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by Björn Döhring and Aurora Mordonu
Directorate-General for Economic and Financial Affairs

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European Commission
Directorate-General for Economic and Financial Affairs
Publications
BU-1
B - 1049 Brussels, Belgium

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What drives inflation perceptions?

A dynamic panel data analysis[1]

Björn Döhring and Aurora Mordonu

European Commission
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Abstract
At the moment of the euro cash changeover, inflation perceptions in the euro area deviated from measured inflation, and in some euro-area Member States in a persistent way. In recent years, a growing body of literature has developed on the factors that might explain this deviation. This paper formally tests various explanations advanced in this literature. It adopts a cross-country perspective at the level of the euro area which is empirically implemented through a dynamic panel data model. Inflation perceptions are found to be highly persistent (the autoregressive term is large and statistically highly significant). In contrast to much of the – descriptive – literature, an index of "out-of-the-pocket expenditure" is found not to explain inflation perceptions better than does the all-items HICP index. As suggested by psychological experiments, inflation expectations seem to contribute to the formation of inflation perceptions, although to a limited extent. Prices of residential real estate contribute significantly to inflation perceptions, suggesting that households have a broader view of the cost of living when forming inflation perceptions. Our results have implications for policy, for the further research agenda and for the development of statistics. In particular, the persistence of inflation perceptions makes us think that communication efforts prior to euro introduction are essential to anchor perceptions. Once perceptions increase, it will be much harder to bring them back in line with measured inflation.

Key words: inflation, perceived inflation, dynamic panel data model
JEL classification: C23, D12, D84, E31

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1. Introduction

More than five years after the introduction of euro banknotes and coins - the euro cash changeover, polls reveal a widespread perception that the euro has led to higher inflation. In a Eurobarometer poll[2] of autumn 2006, more than 90% of respondents in the euro area considered that the euro had "*added to the increase of prices*" in the past 5 years.

This feeling of accelerated price increases persists despite the fact that inflation since the creation of the euro in 1999, or since the introduction of euro banknotes and coins in 2002, has clearly not been higher than before. The opposite is true in most euro-area Member States. The prices of some goods and services did increase more strongly around the date of the euro cash changeover. The impact on the overall HICP price index was, however, only small and temporary.

So, if measured inflation remained low after the introduction of the euro, why do people perceive much stronger price increases? A flourishing literature on the issue has put forward several explanations. Firstly, products which saw strong price increases at some point in time may be particularly important for the perception of price developments in general. Secondly, households whose consumption differs from the average HICP basket may have experienced a different pace and magnitude of price increases. Thirdly, the feeling that life has become more expensive might be influenced by the development of households' disposable income in the past few years. Fourthly, inflation perceptions may have been blurred by expectations of price increases, the complexity of the conversion rate from national currency to euro, extensive media coverage of price developments or by the way people compare current euro prices with prices of 2001 in national currency.

So far, much of this literature has been of a descriptive nature. Where explanations were tested formally, this has mostly – with few exceptions[3] – been done at the level of an individual Member State. This paper therefore contributes to filling the empirical gap by testing, from a euro-area[4] perspective, the joint validity of some of the hypotheses mentioned above within a single framework. Dynamic panel data analysis is employed to test whether inflation perceptions can be explained by different sub-indices of the harmonised index of consumer prices, e.g. frequently purchased goods (an index of "out-of-the-pocket" expenditure is constructed for the purpose), by residential property prices, house rents and other housing related costs, developments of household income or inflation expectations.

The results find mixed support for some of the hypotheses generally advanced in the literature and also bring in new findings. The price index of out-of-the-pocket expenditure has not more explanatory power than the all-items HICP itself. If the out-of-the-pocket index played a larger role than headline inflation itself closely before and after the euro cash introduction, this effect was transitory and did not last long enough to be identified by our regressions. In any event, the development in the out-of-the-pocket index has less explanatory power with regards to the persistence of a difference between perceived and measured inflation.

House price developments appear to play a significant role in explaining inflation perceptions, while the compensation per employee does not seem to have additional explanatory power. The results suggest that inflation expectations may explain inflation perceptions to a limited extent. Moreover, the introduction of the euro appears as a regime change.

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[2] Flash Eurobarometer 193, available at: http://www.ec.europa.eu/public_opinion/flash/fl193_en.pdf

[3] Aucremanne *et al*. (2007), for example.

[4] The euro area is, for the purpose of this paper, defined as the 12 Member States that introduced the euro cash in 2002.

We find that inflation perceptions are highly persistent, which has important policy implications. In fact, the persistence of perceptions suggests that it is hard to dispel the perception of price increases once it has taken hold. Therefore, communication efforts should address inflation perceptions well before future cash changeover operations.

