



www.esri.ie

Working Paper No. 338

March 2010 (Updated, January 2011)

The Euro Through the Looking-Glass: Perceptual Error and Perceived Inflation After the 2002 Currency Changeover

Peter D. Lunn^{a,b} and David Duffy^{a,b}

Subsequently published in "Perceptual noise and perceived inflation after the Euro currency changeover", *Journal of Behavioral and Experimental Finance*, Vol. 7, September, 2015, pp. 1-16, <http://dx.doi.org/10.1016/j.jbef.2015.04.001>

Abstract: Following the Euro changeover in January 2002, Euro Area consumers perceived an increase in inflation of striking magnitude and persistence, despite low and stable recorded inflation. We offer a theoretical and empirical analysis that rationalises this apparent economic illusion. Our theory contends that the currency changeover increased consumers' perceptual error when assessing the value of monetary amounts. Under plausible assumptions regarding preferences, this would have led them to experience a genuine loss of purchasing power. Our perceptual error theory is consistent with the timing and persistence of the illusion. Using panel data, we confirm a strong positive relationship between the overestimation of inflation and a contemporaneous measure of consumers' subjective difficulty using the new currency. Additionally, we hypothesise that consumers' anticipation of learning to value Euro amounts would have produced a simultaneous downward shift in expected inflation, which we also confirm. The analysis has implications for models of household decision-making, assumptions of rationality and policy surrounding currency changeovers.

Keywords: Euro changeover, uncertainty, inflation perceptions, inflation expectations, consumer behavior.

Corresponding Author: pete.lunn@esri.ie.

^a Economic and Social Research Institute,

^b Department of Economics, Trinity College Dublin

ESRI working papers represent un-refereed work-in-progress by researchers who are solely responsible for the content and any views expressed therein. Any comments on these papers will be welcome and should be sent to the author(s) by email. Papers may be downloaded for personal use only.

“It’s a poor sort of memory that only works backwards.”

Lewis Carroll, Through the Looking-Glass.

1. Introduction

In January 2002, everyday transactions in 12 European nations switched to being conducted in Euro. After the currency changeover, consumers perceived a steep rise in prices followed by continued high inflation in subsequent years. These perceptions, as measured by consumer surveys, cannot be reconciled with official figures, which recorded low and stable inflation by historical standards.¹ There is no agreed term for this apparent illusion, which we refer to hereafter as the “perceived Euro price increase” (PEPI).

The PEPI occurred in every Euro Area country and across all social groups, such that almost five years after the changeover 92% of Euro Area consumers believed that the introduction of the Euro had increased prices.² We show below that the start of the PEPI was perfectly synchronous with January 2002 and that it took approximately six months to reach its peak. There followed three years during which Euro Area consumers effectively perceived the inflation rate to be more than double its actual (unweighted) average of 2.3%, although there was variation across countries in both the scale and duration of the PEPI.

This paper offers a theoretical and empirical contribution to understanding what generated this phenomenon. Our primary motivation is to exploit the PEPI as an opportunity to improve understanding of perceptions and expectations of inflation. As potentially important inputs to household decision-making, both concepts feature in the assumptions of many microeconomic and macroeconomic models.

¹ The opening up of a large and persistent gap between perceived and actual inflation is an accepted fact within the literature surrounding this phenomenon. See for example, European Central Bank (2002, 2005), Aucremanne et al. (2005), Fluch and Stix (2007), Trautt-Mattausch et al. (2007), Antonides (2008), Brachinger (2008) Dziuda and Mastrobuoni (2009), and Ranyard et al. (2008) for review.

² Flash Eurobarometer 193, The Eurozone, five years after the introduction of the banknotes and coins in the 12 member states, September 2006.

The analysis may also be of relevance to policy, most obviously in countries where a currency changeover is being considered. Indeed, the PEPI troubled monetary policymakers. In July 2002, the European Central Bank (ECB) described it as a “cause for concern” with the potential to lead to “misguided wage demands” and “suboptimal consumption decisions” (ECB, 2002). The possibility that the PEPI might undermine the credibility of official HICP statistics was also raised (e.g., Aucremmane et al., 2005).

