Universität Hamburg

Department Economics and Politics

Prospect Theory and Inflation Perceptions – An Empirical Assessment

Lena Vogel, Jan-Oliver Menz, Ulrich Fritsche

DEP Discussion Papers
Macroeconomics and Finance Series
3/2009

Hamburg, 2009

Prospect Theory and Inflation Perceptions - An Empirical Assessment

Lena Vogel*
Jan-Oliver Menz**
Ulrich Fritsche‡

July 14, 2009

Abstract

Building on the hypotheses of loss aversion with respect to price increases and availability of frequently bought goods, Brachinger (2006, 2008) constructs an alternative index of perceived inflation (IPI), which can reproduce the jump in the measure for perceived inflation after the Euro introduction in Germany that was not observable in standard HICP inflation. We test the hypotheses of Prospect Theory with regard to households' inflation perceptions underlying Brachinger's IPI in a panel estimation for 12 European countries. There is evidence that perceptions react more strongly to 'losses' in inflation than to 'gains' before the Euro cash changeover, but not afterwards. Moreover, we find empirical support for the availability hypothesis, stating that frequently bought goods have a stronger influence on inflation perceptions than on the overall price index.

Keywords: Inflation Perceptions, Prospect Theory, Dynamic Panel.

JEL classification: D81, D82, E52, C33.

*University Hamburg, Faculty Economics and Social Sciences, Department Economics and Politics, Von-Melle-Park 9, D-20146 Hamburg & KOF, ETH Zurich. e-mail: Lena.Vogel@wiso.uni-hamburg.de
We would like to thank Michael Lamla and Thomas Maag for their very helpful suggestions and comments and Torsten Schünemann for excellent research support. All authors thankfully acknowledge financial support from the Deutsche Forschungsgemeinschaft.
**University Hamburg, e-mail: Jan-Oliver.Menz@wiso.uni-hamburg.de
‡University Hamburg, e-mail: Ulrich.Fritsche@wiso.uni-hamburg.de

1 Introduction

When assessing macroeconomic models empirically, economists mostly use actual data as published by statistical institutes for the theoretical variables in these models. However, there exists overwhelming empirical evidence that peoples' knowledge and perception of these variables deviates considerably from official statistical data and their underlying concepts, questioning the widely assumed rationality of agents.[1] The gap between the actual figures and individuals' perceptions raises important policy questions. This is especially true for inflation. As argued by van der Klaauw et al. (2008), among others, if individuals have biased beliefs about inflation, this can seriously undermine the central bank's credibility. Conversely, a credible monetary regime can also influence inflation perceptions, for instance by creating a focal point at the inflation target.[2] Furthermore, and relating to the concept of money illusion[3], the perception gap may lead to distortions in bargaining if individuals misperceive their actual real purchasing power. To assess the effectiveness of policy propositions suggested by macroeconomic models, it is thus necessary to understand how people form perceptions about macroeconomic variables and how these perceptions influence individual behavior.

Agents' perceptions have been measured empirically since 1985 by the survey of the *Joint Harmonized EU Program of Business and Consumer Surveys* directed by the European Commission[4], questioning individuals directly about their judgments of the level and change of economic variables such as unemployment, GDP and inflation. In order to gain quantitative measures of these perceptions, various methods are used. However, the underlying statistical assumptions are rather restrictive and lead to different results depending on the method applied.[5] These problems have motivated Brachinger

[1] Blanchflower and Kelly (2008), Blinder and Krueger (2004), Jonung and Laidler (1988), Malgarini (2008), Curtin (2007) and van der Klaauw et al. (2008).

[2] Evidence for this channel has been found in inflation perception surveys for Sweden, see Bryan and Palmqvist (2005).

[3] See Fisher (1928) for the original contribution, and Shafir et al. (2004) and Fehr and Tyran (2004) for a Behavioral Economics perspective.

[4] European Commission (2008).

[5] See Nardo (2003) for an overview.

(2006, 2008) to construct an alternative *Index of Perceived Inflation* (IPI). His approach uses insights of *Prospect Theory*[6], providing several theoretical assumptions about peoples' formation of perceptions, most prominently the concepts of loss aversion and the availability heuristic. Evaluating their concept for German data, Brachinger (2006) and Jungermann et al. (2007) claim that this index represents a much more adequate way of capturing inflation as perceived by individuals. By contrast, their approach has been criticized by Hoffmann et al. (2006) for its use of arbitrary ad hoc assumptions, while in a larger empirical sample neither Döhring and Mordonu (2007) nor Aucremanne et al. (2007) find that an index of frequent out-of-pocket purchases (FROOPP) used as a proxy for Brachinger's index of perceived inflation outperforms the HICP.[7]

Especially one stylized fact has motivated several empirical studies in the area of inflation perceptions, namely the observed jump in perceptions after the Euro cash changeover in 2002 compared to the actual inflation rate that continued to stay on a low level. Explanation for this jump range from *price intransparencies* (Dziuda and Mastrobuoni, 2005), difficulties in applying the *conversion rates* (Ehrmann, 2006), *perceptual crisis* (Eife, 2006, Eife and Coombs, 2007, Fullone et al., 2007 and Blinder and Krueger, 2004), *macroeconomic illiteracy* (Del Giovane et al., 2008, Cestari et al., 2007), a *media bias* (Lamla and Lein, 2008), and *expectancy confirmation* (Traut-Mattausch et al., 2004).

However, less work has been conducted on what determines inflation perceptions in general. An exception is Del Giovane et al. (2008) who designed a detailed survey for Italian consumers in 2006 and investigate the answers econometrically. Especially, they find a strong impact of socioeconomic factors on inflation perceptions. This is in line with findings in Jonung (1981) who claims that inflation perceptions in Sweden differ significantly between genders. Furthermore, in a recent survey, Jonung and Conflitti (2008) report differences between age, gender, occupational and regional groups with

[6] Kahneman and Tversky (1979).

[7] Note, however, that the FROOPP index is not directly comparable to Brachinger's IPI, since it combines prices of frequently bought goods, but does not account for loss aversion.

respect to opinions of the Euro currency, which may also be reflected in inflation perceptions. Moreover, in a dynamic panel model for the countries that adopted the Euro in 2002, Döhring and Mordonu (2007) find an influence of inflation expectations on perceptions, in addition to actual inflation.

Our paper adds to the literature as follows. Using the balance statistics for inflation perceptions as a rather simple and publicly available measure summarizing the shift in the answer fractions of the underlying qualitative data, we forgo dealing with the problem of how to measure quantitative inflation perceptions in the most adequate way. Rather, we test empirically the two main theoretical assumptions on the formation of inflation perceptions, as put forward by Brachinger (2006, 2008). First, we investigate whether individuals code price increases and decreases in a different way and with different weights, implying *loss aversion* as in Kahneman and Tversky (1979), and Tversky and Kahneman (1981, 1991). Second, we examine which category of products has the highest impact on perceptions compared to its estimated weight in CPI inflation, and whether these are products that are bought more frequently, thus testing for the *availability hypothesis* put forward by Kahneman and Tversky (1973).

Using a panel of 12 countries within and outside the Euro Area, our results provide evidence of both loss aversion and availability:

First, we find that before the Euro introduction loss aversion with respect to inflation was existent and even more pronounced for the countries of the EMU-sample, while there is no indication of loss aversion after the Euro cash changeover in either the EMU- or the EU-sample. This suggests a strong structural break in the perception-inflation relation at the changeover, which might be due to confusion regarding the reference point after the Euro introduction.

Second, we find that price inflation of frequently bought goods categories has a significant effect on perceived inflation in the pre-Euro sample period, while inflation rates of other price categories are not found to be significant. For the post-Euro sample period, we find that the most frequently bought categories of goods, such as food and transport, again have a highly significant effect on inflation perceptions, but other, less frequently purchased,

categories become significant as well. This suggests a generally increased awareness of rising inflation after the Euro introduction in our sample.

In addition, we test the two hypotheses from Brachinger (2006, 2008) for different age, income and education groups. The main results remain robust also for individual socioeconomic groups, however, we find that only high income and working age groups exhibit loss aversion also with respect to their group-specific inflation rates, while the remaining groups show loss aversion only with respect to aggregate inflation and otherwise suggest either rationality or alternatively a 'bargain' or 'ostrich' behavior.

The paper is structured as follows. Section 2 contains a detailed discussion of the theoretical propositions with regard to inflation perceptions. Section 3 proceeds with describing the data set and the econometric methodology, followed by Section 4 in which we discuss our results. Section 5 concludes.

2 Theoretical Hypotheses

In order to develop testable theoretical hypotheses about individuals' formation of inflation perceptions, insights from Behavioral Economics can be used. Especially, one can build on *Prospect Theory*, which was developed by Kahneman and Tversky (1979), and Tversky and Kahneman (1981, 1991) as an alternative decision theory under risk and uncertainty opposed to the traditional expected utility theory.[8] Brachinger (2006, 2008) was the first to apply this theory to inflation perceptions. We follow his approach and test empirically for two fundamental theoretical assumptions underlying his *Index of Perceived Inflation*. The principal ideas of loss aversion and reference dependence of inflation perceptions are summarized in Figure 1.

< *Figure 1 here* >

1. Individuals code price changes and evaluate them against a reference price. Higher prices are perceived as losses whereas

[8] See Starmer (2004) for an overview of developments in decision theory under risk.

> lower prices are perceived as gains. Price increases are evaluated more strongly than price decreases, the exact quantity being captured by the loss aversion parameter.

In order to determine the reference price, two routes can be followed. In the context of consumer choice, the reference price is given by the *fair* price, which is determined by consumers' perceptions of sellers' costs. This idea has first been proposed by Thaler (1985) as the original study relating prospect theory to consumer choice and has recently been pursued further by Rotemberg (2005, 2008). With regard to inflation perceptions, Brachinger (2006) argues that one could simply take a past price as the reference price. However, it is not clear whether one should use an average price of a bundle of goods and how long the reference time period should be.

To our knowledge, Jungermann et al. (2007) present the only empirical investigation of the loss aversion parameter with respect to inflation expectations and find a value of about 2 in an experiment. This relates well to studies of loss aversion in other areas where approximately the same parameter has been found.[9] Hoffmann et al. (2006) question the claim that price increases are judged differently from price decreases, i.e. whether individuals behave asymmetrically with respect to price changes. Whereas Hoch et al. (1994) in an experimental study for US retailers deny any asymmetry, support for Brachinger's hypothesis is given by Hardie et al. (1993) and Camerer (2000). However, both of the quoted studies examine consumers' purchasing reactions to price changes, not individuals' changes in perceptions with regard to price changes. To the best of our knowledge, the only existing study dealing with asymmetries in inflation perceptions is Del Giovane et al. (2008). They add an additional question to their survey of Italian consumers, asking respondents whether they have observed any price decrease over the last five years. They then find that those who replied with 'yes' exhibit considerably lower inflation perceptions than the re-

[9] See for example Hardie et al. (1993) and Tversky and Kahneman (1991).

maining sample, hence providing some support for asymmetric inflation perceptions. Our analysis allows us to directly test for this hypothesis in a panel setup, evaluating if there exists a higher impact of periods with 'losses' in inflation on perceptions. We distinguish between loss aversion in the long and in the short run, and test for differences in the relation between the pre-Euro and the post-Euro periods.

2. Individuals perceive price changes the stronger the more often they buy a particular product.

According to the *Weber-Fechner Psychophysical Law*[10], inflation perceptions are a logarithmic function of actual inflation. Indeed, Tversky and Kahneman (1981) have shown in an experimental study that individuals perceive a price change of 5% stronger for a relatively cheap good than for a relatively expensive one. This can be explained by the *Availability Heuristic*, a term coined by Kahneman and Tversky (1973), who claim that agents will assess the frequency of events by the ease with which they can be remembered. Hence, for inflation perceptions, individuals perceive price changes the stronger, the more often they buy a particular product. In an experimental study for Germany, Jungermann et al. (2007) find empirical support for this hypothesis, and Del Giovane et al. (2008) point to several studies providing further evidence for single countries. Kurri (2006), for instance, analyses correlation coefficients of inflation perceptions and price changes in product groups included in the CPI and finds some evidence for the availability heuristic, which, however, is not robust between pre- and post-Euro periods. In contrast, Hoffmann et al. (2006) state that what matters is the impact of the price increase on the consumer's overall budget, not the frequency of the purchase. Döhring and Mordonu (2007) and Aucremanne et al. (2007) use an index of frequently bought goods (FROOPP) in their panel estimations and do not find that it performs better than aggregate HICP inflation. We test the availability hypothesis by estimating the effects of inflation of COICOP goods categories

[10] See Thaler (1980) and Batchelor (1986).

on perceptions and calculating one-standard-deviation impulses that can be compared to impulses of COICOP goods inflation on actual HICP inflation, leaving the question of the assumed linearity of inflation perceptions for further research. Additionally, we compare the explanatory content and individual R^2 of HICP vs. FROOPP inflation for perceptions as robustness check for the availability test.

3 Data Set and Statistical Properties

3.1 Data

The two hypotheses from Prospect Theory underlying Brachinger's Index of Perceived Inflation are tested empirically for a panel of 12 EU-Countries consisting of Austria, Belgium, Finland, France, Germany, Greece, Italy, the Netherlands, Portugal, Spain, Sweden and the UK for the time period from January 1996 to November 2008. Our sample thus covers the Euro Area almost completely and allows us to test for differences to non-Euro countries by including Sweden and the United Kingdom as control group. Furthermore, the sample period is long enough to enable us to test for differences between the pre-Euro and the post-Euro periods.

We use the balance statistic of Question 5 of the Joint Harmonized Consumer Survey by the European Commission as our measure of perceived inflation. The survey provides a qualitative measure from a pentachotomous survey, asking participants whether they think prices have risen a lot/ risen moderately/ risen slightly/ stayed about the same/ fallen over the last 12 months. Although this measure cannot be interpreted as a quantitative time series of perceived inflation, changes in the balance statistic nevertheless mirror changes in perceived inflation.[11] Actual inflation rates are measured with

[11] While most empirical studies on perceived or expected inflation with data from the Joint Harmonized Consumer Survey by the EC also make use of the balance statistic, there exist methods to quantify the qualitative data, most notably the probability method by Carlson and Parkin (1975) and Batchelor and Orr (1988). However, the quantification method demands a scaling series that perceptions, respectively expectations, are assumed to be based upon. Since it is usually assumed that perceptions of inflation are formed relative to actual inflation rates, the quantification method may lead to biased measures

annual inflation rates of harmonized consumer price indices (HICP) from the International Financial Statistics (IFS) database by the IMF. Additionally, in order to be able to test the availability hypothesis, we employ data on the 12 COICOP-categories[12], that together form the HICP, and the index of frequent out-of-pocket purchases (FROOPP) from Eurostat. The FROOPP index consists of a weighted average of goods that are purchased on a frequent basis such as food, beverages, tobacco, non-durable household goods, transport services and fuel, hotels, restaurants and hairdressing. Data on perceptions and inflation rates on the socioeconomic level are taken from the EC Joint Harmonized Consumer Survey for perceptions and calculated from socioeconomic COICOP-weights from Eurostat for actual inflation rates as in KOF Swiss Economic Institute (2008). All data are available on a monthly basis.

Comparing time series for actual HICP inflation and for perceived inflation from the balance statistics in the countries of our EU-sample, the jump in perceptions at the Euro introduction in the EMU countries is again strikingly obvious. By contrast, the non-EMU countries Sweden and the UK show no rise in perceived inflation. Actual HICP inflation rates in all the countries of our sample do not match the strong increase of perceptions at the Euro cash changeover, and in some cases even fall after the currency change (see Figures 2 and 3).

< Figure 2 here >

< Figure 3 here >

3.2 Unit Root Tests and Cointegration

Both inflation perceptions and actual inflation rates in our panel are tested for unit roots, where we assess the unit root properties as well as cointegration relations in a panel setting over the whole sample and separately over the

of perceived inflation if an existing bias in the relation between actual and perceived inflation is assumed away.

[12]COICOP stands for 'Classification of Individual Consumption by Purpose'.

period before and after the Euro introduction (1996 - 2001 and 2002 - 2008). We apply six different panel unit root tests: The Levin et al. (2002) test and the Breitung (2000) test assume a common unit root process over all series in the sample. Both the Levin-Lin-Chu test and the Breitung test estimate proxies for Δy_{it} and y_{it-1} and test for the null hypothesis $H_0 : \alpha = 1$ in the regression $\Delta y^*_{it} = \alpha y^*_{it-1} + \eta_{it}$, whereby the Levin-Lin-Chu test also allows for individual-specific deterministic elements such as intercept and time trend. The Breitung (2000) test argues that the Levin-Lin-Chu test looses power by including individual deterministics and thus constructs a test statistic without bias correction. Both tests suffer from the restriction that no cross-sectional correlation is allowed and that they can only test for stationarity of all series in the sample. By contrast, the tests by Im et al. (2003), Maddala and Wu (1999) as well as Choi (2001) (Fisher's ADF and PP test) allow for individual unit root processes. They specify individual unit root tests and derive test statistics to test the null hypothesis $H_0 : \alpha_i = 0$, for all i against the alternative that at least one $\alpha_i \neq 0$. While the tests may include individual-specific short-run dynamics and deterministics such as time trends for each panel member, cross-sectional correlation between countries is still not fully accounted for. This may be a relevant issue for actual and perceived inflation rates in a panel of closely related countries, such as the European countries analyzed here. Therefore, we additionally test for panel unit roots with the Pesaran (2007) Cross-Sectionally Augmented Dickey-Fuller (CADF) test. The test computes a t-bar statistic averaging t-statistic values for $H_0 : \alpha_i = 0$ from a standard ADF-regression augmented with lagged and first-differenced values of the cross-sectional mean of the series. All panel unit root tests are calculated with three lags.

The results in Table A1 and Table A2 in the Appendix imply uniform non-rejection of the null hypothesis of a unit root in perceptions over the whole sample period, both assuming common and individual unit root processes. Regarding the period before the Euro cash changeover, most tests cannot reject the null of a unit root in perceived inflation, while the Choi (2001) PP test and the Pesaran (2007) CADF test find stationarity of some series in the panel at the 10% and 5% level, respectively. Panel unit root tests in

the period after the Euro cash changeover mostly reject the null of a unit root in perceptions, with the exception of the Breitung (2000) test and the Pesaran (2007) test. Overall, thus, while there is convincing evidence of a panel unit root in perceptions over the whole sample period, dividing the sample with the Euro introduction leads to less conclusive results pointing to stationarity of perceptions after the Euro cash changeover. However, the Pesaran (2007) test indicates that this result might be biased due to the cross-sectional correlation of perceived inflation rates in the panel.