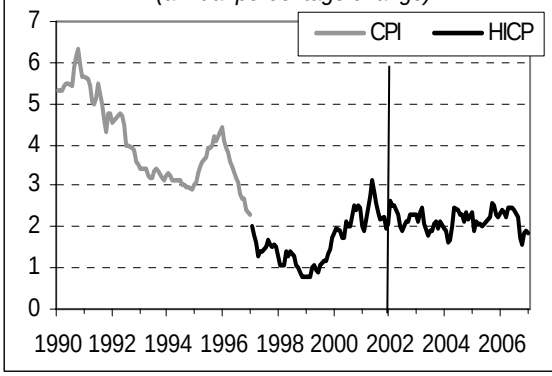
The remainder of this paper is organised as follows. Section 2 reviews developments in perceived and measured inflation, with an emphasis on HICP sub-categories which saw the most significant price changes around the cash changeover. A literature review is provided in Section 3, both on price-setting behaviour and market structure and on the suggested explanations for high inflation perceptions. The specific approach employed in this paper is discussed in Section 4, under three subsections: the model, the data, and the results. Section 5 concludes and discusses possibilities for further avenues of research.

2. Measured price developments at the euro cash changeover and perceived inflation

2.1. Headline inflation and some components

Annual consumer price increases in the euro area have averaged 2.0% since the creation of the euro and 2.2% since 2002. Inflation in most euro area Member States was higher, often significantly, in the first half of the 1990s than it has been since the adoption of the euro (chart 1). In the year following the euro cash changeover, annual inflation in the euro area was 2.3%, marginally down from 2.4% the year before. At the country level, average inflation in 2002 was lower than in 2001 in seven out of the twelve euro-area Member States (table 1). Mild inflation in 2002 is a first indication that the impact of the euro cash changeover on HICP inflation in 2002 was rather limited.

Chart 1: euro area inflation
(annual percentage change)



Source: Eurostat

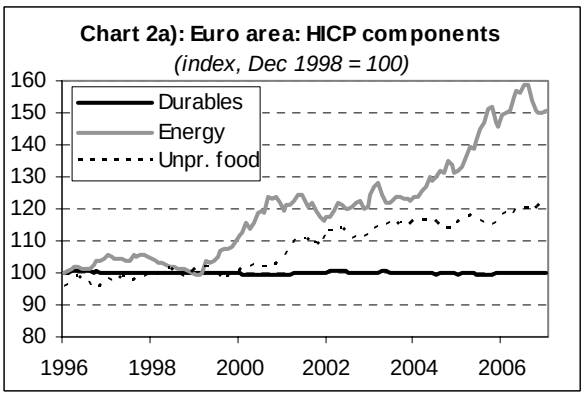
Table 1: Consumer price inflation (HICP) in the euro area and Member States
(annual average rate of change in %)

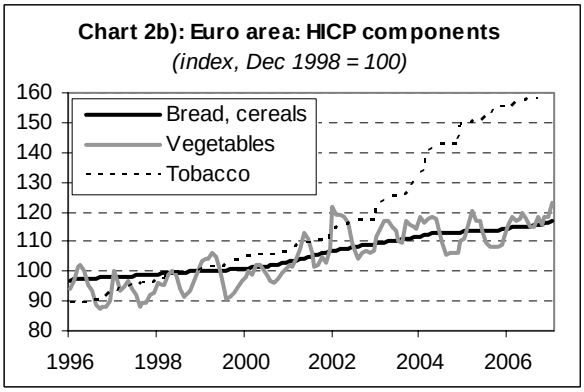
	euro area	BE	DE	IE	GR	ES	FR	IT	LU	NL	AT	PT	FI
1999	1.1	1.1	0.6	2.5	2.1	2.2	0.6	1.7	1.0	2.0	0.5	2.2	1.3
2000	2.1	2.7	1.4	5.3	2.9	3.5	1.8	2.6	3.8	2.3	2.0	2.8	2.9
2001	2.4	2.4	1.9	4.0	3.7	2.8	1.8	2.3	2.4	5.1	2.3	4.4	2.7
2002	2.3	1.6	1.4	4.7	3.9	3.6	1.9	2.6	2.1	3.9	1.7	3.7	2.0
2003	2.1	1.5	1.0	4.0	3.4	3.1	2.2	2.8	2.5	2.2	1.3	3.3	1.3
2004	2.1	1.9	1.8	2.3	3.0	3.1	2.3	2.3	3.2	1.4	2.0	2.5	0.1
2005	2.2	2.5	1.9	2.2	3.5	3.4	1.9	2.2	3.8	1.5	2.1	2.1	0.8
2006	2.2	2.3	1.8	2.7	3.3	3.6	1.9	2.2	3.0	1.7	1.7	3.0	1.3

Source: Eurostat.