For the PEPI to have had the macroeconomic consequences envisaged by the ECB, misperception of inflation would have to affect subsequent economic behaviour. There is evidence to support such a misperception-behaviour link, both general and specific to the Euro changeover. Different individual perceptions (which by definition include misperceptions) of the state of the economy influence subsequent purchases (Katona, 1975). Direct evidence suggests that the Euro changeover negatively affected eating out in German restaurants (Eife and Maier, 2007), while consumers who overestimated inflation in Ireland between 2002 and 2007 were keener to curb household expenditure and less likely to plan a car purchase (Duffy and Lunn, 2009).

Our main aim, however, is to improve understanding of inflation perceptions, because the PEPI came as a surprise to economists as well as policymakers. Although some concerns were raised about the possibility of genuine price increases, the only study we have found that foresaw erroneous perceptions was undertaken by psychologists. Burgoyne, Routh and Ellis (1999) cited evidence of widespread misperceptions of price rises following decimalisation of the British pound in 1971, and conjectured that the Euro changeover might generate an analogous effect. In general, however, the PEPI was unanticipated, which suggests shortcomings in our understanding of how consumers perceive inflation. A better understanding may help to improve models of household decisions for which inflation is relevant and to qualify macroeconomic theories reliant upon rational inflation expectations or *ex ante* real interest rates. Systematic misperception of inflation represents an obvious challenge to the rational expectations approach (Jonung and Laidler, 1988), especially given the strong positive relationship between perceived inflation and expected inflation (e.g. Carlson, 1977; Jonung, 1981).

A number of studies have sought to isolate the cause of the PEPI. Explanations can be divided into two types (see Section 2 for references). According to one approach, the Euro changeover coincided with (or caused) price increases for certain kinds of goods that consumers might weight more heavily than the weighting given by the HICP, such as frequently purchased items. In other words, consumers accurately perceived price changes but aggregated them in a biased manner. The second type of theory proposes that consumers misperceived individual price changes, because they expected to see price increases or because their perceptions were biased by media reporting. The evidence we provide allows us to test these theories as well as our own.

Our alternative explanation is that the change of currency introduced error into consumers' perceptions of the value of monetary amounts, and that they took this new source of uncertainty into account when considering purchases. We show how, given plausible preferences over risk, loss or costs associated with delaying purchases, increased perceptual error would have resulted in a genuine loss of purchasing power. We derive and test two original empirical hypotheses based on the new theory, which are confirmed by econometric tests using panel data for 11 Euro Area countries.

Section 2 provides detailed time-series of inflation perceptions from 1997-2006 and briefly compares them with existing accounts of the PEPI. Section 3 introduces our alternative theory. Section 4 presents econometric analysis. Lastly, section 5 discusses broader implications relating to assumptions of rationality and policymakers' approach to currency changeovers.

2. The Magnitude and Time-Course of the PEPI

To appreciate what is required of an explanation, it is necessary to absorb both the scale and temporal pattern of inflation misperceptions following January 2002. Figure 1 presents two time-series: monthly mean standardised inflation perceptions across countries (unweighted) and the equivalent monthly mean Harmonised Index of Consumer Prices (HICP). The panels on the left are for 11 original Euro Area countries (not Luxembourg), while those on the right are for three countries that did not join the Euro (Denmark, Sweden and the United Kingdom). Inflation perceptions are based on the "balance statistic", which is derived from the Joint Harmonised EU Programme of Business and Consumer Surveys and is widely used as a measure of

perceived inflation.³ To cope with the considerable between-country variation in both the level and volatility of inflation perceptions and the HICP, both series are standardised at the country-level by transforming them into z-scores based on their mean and standard deviation over the five-years prior to the changeover (January 1997-December 2001).⁴

*** Figure 1 ***

Looking at the top left panel, the balance statistic for perceived inflation in the Euro Area shadowed the HICP up to December 2001 – a “wisdom of crowds” effect. The impact of the changeover was dramatic, however. Plotting the difference between the two series (bottom left panel) reveals that the onset of the PEPI was precisely synchronous with January 2002. Then, over the first six months of 2002, a gap of more than 2.5 standard deviations opened up; five times greater than the largest overestimation in the preceding five years.