Evidence for a unit root in the inflation series over the whole estimation period is less conclusive (see Table A1): While the Levin et al. (2002) and the Breitung (2000) tests find evidence of a common unit root process in inflation, the other test statistics reject the null of individual unit roots in favor of stationarity of at least some of the inflation series in the panel. In the pre-Euro period, a common unit root cannot be rejected by the Breitung (2000) test, while the tests for individual unit root processes only reject the null at the 5% or 10% level. Results for the post-Euro period are more in line with those over the whole estimation period, but, accounting for cross-sectional correlation, the Pesaran (2007) test cannot reject the null of a unit root in inflation. Overall, while there is evidence of stationarity of inflation rates in some countries of our panel, the Pesaran (2007) test indicates that this result might be biased due to cross-sectional correlation of inflation rates across countries in our sample, at least in the period after the Euro introduction. This ambiguous result is in line with findings in Lein and Maag (2008), who also find that inflation perceptions are more persistent in a similar panel setting. Generally, empirical evidence on the order of integration of inflation series is mixed, Altissimo et al. (2006) conclude in a survey that empirical findings seem to lean towards stationarity of inflation.

Additionally, we also test for unit roots in the inflation rates of COICOP-price categories, where results are given in Table A3 in the Appendix. While the Levin-Lin-Chu test cannot reject the null hypothesis of a common unit root process for most of the COICOP-inflation rates, the remaining tests generally reject the null, suggesting at least weak stationarity of individual COICOP-inflation. It thus seems that the evidence in favor of stationarity

of inflation is more obvious when testing individual price categories, even though some ambiguity remains.

Due to the inconclusive evidence on stationarity of inflation in our panel, we furthermore test for panel cointegration between perceived and (aggregate as well as COICOP) actual inflation, see Table A4 in the Appendix. Again, we report test statistics both over the whole estimation period and separately for the pre-Euro and post-Euro periods. Table A4 shows seven panel cointegration test statistics proposed by Pedroni (1999, 2001, 2004) that are calculated by extending the Engle-Granger-framework to the panel setting and testing for stationarity of the residual from a regression with I(1) variables, while allowing for individual fixed effects and time trends.The null hypothesis of no cointegration ($\rho_i = 1$) is tested either against the alternative of a common cointegrating vector ($\rho_i = \rho < 1$) or against the alternative of individual cointegrating relationships ($\rho_i < 1$). The Kao (1999) panel cointegration test is also residual-based, but does not allow for individual-specific deterministics. Stationarity of the residuals from the first-stage regression is then tested with a panel ADF test on the null of no cointegration against the alternative of a common cointegrating vector. Finally, the Maddala and Wu (1999) test computes individual Johansen cointegration trace tests and maximum eigenvalue tests and uses those to obtain a combined Fisher statistic. Gutierrez (2003) conducts a Monte Carlo experiment to compare the power of Kao (1999) and Pedroni (1999, 2001, 2004) tests and finds that as T gets large, the Pedroni tests have higher power than the Kao test.

Evidence of panel cointegration between perceptions and inflation over the whole estimation period from the Pedroni (1999, 2001, 2004) tests is mixed: As in shown in Table A4, only two of the Pedroni Panel statistics reject the null of no cointegration in favor of the alternative of a common cointegration relationship. However, the Kao (1999) test statistic only marginally misses significance at the 5% level and the trace and maximum eigenvalue tests of the Maddala and Wu (1999) test are in favor of cointegration. Analyzing the pre-Euro and post-Euro periods separately, the results suggest a robust cointegration relationship between perceptions and inflation: In the period 1996 - 2001, most test statistics reject the null of no cointegration at the

1% level with only a few rejecting at the 5% and 10% level, while in the 2002 - 2008 period, all panel cointegration tests in Table A4 reject the null of no cointegration at the 1% level. Thus, there is convincing evidence for panel cointegration between perceived and actual inflation once the structural break of the Euro introduction is accounted for.[13] This result holds both for the alternative of individual cointegration relations and the alternative of a common cointegration vector. Our, quite intuitive, result is in line with findings in Lein and Maag (2008) who also report panel cointegration between perceptions and inflation with a slightly different sample. In addition to panel cointegration tests between perceptions and inflation, we furthermore report results of a Kao (1999) test on cointegration between perceptions and inflation of the 12 COICOP-price aggregates that together form the HICP index. Due to the relatively large number of variables, we could not calculate the other test statistics. Over the whole sample, the Kao (1999) test rejects the null of no cointegration at the 1% level, with cointegration between perceptions and COICOP-Inflation also indicated separately for the 1996 - 2001 and 2002 - 2003 periods. Since we find robust evidence for panel cointegration of perceptions with both aggregate and COICOP inflation, we proceed to estimate regressions in the analysis in levels, making use of Engle and Granger's superconsistency argument.

[13] We did not explicitly test for cointegration between perceptions and inflation at the socioeconomic level. However, since socioeconomic group-specific inflation rates are cointegrated with aggregate HICP inflation, and furthermore correlated at about 90%, they must be cointegrated with perceptions as well (see KOF Swiss Economic Institute, 2008).

4 Results

4.1 Estimation Design

We assess the existence of loss aversion with respect to inflation and the validity of the availability hypothesis for our sample of EU-countries in two panel regressions. Due to our finding of cointegration between actual and perceived inflation, we estimate all equations in levels and use the dynamic Arellano and Bond (1991) estimator to account for the high degree of persistence in perceived inflation.[14] All panel coefficients are reported with robust standard errors.

Loss Aversion

In order to test for the existence of loss aversion with respect to rising inflation in the countries in our sample, we construct two threshold-dummies that serve to capture the periods where losses in the form of rising inflation occurred. If the hypothesis of loss aversion holds, we should find a significantly stronger impact of those 'loss' periods on perceived inflation than of the 'gain' periods in inflation. This corresponds to the finding of a kink in the perceptions-inflation relation as shown in Figure 1. The threshold-dummies for all $i = 1, 2, ..., 12$ countries in the panel are defined as follows:

$$\text{thold}_{1,it} = \begin{cases} 1 \text{ if } \pi_{it} > \pi_{it}^{MA} \\ 0 \text{ otherwise,} \end{cases}$$

$$\text{thold}_{2,it} = \begin{cases} 1 \text{ if } \pi_{it} > \pi_{it}^{HP} \\ 0 \text{ otherwise,} \end{cases}$$

where π_{it}^{MA} represents a five-month moving-average of inflation and π_{it}^{HP} stands for recursively HP-filtered inflation. The dummies thus take on the value of one for periods with above-average inflation, and zero otherwise.

[14] As a robustness check, we also used dynamic fixed effects and found that estimated coefficients differed only marginally from those obtained with the Arellano and Bond (1991) estimator. This is due to the fact that, as T gets large relative to N, the bias from using dynamic fixed effects becomes small.

The threshold-dummies are then combined with HICP inflation rates to test for a significant difference between periods of 'losses' in prices (i.e. rising inflation) and periods of 'gains' in prices (i.e. stable or falling inflation):

$$perc_{it} = \alpha_0 + \alpha_1 perc_{it-1} + \beta_1 infl_{it} + \beta_2 (thold_{1,2it} * infl_{it}) + \varepsilon_{it} \qquad (1)$$

A significantly positive coefficient β_2 in equation (1) suggests higher perceived inflation rates in periods of rising inflation for our panel and, thus, gives evidence of loss aversion with respect to prices. Note that equation (1) models loss aversion with respect to inflation as a long-run phenomenon, in line with the theory in Kahneman and Tversky (1979).

Before estimating equation (1) with the threshold dummies defined above, we test for non-linearities in the relationship between perceived and officially reported inflation rates in order to evaluate whether the threshold-dummy approach provides an appropriate model of loss aversion in the perceptions-inflation relation. Hence, we estimate a popular model for non-linear behavior – the so-called smooth-transition autoregressive model or STR model (Van Dijk et al., 2002, Teräsvirta, 2004).

$$y_t = \phi^{'} z_t + \theta^{'} z_t G(\gamma, c, s_t) + u_t \qquad (2)$$

where $\mathbf{z_t} = \left(\mathbf{w_t^{'}}, \mathbf{x_t^{'}}\right)^{'}$ is a vector of explanatory variables,
$\mathbf{w_t^{'}} = (1, y_{t-1}, \ldots, y_{t-p})^{'}$ and $\mathbf{x_t} = (x_{1t}, \ldots, x_{kt})^{'}$.

Furthermore, ϕ and γ are parameter vectors and $u_t \sim \text{iid}(0, \sigma^2)$. The transition function $G(\gamma, c, s_t)$ is a continuous function that is bounded between 0 and 1 with s_t as a transition variable, γ as a parameter governing the smoothness and c as a kind of threshold parameter. In general, it is possible to interpret such a model either as a regime-switching model with two (or more) regimes – as we do here – or as a model containing a continuum of possible regimes. Our choice for the transition function is a logistic function

$$G(\gamma, c, s_t) = \left(1 + \exp\left\{-\gamma \prod_{k=1}^{K} (s_t - c_k)\right\}\right)^{-1}, \quad \gamma > 0 \qquad (3)$$

Under $K = 1$, this gives a so-called logistic STR model with one threshold and two regimes (LSTR1). Under this specification, the parameter c can be interpreted as a 50% probability threshold for being in one of the two regimes as the function changes monotonically from 0 to 1 in s_t and $G(\gamma, c, c) = 0.5$.

The baseline country-by-country STR model of loss aversion in equation (1) is specified with one lag of the endogenous variable ($perc_t$) and the current value of the exogenous variable ($infl_t$) and setting $K = 1$.[15]

In addition to the long-run model of loss aversion in the perceptions-inflation relation in (1), we also test for loss aversion in the short-run, extending the bivariate two-regime error correction model of Hansen and Seo (2002) to the panel setting.[16] The authors assume a uniform cointegrating vector and an endogenous threshold that affects the error correction term in the two regimes. Thus, the speed of adjustment to the long-run equilibrium may differ between regimes. An important distinction to our approach is that while Hansen and Seo (2002) determine the threshold endogenously for the bivariate case, we use our theory-based thresholds defined above. All error correction models are estimated with fixed effects.

We estimate two different models of two-regime error correction: The first model assumes a linear cointegrating relationship between perceived and actual inflation which holds both for periods of gains and for periods of losses in inflation. However, loss aversion causes a change in the speed of adjustment to the long-run equilibrium between gain and loss periods. It is thus viewed here solely as a short-run phenomenon. The model takes the following form:

$$\begin{aligned} \Delta perc_{it} &= \alpha_1(1 - thold_{1,2it})ecm^{linear}_{it-1} + \alpha_2 thold_{1,2it} ecm^{linear}_{it-1} \\ &+ \beta_1(1 - thold_{1,2it})\Delta infl_{it} + \beta_2 thold_{1,2it}\Delta inflt_{it} + \beta_3 \Delta perc_{it-1} + u_{it} \end{aligned} \tag{4}$$

[15] Only in the case of Belgium, we estimated a three-regime model ($K = 2$ = LSTR2) since a LSTR1 did not yield satisfactory results.

[16] We also tried to model the long-run and short-run relations between perceptions and inflation with the Pesaran et al. (1999) Pooled Mean Group (PMG) estimator, but were not able to obtain any plausible results. This may be due to the fact that the PMG estimator cannot account for any non-linearities in the error correction term.

The second two-regime error correction model allows for non-linearity also in the cointegrating vector: We approximate the error correction term with the residuals from the level estimations of loss aversion in equations (1). Hence, we assume that loss aversion may change the relation between perceived and actual inflation rates both in the short and in the long run. Similar to equation (4), the non-linear two-regime error correction model is specified as:

$$\begin{aligned}\Delta perc_{it} &= \alpha_1(1-thold_{1,2it})\alpha_1 ecm_{it-1}^{non-linear} + \alpha_2 thold_{1,2it} ecm_{it-1}^{non-linear} \\ &+ \beta_1(1-thold_{1,2it})\Delta infl_{it} + \beta_2 thold_{1,2it}\Delta infl t_{it} + \beta_3 \Delta perc_{it-1} + u_{it}\end{aligned} \tag{5}$$

Availability

The availability heuristic is tested in equation (6), were we estimate the impact of price inflation of individual COICOP-categories on perceived inflation. The twelve COICOP-categories comprise price indices for those goods categories that form the harmonized consumer price indices, such as food, housing, transport, education etc. A description of the COICOP-categories is given in Table A6 in the appendix.

$$perc_{it} = \alpha_0 + \alpha_1 perc_{it-1} + \sum_{j=1}^{12} \beta_j infl\_COICOP_{j,it} + \varepsilon_{it} \tag{6}$$

In order to evaluate the strength of the effect of COICOP-inflation rates on perceptions, we then normalize the significant β_j coefficients to one-standard-deviation impulse-responses summing to one:

$$IR(infl\_COICOP_j) = \frac{\beta_j * s.d.(infl\_COICOP_j)}{\sum_{j=1}^{12} \beta_j * s.d.(infl\_COICOP_j)}$$

The normalized impulse-responses are then compared to those constructed with the average weight of each COICOP-category in the HICP index over the period analyzed here:

$$IR(infl\_COICOP_j) = \frac{weight_j^{HICP} * s.d.(infl\_COICOP_j)}{\sum_{j=1}^{12} weight_j^{HICP} * s.d.(infl\_COICOP_j)}$$

These impulse-responses thus reflect the weights that individual COICOP-inflation should receive if perceptions were equal to actual inflation rates. If the availability hypothesis by Brachinger (2006) holds, we should find a significantly stronger effect of inflation of price categories of frequently bought goods, such as food and transport, on perceived inflation compared to actual inflation. As an additional test for the availability heuristic, we regress perceived inflation on HICP inflation and FROOPP inflation, both separately and together in one model. If the availability hypothesis holds, we should find a stronger effect of FROOPP inflation on perceptions relative to aggregate HICP inflation.

4.2 Testing for Structural Breaks

Since much of the empirical literature on perceived inflation has found a jump in perceptions occurring shortly after the Euro cash changeover, it seems natural to test for a structural break in the relation between actual and perceived inflation in our panel.

Table A5 in the Appendix presents results from a Quandt-Likelihood-Ratio test for structural breaks for each country in our sample, that runs individual tests over each time period and selects the date with the maximum Wald F-Statistic as the break date. The test is estimated for equation (1) above, with both threshold 1 and threshold 2, as well as for equation (6).

< Figure 4 here >

Regardless of the threshold used, it clearly emerges that a highly significant structural break occurred in both loss aversion models shortly after the Euro cash changeover in January 2002 in all EMU countries, with the exception of France, where the break occurred shortly before the changeover. By contrast, the two non-EMU countries in the control group show structural

breaks unrelated to the Euro introduction, thus emphasizing again that the break in perceptions was related to the Euro introduction, see also Figure 4.

Similarly, test statistics for the availability model point to a structural break in 2002/2003 in all EMU countries, albeit significantly only in Austria and Greece. While most of the other EMU countries only marginally miss significance of the test statistics, the non-EMU countries Sweden and UK, however, strongly reject the existence of a structural break, see also Figure 5.

< Figure 5 here >

Overall, there thus seems convincing evidence of a structural break at the Euro cash changeover and we thus divide our sample period into pre-Euro (Jan 1996 - Dec 2001) and post-Euro (Jan 2002 - Nov 2008) periods.

4.3 Loss Aversion

4.3.1 Country-by-Country Tests for Non-Linearity in the Perception-Inflation Nexus

To start our empirical investigation of loss aversion with respect to inflation, we run country-by-country regressions to analyze the type of non-linearity in the relationship between perceived and actual inflation. The estimated STR models enable us to provide evidence first for the use of dummy variables in the panel estimations of (1) and second for the threshold value that should be used in constructing the dummy. As proposed by Teräsvirta (2004), we start the analysis with tests for linearity, where the results are given in Table 1:

< Table 1 here >

In 7 out of 12 cases, the results point to only mildly non-linear effects. The linear model is preferred for those cases. In 5 cases, we find evidence for non-linearity – mostly in the form of an LSTR1 model. We will see later that even for the two cases of Germany and Belgium, where a LSTR2 model

is suggested, the data speak more in favor of a LSTR1 model with some outliers on the lower side of the inflation range. We interpret these results in such a way that there is mild evidence for some non-linear behavior even after controlling for the perception jump in 2002.

After estimating the initial parameters by a grid search, as proposed in Teräsvirta (2004), we estimate the respective model for each country. Table 2 gives a summary of the main relevant parameters, namely the smoothness parameter γ and the threshold c together with the mean of inflation rates over the sample periods. Furthermore, crossplots of the estimated transition functions versus the HICP inflation rates in each country are given in Figures A1 – A14 in the Appendix.

< Table 2 here >

Three points are worthwhile mentioning here:

1. First of all, in almost all cases for the EMU countries, there is evidence of a very steep transition function – i.e. γ is quite large and the crossplots show sudden jumps rather than a smooth change.

2. On average over all countries, the thresholds do not differ much from the historical averages as the respective column in Table 2 indicates – therefore a mean or a mean with some time variation seems to be not a bad choice for a threshold between regimes of 'gains' and 'losses' in perceived inflation.

3. For those countries where inflation fell radically over the course of the estimation sample (Spain, Greece, Portugal), we find that the estimated threshold is lower than the reported inflation rate. This could indicate that for a certain period households regarded or perceived actual inflation as 'too high' relative to levels which are regarded as 'normal levels' of inflation.

4. The non-EMU countries deviate with respect to two features: the transition function is smooth and the thresholds are quite high.

Overall, estimations of STR models of equation (1) thus support the use of threshold dummies to distinguish between periods of 'losses' and periods of 'gains' in perceived inflation. At least for the EMU-countries in our sample, the change between the two regimes resembles a jump more than a smooth transition, and can thus be captured via threshold dummies. In the following, we thus proceed to estimate panel models of equation (1) with threshold dummies as specified in section 4.1. Furthermore, we decided to split the sample into pre- and post-Euro-cash-changeover samples – which still leaves us with a high number of observations in the panel framework due to the sufficiently high number of countries in the sample.

4.3.2 Panel Estimations of Loss Aversion

We present results of the panel estimation of equation (1) with the two threshold dummies in Table 3.