According to Eurostat (2003), the impact of changeover-related inflation on the HICP for the whole year 2002 is most likely to lie within a range of 0.12 and 0.29 percentage points of inflation. Angelini and Lippi (2006) use the evolution of cash withdrawals at ATMs in Italy as indirect evidence of price developments. Their argument is that since these data do not rely on official inflation statistics, they provide an independent check for the latter. They do not find evidence that consumer prices increased after the cash changeover in a way that would not be recorded in official statistics.

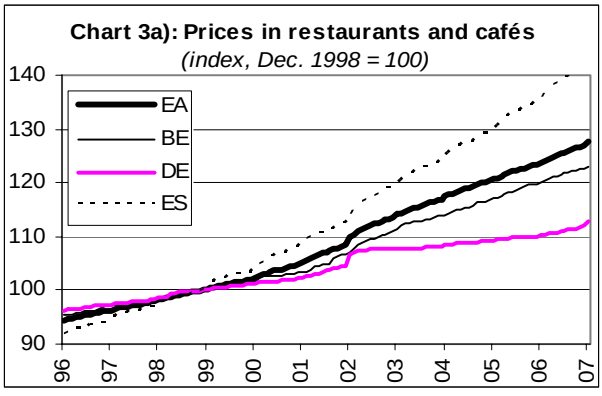
However, the euro cash changeover was accompanied by a much higher number of price adjustments than usual (cf. Chlumsky and Engelhard, 2002; Angeloni et al, 2006). And indeed, prices for some goods and services did increase at the time of the euro cash changeover (charts 2a and 2b). In the euro area as a whole, this was particularly the case for unprocessed food. Prices for fresh vegetables, that are usually quite volatile, increased sharply in early 2002. Prices for bread and cereals, which are generally far less volatile, experienced significant increases throughout 2001 and 2002. Energy prices also picked up in early 2002 across the euro area.

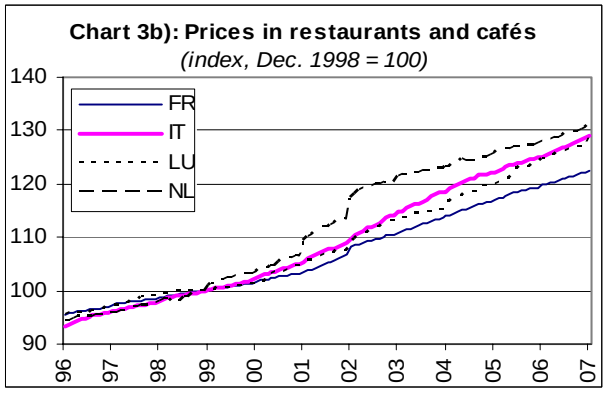




Source: Eurostat

An increase in prices of restaurants and cafés that seemed to be related to the euro cash changeover was widely noticed (charts 3a and 3b). In a number of Member States, a jump in these prices in January 2002 was clearly visible. In some countries, such as Germany and the Netherlands, an upward price adjustment in early 2002 was followed by a long period of more subdued price increases in restaurants and cafés, such that these price increases have reverted to their longer-term trend. In some others (including Belgium, France, Italy and Spain), however, a faster pace of price increases in the restaurant and café sector has been sustained after 2002. Restaurants and cafés exemplify similar developments in some other services, in particular recreational services (e.g. prices of cinema tickets), hairdressers and various repair and cleaning services.





Source: Eurostat

In its final report on the impact of the euro cash changeover on prices, Eurostat (2003) differentiates price increases in 2001/2002 into those which were due to the euro cash changeover and those that were due to other factors (cf. also Ercolani and Dutta, 2006). The main findings are as follows:

- The price increases for a number of items were unrelated to the euro cash changeover. Short-term variations in energy prices depend mainly on international energy market conditions. The energy price increase in the euro area in 2002 was similar to energy price developments outside the euro area and can thus not be ascribed to the euro cash changeover. Similarly, price increases for holiday packages and air travel were found to depend on energy prices and security measures rather than the euro cash changeover. Other increases, such as tobacco prices, were driven by tax increases.
- Price increases for fruit and vegetables were driven to a large extent by bad harvests in parts of Europe in 2001. Nonetheless, the typical pattern of their price developments changed around the euro cash changeover date. They might thus have been influenced by the changeover as well. The same is true for the prices for bread, beer and some services.
- Finally, a number of products show rather clear changeover-related price patterns. These include the above mentioned restaurants and cafés, hairdressers, repair and cleaning and recreational services.