The PEPI was not only dramatic in scale, but also in persistence. Based on the 1997-2001 standardisation, one standard deviation of the balance statistic equates to 0.92 percentage points of inflation. Thus, we calculate that for the three years from July 2002 to June 2005, a period with a mean HICP of 2.3%, the overestimation due to the PEPI averaged the equivalent of 2.5 percentage points. Roughly speaking, therefore, *in consumers’ eyes* the introduction of the Euro effectively doubled the rate of inflation for three years. Even by the end of 2006, perceived inflation remained unusually high relative to 1997-2001.

The equivalent time-series for Denmark, Sweden and the UK (right panels) confirm that these effects were confined to the Euro Area. We provide the z-score

³ The survey asks 1,000 to 1,500 consumers in each EU country a qualitative question about how prices compare with 12 months ago. Respondents select one of six responses: Lower (r_1), About the same (r_2), A little higher (r_3), Quite a bit higher (r_4), Very much higher (r_5), Don’t know (r_6). The “balance statistic” is calculated as: $(r_1 + \frac{1}{2}r_2) - (\frac{1}{2}r_4 + r_5)$. Data are available for 11 of the original 12 Euro Area countries. Luxembourg is excluded, because data prior to 2002 are not available. Data for Portugal are also missing for the first eight months of 1997, so all analyses for Portugal use data from September 1997 onwards.

⁴ Given the qualitative nature of the survey question such variation is inevitable. There are nuances of language surrounding descriptions of magnitudes, which doubtless influence the distributions of answers across categories. Furthermore, the different inflation histories of each country are likely to have a calibrating effect on what is judged to be “a little higher”, “quite a bit higher” or “very much higher”. Overall, the standardisation increases the consistency of the pattern of the PEPI across countries, which suggests that it helps to extract the signal from the noise.

difference series separately for 11 Euro Area countries in Figure A1 of the Appendix. For each country, January 2002 marks the beginning of a substantial increase in perceived inflation. The steepness of the increase varies, as does peak magnitude and persistence. Ireland had the smallest PEPI, but nevertheless a substantial and significant effect, while Germany is the only country where the phenomenon had apparently run its entire course by 2006.

Given these patterns, the primary job of any theory of what caused the PEPI must be to account for the extraordinary magnitude and time-course of the effect. We briefly assess existing accounts before offering an alternative.

2.1 Aggregation Errors

Several theories assert that consumers accurately perceived price changes relating to individual items, but weighted price increases on certain types of item disproportionately relative to official calculations. On this view, the PEPI was caused by systematic biases in the way consumers aggregated otherwise accurate assessments of price changes, combined with real increases in the prices of those goods that were overweighted. One possibility is that frequently purchased or low-cost items, such as food, clothing or restaurant meals, had disproportionate impacts on perceptions (e.g., Del Giovane and Sabbatini, 2006; Ehrmann, 2006; Fluch and Stix, 2007; Brachinger, 2008; Dziuda and Mastrobuoni, 2009).

While plausible, these theories struggle to explain the more striking properties of the effect. Firstly, while the price of some frequently purchased and low cost goods, notably food, did rise substantially around the time of the Euro changeover, the relevant price increases began in 2001 (Hoffman et al., 2006; Brachinger, 2008). As Figure 1 makes clear, the onset of the PEPI in January 2002 is precise. Secondly, econometric estimates of the relationship between inflation perceptions and inflation indices for frequent out-of-pocket expenditures or similar subcategories (e.g., Ehrmann, 2006; Dohring and Mordonu, 2007) do not reveal a strong enough association to explain the PEPI. Thirdly, similar relative price movements also occurred in some European countries that opted not to join the Euro, yet no rise in inflation perceptions occurred. Lastly, while Dziuda and Mastrobuoni (2009) found that price increases for lower-priced items were greater in the Euro Area during 2002

than in European countries that did not join the Euro, the finding was not consistent across all Euro Area countries. The PEPI, meanwhile, occurred in every one (see Appendix).

