factors we know would contribute to altering the reduced forms for inflation

As the authors point out, shifts in reduced form inflation dynamics could come from either shifts in structural features of the equations that define price-setting behaviour, or shifts in either the shocks or the monetary policy behaviour that drives the output gap. An alternative to studying the mix of all things affecting inflation, via the reduced form, is to study the contribution of those things we can separately identify directly.

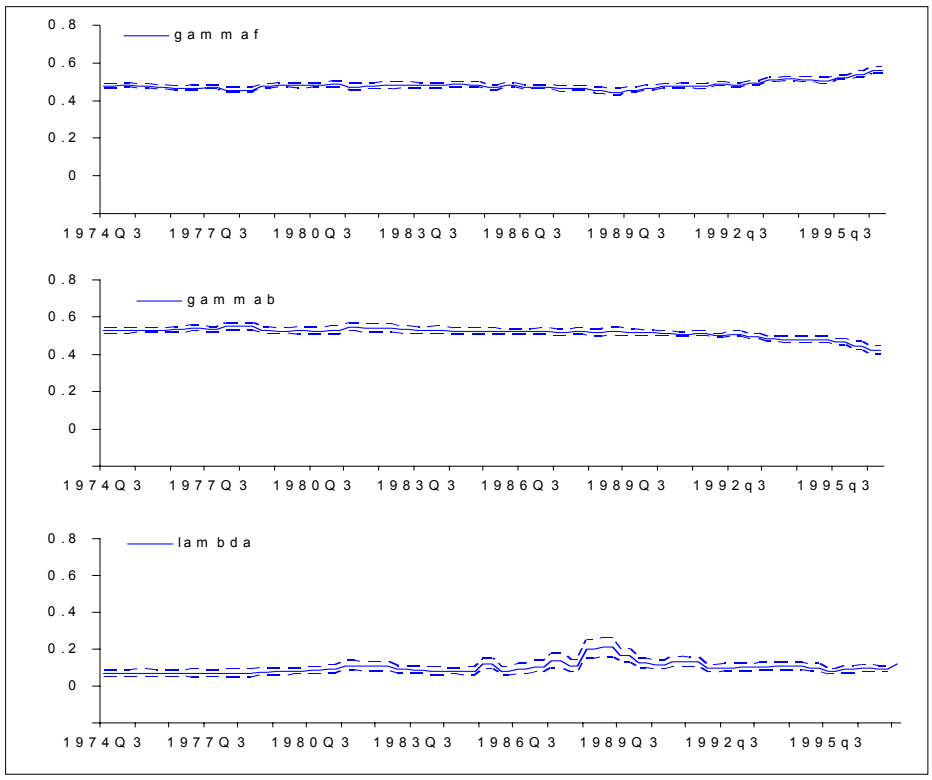
The authors could have studied:

- the stability of structural equations for inflation,
- the stability of monetary policy reaction functions.
- Or they could have conducted some formal tests on the expectations data they have.
- the time series for proxies for competition; estimated shocks to the mark up; or 'off-model' estimates of profitability or mark-ups

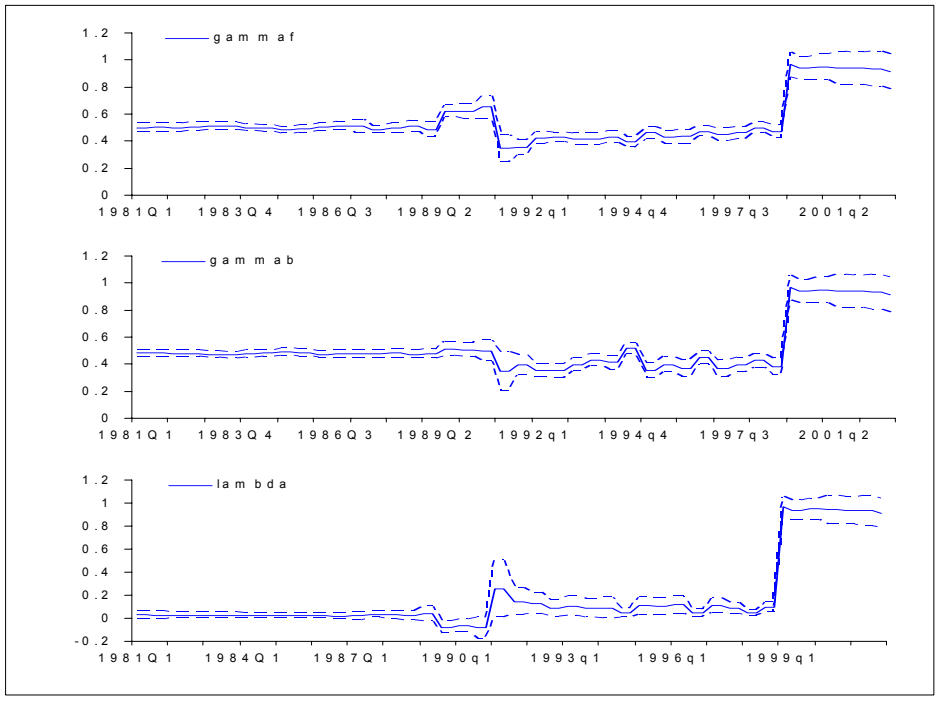
By way of an example, one contribution can be got by estimating the structural inflation equation directly and studying its stability over time. An example in this line of work is a forthcoming paper by Barkbu, Cassino, Gosselin-Lotz and Piscitelli (2005) at the Bank of England.