< Table 3 here >

Regarding the pre-Euro estimation period, both models yield highly significant results, and give evidence of loss aversion with respect to prices: Coefficients on $thold_{1,2it} * infl_{it}$ are significantly positive for both threshold1 and threshold2, with slightly higher coefficients for the latter threshold. Hence, perceived inflation is found to be significantly higher for those periods where inflation was above average, i.e. losses in inflation occurred. Comparing estimates over the whole EU-sample to those from a model estimated only for the EMU countries in the sample, we find slightly higher coefficients on $thold_{1,2it} * infl_{it}$ for the EMU-sample, implying that loss aversion might have been more pronounced in those countries.[17] Test statistics for a Sargan test of overidentifying restrictions, of a Wald test for overall significance of the model coefficients and a Pesaran (2007) CADF test for a panel unit root in the residuals show no indication of misspecification.

[17] We also estimated models for the two non-Euro countries Sweden and UK alone, but found that cointegration between perception and inflation in this small panel was rejected and results are therefore misspecified and implausible.

For the post-Euro estimation period, coefficients on the lagged dependent variable and the inflation rate are approximately comparable to those from the models over the pre-Euro sample period, but all coefficients on $thold_{1,2it} * infl_{it}$ are now found to be insignificant. Again, test statistics suggest that all models are well specified. Our result for the post-Euro period implies that the loss aversion relationship with respect to price changes was disturbed after the introduction of the Euro, so that we no longer find a significant difference between effects of 'loss' and 'gain' periods of inflation on perceptions. Our finding could have various interpretations: On the one hand, the asymmetry in the perception of 'losses' and 'gains' in inflation as visualized by the kink of the perceptions function at the reference point could have broken down after the Euro introduction. On the other hand, our finding could be due to confusion regarding the reference point after the Euro introduction, so that 'losses' and 'gains' in inflation could no longer be distinguished clearly. This argument relates to Ehrmann (2006), who states that the increase in perceived inflation after the Euro cash changeover might have been due to complex conversion rates that introduced an upwards bias in perceptions caused by rounding errors.

4.3.3 Two-Regime Error Correction Models for Perceptions and Inflation

After testing for a non-linear relationship between perceived and actual inflation rates in the form of long-run loss aversion in sections 4.3.1 and 4.3.2, we extend the analysis to the short run by estimating two-regime error correction models of perceptions and inflation with differing speeds of adjustment between loss aversion regimes (Hansen and Seo, 2002). Results for the pre-Euro period 1996m1 - 2001m12 are presented in Table 4:

< Table 4 here >

While we find a highly significant error correction term with respect to both linear and non-linear cointegration between perceptions and inflation over all periods (α_1), there seems to be little evidence of a change in the

speed of adjustment in periods with above-average inflation (α_2). The exception is the linear cointegration two-regime model with threshold 1 where we find a significantly higher speed of adjustment in periods of losses in inflation, assuming that loss aversion does not exist in the long-run cointegration relationship between perceptions and inflation. This result seems at odds with our findings in the previous section and is not robust, once we allow for loss aversion also in the cointegrating relationship. Overall, the results from the two-regime error correction models for the pre-Euro period seem to support the theory's view that loss aversion must be regarded as a long-run phenomenon. Coefficients for the whole EU sample and for the EMU-sample do not differ much, and the models seem generally well specified.

< Table 5 here >

Table 5 summarizes results from the two-regime error correction estimations for the post-Euro period 2002m1 - 2008m11. In line with our results for loss aversion in the long run, we find no evidence for a significantly different speed of adjustment in loss periods after the Euro introduction. However, the error correction terms over all period are again found highly significant, reinforcing our findings of cointegration between perceptions and inflation even when a non-linear (albeit insignificant) loss aversion term is included. Not surprisingly, this result is also robust across the EU- and the EMU-sample.

Summing up, while we find significant evidence of loss aversion with respect to inflation in the long run before the Euro introduction, there is little evidence of loss aversion affecting the speed of adjustment to a cointegrating equilibrium. After the Euro cash changeover, we cannot identify any loss aversion effects either in the long or in the short run, implying that a fundamental break occurred in the perceptions-inflation relation.

4.4 Availability

4.4.1 Availability of Price Changes in COICOP-Categories

Table 6 gives results of the estimations of equation (6), testing the availability hypothesis with respect to price changes in COICOP-categories for the EU-

Sample and the EMU-Sample.

< Table 6 here >

Overall, our results in the pre-Euro period are in favor of Brachinger's hypothesis: We find significant coefficients for inflation of those COICOP-price categories that relate to frequently bought goods, such as food (inflcp1), clothing (inflcp3), housing (inflcp4), transport (inflcp7) as well as restaurants and hotels (inflcp11). By contrast, inflation of prices for alcohol, tobacco and narcotics (inflcp2), furnishings (inflcp5), health (inflcp6), communications (inflcp8), recreation and culture (inflcp9) and education (inflcp10) are not found to significantly influence perceived inflation. While there is a certain overlap between categories, such as prices for alcohol and prices in restaurants, the tendency emerges nevertheless that prices of those categories that are purchased on a frequent basis exert more influence over perceived inflation. Generally, we find that price inflation of the same COICOP-categories significantly affects inflation perceptions in the models for the EU-sample and for the restricted EMU-sample. However, coefficients in the model for the EMU-sample are slightly larger. Contrary to Brachinger (2006, 2008), we also find that prices of housing, water, gas and electricity have a highly significant impact on inflation perceptions. This result relates to arguments by Del Giovane and Sabbatini (2006) and Döhring and Mordonu (2007) who suggest that prices not included in consumer price indices such as house prices might nonetheless have an impact on inflation perceptions.

Further evidence of the availability heuristic in our EU-sample is given by the computed one-standard-deviation impulse-responses of perceived and actual inflation to price changes in COICOP-categories. Figures 6 and 7 present impulse responses of the EU- and the EMU-sample in the pre-Euro period.

< Figure 6 here >
< Figure 7 here >

Although of course all COICOP-categories receive a positive weight in the HICP index, perceptions seem only to react to a number of price categories. The largest impulse on perceived inflation seems to come from food and transport prices, with impulse-responses markedly stronger compared to those on actual inflation. But also housing and restaurant prices are found to affect inflation perceptions significantly more than actual inflation in the pre-Euro EU-sample. In the EMU-sample impulse-responses of inflation perceptions differ slightly: While we still find that perceptions react stronger to food, housing and restaurant prices, the effect of changes in transport prices is now found to be somewhat smaller than that on actual inflation. Overall, there is evidence in favor of the availability hypothesis in both the EU- and the EMU-sample for the pre-Euro period.

Regarding estimation results for the post-Euro period in Table 6, the following results emerge: Similar to our findings with respect to loss aversion, the availability of price categories regarding perceptions also seems to have shifted substantially after the Euro cash changeover. However, the most frequently bought price categories, namely food and transport, remain highly significant also in the post-Euro sample, suggesting that availability of these price changes still significantly influenced inflation perceptions. Yet price changes of clothing and housing and, surprisingly, also restaurant and hotels, are no longer found to be significant in the post-Euro sample models, with the exception of changes in housing prices for the model of the EU-sample. Moreover, we find significant effects of price changes in furnishings, communications, recreation and culture, as well as education on perceptions after the Euro introduction. Overall, it seems that availability of price categories with regard to perceptions generally increased after the Euro cash changeover, but the clear pattern of higher availability of frequently bought goods to some extent broke down. Furthermore, the persistence of the perception series – as measured by the first lag – is stronger. This points to the fact, that perception in itself is more persistent and shocks die out more slowly than before the Euro introduction.

In order to compare effects of COICOP-inflation rates on perceived and aggregate inflation, we again computed one-standard-deviation impulse re-

sponses, shown in Figures 8 and 9.

< *Figure 8 here* >

< *Figure 9 here* >

Comparing impulse-responses on HICP inflation between the pre- and post-Euro periods, the weights of individual COICOP-categories remain similar with only minor changes. By contrast, impulse responses on perceived inflation show a markedly different pattern after the Euro cash changeover: While changes in food and transport prices still have the largest impact on perceptions in the EU-sample, in the EMU-sample food price changes seem to affect perceptions less than actual inflation, whereas price changes in furnishings are found to have a very pronounced effect in both samples after the Euro introduction. This stands in contrast to their small impulse on actual inflation rates and once again emphasizes the argument that perceptions may be formed with different weights than aggregate inflation. Furthermore, we find in the post-Euro period a significant impulse of communications, recreation and culture as well as education prices on perceptions, that is significantly higher than the matching impulses on aggregate inflation. To sum up, although the price categories relevant for perceived inflation seem to have changed somewhat after the Euro cash changeover, the result still remains intact that those categories with a significant impact on perception generally have a relatively stronger influence compared to their effect on actual inflation rates.

4.4.2 Availability of Price Changes in the Index of Frequent Out-Of-Pocket Purchases (FROOPP)

In addition to the availability test related to prices of individual goods' categories, we furthermore present estimations comparing the effects of actual HICP inflation on perceived inflation to that of FROOPP inflation. Thus, we are here concerned with evaluating whether our results from the previous section remain robust if we summarize frequently bought goods in the FROOPP index.

< Table 7 here >

Table 7 presents estimates of dynamic fixed effects models for the pre-Euro period, were we regressed perceptions on HICP inflation and on FROOPP inflation both separately and together in one model. For the EU-Sample and the EMU-Sample we note that FROOPP inflation influences perceptions with a slightly higher coefficient, but both inflation series have a highly significant effect on perceptions. Comparing the overall R^2, we find marginally higher values for the first model, implying that the variance of perceived inflation is explained slightly better by the variance of HICP inflation. However, when we regress perceptions on HICP and FROOPP inflation together, the former becomes insignificant. It thus seems that in the pre-Euro period, frequent out-of-pocket purchases contained more explanatory content for perceived inflation than overall HICP inflation. Furthermore, comparing the Akaike Information Criterion (AIC) and the Bayes Information Criterion (BIC) for all three models, criteria for the FROOPP and the combined model are close, but the FROOPP model is preferred. Overall, the findings here reinforce our result with respect to availability of COICOP-price categories from the previous section.

< Table 8 here >

Finally, estimates for the post-Euro period are given in Table 8. Again, we find that both HICP and FROOPP inflation exhibit a highly significant influence over perceptions, but contrary to our results for the pre-Euro period we now find a smaller coefficient of FROOPP inflation compared to that for HICP inflation. Nevertheless, the overall R^2 is higher for the model with FROOPP inflation. Regressing perceptions on both inflation rates, we find significant coefficients for HICP and FROOPP inflation, in contrast to our results for the earlier period. Hence, it seems that while frequently bought goods in the FROOPP index retained their influence on perceptions after the Euro introduction, other goods categories contained in HICP inflation became more relevant as well. This result is in line with our findings of availability of COICOP-inflation in the previous section. Interestingly, FROOPP

inflation obtains a higher coefficient in the third model for the EU-sample, while HICP inflation seems relatively more important in explaining perceptions in the EMU-Sample. Comparing the information criteria, we find for the post-Euro period that the AIC prefers the third (combined) model, while the BIC is in favor of the second (FROOPP) model.

4.5 Socioeconomic Groups

In addition to the analysis for the aggregate economies in our panel presented in Sections 4.3.2 and 4.4.1, the estimations are repeated for different socioeconomic sub-groups in order to test for differences with respect to loss aversion and availability between groups. We compare results for four age-groups, four income-groups and three education-groups.[18] Table A7 in the appendix gives an exact definition of the age-, income and education groups for both perceived and actual inflation rates, whereby data for education groups exists only for perceptions.

4.5.1 Loss Aversion

A summary of the results of the loss aversion estimations for all socioeconomic categories is given in Table 9.[19] We estimated the models in equation (1) with both threshold 1 and 2 and furthermore distinguished between models with aggregate and models with group-specific inflation rates.

< Table 9 here >

For the pre-Euro period 1996-2001 we find a significantly positive coefficient on $thold_{1,2it} * infl_{it}$ for at least one model for all socioeconomic groups

[18] We also estimated equations (1)-(6) for four employment groups, namely workers, employees, self-employed and unemployed, but found no significant results. Estimation results are available from the authors upon request.

[19] Detailed estimation results for the loss aversion coefficients on $thold_{1,2it} * infl_{it}$ from the various models for all socioeconomic groups are given in Tables A8 - A10 in the Appendix. Although omitted here for lack of space, we tested all models for unit roots in the residuals and validity of overidentifying restrictions and generally found no indication of misspecification. Results are available from the authors upon request.

except Q1, the lowest income quartile. In accordance with our aggregate results in Section 4.3.2, it thus seems that loss aversion is prevalent in nearly all socioeconomic groups before the Euro introduction. However, it is interesting to note that except for the highest income quartile Q4 and the two working age categories Age2 and Age3, we find no significant loss aversion with group-specific inflation rates. This suggests that households show loss aversion only with respect to aggregate inflation rates, and not with respect to their own experienced inflation. Our finding relates well to arguments by Caplan (2007), who claims that agents will only be economically irrational as long as it does not affect their monetary resources. Indeed, our results imply that those groups with larger income or those still in the working force show loss aversion also with respect to their group-specific inflation. The remaining groups either have no kink in their perception function, suggesting equal attention to both gains and losses in inflation, or show even a negative impact of loss periods in inflation on their inflation perceptions, implying an 'ostrich' effect[20] of ignoring personally experienced price increases for fear of psychological discomfort. Alternatively, a negative coefficient may be interpreted as an indicator of a kind of 'bargain' mentality, where agents concentrate disproportionally on favorable changes in prices, thus underestimating increases in inflation.[21]

Results for the loss aversion models in the post-Euro period also reinforce our finding of no loss aversion after the Euro introduction in the aggregate panel. While we find no evidence of loss aversion in any of the education or age groups with respect to aggregate inflation, in the models for the income groups there is some evidence for loss aversion in the highest income quartile Q4. However, the models for the lowest two income quartiles Q1 and Q2 report a significantly negative coefficient on loss periods with respect to ag-

[20]The 'ostrich' effect is defined as ignoring or avoiding information that one fears will cause psychological distress and has be shown to exist in experiments, for instance related to health issues or IQ tests, see Karlsson et al. (2009), Galai and Sade (2006) as well as Frey and Stahlberg (1986).

[21]Note that the negative coefficient found for the model of Age4 with respect to their group-specific inflation rate is not robust when estimating without robust standard errors or with dynamic fixed effects. The coefficient then becomes insignificant and should therefore be interpreted with great care.

gregate inflation, pointing to an 'ostrich' effect even at the aggregate inflation level. At the group-specific level, we find some evidence for loss aversion in the second age group Age2 and the highest income quartile Q4, and again a negative coefficient in the model for the lowest income quartile Q1.

4.5.2 Availability

We present a summary of the availability estimations of equation (6) for all socioeconomic groups for the period before the Euro introduction in Table 10.[22]

< Table 10 here >

Overall, it seems that there is little divergence in the price categories that significantly affected inflation perceptions across socioeconomic groups before the Euro cash changeover.In line with our results for the aggregate panel, we find a significantly positive effect of price changes in food prices (inflcp1), housing prices (inflcp4), transport prices (inflcp7) as well as restaurant and hotel prices (inflcp11) in all socio-economic groups. These groups are also found to cause the strongest impulse response in perceptions in the aggregate panel. Interestingly, while we find a significant impulse of clothing prices (inflcp3) on inflation perceptions in the aggregate, this effect is only found for perceptions of the highest income quartile Q1 in the socioeconomic analysis. By contrast, we now find significant effects of communications prices (inflcp8) on inflation perceptions of the higher age groups, the lower income groups and the lower education groups; an effect which is not found for the highest income quartile and not replicated in the aggregate results. It thus seems that the highest income group Q1 dominated the aggregate result to some extent. Furthermore, we find significantly negative effects of furnishing prices (inflcp5) and education prices (inflcp10) on inflation perceptions of middle and high age groups, middle income groups and low as well as high education groups.

[22]We provide detailed estimation results of equation (6) for all socioeconomic groups in Tables A11 - A15 in the Appendix.

Results from the availability estimations for the post-Euro period are summarized for all socioeconomic groups in Table 11.

< Table 11 here >

Again, results for the socioeconomic sub-groups imply very prevalent patterns regarding those price categories that affect inflation perceptions across groups. In accordance with our results for the aggregate panel, availability of price changes after the Euro introduction seems to have shifted: While food and transport prices still have a significantly positive impact on inflation perceptions across all groups, housing and restaurant prices are no longer found to be significant. Instead, perceptions across all socioeconomic groups after the Euro cash changeover seem to have focused on price changes of furnishings (inflcp5), which in the pre-Euro period even had a dampening effect on perceptions of some groups, communications (inflcp8), recreation & culture (inflcp9) and education (inflcp10). Surprisingly, while we found changes in housing prices to have a strongly significant positive effect on inflation perceptions before the Euro, after the cash changeover we find that it has a dampening effect on perceptions of the two middle age and middle income groups, as well as on the two higher education groups. This effect seems strong enough to be replicated in the aggregate panel of the EU-sample, and stands in stark contrast to the positive weight of housing prices in CPI inflation. Overall, our main results with respect to availability of price categories from the aggregate panel are reinforced by the analysis of separate socioeconomic groups: While we find strong indication of availability of frequently bought goods such as food, transport, housing and restaurant visits before the Euro introduction, patterns seem to have altered substantially after the cash changeover with a general increase in price awareness also of less frequently bought goods such as education. Furthermore, the dominant effect of the highest income quartile Q1 in the pre-Euro period seems to have diminished after the Euro cash changeover.

5 Conclusion

This paper investigates whether insights from Behavioral Economics, notably Prospect Theory, can be meaningfully applied to provide explanations for individuals' formation of inflation perceptions. Using a dynamic panel model for 12 European countries, we find sound empirical support for the two main theoretical hypotheses stemming from Prospect Theory that underly Brachinger (2006)'s index of perceived inflation:

First, with regard to loss aversion of households to rising inflation, there is convincing evidence of loss aversion for the whole panel in the pre-Euro sample period. Analysis of linear and non-linear two-regime error correction models furthermore suggests that loss aversion is a predominantly long-run phenomenon and does not affect the speed of adjustment to a cointegration equilibrium. While our results suggest that before the Euro introduction loss aversion was even more pronounced for the EMU countries, there is no indication of loss aversion after the Euro cash changeover in any of the models. This suggests a strong structural break in the perception-inflation relation, where the break-down of loss aversion might be due to confusion regarding the reference price in the new currency. Whether this constitutes a temporary or a permanent effect remains to be investigated in future research.