Many of the prices most likely to have been affected by the euro cash changeover are thus indeed prices of products of everyday consumption: foodstuff and regularly purchased services. The prices of other items of regular consumption (fuel, tobacco) also increased, but independently of the euro cash changeover. By contrast to these "out-of-the-pocket" purchases, the prices for many "big-ticket" items consumed at lower frequency have remained stable or actually fallen.[5]

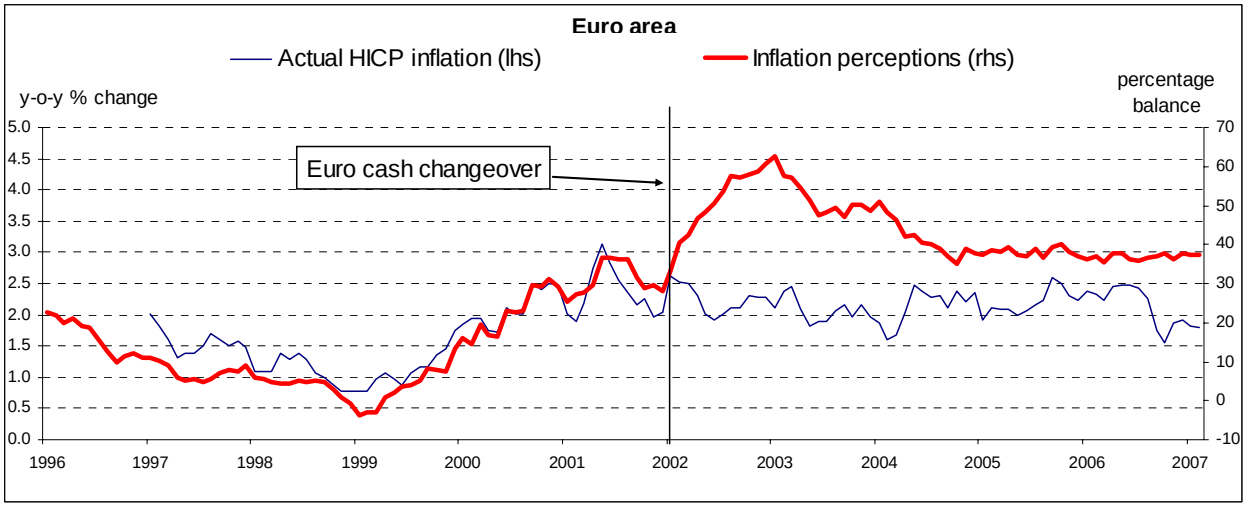
2.2. Inflation perceptions

Although the annual HICP inflation rate in 2002 was slightly below inflation in 2001, people's perceptions of inflation increased significantly with the euro cash changeover and, in a number of Member States, remained well above measured inflation thereafter.

The European Commission collects data on inflation perceptions within the framework of the Joint Harmonised EU Programme of Business and Consumer Surveys. The Commission indicator of perceived inflation corresponds to the difference between the weighted proportion of respondents stating that prices have risen over the past twelve months and the weighted proportion of respondents stating that prices have fallen or remained unchanged over the same period. This balance statistic used to track HICP inflation remarkably well in the period 1996-2001.

[5] It is important to note in this context that the HICP measures price developments net of quality improvements.

Chart 4: Inflation perceptions and the HICP



Source: European Commission

However, in the course of 2002, inflation perceptions measured by the Consumer Survey moved significantly away form measured inflation. Thus, the prior close correlation between perceived and headline inflation broke as perceptions were moving to levels never registered before. The perception gap narrowed between early 2003 and the end of 2004. The narrowing of the gap came however to a halt in 2005, indicating either strong persistence in perceptions or a new relationship between perceptions and headline inflation induced by the regime change. If the latter explanation holds, one should not expect the gap to entirely close.

The break in the relationship between measured and perceived inflation occurred in all euro-area Member States (see detailed charts in the Annex 1). Developments at the level of Member States differed, however, with respect to the size of the perception gap, the precise moment when the gap widened and its persistence. For instance, the gap was large but temporary in countries such as Germany, Italy and the Netherlands, but large and persistent in France, Belgium, Greece and Finland.

3. A review of the literature

The literature has focused on two main themes. Firstly, the reasons for cash changeover-related price increases and, secondly, the reasons for higher inflation perceptions.

3.1. Price-setting behaviour and market structure

The mechanisms behind changeover-related price increases are theoretically well understood and empirically fairly well documented. Market structure, dual pricing regulations, attractive pricing and menu costs are the main factors put forward to explain such increases. Angeloni et al. (2006) identify a sharp increase in the number of price adjustments – both upwards and downwards – in six euro-area countries in early 2002, in line with "menu costs" related to price adjustments. They find that after the initial adjustment, price setting behaviour returned to normal. Dziuda et al. (2005) build a model of imperfect competition among retailers in order to explain changeover-related price increases. In their model, the introduction of the new currency temporarily decreases price transparency and thereby weakens competitive pressure among retailers. The individual retailer can exploit that situation by increasing his prices, or he can invest in measures to increase price transparency in an effort to attract additional business from customers who find it difficult to deal with the new currency. The

authors show that the choice between the two possibilities depends on the market structure: the more concentrated the retail market, the stronger an investment in transparency is expected to pay off. (Efforts to increase transparency are more visible to the consumer in a market dominated by a small number of retail chains, and there are economies of scale to advertisement.) Indeed, their evidence from euro-area countries confirms that changeover-related inflation was weaker in countries with more concentrated retail markets.