They estimate:

$$\pi_t = \gamma_b \pi_{t-1} + \gamma_f \pi_{t+1} + \lambda . rmc + u_t$$



US



euro area

We that this equation can be derived by assuming a certain fraction of firms index prices to last period's inflation rate when they do not get the 'Calvo' signal to change prices.

When they estimate this equation, the authors find some evidence of instability, first around the date of German unification; and second around the date of the Euro changeover. There is no similar instability in the US.

Of course, precisely what is difficult to say. Since we don't have a proper theory of how EMU affects price-setting, we can't tell how a misspecified model that excludes such a possibility would behave under EMU. But it's indicative.

At the same time it would be instructive to estimate shifts in the implied country by country monetary policy reaction functions that EMU will have brought about. The one example I could find was Gerlach-Kristen (2003). She found that the euro area Taylor rule was unstable, though interestingly there was no break at the time exchange rates became irrevocably fixed in 1999. The authors also reference Angeloni and Dedola (1999). They found some evidence that policy rules of member central banks converged during the 1990s.

Hard to test the effect of EMU since we don't have an acceptable non controversial null model of nominal rigidities that explains macroeconomic fluctuations

In the background, the authors face a deeper problem still, and one brought home by the research of the IPN itself. This is that discontinuous price changes are a profound and universal fact of price-setting. This contradicts models of indexation, or sticky information, or quadratic price adjustment, or rule of thumb pricers. Yet without those features we struggle to match macro dynamics. Neil Wallace once said that 'it takes a model to beat a model'. But then again, until we have access to a tractable model of price stickiness that can reconcile the micro and the macro facts, it's hard to answer questions like the one posed by the authors today.

An era of unprecedented monetary stability is a hard one in which to detect shifts in expectations formation

The authors estimate equations like this:

$$\pi_t = \alpha + \rho\pi_{t-1} + u_t$$

In the background, they have that the structural equation is something like this:

$$\pi_t = \gamma_b\pi_{t-1} + \gamma_f\pi_{t+1} + \lambda.rmc + u_t$$

In turn, they conjecture that EMU may have altered the expectations formation mechanism in such a way as to have reduced ρ. I think that this general conjecture is an important one, but the authors should sharpen it. I also want to argue that when they do, they'll have a hard time of figuring out what is going on in a world of very stable inflation.

We could imagine three different expectations formation mechanisms:

$\pi_{t+1} = E_t \pi_{t+1}$;
$\pi_{t+1} = A(L)\pi_t$;
$\pi_{t+1} = \pi^T$

Imagine a world in which the central bank was able to control inflation perfectly and inflation was held at a positive constant number α. In this world, actual inflation, the distributed lag of inflation, and a rational expectation of future inflation would all be equal to the constant . Arguably, for some time now, inflation in the euro area has been very stable. In such an era, it is going to be very difficult to distinguish between different models of inflation expectations formation. In such a world, radical shifts in the expectations formation would go undetected, since the same reduced form ($\pi_t = \alpha$) would hold for all of them.