Second, we find that price inflation of frequently bought goods categories has a significant effect on perceived inflation in the pre-Euro sample period, while inflation rates of other price categories are not found to be significant. Again, this result holds for models with both the EU-sample and the EMU-sample. Moreover, one-standard-deviation impulse-responses of those significant goods categories on perceptions are much higher than equivalent impulse-responses constructed from HICP weights. For the post-Euro sample period, we find that the most frequently bought categories of goods, such as food and transport, again have a highly significant effect on inflation perceptions, but other, less frequently purchased, categories become significant as well. This suggests a generally increased awareness of rising inflation after the Euro introduction in our sample. Our results from the availability test remain robust when we test with an index of frequently out-of-pocket

purchases (FROOPP) instead of individual COICOP-prices.

Third, testing Brachinger (2006, 2008)'s hypotheses separately for age, income and education groups in our EU12 sample, we find strong evidence of loss aversion with respect to aggregate inflation before the Euro introduction in all socioeconomic groups. However, when testing for loss aversion with respect to group-specific inflation rates, we only find significantly positive coefficients for the highest income quartile and the two working age groups. The remaining socioeconomic groups either give no evidence of loss aversion, implying equal awareness of all price changes, or even reversed loss aversion, suggesting an 'ostrich' or 'bargain' effect with respect to inflation for the more marginalized groups in society. In line with results from the aggregate panel, we find very few evidence of loss aversion in the socioeconomic groups after the Euro cash change over, reinforcing the importance of the currency change as structural break in the perception-inflation relation. Nevertheless, there is some evidence of loss aversion in high income and middle age groups and of an 'ostrich' behavior in low income groups even after the Euro introduction. With respect to the availability hypothesis, our results from the aggregate panel are mainly affirmed by the socioeconomic panels. We find significant evidence of availability of frequently bought goods such as food, housing, transport and restaurant prices across all socioeconomic groups in the pre-Euro period, with the addition of communication prices, that were not found to be significant in the aggregate panel. Again, the structural break that occurred with the Euro introduction is also visible in the estimations across socioeconomic panels: In the post-Euro period, we find a general increase in price awareness of goods categories across all groups, where in addition to frequently bought goods also categories such as education exhibit a significant influence on inflation perceptions.

Several areas of future research seem to be worth following up. First, note that it will be interesting to explain why the effect of loss aversion on inflation perceptions has weakened after the Euro introduction and whether this change will turn out to be stable in the future. Second, the role of inflation expectations in explaining the relation between actual and perceived inflation rates should be explored further.

References

Altissimo, F., M. Ehrmann, and F. Smets (2006, June). Inflation Persistence and Price-Setting Behaviour in the Euro Area - A Summary of the IPN Evidence. *ECB Occasional Paper 46*.

Arellano, M. and S. Bond (1991, April). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *Review of Economic Studies 58*(2), 277–297.

Aucremanne, L., M. Collin, and T. Stragier (2007, April). Assessing the Gap Between Observed and Perceived Inflation in the Euro Area: Is the Credibility of the HICP at Stake? *National Bank of Belgium Working Paper Research 112*.

Batchelor, R. A. (1986, September). The Psychophysics of Inflation. *Journal of Economic Psychology 7*(3), 269–290.

Batchelor, R. A. and A. B. Orr (1988, August). Inflation Expectations Revisited. *Economica 55*(219), 317–331.

Blanchflower, D. G. and R. Kelly (2008, April). Macroeconomic Literacy, Numeracy and the Implications for Monetary Policy. *Manuscript*.

Blinder, A. S. and A. B. Krueger (2004, September). What Does the Public Know About Economic Policy, and How Does It Know It? *NBER Working Paper 10787*.

Brachinger, H. W. (2006, July). Euro or "Teuro"?: The Euro-Induced Perceived Inflation in Germany. *University of Fribourg Switzerland Department of Quantitative Economics Working Paper 5*.

Brachinger, H. W. (2008, August). A New Index of Perceived Inflation: Assumptions, Method, and Application to Germany. *Journal of Economic Psychology 29*(4), 433–457.

Breitung, J. (2000, December). The Local Power of Some Unit Root Tests for Panel Data. In B. H. Baltagi (Ed.), *Nonstationary Panels, Panel Cointegration and Dynamic Panels*, Volume 15 of *Advances in Econometrics*, pp. 161–178. Greenwich, Connecticut: JAI Press.

Bryan, M. and S. Palmqvist (2005, April). Testing Near-Rationality Using Detailed Survey Data. *Federal Reserve Bank of Cleveland Working Paper Series 05-02*.

Camerer, C. F. (2000, September). Prospect Theory in the Wild: Evidence from the Field. In D. Kahneman and A. Tversky (Eds.), *Choices, Values and Frames*, Chapter 16, pp. 288–300. Cambridge: Cambridge University Press.

Caplan, B. (2007, April). *The Myth of the Rational Voter: Why Democracies Choose Bad Policies*. Princeton, New Jersey: Princeton University Press.

Carlson, J. A. and M. Parkin (1975, May). Inflation Expectations. *Economica 42*(166), 123–138.

Cestari, V., P. Del Giovane, and C. Rossi-Arnaud (2007, February). Memory for Prices and the Euro Cash Changeover: An Analysis for Cinema Prices in Italy. *Banca d'Italia Eurosistema Temi di discussione del Servicio Studi 619*.

Choi, I. (2001, April). Unit Root Tests for Panel Data. *Journal for International Money and Finance 20*(2), 249–272.

Curtin, R. (2007, June). What U.S. Consumers Know About Economic Conditions. *University of Michigan Working Paper*.

Del Giovane, P., S. Fabiani, and R. Sabbatini (2008, January). What's Behind "Inflation Perceptions"? – A Survey-Based Analysis of Italian Consumers. *Banca d'Italia Eurosistema Working Paper 655*.

Del Giovane, P. and R. Sabbatini (2006, November). Perceived and Measured Inflation after the Launch of the Euro: Explaining the Gap in Italy. *Giornale degli Economisti e Annali di Economia 65*(2), 155–192.

Döhring, B. and A. Mordonu (2007, July). What Drives Inflation Perceptions? A Dynamic Panel Data Analysis. *European Economy Economic Papers 284*.

Dziuda, W. and G. Mastrobuoni (2005, May). The Euro Changeover and Its Effects on Price Transparency, and Inflation. Mission Euro, Mission Accomplished! *Working Paper*.

Ehrmann, M. (2006, February). Rational Inattention, Inflation Developments and Perceptions after the Euro Cash Changeover. *ECB Working Paper Series 588*.

Eife, T. A. (2006, July). Currency Changeovers as Natural Experiments. *Inaugural Dissertation Ludwig-Maximilians-Universität München*.

Eife, T. A. and W. T. Coombs (2007, November). Coping with People's Inflation Perceptions During a Currency Changeover. *University of Heidelberg - Department of Economics - Discussion Paper Series 458*.

European Commission (2008). The Joint Harmonised EU Programme of Business and Consumer Surveys.

Fehr, E. and J.-R. Tyran (2004, February). Money Illusion and Coordination Failure. *CESifo Working Paper 1141*.

Fisher, I. (1928). *The Money Illusion*. New York: Adelphi Company.

Frey, D. and D. Stahlberg (1986, December). Selection of Information after Receiving More or Less Reliable Self-Threating Information. *Personality and Social Psychology Bulletin 12*(4), 434–441.

Fullone, F., M. Gamba, E. Giovannini, and M. Malgarini (2007, May). What Do Citizens Know about Statistics? The Results of an OECD/ ISAE Survey on Italian Consumers. *Manuscript*.

Galai, D. and O. Sade (2006, September). The 'Ostrich Effect' and the Relationship between the Liquidity and the Yields of Financial Assets. *Journal of Business 79*(5), 2741–2759.

Gutierrez, L. (2003). On the power of panel cointegration tests: a Monte Carlo comparison. *Economics Letters 80*(1), 105 – 111.

Hansen, B. E. and B. Seo (2002, October). Testing for Two-Regime Threshold Cointegration in Vector Error-Correction Models. *Journal of Econometrics 110*(2), 293–318.

Hardie, B. G. S., E. J. Johnson, and P. S. Fader (1993, Fall). Modeling Loss Aversion and Reference Dependence Effects on Brand Choice. *Marketing Science 12*(4), 378–394.

Hoch, S. J., X. Drèze, and M. E. Purk (1994, October). EDLP, Hi-Lo, and Margin Arithmetic. *Journal of Marketing 58*(4), 16–27.

Hoffmann, J., H.-A. Leifer, and A. Lorenz (2006, May-June). Index of Perceived Inflation or EU Consumer Surveys? An Assessment of Professor H. W. Brachinger's Approach. *Intereconomics 41*(3), 142–150.

Im, K. S., M. H. Pesaran, and Y. Shin (2003, July). Testing for Unit Roots in Heterogeneous Panels. *Journal of Econometrics 115*(1), 53 – 74.

Jonung, L. (1981, December). Perceived and Expected Rates of Inflation in Sweden. *American Economic Review 71*(5), 961–968.

Jonung, L. and C. Conflitti (2008, March). Is the Euro Advantageous? Does it Foster European Feelings? Europeans on the Euro after Five Years. *European Economy Economic Papers 313*.

Jonung, L. and D. Laidler (1988, December). Are Perceptions of Inflation Rational? Some Evidence for Sweden. *American Economic Review 78*(5), 1080–1087.

Jungermann, H., H. W. Brachinger, J. Belting, K. Grinberg, and E. Zacharias (2007, December). The Euro Changeover and the Factors Influencing Perceived Inflation. *Journal of Consumer Policy 30*(4), 405–419.

Kahneman, D. and A. Tversky (1973, July). On the Psychology of Prediction. *Psychological Review 80*(4), 237–257.

Kahneman, D. and A. Tversky (1979, March). Prospect Theory: An Analysis of Decision under Risk. *Econometrica 47*(2), 263–291.

Kao, C. (1999). Spurious regression and residual-based tests for cointegration in panel data. *Journal of Econometrics 90*(1), 1–44.

Karlsson, N., G. Loewenstein, and D. Seppi (2009, April). The Ostrich Effect: Selective Attention to Information. *Journal of Risk and Uncertainty 38*(2), 95–115.

KOF Swiss Economic Institute (2008, November). The Euro and Prices: Changeover-related Inflation and Price Convergence in the Euro Area. mimeo.

Kurri, S. (2006, September). Why does Consumers' Perceived Inflation Differ so much from Actual Inflation? *Bank of Finland Bulletin 80*(3), 75–82.

Lamla, M. J. and S. M. Lein (2008, June). The Role of Media for Consumers' Inflation Expectation Formation. *Konjunkturforschungsstelle Eidgenössische Technische Hochschule Zürich - KOF Working Paper 201.*

Lein, S. M. and T. Maag (2008, September). The Formation of Inflation Perceptions - Some Empirical Facts for European Countries. *Konjunkturforschungsstelle Eidgenössische Technische Hochschule Zürich - KOF Working Paper 204.*

Levin, A., C.-F. Lin, and C.-S. J. Chu (2002, May). Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties. *Journal of Econometrics 108*(1), 1–24.

Maddala, G. S. and S. Wu (1999, November). A Comparative Study of Unit Root Tests with Panel Data and a New Simple Test. *Oxford Bulletin of Economics and Statistics 61*(Special Issue), 631–652.

Malgarini, M. (2008, January). Quantitative Inflation Perceptions and Expectations of Italian Consumers. *ISAE Working Paper 90.*

Nardo, M. (2003, December). The Quantification of Qualitative Survey Data: A Critical Assessment. *Journal of Economic Surveys 17*(5), 645–668.

Pedroni, P. (1999, November). Critical Values for Cointegration Tests in Heterogenous Panels With Multiple Regressors. *Oxford Bulletin of Economics and Statistics 61*(Special Issue), 653–670.

Pedroni, P. (2001, November). Purchasing Power Parity Tests in Cointegrated Panels. *The Review of Economic and Statistics 83*(4), 727–731.

Pedroni, P. (2004, June). Panel Cointegration: Asymptotic and Finite Sample Properties of Pooled Time Series Tests With an Application to the PPP Hypothesis. *Econometric Theory 20*(3), 597–625.

Pesaran, M. H. (2007, March). A Simple Panel Unit Root Test in the Presence of Cross-Section Dependence. *Journal of Applied Economics 22*(2), 265–312.

Pesaran, M. H., Y. Shin, and R. P. Smith (1999, June). Pooled Mean Group Estimation of Dynamic Heterogeneous Panels. *Journal of the American Statistical Association 94*(446), 621–634.

Rotemberg, J. J. (2005, May). Customer Anger at Price Increases, Changes in the Frequency of Price Adjustment and Monetary Policy. *Journal of Monetary Economics 52*(4), 829–852.

Rotemberg, J. J. (2008, January). Behavioral Aspects of Price Setting, and Their Policy Implications. *NBER Working Paper 13754*.

Shafir, E., P. Diamond, and A. Tversky (2004, February). Money Illusion. In C. Camerer, G. Loewenstein, and M. Rabin (Eds.), *Advances in Behavioral Economics*, The Roundtable Series in Behavioral Economics, Chapter 17, pp. 483–509. Princeton, New Jersey: Princeton University Press.

Starmer, C. (2004, February). Developments in Nonexpected-Utility Theory: The Hunt for a Descriptive Theory of Choice under Risk. In C. Camerer, G. Loewenstein, and M. Rabin (Eds.), *Advances in Behavioral Economics*,

The Roundtable Series in Behavioral Economics, Chapter 4, pp. 104–147. Princeton, New Jersey: Princeton University Press.

Teräsvirta, T. (2004, August). Smooth Transition Regression Modeling. In H. Lütkepohl and M. Krätzig (Eds.), *Applied Time Series Econometrics*, Themes in Modern Economics, Chapter 6, pp. 222–242. Cambridge: Cambridge University Press.

Thaler, R. (1980, March). Toward a Positive Theory of Consumer Choice. *Journal of Economic Behavior and Organization 1*(1), 39–60.

Thaler, R. (1985, Summer). Mental Accounting and Consumer Choice. *Marketing Science 4*(3), 199–214.

Traut-Mattausch, E., S. Schulz-Hardt, T. Greitemeyer, and D. Frey (2004, November-December). Expectancy Confirmation in Spite of Disconfirming Evidence: The Case of Price Increases Due to the Introduction of the Euro. *European Journal of Social Psychology 34*(6), 739–760.

Tversky, A. and D. Kahneman (1981, January). The Framing of Decisions and the Psychology of Choice. *Science 211*(4481), 453–458.

Tversky, A. and D. Kahneman (1991, November). Loss Aversion in Riskless Choice: A Reference-Dependent Model. *Quarterly Journal of Economics 106*(4), 1039–1061.

van der Klaauw, W., W. Bruine de Bruin, G. Topa, S. Potter, and M. Bryan (2008, December). Rethinking the Measurement of Household Inflation Expectations: Preliminary Findings. *Federal Reserve Bank of New York Staff Reports 359*, 1–149.

Van Dijk, D., P. H. Franses, and R. Paap (2002, October). A Nonlinear Long Memory Model, With an Application to US Unemployment. *Journal of Econometrics 110*(2), 135–165.

Appendix

Table 1: Country-by-country estimates: Linearity test results

Country	F-test (linearity)	F-test 4	F-test 3	F-test 2	suggested model	estimated model
Austria	0.610	0.582	0.992	0.180	Linear	LSTR1
Belgium	0.018	0.493	0.010	0.092	LSTR2	LSTR2
Spain	0.124	0.151	0.532	0.082	Linear	LSTR1
Finland	0.346	0.243	0.618	0.229	Linear	LSTR1
France	0.029	0.207	0.920	0.004	LSTR1	LSTR1
Germany	0.040	0.232	0.015	0.413	LSTR2	LSTR2
Greece	0.963	0.932	0.532	0.978	Linear	LSTR1
Italy	0.128	0.052	0.168	0.849	Linear	LSTR1
Netherlands	0.096	0.278	0.098	0.167	Linear	LSTR1
Portugal	0.022	0.011	0.112	0.553	LSTR1	LSTR1
Sweden	0.012	0.012	0.566	0.041	LSTR1	LSTR1
UK	0.264	0.348	0.193	0.323	Linear	LSTR1

Note: LSTR1 denotes logistic STR with 2 regimes. LSTR2 denotes logistic STR with 3 regimes.

Table 2: Country-by-country estimates: Main model parameters

Country	Estimated	Gamma	C1	C2	Mean (Inflation)	Difference C-Mean
Austria	LSTR1	429.007	2.186	–	1.750	0.436
Belgium	LSTR2	50.336	0.418	2.906	2.039	0.867
Spain	LSTR1	1311.666	2.041	–	3.042	-1.001
Finland	LSTR1	162.071	3.650	–	1.649	2.001
France	LSTR1	4543.267	1.776	–	1.796	-0.020
Germany	LSTR1	32.007	2.559	–	1.555	1.004
Greece	LSTR1	1040.958	2.347	–	3.932	-1.585
Italy	LSTR1	1428.131	2.544	–	2.468	0.076
Netherlands	LSTR1	466.823	4.584	–	2.232	2.352
Portugal	LSTR1	385.592	1.675	–	2.927	-1.252
Sweden	LSTR1	4.733	6.007	–	1.596	4.411
UK	LSTR1	8.081	7.226	–	1.860	5.366
Average(EMU)		984.986	2.627		2.339	0.288
Average (Non-EMU)		6.407	6.617		1.728	4.889

Note: LSTR1 denotes logistic STR with 2 regimes. LSTR2 denotes logistic STR with 3 regimes.