Ehrmann (2006) finds that consumers use simple “rules of thumb” for the mental conversion of national currency to euro, in euro-area countries where conversion rates are complex. He shows that this approximative conversion has given retailers in the food and clothing sectors opportunities to increase prices by stealth.

Eife and Moschitz (2005) point to the role of changeover-related pricing regulations. They find that the obligation to use dual price tags in Austria for five months and a long "replacement" period for fading out prices in Schilling explain why the changeover produced less price increases in Austria than in Germany where there was no obligation for dual display of prices.

Some articles focus on menu costs and market structure in the restaurant sector, where price increases around the cash changeover were particularly strong. Hobijn et al (2006) argue that due to menu costs, restaurants adjust their prices only intermittently. At the moment of the cash changeover, where menus had to be re-written anyway, an unusually large number of restaurants in the euro area also adjusted their prices. Gaiotti and Lippi (2005) analyse price increases in a panel of restaurants in Italy. They acknowledge the concentration of price adjustments at the moment of the changeover, but find that the strong price increases in 2001 and 2002 can only partly be attributed to the changeover. Their empirical results show that cost factors (rising unit labour costs and food prices) as well as strong demand explain a great deal of the increases. Moreover, the authors find evidence that price increases were stronger where the geographical concentration of restaurants (a proxy for competition) is lower. In the model of Adriani et al. (2003) restaurants specialise on either local customers, who are well informed about the quality at offer, or tourists, for whom the offer is more intransparent. They collect data for six euro-area Member States and conclude that the cash changeover allows restaurants serving mostly tourists to coordinate on a new equilibrium with permanently higher prices and thus to extract rents from their customers.

Chlumsky and Engelhard (2002) analyse the inflationary impact of the movement from "attractive prices" in DEM to "attractive" euro prices (see also National Bank of Belgium, 2002 as well as Aucremanne and Corneille, 2001).[6] They find strong sectoral variations in the timing and the inflationary impact of the move from prices converted at the official rate towards attractive euro prices. The services sector applied attractive euro prices mostly as of January 2002, and this was accompanied by significant price increases for items such as cinema tickets, hotel stays and car wash. For food and consumer durables the move towards attractive prices was more gradual and accompanied by price decreases for durables and price volatility for food (as mentioned above, the volatility of food prices was to a large extent unrelated to the euro cash changeover). Also for Germany, the Bundesbank (2004) reports that the prices of some items that saw the strongest increases in early 2002 later stagnated, thus reverting towards their longer-term trend.

[6] An "attractive" price is understood as a price that ends on 0; 5; 8 or 9 (€2.99 and €3 are "attractive" prices for, say, a sandwich; €2.97 and €3.02 are not).

3.2. Explanations for high inflation perceptions

A growing literature deals with the factors that seem to influence the way consumers deal with price variations and could explain the divergence of measured and perceived inflation related to the euro cash changeover (Fluch and Stix, 2005, as well as ECB, 2007 are good overview articles). Most of the literature discusses one or more of the following classes of explanations: Individual prices or groups of prices within the HICP could influence perceptions more than headline inflation itself; price developments outside the scope of the HICP and household income developments could drive perceptions of a broad "cost of living"; technical factors (such as the complexity of the euro conversion rate) as well as psychological factors might have produced a bias of perceptions in the specific situation of the cash changeover.

The most prominent explanation for increased inflation perceptions is based on the observation, confirmed by the official price statistics, of substantial price increases for products purchased very frequently. Many authors argue that consumers' inflation perceptions are mainly formed on the basis of such "out-of-the-pocket" expenditure.[7] The fact that TV sets are becoming cheaper will strike consumers only when they buy one. Consumers are also less frequently reminded of the price developments of items they pay for by standing bank order (e.g. rents). However, the ECB (2003 and 2005) and the European Commission (2004) argue that the price dynamics of out-of-the-pocket expenditure only partly explain the development of inflation perceptions.