For what it's worth, some exercises we have done in the bank[2] show some evidence of shifts in the process driving expectations, but it's hardly conclusive. Below are the results from the following regression:
$\pi_{t+1} = \varphi\pi_{t-1} + (1-\varphi)\pi^T$

Where the data is allowed to estimate the target π^T

	1992-1997		**1997-2003**	
	φ	π^T	φ	π^T
Consensus				
One year ahead	0.31	3.71*	0.39*	2.40*
Two years ahead	0.63*	5.22*	0.23	2.47*
BASIX				
One year ahead	0.31*	3.51*	0.38*	4.83*
Two years ahead	0.61*	2.83*	0.45*	3.10*

(Source of data: Barclays, and Consensus Economics)

Two year ahead inflation expectations appear more 'anchored' by the inflation target, measured by the fall in the AR coefficient. But this is not true for one year ahead expectations.

Some minor comments

There is a disconnect between the equation taken to the sectoral and aggregate price data, and the individual goods data. In principle one could create individual goods price inflation rates, and run the same regression on these inflation rates as the authors run on the aggregates. If there is a confidentiality problem in doing so, persuade the statisticians to run the regressions!

[2] This draws on a larger body of work joint with Richard Harrison and Jan Vlieghe at the Bank of England.

The authors de-seasonalise their inflation data. Why? This seems to introduce a disjoint between the data used and the theory. The PC expresses the first order condition for firms. Forecastable changes in marginal costs or demand will be acted on. If something is going to cause prices to need to be higher tomorrow, and I expect that, then that will cause me to put up prices today if I can.

Why use Bayesian estimates at all? What priors can we have about the reduced form? I can see the motivation if the coefficients are bounded by the structure, but here we can't do that without some work, so what's the point? Especially if as the authors say the estimates converge on classical ones anyway.

Lots of price changes doesn't mean less price stickiness. Models like the quadratic costs of adjustment model and the sticky information model imply continuously changing prices, yet still would generate prices stuck far away from those that would give us the efficient level of output.

It would help to make the distinction between the effects EMU could have had on real rigidities vs those it would have had on nominal rigidities.

It doesn't make economic sense to assume that the parameters of the AR(1) follow a random walk. Since these things are a function of the monetary policy process, the shocks and the expectations and price setting processes, we have priors that these coefficients are bounded.

It is difficult to know what theory would predict about the correlation between the level of inflation expectations, and the degree to which current inflation depends on lagged inflation (inflation persistence), so I don't think this evidence can add much to the general inquiry in the paper

Conclusions

The authors set themselves an ambitious task – to ask how the introduction of a common currency might have affected price-setting, and the inflation process. They have amassed some very interesting data that bears on the question and which could keep either the authors or their successors occupied for some time. This project, however, cannot help but be hampered by the primitive state of the modelling tools the literature on price-setting offers us, which leaves without a very clear hypothesis to confront with the data.

References

Angeloni and Dedola (1999) 'From the ERM to the euro: new evidence on economic and policy convergence among EU countries, by Ignazio Angeloni and Luca Dedola', ECB Working Paper no 4, May.

Barkbu, Cassino, Gosselin-Lotz and Piscitelli (2005) The New Keynesian Phillips Curve in the United States and the Euro Area: Aggregation Bias, Stability and Robustness., Bank of England Working Paper no 285.

Gerlach-Kristen (2003) 'Interest rate reaction functions and the Taylor rule in the Euro Area', ECB working paper no 258, September.

European Central Bank Working Paper Series

For a complete list of Working Papers published by the ECB, please visit the ECB's website (http://www.ecb.int)

559 "When did unsystematic monetary policy have an effect on inflation?" by B. Mojon, December 2005.

560 "The determinants of 'domestic' original sin in emerging market economies" by A. Mehl and J. Reynaud, December 2005.

561 "Price setting in German manufacturing: new evidence from new survey data" by H. Stahl, December 2005.

562 "The price setting behaviour of Portuguese firms: evidence from survey data" by F. Martins, December 2005.

563 "Sticky prices in the euro area: a summary of new micro evidence" by L. J. Álvarez, E. Dhyne, M. M. Hoeberichts, C. Kwapil, H. Le Bihan, P. Lünnemann, F. Martins, R. Sabbatini, H. Stahl, P. Vermeulen and J. Vilmunen, December 2005.

564 "Forecasting the central bank's inflation objective is a good rule of thumb" by M. Diron and B. Mojon, December 2005.