Table 3: Loss Aversion with Respect to Inflation

	1996 - 2001				2002 - 2008			
	EU Sample		EMU Sample		EU Sample		EMU Sample	
perc	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
l.perc	.8528***	.8320***	.8587***	.8263***	.8969***	.8977***	.8931***	.8934***
	(.0210)	(.0208)	(.0214)	(.0209)	(.0118)	(.0114)	(.0118)	(.0108)
infl	1.214***	1.2975***	1.1393**	1.3965***	1.4077***	1.3581***	1.2789***	1.3002**
	(.4195)	(.22645)	(.4721)	(.2511)	(.2978)	(.4685)	(.2904)	(.5236)
thold1*infl	.4220***	-	.4402**	-	.0478	-	.0836	-
	(.1621)		(.1782)		(.0795)		(.0853)	
thold2*infl	-	.6237***	-	.6975***	-	.0672	-	.0490
		(.1029)		(.1003)		(.1942)		(.2205)
constant	-1.804**	-1.9769***	-1.2877*	-1.7041***	0.6364	.6919	1.7676**	1.7471
	(.7409)	(.5719)	(.7029)	(.6049)	(.9273)	(1.0282)	(.8764)	(1.0713)
Sargan (χ^2)	752.8592	707.9301	632.8363	590.808	1019.566	1018.066	837.944	836.543
prob.	0.691	0.831	0.717	0.840	0.005	0.005	0.032	0.035
Wald (χ^2)	2796.7	2354.69	3168.76	2664.16	8206.68	10495.7	6320.08	8480.93
prob.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CADF resid.	-3.908	-3.435	-3.936	-3.367	-4.054	-4.059	-4.063	-4.059
prob.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: Robust standard errors in parentheses. ***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Table 4: Two-Regime Error Correction Models of Loss Aversion, Pre-Euro 1996 - 2001

	Linear Cointegration				Non-Linear Cointegration			
	EU Sample		EMU Sample		EU Sample		EMU Sample	
d.perc	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
l.ecm	-.1611***	-.1572***	-.1582***	-.1637***	-.9712***	-.8872***	-.9652***	-.8880***
	(.0235)	(.0285)	(.0253)	(.0309)	(.1172)	(.1142)	(.1277)	(.1196)
thold1*l.ecm	.0649**	-	.0610*	-	.1111	-	.0913	-
	(.0323)		(.0349)		(.0694)		(.0767)	
thold2*l.ecm	-	.0294	-	.0348	-	-.0045	-	-.0211
		(.0377)		(.0410)		(.0757)		(.0827)
d.infl	3.4813***	3.2761***	3.7435***	3.5922***	3.3800***	2.7171***	3.5995***	2.9355***
	(.5904)	(.6267)	(.6543)	(.7030)	(.5874)	(.6208)	(.6501)	(.6958)
thold1,2*d.infl	-.0208	-.0171	-.0174	-.0416	.1830*	.3765	.2004*	.3996
	(.1035)	(.2407)	(.1122)	(.2648)	(.1056)	(.2406)	(.1145)	(.2641)
d.l.perc	-.0675**	-.0648*	-.0689*	-.0659*	.7064***	.6581***	.7079***	.6570***
	(.0330)	(.0353)	(.0361)	(.0383)	(.1054)	(.0983)	(.1144)	(.1023)
constant	.1931	.2957*	.2354	.3710**	.0579	.0770	.0604	.0968
	(.1456)	(.1557)	(.1663)	(.1785)	(.1454)	(.1543)	(.1666)	(.1759)
F-test	25.40	21.93	22.29	19.75	26.38	25.38	23.10	23.56
prob.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CADF resid.	-4.003	-3.701	-4.071	-3.808	-4.022	-3.498	-4.074	-3.555
prob.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: Robust standard errors in parentheses. ***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Table 5: Two-Regime Error Correction Models of Loss Aversion, Post-Euro 2002 - 2008

	Linear Cointegration				Non-Linear Cointegration			
	EU Sample		EMU Sample		EU Sample		EMU Sample	
d.perc	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
l.ecm	-.0902***	-.0861***	-.0931***	-.0846***	-.8240***	-.8508***	-.8413***	-.8465***
	(.0159)	(.0165)	(.0174)	(.0174)	(.1121)	(.1146)	(.1185)	(.1203)
thold1*l.ecm	.0127	-	.0093	-	.0264	-	.0217	-
	(.0225)		(.0243)		(.0642)		(.0703)	
thold2*l.ecm	-	.0043	-	-.0087	-	.0601	-	.0144
		(.0242)		(.0265)		(.0652)		(.0714)
d.infl	3.5570***	2.9356***	3.2712***	2.7532***	3.7112***	3.0385***	3.4312***	2.8850***
	(.5137)	(.4710)	(.5784)	(.5273)	(.5153)	(.4717)	(.5794)	(.5278)
thold1,2*d.infl	-.1382	.0374	-.0985	.0641	-.1196	.0587	-.0664	.0837
	(.0885)	(.1517)	(.0964)	(.1647)	(.0886)	(.1520)	(.0965)	(.1651)
d.l.perc	.0414	.0454	.0258	.0301	.7621***	.7726***	.7621***	.7728***
	(.0312)	(.0312)	(.0340)	(.0339)	(.1041)	(.1039)	(.1090)	(.1087)
constant	.2746**	.2689**	.2495*	.2315	.0076	.0038	.0038	-.0004
	(.1242)	(.1272)	(.1379)	(.1411)	(.1274)	(.1274)	(.1406)	(.1406)
F-test	23.13	22.52	19.21	18.99	23.05	22.79	19.18	19.16
prob.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CADF resid.	-4.358	-4.345	-4.532	-4.523	4.300	-4.299	-4.484	-4.461
prob.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: Robust standard errors in parentheses. ***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Table 6: Availability of COICOP-Categories

	1996 - 2001		2002 - 2008	
	EU Sample	EMU Sample	EU Sample	EMU Sample
perc	Coeff.	Coeff.	Coeff.	Coeff.
l.perc	.7704***	.7281***	.8499***	.8484***
	(.0299)	(.0190)	(.0092)	(.0056)
inflcp1	.7122***	.8899***	.4162***	.3187***
	(.1606)	(.1363)	(.0826)	(.0593)
inflcp2	.0321	.0006	.0155	-.0107
	(.0541)	(.0870)	(.0382)	(.0447)
inflcp3	.1830*	.2856**	.0135	-.0153
	(.0973)	(.1153)	(.0768)	(.1002)
inflcp4	.4232***	.5924***	-.1635**	-.1659
	(.1072)	(.1132)	(.0735)	(.1048)
inflcp5	-.3758	-.3744	.7070***	.9928***
	(.3004)	(.2923)	(.2072)	(.2796)
inflcp6	-.0269	-.0193	.0524	.0528
	(.0564)	(.0661)	(.0743)	(.0801)
inflcp7	.6913***	.6125***	.4931***	.4571***
	(.0728)	(.0800)	(.0609)	(.0603)
inflcp8	.0470	.0464	.1215***	.1193***
	(.0437)	(.0432)	(.0416)	(.0412)
inflcp9	-.2195	-.3859	.3158***	.3681***
	(.2145)	(.2388)	(.0991)	(.0893)
inflcp10	.0325	.0456	.1067***	.0955***
	(.0538)	(.0457)	(.0272)	(.0323)
inflcp11	.6643**	.8344***	.0860	.0550
	(.3039)	(.2834)	(.1873)	(.1944)
inflcp12	.1718	.3949**	.2144	.1233
	(.2463)	(.1963)	(.2177)	(.3146)
constant	-4.1895***	-4.5461***	1.723	3.214***
	(1.3663)	(1.4570)	(1.1349)	(.7622)
Sargan (χ^2)	642.414	531.49	964.6409	789.162
prob.	0.544	0.461	0.083	0.257
Wald (χ^2)	7657.35	3282.74	982.39	887.21
prob.	0.000	0.000	0.000	0.000
CADF resid.	-2.52	-2.365	-3.833	-3.867
prob.	0.003	0.015	0.000	0.000

Note: Robust standard errors in parentheses.

***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Table 7: Availability of HICP vs. FROOPP Inflation, Pre-Euro 1996 - 2001

	EU Sample			EMU Sample		
perc	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
l.perc	.8579***	.8444***	.8429***	.8594***	.8366***	.8370***
	(.0156)	(.0156)	(.0159)	(.0168)	(.0172)	(.0173)
infl_hicp	1.3402***	-	.1777	1.3823***	-	-.1033
	(.1944)		(.3301)	(.2165)		(.3914)
infl_froopp	-	1.3861***	1.2631***	-	1.5790***	1.6584***
		(.1680)	(.2836)		(.1975)	(.3600)
constant	-1.6168***	-2.1525***	-2.2047***	-1.2946***	-1.9211***	-1.8973
	(.3773)	(.3883)	(.4004)	(.4241)	(.4310)	(.4406)
F-test	2889.26	2910.29	1938.60	2583.54	2650.71	1764.77
prob.	0.000	0.000	0.000	0.000	0.000	0.000
R^2 overall	0.9546	0.9540	0.9540	0.9435	0.9425	0.9425
AIC	4892.675	4758.369	4760.073	4133.547	4052.401	4054.33
BIC	4906.918	4772.533	4778.959	4147.243	4066.05	4072.529
CADF resid.	-3.881	-7.138	-7.170	-3.941	-6.333	-6.287
prob.	0.000	0.000	0.000	0.000	0.000	0.000

Note: Robust standard errors in parentheses.

***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Table 8: Availability of HICP vs. FROOPP Inflation, Post-Euro 2002 - 2008

	EU Sample			EMU Sample		
perc	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
l.perc	.9003***	.9188***	.9142***	.8967***	.9229***	.9182***
	(.0109)	(.0111)	(.0114)	(.0118)	(.0119)	(.0121)
infl_hicp	1.4505***	-	.6533*	1.3829***	-	.8583*
	(.1899)		(.3526)	(.2061)		(.4390)
infl_froopp	-	1.1524***	.8103***	-	1.1227***	.6541**
		(.1546)	(.2407)		(.1719)	(.2947)
constant	.4755	.1065	-.2781	1.4707***	.6735	.1607
	(.4017)	(.4892)	(.5307)	(.5198)	(.6164)	(.6688)
F-test	5756.75	3724.09	2491.08	4283.37	3215.21	2153.42
prob.	0.000	0.000	0.000	0.000	0.000	0.000
R^2 overall	0.9792	0.9818	0.9817	0.9626	0.9651	0.9649
AIC	5475.108	4620.969	4619.482	4593.998	3898.325	3896.442
BIC	5489.783	4635.211	4638.472	4608.126	3912.02	3914.703
CADF resid.	-4.068	-4.140	-4.132	-4.291	-4.112	-4.125
prob.	0.000	0.000	0.000	0.000	0.000	0.000

Note: Robust standard errors in parentheses.
***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Table 9: Summary of Results from the Loss Aversion Models for Socioeconomic Groups

	1996 - 2001				2002 - 2008			
	thold1*	thold2*	thold1*	thold2*	thold1*	thold2*	thold1*	thold2*
perc_socio	infl_socio	infl_socio	infl	infl	infl_socio	infl_socio	infl	infl
Age1			+	+				
Age2	+		+	+	+			
Age3	+		+	+				
Age4		−		+				
Q1		−			−		−	
Q2			+	+			−	
Q3				+				
Q4	+	+	+	+	+		+	
ED1	NA	NA	+	+	NA	NA		
ED2	NA	NA	+	+	NA	NA		
ED3	NA	NA		+	NA	NA		

Note: + denotes a significant positive coefficient and – denotes a significant negative coefficient.

Table 10: Summary of Results from the Availability Models for Socioeconomic Groups, Pre-Euro 1996 - 2001

perc_socio	Age1	Age2	Age3	Age4	Q1	Q2	Q3	Q4	ED1	ED2	ED3
inflcp1	+	+	+	+	+	+	+	+	+	+	+
inflcp2											
inflcp3								+			
inflcp4	+	+	+	+	+	+	+	+	+	+	+
inflcp5				−		−	−				−
inflcp6											
inflcp7	+	+	+	+	+	+	+	+	+	+	+
inflcp8		+	+	+	+	+	+		+	+	
inflcp9											
inflcp10		−							−		
inflcp11	+	+	+	+	+	+	+	+	+	+	+
inflcp12				+	+						

Note: + denotes a significant positive coefficient and − denotes a significant negative coefficient.

Table 11: Summary of Results from the Availability Models for Socioeconomic Groups, Post-Euro 2002 - 2008

perc_socio	Age1	Age2	Age3	Age4	Q1	Q2	Q3	Q4	ED1	ED2	ED3
inflcp1	+	+	+	+	+	+	+	+	+	+	+
inflcp2											
inflcp3											
inflcp4		−	−			−	−			−	−
inflcp5	+	+	+	+	+	+	+	+	+	+	+
inflcp6											
inflcp7	+	+	+	+	+	+	+	+	+	+	+
inflcp8	+	+	+	+	+	+	+	+	+	+	+
inflcp9	+	+	+	+	+	+	+	+	+	+	+
inflcp10	+	+	+	+	+	+	+	+	+	+	+
inflcp11											
inflcp12	+						+			+	

Note: + denotes a significant positive coefficient and − denotes a significant negative coefficient.

Table A1: Panel Unit Root Tests for Perceptions and Aggregate Inflation I

	Whole Sample Period			
	perceptions		inflation	
Alternative: Stationarity of all series in the panel				
Method	Statistic	Prob.*	Statistic	Prob.*
Levin. Lin & Chu t	-0.482	0.315	-0.679	0.248
Breitung t-stat	0.197	0.578	1.171	0.879
Alternative: Stationarity of some series in the panel				
Method	Statistic	Prob.*	Statistic	Prob.*
Im. Pesaran and Shin W-stat	-0.148	0.441	-4.044	0.000
ADF - Fisher Chi-square	21.737	0.595	59.573	0.000
PP - Fisher Chi-square	20.185	0.686	61.807	0.000
Pesaran CADF t-bar	-2.065	0.145	-2.422	0.008

* Probabilities for Fisher tests are computed using an asympotic Chi-square distribution. All other tests assume asymptotic normality.

Table A2: Panel Unit Root Tests for Perceptions and Aggregate Inflation II

	1996m1 - 2001m12				2002m1 - 2008m11			
	perceptions		inflation		perceptions		inflation	
Alternative: Stationarity of all series in the panel								
Method	Statistic	Prob.*	Statistic	Prob.*	Statistic	Prob.*	Statistic	Prob.*
Levin. Lin & Chu t	-0.858	0.195	-1.958	0.025	-2.537	0.006	-0.907	0.182
Breitung t-stat	-0.025	0.490	0.078	0.531	0.822	0.794	4.021	1.000
Alternative: Stationarity of some series in the panel								
Method	Statistic	Prob.*	Statistic	Prob.*	Statistic	Prob.*	Statistic	Prob.*
Im. Pesaran and Shin W-stat	-0.814	0.208	-1.481	0.069	-3.371	0.000	-3.235	0.001
ADF - Fisher Chi-square	25.246	0.393	33.423	0.096	56.936	0.000	50.878	0.001
PP - Fisher Chi-square	34.353	0.079	37.910	0.035	49.122	0.002	48.265	0.002
Pesaran CADF t-bar	-2.211	0.050	-2.204	0.053	-1.999	0.202	-1.925	0.290

* Probabilities for Fisher tests are computed using an asympotic Chi-square distribution.

All other tests assume asymptotic normality.

Table A3: Panel Unit Root Tests for COICOP-Inflation

Inflation COICOP-Category	Levin. Lin & Chu t		Breitung t-stat		Im. Pesaran & Shin W-stat		ADF - Fisher Chi-square		Pesaran CIPS t-bar	
	Stat.	Prob.*	Stat.	Prob.*	Stat.	Prob.*	Stat.	Prob.*	Stat.	Prob.*
CP1	1.522	0.936	-1.381	0.084	-1.427	0.077	38.056	0.034	-2.459	0.005
CP2	-1.686	0.046	-6.046	0.000	-4.985	0.000	70.977	0.000	-2.650	0.000
CP3	-10.126	0.000	-7.292	0.000	-12.631	0.000	239.767	0.000	-3.230	0.000
CP4	0.318	0.625	-2.409	0.008	-3.214	0.001	49.077	0.002	-2.724	0.000
CP5	1.013	0.845	-1.679	0.047	-1.334	0.091	30.503	0.169	-2.312	0.022
CP6	0.778	0.782	-1.126	0.130	-3.223	0.001	55.084	0.000	-2.338	0.017
CP7	2.971	0.999	-2.540	0.006	-6.094	0.000	84.372	0.000	-2.567	0.001
CP8	0.449	0.673	-2.201	0.014	-3.234	0.001	46.259	0.004	-2.527	0.002
CP9	-1.834	0.033	-3.545	0.000	-4.015	0.000	56.954	0.000	-2.727	0.000
CP10	-0.495	0.310	-1.968	0.025	-3.102	0.001	47.114	0.003	-2.321	0.020
CP11	-1.243	0.107	-4.011	0.000	-3.432	0.000	52.178	0.001	-2.063	0.147
CP12	-0.055	0.478	-1.833	0.033	-1.863	0.031	34.055	0.084	-2.417	0.008

* Probabilities for Fisher tests are computed using an asympotic Chi-square distribution.
All other tests assume asymptotic normality.

Table A4: Panel Cointegration Tests between Perceptions and HICP/COICOP Inflation

Method	Whole Sample		1996m1 - 2001m12		2002m1 - 2008m11	
Pedroni Tests: Alternative hypothesis: common AR coefs.						
	Weighted Stat.	Prob.	Weighted Stat.	Prob.	Weighted Stat.	Prob.
Panel v-Statistic	0.157593	0.4374	1.956497	0.0252	3.270188	0.0005
Panel rho-Statistic	-1.793	0.0365	-4.278	0.0000	-5.271	0.0000
Panel PP-Statistic	-1.692	0.0453	-3.703	0.0001	-5.639	0.0000
Panel ADF-Statistic	-0.877	0.1902	-1.613	0.0534	-3.868	0.0001
Pedroni Tests: Alternative hypothesis: individual AR coefs.						
	Stat.	Prob.	Stat.	Prob.	Stat.	Prob.
Group rho-Statistic	-0.775	0.2193	-4.803	0.0000	-4.596	0.0000
Group PP-Statistic	-1.217	0.1118	-4.318	0.0000	-6.396	0.0000
Group ADF-Statistic	-0.237	0.4065	-1.404	0.0801	-4.241	0.0000
Kao ADF Test	t-Stat.	Prob.	t-Stat.	Prob.	t-Stat.	Prob.
	-1.622	0.0524	-1.850	0.0321	-3.016	0.0013
Maddala & Wu Test	Fisher-Stat.*	Prob.	Fisher-Stat.*	Prob.	Fisher-Stat.*	Prob.
Trace Test (None)	76.44	0.0000	63.11	0.0000	103.4	0.0000
(At most 1)	47.89	0.0026	41.02	0.0166	78.76	0.0000
Max.-Eigenvalue Test (None)	68.21	0.0000	57.78	0.0001	75.59	0.0000
(At most 1)	47.89	0.0026	41.02	0.0166	78.76	0.0000
Cointegration between Perceptions and COICOP-Inflation:						
Kao ADF Test	t-Stat.	Prob.	t-Stat.	Prob.	t-Stat.	Prob.
	-2.358	0.0092	-1.814	0.0349	-3.325	0.0004

* Probabilities for Fisher tests are computed using an asympotic Chi-square distribution.
All other tests assume asymptotic normality.