Since the HICP is based on the consumption of an average household, the price developments faced by individual households will differ more or less strongly from the HICP, depending on their individual consumption patterns. For the individual household, the price for particular goods or services can play a role significantly higher or lower than the HICP weight. Del Giovane and Sabbatini (2005, 2006) look at different socioeconomic categories of consumers in Italy and show that dissimilar inflation perceptions across socioeconomic groups can arise from their different consumption patterns (e.g. the weight of basic foodstuff in the overall consumption of a particular group). When analysing the underlying factors of high perceptions in Italy, Giovane and Sabbatini (2006) suggest that "a *combination of … factors contributed to the gap*". In addition to frequently purchased goods, they advance the hypothesis that the public is influenced more by upward (than downward) changes in prices. Differences between individual consumption baskets and the consumer price index basket are also found to play a role. In relation to this, the sharp rise in the price of items not included in the consumer price index basket, such as house prices, is identified as another factor. Extensive media coverage is equally found to be highly correlated with inflation perceptions. Finally, for rarely purchased durable goods, consumers may compare current prices with the prices when they last made such purchases -which can be well before December 2001.

Brachinger (2005, 2006) attempts to capture some of these elements more formally in his index of perceived inflation for Germany. It builds on the following hypotheses on human behaviour: First, people compare prices for any particular good with an internal, good-specific reference price, usually the memory of a price observed some time in the past. If the price for a good is lower than its reference price, this is perceived as a benefit; if it is higher, this is perceived as a loss. Second, people value such losses higher than benefits of equal size (i.e. they are more sensitive to price increases than to price reductions). Third, the perception of price variations is stronger the higher the frequency of concretely experiencing them. Brachinger formalises these hypotheses and combines them with official data on prices and

[7] A different pace of price increases by frequency of purchase was, besides, also observed in the UK (O'Donogue, 2007).

approximate purchase frequencies[8] to calculate his index of perceived inflation. However, in order to determine the concrete level of perceived inflation, an exogenous parameter of loss aversion is needed. In the author's preferred specification, this parameter is set at 2 (losses are felt twice as strongly as benefits), a level derived from experiments reported in related literature. By construction, the index so derived does not depend on any survey measure of inflation perceptions. The index of perceived inflation for Germany shows perceived inflation between 7% and 11% in most of 2001 and the first half of 2002 before converging back to the level of the HICP. If, in addition, one assumes that the adaptation of reference prices was slower than usual at the time of the cash changeover, because people continued for some time to use the latest DEM prices as reference, the index re-converges towards the level of HICP inflation much more gradually. Those who continue to use old DEM prices as a reference would even perceive a constant acceleration of inflation. Hoffmann *et al.* (2006) critically discuss the assumptions inherent to the index developed by Brachinger. In particular, they point out that households' inflation perceptions are likely to be influenced by the impact of large expenditure items on their budget. By assigning a high weight to frequently purchased items, Brachinger's index fails to take into account the impact of large, but less frequent expenditure items (such as rents) on households' budget. They also criticise the "*certain degree of arbitrariness*" that arises from the choice of the exogenous parameters.

Ehrmann (2006) shows that the complexity of euro conversion rates together with approximative “rules of thumb” for mental rounding may have contributed to the mismatch of perceived and actual inflation. The survey of cinema-goers by Cestari *et al.* (2007) demonstrates that consumers’ memory of prices may be rather poor. The respondents to their survey recalled much lower pre-euro prices, but also lower euro prices of 2003, than the actual ones. Traut-Mattausch *et al*. (2004) demonstrate that expectations of changeover-related price increases are not dispelled by the presence of evidence to the contrary. In their experiments, test persons compared the old DEM prices and new euro prices on the menu of a fictitious restaurant. Three groups of respondents received menus where euro prices were higher, lower or unchanged from DEM prices. Asked to estimate by how much the restaurant had increased its prices, respondents in all groups delivered estimates that were biased upwards. When the average price had remained stable, significant price increases were perceived. Where the average price had increased (fallen), the prices were estimated to have increased by a larger than the actual rate (to have remained stable).

The empirical strategy closest to ours is the one employed by Aucremanne *et al.* (2007). The authors formally analyse the gap between measured inflation and inflation perceptions in view of some potential explanatory factors with a euro-area perspective. They first transform the balance statistic on inflation perceptions into a "quantitative" measure by standardising it on the means and standard deviation of observed inflation. They then use panel unit root tests in order to look at the relationship between standardised inflation perceptions and headline inflation over time. They test whether there is cointegration of perceived and measured inflation, and whether it is stable over time. Their main finding is that the gap between perceived and measured inflation is non-stationary after the euro cash changeover. While perceptions are found to track inflation prior to December 2001, this changes shortly after January 2002 - indicating that it is the euro that introduced the "wedge" between actual and perceived inflation. With regards to the contribution of socio-economic characteristics of consumers and a sub-index of frequently purchased goods to explaining inflation perceptions, no supportive evidence is found.