565 "The timing of central bank communication" by M. Ehrmann and M. Fratzscher, December 2005.

566 "Real versus financial frictions to capital investment" by N. Bayraktar, P. Sakellaris and P. Vermeulen, December 2005.

567 "Is time ripe for a currency union in emerging East Asia? The role of monetary stabilisation" by M. Sánchez, December 2005.

568 "Exploring the international linkages of the euro area: a global VAR analysis" by S. Dées, F. di Mauro, M. H. Pesaran and L. V. Smith, December 2005.

569 "Towards European monetary integration: the evolution of currency risk premium as a measure for monetary convergence prior to the implementation of currency unions" by F. González and S. Launonen, December 2005.

570 "Household debt sustainability: what explains household non-performing loans? An empirical analysis" by L. Rinaldi and A. Sanchis-Arellano, January 2006.

571 "Are emerging market currency crises predictable? A test" by T. A. Peltonen, January 2006.

572 "Information, habits, and consumption behavior: evidence from micro data" by M. Kuismanen and L. Pistaferri, January 2006.

573 "Credit chains and the propagation of financial distress" by F. Boissay, January 2006.

574 "Inflation convergence and divergence within the European Monetary Union" by F. Busetti, L. Forni, A. Harvey and F. Venditti, January 2006.

575 "Growth in euro area labour quality" by G. Schwerdt and J. Turunen, January 2006.

576 "Debt stabilizing fiscal rules" by P. Michel, L. von Thadden and J.-P. Vidal, January 2006.

577 "Distortionary taxation, debt, and the price level" by A. Schabert and L. von Thadden, January 2006.

578 "Forecasting ECB monetary policy: accuracy is (still) a matter of geography" by H. Berger, M. Ehrmann and M. Fratzscher, January 2006.

579 "A disaggregated framework for the analysis of structural developments in public finances" by J. Kremer, C. Rodrigues Braz, T. Brosens, G. Langenus, S. Momigliano and M. Spolander, January 2006.

580 "Bank interest rate pass-through in the euro area: a cross country comparison" by C. K. Sørensen and T. Werner, January 2006.

581 "Public sector efficiency for new EU Member States and emerging markets" by A. Afonso, L. Schuknecht and V. Tanzi, January 2006.

582 "What accounts for the changes in U.S. fiscal policy transmission?" by F. O. Bilbiie, A. Meier and G. J. Müller, January 2006.

583 "Back to square one: identification issues in DSGE models" by F. Canova and L. Sala, January 2006.

584 "A new theory of forecasting" by S. Manganelli, January 2006.

585 "Are specific skills an obstacle to labor market adjustment? Theory and an application to the EU enlargement" by A. Lamo, J. Messina and E. Wasmer, February 2006.

586 "A method to generate structural impulse-responses for measuring the effects of shocks in structural macro models" by A. Beyer and R. E. A. Farmer, February 2006.

587 "Determinants of business cycle synchronisation across euro area countries" by U. Böwer and C. Guillemineau, February 2006.

588 "Rational inattention, inflation developments and perceptions after the euro cash changeover" by M. Ehrmann, February 2006.

589 "Forecasting economic aggregates by disaggregates" by D. F. Hendry and K. Hubrich, February 2006.

590 "The pecking order of cross-border investment" by C. Daude and M. Fratzscher, February 2006.

591 "Cointegration in panel data with breaks and cross-section dependence" by A. Banerjee and J. L. Carrion-i-Silvestre, February 2006.

592 "Non-linear dynamics in the euro area demand for M1" by A. Calza and A. Zaghini, February 2006.

593 "Robustifying learnability" by R. J. Tetlow and P. von zur Muehlen, February 2006.

594 "The euro's trade effects" by R. Baldwin, comments by J. A. Frankel and J. Melitz, March 2006.

595 "Trends and cycles in the euro area: how much heterogeneity and should we worry about it?" by D. Giannone and L. Reichlin, comments by B. E. Sørensen and M. McCarthy, March 2006.

596 "The effects of EMU on structural reforms in labour and product markets" by R. Duval and J. Elmeskov, comments by S. Nickell and J. F. Jimeno, March 2006.

597 "Price setting and inflation persistence: did EMU matter?" by I. Angeloni, L. Aucremanne, M. Ciccarelli, comments by W. T. Dickens and T. Yates, March 2006.

ISSN 1561081-0