Table A5: Quandt-Likelihood-Ratio Test for Structural Breaks

Country	Loss Aversion Model with Threshold 1			Loss Aversion Model with Threshold 2			Availability Model		
	Max. Wald F	p-value	date	Max. Wald F	p-value	date	Max. Wald F	p-value	date
Austria	153.670	<0.001	2002M02	160.916	<0.001	2002M02	43.233	<0.001	2002M02
Belgium	182.587	<0.001	2002M04	161.003	<0.001	2002M04	29.170	0.1023	2002M09
Spain	284.427	<0.001	2002M05	243.092	<0.001	2002M05	30.747	0.0674	2002M06
Finland	93.991	<0.001	2002M02	127.207	<0.001	2002M02	16.447	0.8782	2002M02
France	270.878	<0.001	2001M08	169.536	<0.001	2001M08	7.241	1.0000	2002M05
Germany	25.488	<0.001	2001M05	16.045	0.0205	2000M09	12.524	0.9923	2003M09
Greece	465.868	<0.001	2002M09	482.446	<0.001	2002M09	53.423	<0.001	2002M04
Italy	95.775	<0.001	2002M06	80.281	<0.001	2002M06	28.398	0.1243	2002M06
Netherlands	71.422	<0.001	2002M05	64.198	<0.001	2002M05	27.386	0.159	2002M04
Portugal	62.233	<0.001	2002M05	100.184	<0.001	2002M05	20.703	0.5725	2003M02
Sweden	65.748	<0.001	2006M10	79.642	<0.001	2006M09	7.408	1.0000	2004M02
UK	53.291	<0.001	2001M05	40.817	<0.001	2006M03	9.107	1.0000	2006M03

Table A6: Definition of COICOP-Categories

cp1	Food and non-alcoholic beverages
cp2	Alcoholic beverages. tobacco and narcotics
cp3	Clothing and footwear
cp4	Housing. water. electricity. gas and other fuels
cp5	Furnishings. household equipment and routine maintenance of the house
cp6	Health
cp7	Transport
cp8	Communications
cp9	Recreation and culture
cp10	Education
cp11	Restaurants and hotels
cp12	Miscellaneous goods and services

Table A7: Definition of Socioeconomic Groups

	perceptions	inflation
Age1	16 - 29	< 30
Age2	30 - 49	30 - 44
Age3	50 - 64	45 - 59
Age4	> 65	> 60
Q1	1st income quartile	1st income quintile
Q2	2nd income quartile	2nd income quintile
Q3	3rd income quartile	4th income quintile
Q4	4th income quartile	5th income quintile
ED1	primary education	-
ED2	secondary education	-
ED3	further education	-

Table A8: Loss Aversion Age Groups

	1996 - 2001				2002 - 2008			
	Age1	Age2	Age3	Age4	Age1	Age2	Age3	Age4
perc_age	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
thold1*infl_age	.0969	.4118***	.2975*	-.0347	-.0627	.1408*	-.0247	-.1715
	(.1905)	(.1481)	(.1665)	(.2011)	(.1283)	(.0751)	(.1067)	(.1198)
thold2*infl_age	.1144	.3145	.1051	-.4313*	-.0510	-.0590	-.0235	.1000
	(.2388)	(.2191)	(.2673)	(.2359)	(.3930)	(0.2650)	(.2468)	(.1489)
thold1*infl	.2768*	.3964***	.4326*	.1084	-.0093	.0590	-.0393	-.0786
	(.1534)	(.1171)	(.2424)	(.2511)	(.1121)	(.0957)	(.1122)	(.1448)
thold2*infl	.6221***	.6098***	.4827**	.4156**	-.2164	-.0109	.0246	.0242
	(.1879)	(.1912)	(.2247)	(.1904)	(.3734)	(.2079)	(.2094)	(.2029)

Note: Robust standard errors in parentheses.

***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Table A9: Loss Aversion Income Groups

	1996 - 2001				2002 - 2008			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
perc_q	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
thold1*infl_q	.0523	.1550	.0887	.3055*	-.2971**	-.2491	-.0595	.2367*
	(.2011)	(.1967)	(.1970)	(.1673)	(.1283)	(.1537)	(.1100)	(.1386)
thold2*infl_q	-.5681*	-.0152	.2846	.5147*	-.4390	-.4087	.0557	.0173
	(.3043)	(.2688)	(.2192)	(.3097)	(.3214)	(.3837)	(.2742)	(.2813)
thold1*infl	.1939	.3678*	.1789	.4931***	-.2889*	-.4807***	-.0423	.2730*
	(.2501)	(.1984)	(.1414)	(.1871)	(.1704)	(.1805)	(.1308)	(.1614)
thold2*infl	.2215	.5581***	.7207***	.7789***	-.5461	-.3214	-.1165	-.0206
	(.2027)	(.1972)	(.2333)	(.2070)	(.3639)	(.3670)	(.2818)	(.2554)

Note: Robust standard errors in parentheses.

***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Table A10: Loss Aversion Education Groups

	1996 - 2001			2002 - 2008		
	ED1	ED2	ED3	ED1	ED2	ED3
perc_ed	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
thold1*infl	.398**	.3779***	.1209	-.0934	.0642	.0238
	(.1946)	(.1340)	(.3212)	(.1177)	(.1071)	(.1021)
thold2*infl	.3906**	.6188***	.6488**	-.0360	.0392	-.0732
	(.1566)	(.1632)	(.2688)	(.2357)	(.2097)	(.2003)

Note: Robust standard errors in parentheses.

***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Table A11: Availability Age Groups, Pre-Euro 1996 - 2001

perc_age	Age1 Coeff.	Age2 Coeff.	Age3 Coeff.	Age4 Coeff.
l.perc_age	.6275***	.7260***	.6889***	.6218***
	(.0565)	(.0326)	(.0369)	(.0367)
inflcp1	.7628***	.6749***	.8884***	.9477***
	(.2096)	(.2125)	(.2416)	(.2428)
inflcp2	.0420	-.0082	.0515	.0363
	(.0811)	(.0735)	(.1075)	(.0990)
inflcp3	.1269	.1768	.1147	.1988
	(.1053)	(.1231)	(.0983)	(.1367)
inflcp4	.5557**	.4884***	.5459***	.8345***
	(.1830)	(.1171)	(.1156)	(.1854)
inflcp5	-.4566	-.5649	-.4542	-.8686**
	(.3034)	(.3727)	(.3561)	(.3701)
inflcp6	-.0566	-.0230	.0106	.0021
	(.0898)	(.0796)	(.0751)	(.0758)
inflcp7	.7040***	.8153***	.9231***	.6190***
	(.1083)	(.1030)	.1185	(.2058)
inflcp8	.0541	.1273**	.1648**	.2006*
	(.0768)	(.0650)	(.0756)	(.1155)
inflcp9	-.2920	-.1577	-.1483	-.1991
	(.4063)	(.2512)	(.2566)	(.2976)
inflcp10	-.0184	-.0804*	-.0153	.0837
	(.0918)	(.0435)	(.0602)	(.0587)
inflcp11	1.0810***	.9928**	.9487***	1.1178***
	(.3381)	(.3969)	(.3559)	(.3086)
inflcp12	.2847	.0831	.2041	.8536*
	(.3736)	(.2680)	(.3356)	(.4806)
constant	-6.3141**	-4.4179***	-4.8905***	-4.8605***
	(2.5701)	(1.7115)	(1.716)	(1.7692)
Sargan test (χ^2)	548.9548	576.0418	578.9533	544.7087
Prob.	0.9785	0.8854	0.8678	0.9844
Wald test (χ^2)	1243.27	688.70	2594.58	1199.79
Prob.	0.0000	0.0000	0.0000	0.0000
CADF resid.	-1.803	-2.114	-2.418	-2.669
Prob.	0.036	0.017	0.008	0.004

Note: Robust standard errors in parentheses.

***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Table A12: Availability Age Groups, Post-Euro 2002 - 2008

perc_age	Age1 Coeff.	Age2 Coeff.	Age3 Coeff.	Age4 Coeff.
l.perc_age	.7250***	.8404***	.8195***	.8177***
	(.0434)	(.0155)	(.0143)	(.0133)
inflcp1	.3733***	.4493***	.5151***	.5432***
	(.1266)	(.1114)	(.0935)	(.1103)
inflcp2	.0527	.0273	.0306	.0457
	(.0695)	(.0410)	(.0456)	(.0571)
inflcp3	-.0594	-.0515	.0701	.0386
	(.1559)	(.0711)	(.0589)	(.1148)
inflcp4	-.1488	-.1733**	-.1294**	-.0955
	(.0914)	(.0877)	(.0651)	(.0872)
inflcp5	1.1879***	.7113***	.8576***	.8948***
	(.4970)	(.2339)	(.2090)	(.1892)
inflcp6	.0369	.0749	.0644	.0186
	(.0948)	(.0804)	(.0998)	(.0775)
inflcp7	.6598***	.5250***	.6028***	.4816***
	(.1095)	(.0695)	(.0804)	(.0614)
inflcp8	.1899**	.1277***	.1672***	.11079***
	(.0859)	(.0472)	(.0633)	(.0340)
inflcp9	.5329***	.3711***	.2717	.3228***
	(.1721)	(.1034)	(.1212)	(.1025)
inflcp10	.1800***	.1234	.1064***	.07717**
	(.0701)	(.0365)	(.0255)	(.0361)
inflcp11	.1100	.1627	.0934	-.0358
	(.3040)	(.2278)	(.2048)	(.2044)
inflcp12	.8999*	.2373	.1579	.2295
	(.5217)	(.2530)	(.2451)	(.2753)
constant	1.5932	1.319	2.3011	3.048**
	(2.110)	(1.3622)	(1.4246)	(1.4014)
Sargan test (χ^2)	769.692	911.8384	856.9528	802.0247
Prob.	0.9996	0.4301	0.8717	0.9938
Wald test (χ^2)	176.87	113945.51	7765.57	574.63
Prob.	0.0000	0.0000	0.0000	0.0000
CADF resid.	-3.813	-3.656	-3.950	-3.943
Prob.	0.000	0.000	0.000	0.000

Note: Robust standard errors in parentheses.

***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Table A13: Availability Income Groups, Pre-Euro 1996 - 2001

perc_q	Q1 Coeff.	Q2 Coeff.	Q3 Coeff.	Q4 Coeff.
l.perc_q	.6128***	.6515***	.6972***	.6438***
	(.0346)	(.0463)	(.0396)	(.0595)
inflcp1	.8860***	.9106***	.8131***	.9169***
	(.2417005)	(.2530)	(.2393)	(.2744)
inflcp2	.1243	.0713	.0063	.0355
	(.1298)	(.1104)	(.1263)	(.1128)
inflcp3	.0516	.1849	.1138	.2240**
	(.1445)	(.1187)	(.1064)	(.1099)
inflcp4	.6377***	.7178***	.5471***	.6195***
	(.1770)	(.1672)	(.1393)	(.1687)
inflcp5	-.5256	-.7152*	-.5584*	-.3504
	(.4169)	(.3886)	(.2973)	(.2947)
inflcp6	-.0256	.0223	.0047	-.0517
	(.0654)	(.0958)	(.0947)	(.0934)
inflcp7	.6894***	.7476***	.8564***	.9785***
	(.1213)	(.1202)	(.0979)	(.1586)
inflcp8	.2016**	.1477*	.1432*	.0381
	(.0921)	(.0889)	(.0748)	(.0704)
inflcp9	-.2558	-.2520	-.2064	-.4339
	(.2705)	(.3189)	(.3055)	(.3163)
inflcp10	.0168	-.0026	.0186	.0573
	(.0563)	(.0786)	(.0499)	(.0592)
inflcp11	1.0516***	.9745**	.9831***	1.3952***
	(.3160)	(.4974)	(.3823)	(.4144)
inflcp12	.7144**	.3896	.1459	.1658
	(.3494)	(.3781)	(.4038)	(.4004)
constant	-4.0979**	-4.8400**	-5.2709***	-8.2499***
	(1.6773)	(2.2460)	(1.7648)	(2.8891)
Sargan test (χ^2)	555.4893	558.0838	550.5629	552.3905
Prob.	0.9587	0.9512	0.9704	0.7978
Wald test (χ^2)	3709.06	1851.26	1279.01	3259.38
Prob.	0.0000	0.0000	0.0000	0.0000
CADF resid.	-2.411	-2.428	-2.483	-0.738
Prob.	0.009	0.008	0.004	0.230

Note: Robust standard errors in parentheses.

***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Table A14: Availability Income Groups, Post-Euro 2002 - 2008

perc_q	Q1 Coeff.	Q2 Coeff.	Q3 Coeff.	Q4 Coeff.
l.perc_q	.6639***	.7576***	.7924***	.7839***
	(.0799)	(.0324)	(.0149)	(.0304)
inflcp1	.8713***	.6805***	.5834***	.4755***
	(.2359)	(.1433)	(.1132)	(.1356)
inflcp2	.0729	.0622	.0519	.0904
	(.1007)	(.0804)	(.0464)	(.0577)
inflcp3	-.0116	-.1251	-.0346	-.0280
	(.1385)	(.1318)	(.0959)	(.1061)
inflcp4	-.0183	-.1399**	-.1440**	-.1438
	(.1356)	(.0696)	(.0634)	(.0931)
inflcp5	1.4743***	.9584***	1.0796***	1.2000***
	(.4370)	(.2274)	(.2879)	(.3681)
inflcp6	.1093	.0367	.1003	.0483
	(.1197)	(.1045)	(.0824	(.1060)
inflcp7	.7005***	.5699***	.6053***	.6868***
	(.1817)	(.0873)	(.0886)	(.1041)
inflcp8	.2260**	.1479**	.1342**	.1591**
	(.0934)	(.0742)	(.0586)	(.0673)
inflcp9	.5310***	.5698***	.4268***	.5302***
	(.1338)	(.1734)	(.1060)	(.1443)
inflcp10	.1081*	.1442***	.1278***	.1242***
	(.0556)	(.0480)	(.0452)	(.0372)
inflcp11	-.1606	.0886	-.0865	.0041
	(.3905)	(.2969)	(.2775)	(.2282)
inflcp12	.6418	.3205	.5096*	.4110
	(.4405)	(.3204)	(.2982)	(.4045)
constant	6.1852*	3.6555	1.6961	1.1605
	(3.2486)	(2.3185)	(1.745)	(1.6827)
Sargan test (χ^2)	734.6646	819.5345	801.4006	782.3249
Prob.	1.0000	0.9803	0.9941	0.9033
Wald test (χ^2)	1597.31	1554.28	910.17	3871.24
Prob.	0.0000	0.0000	0.0000	0.0000
CADF resid.	-6.350	-6.993	-7.760	-3.638
prob.	0.000	0.000	0.000	0.000

Note: Robust standard errors in parentheses.

***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Table A15: Availability Education Groups

	1996 - 2001			2002 - 2008		
	ED1	ED2	ED3	ED1	ED2	ED3
perc_ed	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
l.perc_ed	.6564***	.7397***	.6439***	.7940***	.8336***	.8359***
	(.0537)	(.0440)	(.0399)	(.0195)	(.0088)	(.0147)
inflcp1	.8662***	.6447***	.8511***	.4506***	.4307***	.4824***
	(.2171)	(.2089)	(.2945)	(.1021)	(.0912)	(.1096)
inflcp2	.0536	.0033	.00063	.0582	.0128	-.0078
	(.0900)	(.0758)	(.1076)	(.0693)	(.0397)	(.0467)
inflcp3	.1780	.1805	.1097	-.0130	-.0161	.0537
	(.1195)	(.1119)	(.1334)	(.1431)	(.0939)	(.0943)
inflcp4	.6630***	.5496***	.6688***	-.0832	-.1500**	-.1763*
	(.1741)	(.1166)	(.1428)	(.0733)	(.0715)	(.0931)
inflcp5	-.6145	-.3228	-.6062**	1.0067***	.7805***	.7152***
	(.4542)	(.2761)	(.2758)	(.2037)	(.1982)	(.2388)
inflcp6	.0225	-.0133	.0124	.0525	.0407	.0435
	(.0690)	(.0745)	(.0968)	(.1184)	(.0580)	(.0971)
inflcp7	.8039***	.7286***	.7730***	.5543***	.5121***	.6222***
	(.1715)	(.0822)	(.0924)	(.0743)	(.0698)	(.0823)
inflcp8	.2069*	.0962*	.1145	.1348***	.1289**	.1401**
	(.1113)	(.0517)	(.0830)	(.0505)	(.0513)	(.0551)
inflcp9	-.1273	-.1628	-.4093	.3267***	.2268**	.4266***
	(.2706)	(.2526)	(.3237)	(.1124)	(.1040)	(.1339)
inflcp10	-.1523**	.0618	.0574	.0963***	.1002***	.0760*
	(.0604)	(.0930)	(.1073)	(.0272)	(.0347)	(.0412)
inflcp11	1.1042***	.8063***	1.3655***	.0572	.2287	.0650
	(.4211)	(.2882)	(.3399)	(.2182)	(.1973)	(.2876)
inflcp12	.3115	-.0286	.6057	.1974	.4352*	.1215
	(.4266)	(.2947)	(.4366)	(.2176	(.2626)	(.2505)
constant	-3.3930**	-4.7132***	-9.1715***	3.7131**	1.0702	1.4336
	(1.6966)	(1.5490)	(2.6313)	(1.4964)	(1.1189)	(1.3928)
Sargan test (χ^2)	558.7316	585.6493	573.1544	798.2596	862.9751	773.4994
Prob.	0.9576	0.8206	0.9013	0.9953	0.8384	0.9994
Wald test (χ^2)	192.92	3270.97	18520.19	42636.28	946.53	22182.94
Prob.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CADF resid.	-2.341	-3.164	-1.792	-3.780	-4.042	-3.851
prob.	0.010	0.001	0.037	0.000	0.000	0.000

Note: Robust standard errors in parentheses.