[8] Purchasing frequencies are contained in the household surveys from which the weights of goods in the CPI are obtained, but they are not compiled as such by the statistical office. The author calculates the approximate purchasing frequency of a good from its weight in the CPI basket and its price.

4. Empirical analysis of inflation perceptions

The main innovation of this paper is to test the various potential explanatory variables of inflation perceptions in a dynamic panel data framework. The fact that the euro cash changeover is a major event common to all euro-area Member States motivates a joint longitudinal data analysis.

4.1. The model

Both from a theoretical (see Annex 2) and empirical point of view, a dynamic panel data model appears more suitable to our case than a static model. In specifying the model, we follow a "*general-to-specific*" strategy, as suggested by Mizon (1995).

We first estimate a static panel data model (the results are not reported here), but the residuals are found to display autocorrelation. We do not attempt to correct for this in a linear regression model, which would involve, as Spanos and McGuirk (2003) show, "*highly unrealistic restrictions and produce inconsistent estimates*". We therefore read the autocorrelation in the residuals as a warning of an omitted autoregressive explanatory variable, or more generally a dynamic misspecification. De Grauwe and Skudenly (1999) mention that "*the lagged dependent variable catches up some of the effect of omitted variables varying over time, so that it helps to correct for autocorrelation.*"

Another argument in favour of a dynamic panel data setting is related to the interpretation of the coefficients. In a static panel data, one can capture either the short run or the long run effects, depending on the estimation method. It is often assumed that the "between" estimator measures long run effects, while the "within" estimator measures short run effects (Pirotte, 1999; Egger and Pfaffermayr, 2003). Moreover, Pirotte (1999) shows that "*when only individual dimension tends to infinity (i.e. the time dimension is fixed), long-run effects can be obtained by estimating a static relation whereas the true model is a dynamic one, as long as the coefficients are homogenous among individual units*". Since the sample is limited in both dimensions, the "between" estimator proves inappropriate for calculating long run impacts in our case.

According to a related view, while the static panel framework is more suitable for long run relationships, the dynamic panel setting addresses better the short term influences (De Benedictis, De Santis and Vicarelli, 2005). Given the novelty of the event and the shortness of the sample, it appears more appropriate to focus the analysis on the short run effects[9] when dealing with the impact of the euro cash changeover. The model we estimate can thus be formalised as:

$Y_{it} = \beta_1 Y_{it-1} + \beta_2 X'_{it} + u_{it}$,

with i = 1, …, N cross sections (countries) and t = 1, …, T periods.

Y_{it} is the vector of the dependent variable inflation perceptions;

X_{it} is a matrix of explanatory variables;

u_{it} is the error term, $u_{it} = \mu_i + \varepsilon_{it}$, μ_i being the unobservable individual specific effects and ε_{it} the remaining disturbance.

[9] While the model would also allow inferring the long run coefficients (see box 1), for the reasons discussed above, we limit our analysis to the short-run coefficients.

As dependent variable, we use qualitative inflation perceptions from the European Commission's Consumer Survey. Being qualitative, the Commission's indicator provides information on the perceived change in inflation, but not on its level. This has led Brachinger (2005) to reject the consumer survey indicator and to propose instead an "index of perceived inflation" based on a theory of inflation perceptions that is based on psychology. Nonetheless, we consider that the Commission's survey statistic, by reflecting respondents' actual perceptions (see also Hoffmann *et al.*, 2006), is better suited for our analysis than an entirely synthetic index.

The choice of explanatory variables (namely X_{it}) is as follows. Were measured inflation and inflation perceptions to correspond neatly, the indicator of perceived inflation should be entirely explained by the underlying consumer price inflation. The Harmonised Index of Consumer Prices (HICP) is therefore an obvious first explanatory variable.

However, the literature suggests that the prices of frequently purchased goods paid mainly in cash have an important impact on inflation perceptions. These prices are reflected in our index of out-of-the-pocket expenditure. Prices contained in this index increased more strongly then others around the time of the euro cash changeover, and might therefore explain the jump in perceived inflation.

Inspired by the work relating differing consumption patterns to inflation perceptions, we choose rents as a main suspect. In the euro area, 37% of households rent their apartment or house. The proportion varies substantially across Member States, from 11% in Spain to 57% in Germany. Rents also depend a lot on the region and type of housing. In some areas, they can easily amount to a third or more of a household's monthly expenditure, compared to an average HICP weight for the euro area of 6.3%. In the euro area as a whole, rents have increased by 1.5% per year on average since 1999 – well below average inflation. However, the differences across Member States were quite large. The average rent-paying household in Germany thus experienced lower inflation than measured by the HICP, while similar households in Ireland, Spain of Greece experienced stronger inflation.