***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Figures

Figure 1: Prospect Theory and Inflation Perceptions

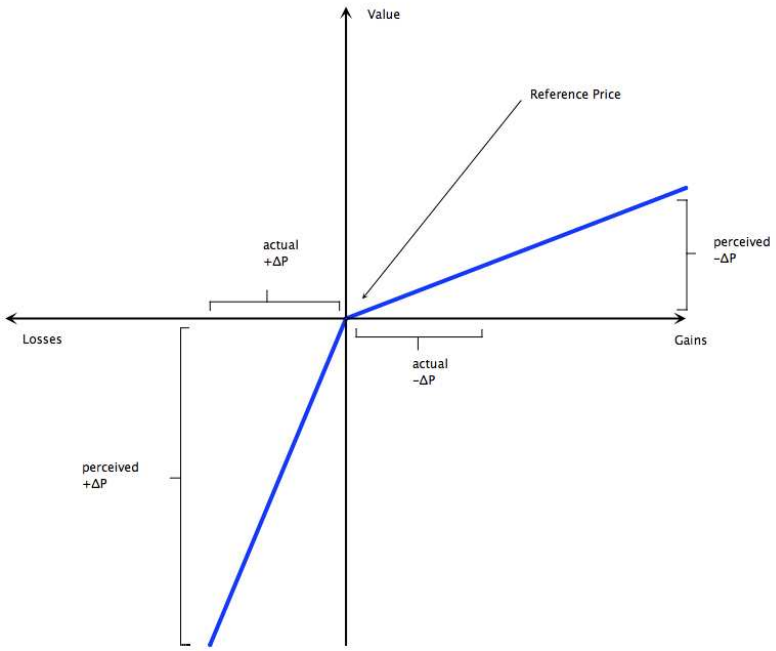


Figure 2: Inflation for all countries

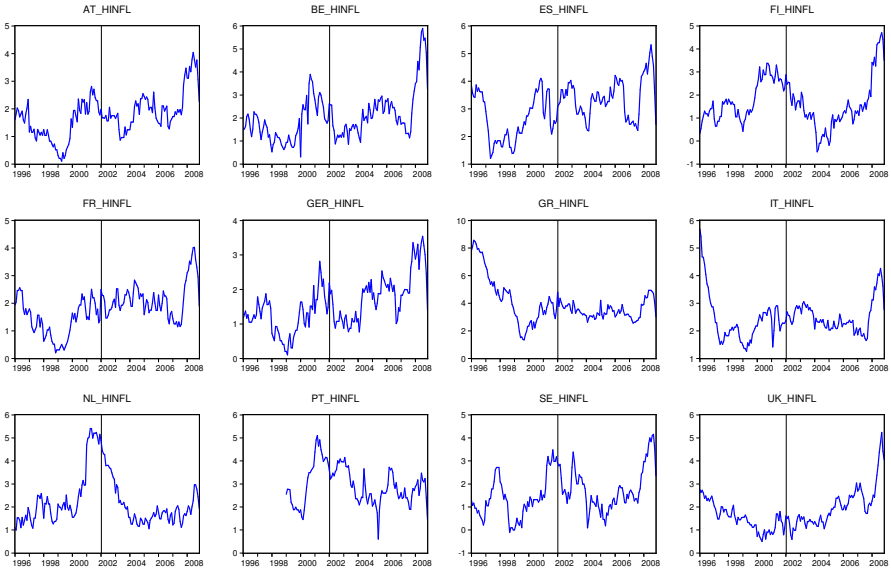


Figure 3: Perception for all countries

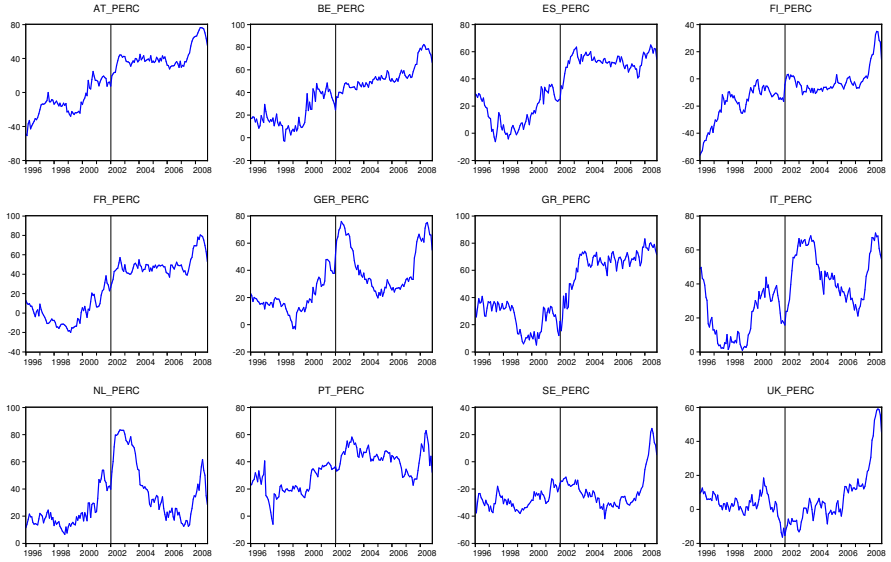
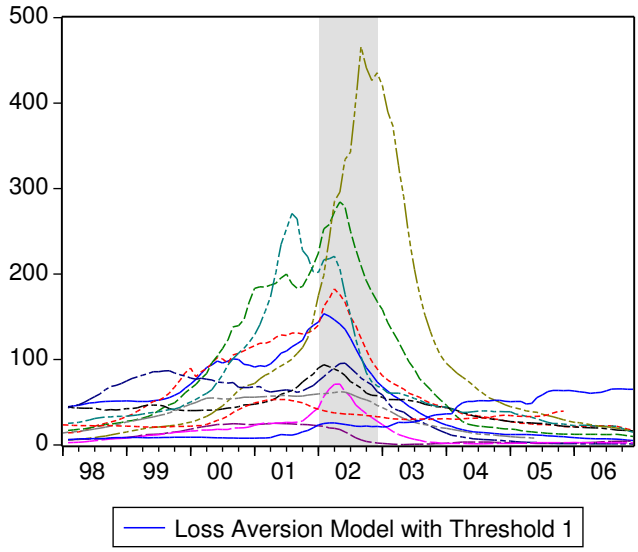


Figure 4: Quandt-Likelihood-Ratio Test for Structural Breaks in Loss Aversion Models



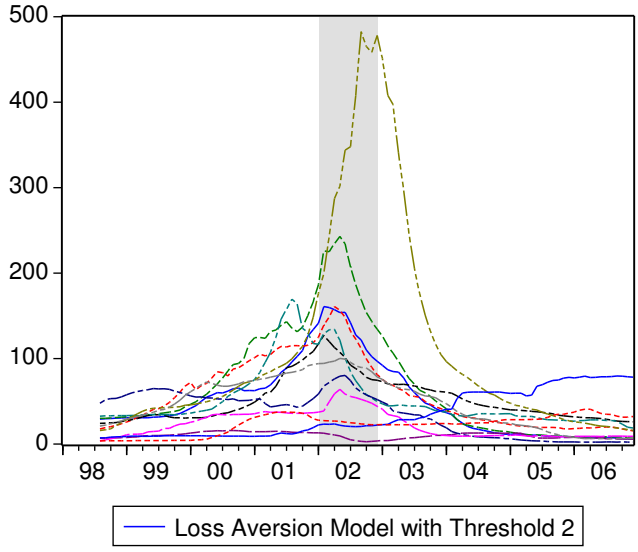


Figure 5: Quandt-Likelihood-Ratio Test for Structural Breaks in Availability Model

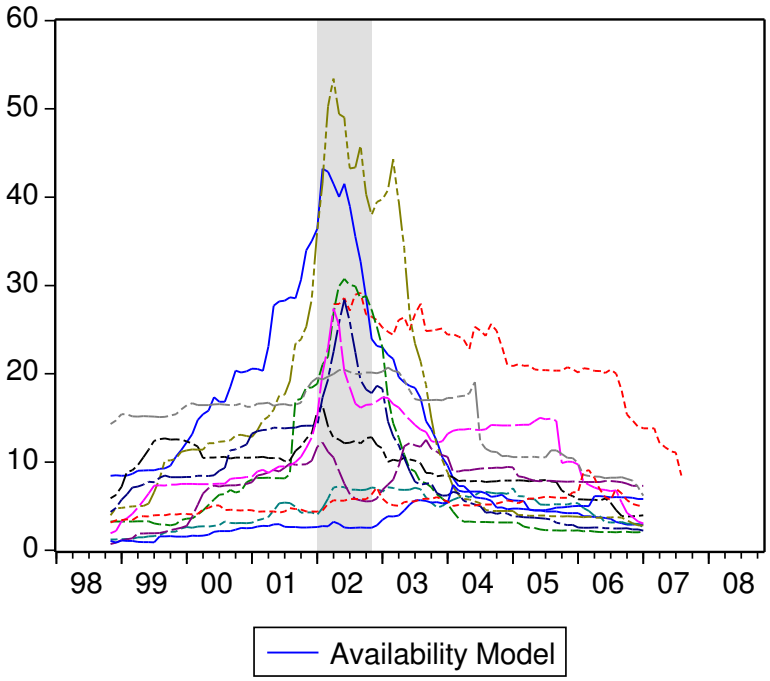


Figure 6: One-Standard-Deviation Impulse Responses Perceptions and Inflation to COICOP-Inflation in the EU-Sample, Pre-Euro 1996-2001

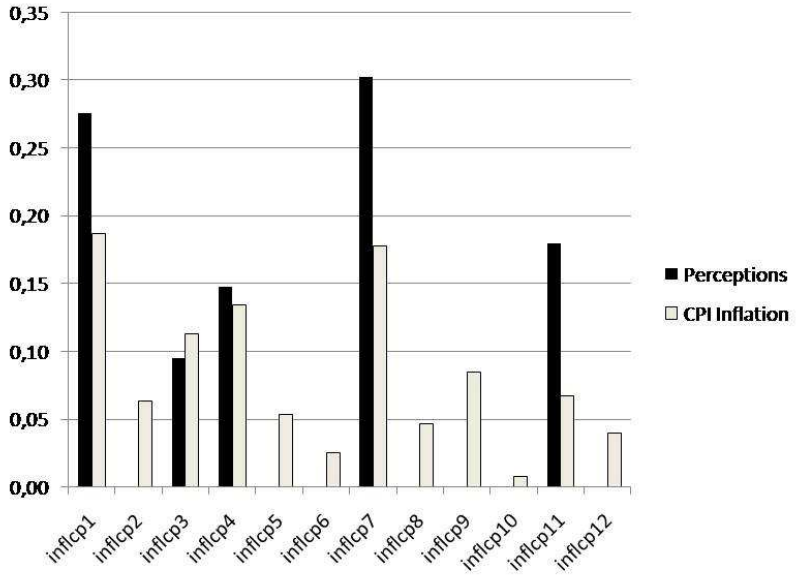


Figure 7: One-Standard-Deviation Impulse Responses Perceptions and Inflation to COICOP-Inflation in the EMU-Sample, Pre-Euro 1996-2001

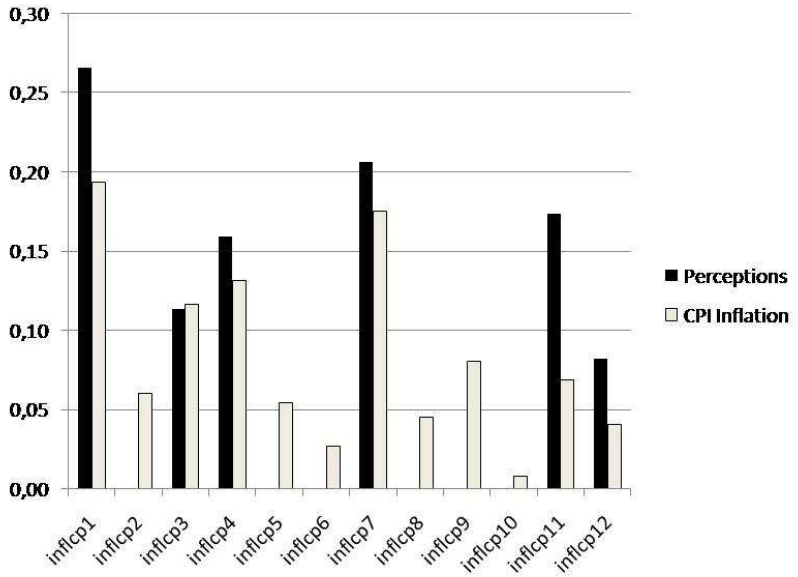


Figure 8: One-Standard-Deviation Impulse Responses Perceptions and Inflation to COICOP-Inflation in the EU-Sample, Post-Euro 2002-2008

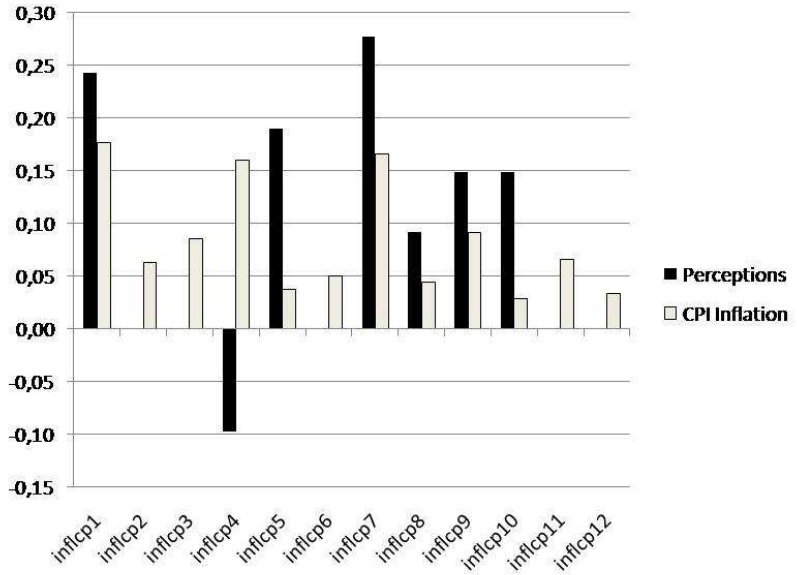


Figure 9: One-Standard-Deviation Impulse Responses Perceptions and Inflation to COICOP-Inflation in the EMU-Sample, Post-Euro 2002-2008

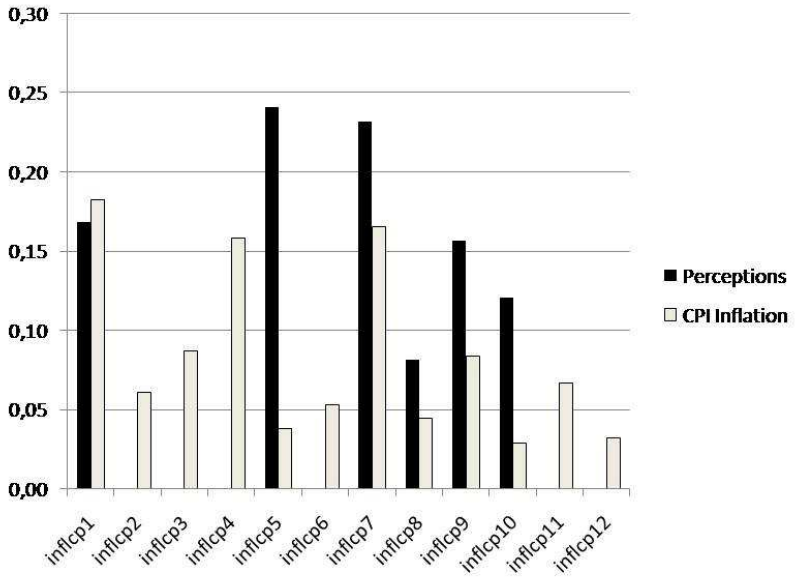


Figure A1: Crossplot Austria (LSTR1)

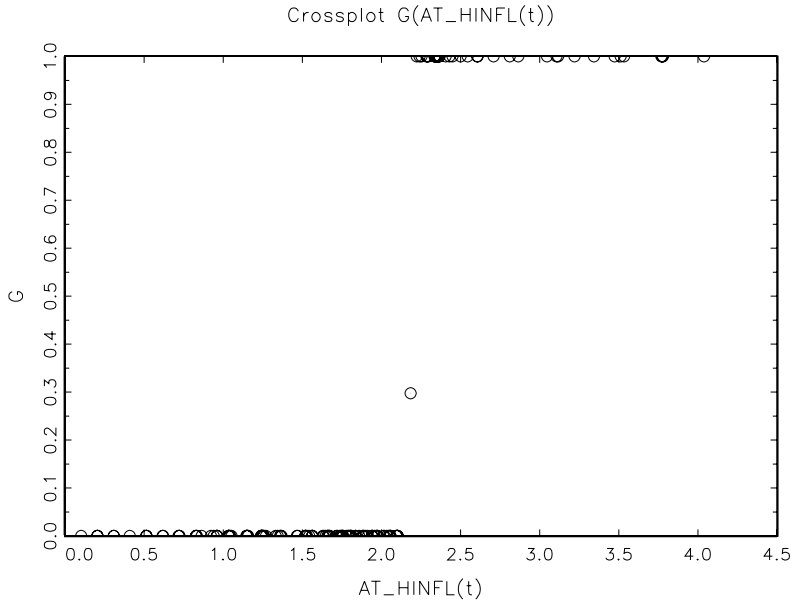


Figure A2: Crossplot Belgium (LSTR1)

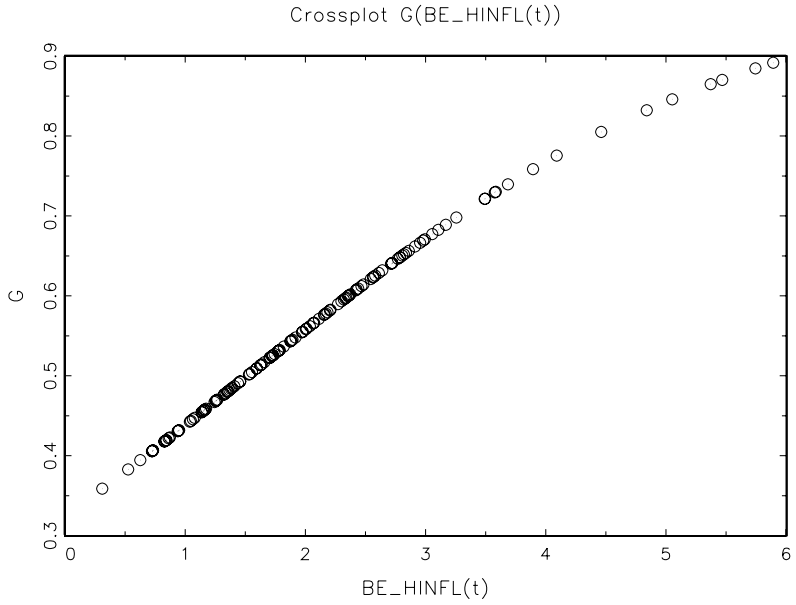


Figure A3: Crossplot Belgium (LSTR2)