The impact of house price developments on inflation perceptions is also examined. Residential property prices are not covered by the HICP, and also the cost for owner-occupied housing is currently not reflected in the HICP (as it is in the national consumer price indices of some Member States). However, most households in the euro area own their home, which is typically their biggest single asset. Others aspire to buying residential property. In both cases, households are likely to follow the development of house prices closely, and this may well influence their perception of inflation.

It has also been suggested (ECB, 2007) that inflation perceptions may be influenced by respondents' personal income situation or their assessment of the general economic situation. The euro-area economy experienced a cyclical downswing after the year 2000. The following upswing took time to gain strength. Only in 2006 was euro-area growth above potential again. These cyclical developments impacted on the labour market and wages with a delay. After 2001, employment in the euro area remained subdued for several years. From 2002 to 2005, the euro area registered annual employment growth of less than 1%. Accordingly, the growth of real wages and households' disposable income slowed down in the euro area and many Member States. The slowdown in income growth might have been mistakenly attributed to an acceleration of inflation rather than to the general economic slowdown. We use the compensation per employee as a proxy for disposable income. Although unrelated to expenditure and price developments, this is likely to have reinforced the perception that life has become more expensive after the euro cash changeover.

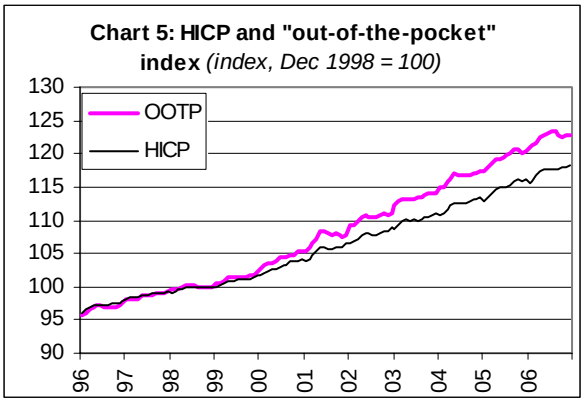
Finally, qualitative inflation expectations from the European Commission's Consumer Survey are used to test if inflation expectations drive perceptions, since expectations about price developments are thought to determine the way inflation is perceived. Expectations are often considered to have played a key role in the decoupling between inflation perceptions and HICP inflation.

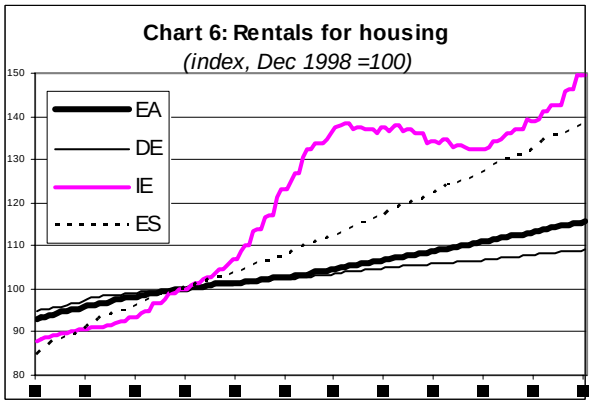
4.2. The data

The available data allow us to construct two panels. The first panel includes all data available at monthly frequency and reaches from January 1997 to February 2007. This leads to up to 1320 observations included in the regressions. The second panel has a quarterly frequency, allowing us to include additional variables. At up to 393, the number of observations included in the regressions is still comfortable.

Monthly data on inflation perceptions in all euro-area Member States are collected within the framework of the Joint Harmonised EU Programme of Business and Consumer Surveys. This monthly survey is carried out on a EU-wide random sample of 21,000 consumers. It contains, among others, the following question: "*How do you think that consumer prices have developed over the past 12 months?*" Respondents have to choose among the possible answers: *(1) risen a lot, (2) risen moderately, (3) risen slightly, (4) stayed about the same, (5) fallen, (6) don't know*. The indicator of perceived inflation corresponds to the difference between the weighted proportion of respondents stating that prices have risen over the past twelve months and the weighted proportion of respondents stating that prices have fallen or remained unchanged over the same period Denoting S_i (for i= 1,…, 5) as the sample proportion opting for each of the five response categories, the balance statistic is calculated as $(S_1 + 0.5\ S_2) – (0.5\ S_4 + S_5)$.

Similar qualitative data on inflation expectations are available from the same survey. The question respondents have to answer this time is: *"By comparison with the past 12 months, how do you expect that consumer prices will develop in the next 12 months?"*, and the possible answers are: "*they will… (1) increase more rapidly, (2) increase at the same rate, (3) increase at a slower rate, (4) stay about the same, (5) fall, (6) don't know*. The balance is calculated similarly as for perceptions.





Source: Eurostat

Consumer price developments in the euro area are measured by the Harmonised Index of Consumer Prices (HICP). The methodology for collecting and aggregating price data is