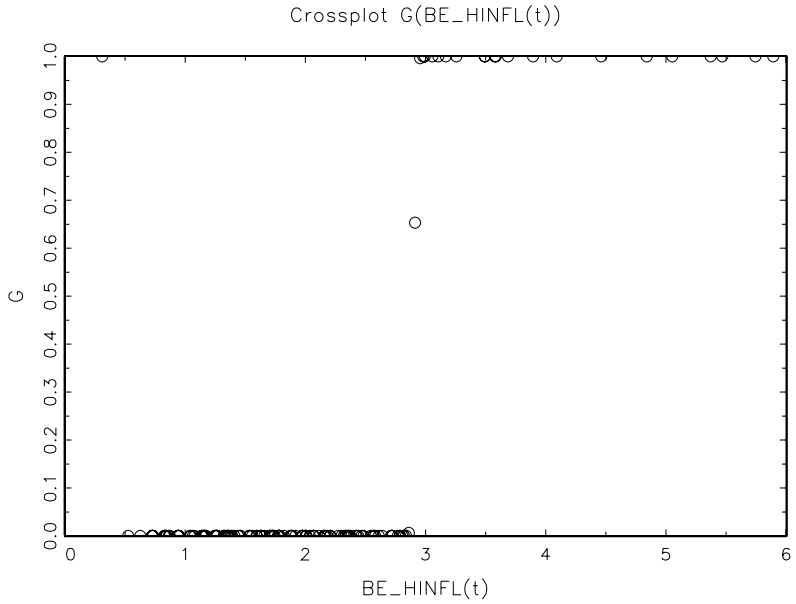


Figure A4: Crossplot Finland (LSTR1)

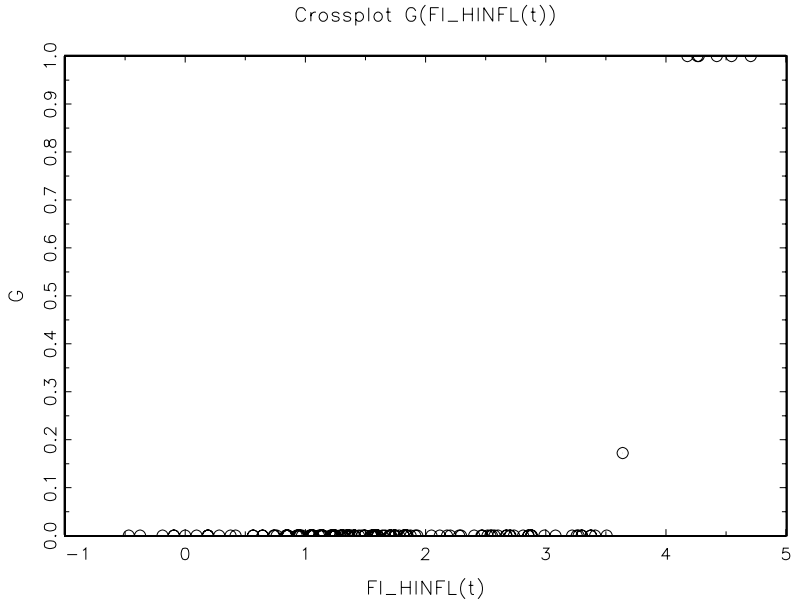


Figure A5: Crossplot France (LSTR1)

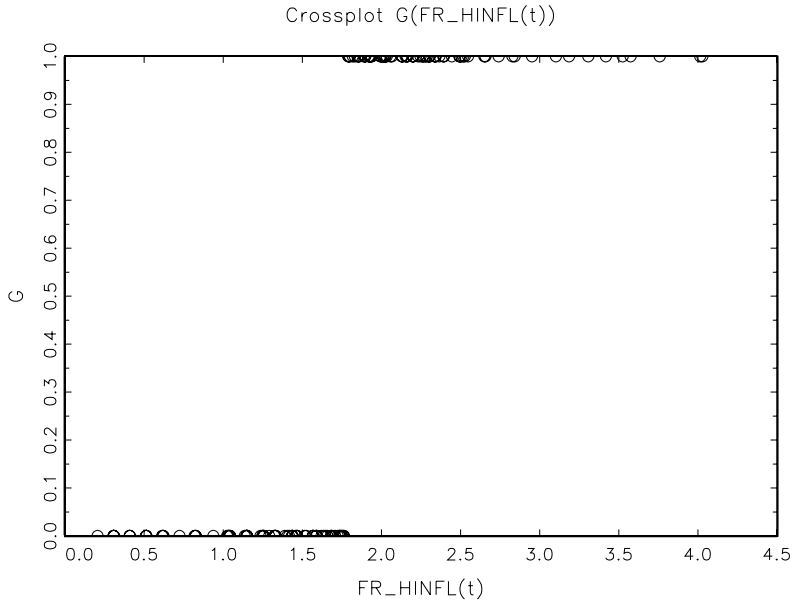


Figure A6: Crossplot Germany (LSTR1)

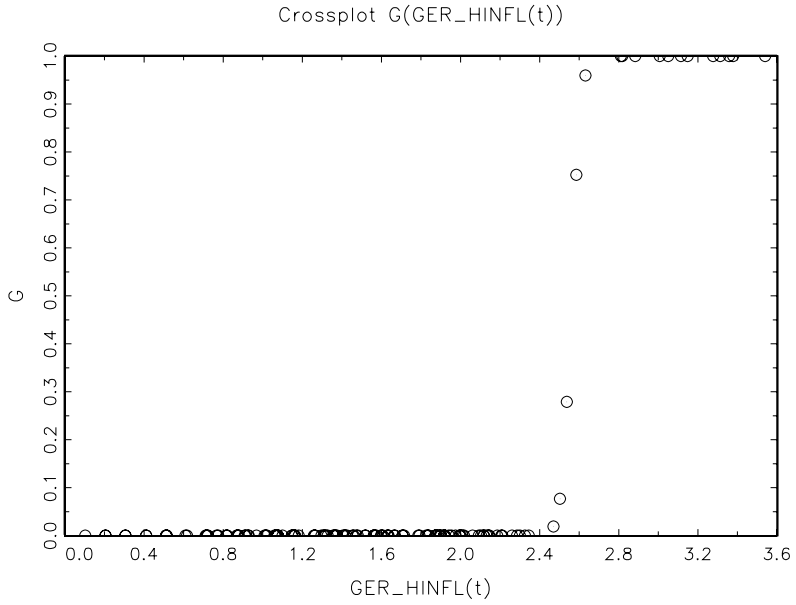


Figure A7: Crossplot Germany (LSTR2)

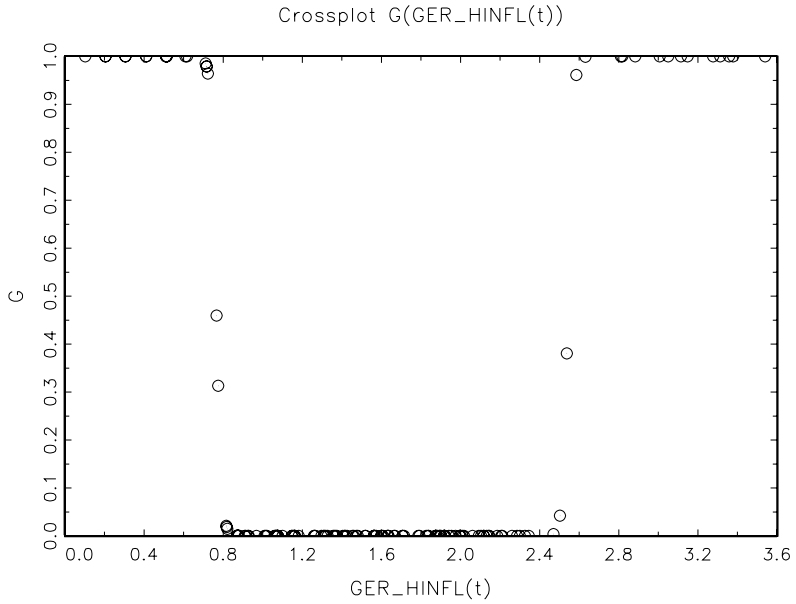


Figure A8: Crossplot Greece (LSTR1)

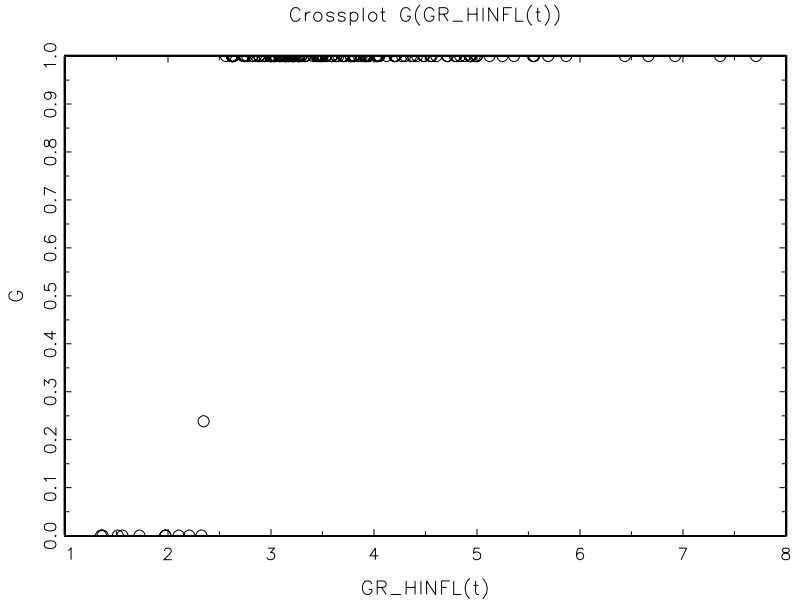


Figure A9: Crossplot Italy (LSTR1)

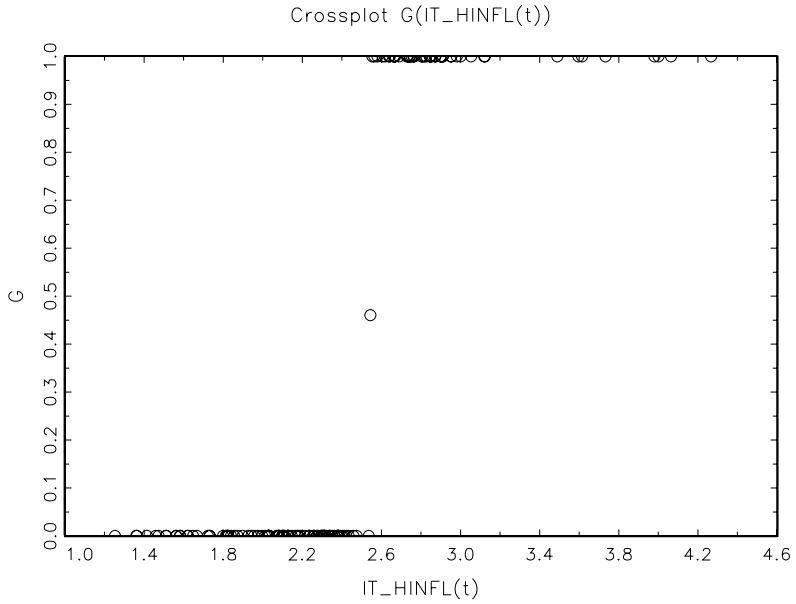


Figure A10: Crossplot Netherlands (LSTR1)

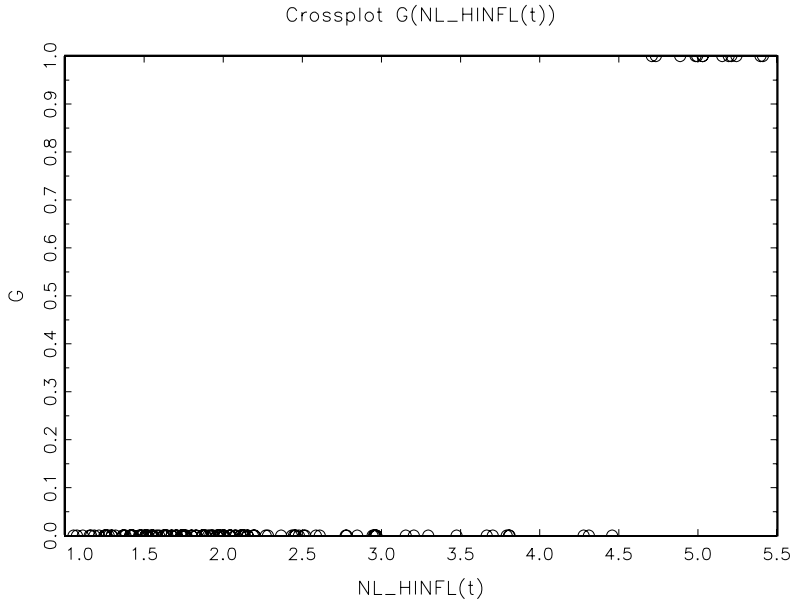


Figure A11: Crossplot Portugal (LSTR1)

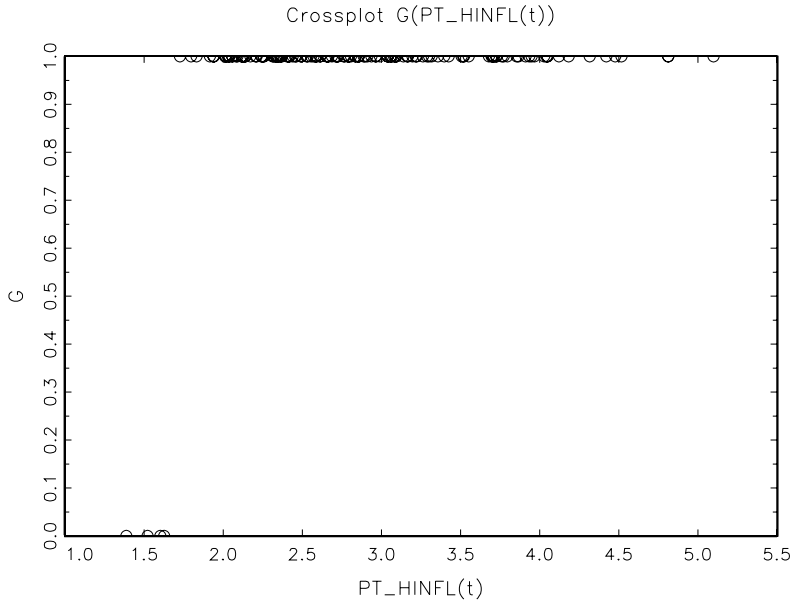


Figure A12: Crossplot Spain (LSTR1)

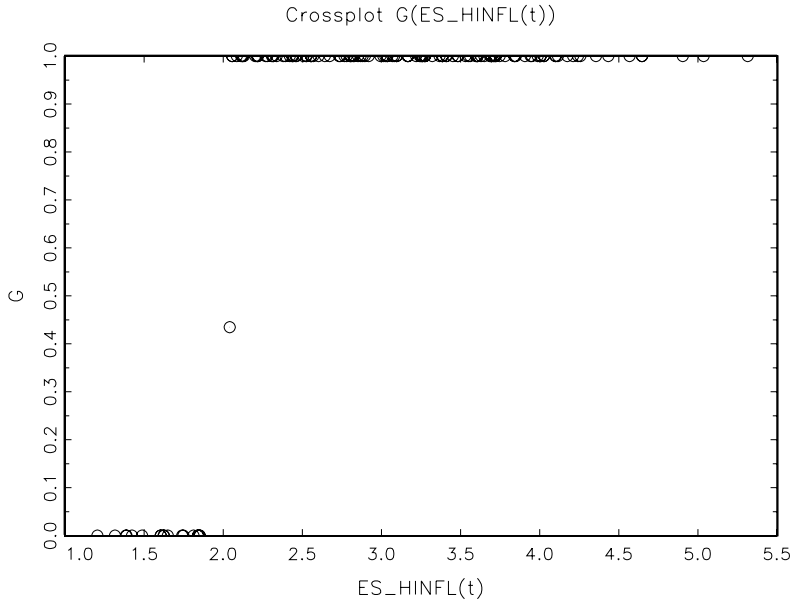


Figure A13: Crossplot Sweden (LSTR1)

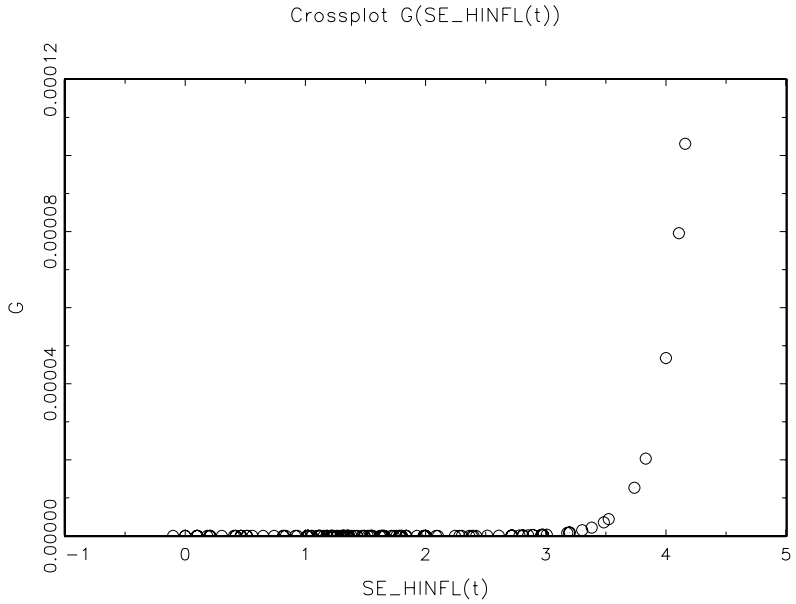


Figure A14: Crossplot United Kingdom (LSTR1)