2.2 Misperception of Individual Price Increases

Another possibility is that the introduction of the Euro resulted in an upward bias in perceptions of individual price changes. Survey evidence certainly suggests that consumers made errors following the changeover (e.g., Ranyard, 2007; Hofmann et al., 2007). There is also experimental evidence that the PEPI applied to individual transactions. German subjects who were asked to compare prices between two restaurant menus, the first priced in Deutschmarks and the second in Euros, perceived price increases that were not there (Traut-Mattausch et al., 2004). One possible explanation derives from a body of social psychological literature suggesting that people's perceptions are, in general, influenced by what they expect. Thus, if consumers expected price rises, they might have mistakenly perceived them.

Some further empirical findings are consistent with expectation-led perception. Ranyard et al. (2005) found that some Irish consumers expected firms to try to hide price increases, or to round prices up rather than down. Perceptions of higher inflation were associated with the prevalence of such claims in media reports (Soroka, 2006; Lamla and Lein, 2010), although disentangling cause from effect here is problematic. Using the experimental menu set-up, Greitemeyer et al. (2005) obtained higher estimates of price increases from subjects exposed to media reports claiming that prices had risen.

A full explanation for the PEPI, however, must not only explain the perception of higher prices but also its time-course. Misperception took six months to peak and lasted years, with some variation in steepness and persistence across countries. Prior expectations of price rises do not obviously accord with this temporal pattern.

Furthermore, the expectations-led theory can be subjected to a straightforward empirical test, namely whether the pattern of perceived inflation was foreshadowed by a period of similarly high expected inflation. Koskimäki (2005) confirmed unusually high expected inflation in Finland in 2001. We compare the perceptions and expectations time-series for all 11 Euro Area countries in Section 4.

2.3 The Role of Reference Prices

A substantial body of evidence suggests that consumers employ reference prices, which they form through years of experience and store in memory, either as single values or ranges (see Mazumdar et al., 2005, for review). It is hence possible that the introduction of the Euro interfered with the normal process of adjusting reference prices, such that consumers failed to update many reference prices from the old currency into Euro (Brachinger, 2008; Stix, 2009). Furthermore, Cestari et al. (2007) found that consumers' recollections of pre-Euro prices were subject to a downward bias, with some recalled prices dating back to well before the changeover. When assessing inflation, therefore, consumers may have continued to compare current prices with pre-Euro prices, perhaps from considerably longer than 12 months previously. Such failure to update reference prices cannot account for the initial steep increase in perceived inflation, but it may help to explain its persistence thereafter.

Table 1 shows that a large proportion of Euro Area consumers were still regularly converting prices into their old currency in 2006, especially for exceptional rather than day-to-day purchases, suggesting that many reference prices remained in the old currency.

*** Table 1 ***

In summary, a successful account of the PEPI must identify a cause both potent enough to explain the phenomenon's sheer scale and consistent with its perfect synchrony with January 2002. Given this, while failure to update reference prices may have played a significant role in the unfolding PEPI story, the presently available theories do not provide a convincing account of how it began. We therefore offer an alternative.

3. The Perceptual Error Theory

The model we present is of the second type identified in Section 2, whereby the perception of Euro price increases applies to individual transactions. Given the need to explain an illusion, we turned to established perceptual theory for insight. Most models of perception emphasise the role of noise, or internal stochastic error, associated with mental representations of the outside world. Consistent with this, our explanation centres on the likelihood that the currency changeover increased the error

associated with consumers' internal representations of the value of monetary amounts. If so, when consumers began to conduct transactions in Euro, they would have faced additional uncertainty and, hence, may have reduced their willingness to pay for items. We show how three psychophysical assumptions, backed by extant empirical work, lead to the conclusion that consumers' perceptions of the available surplus for each transaction would have been subject to greater error once the Euro was introduced. Additionally, our theory assumes that consumer purchases are sensitive to uncertainty surrounding perceived surplus and, importantly, that consumers do not generally distinguish between reduced willingness to pay and higher prices.

3.1 The Psychophysics of Exchange

To identify and choose between available gains from trade, economic agents must be able to discriminate differences in private value between what might be gained and what must be given up.⁵ Thus, an agent must compare two mental representations of value to form another perception of the likely transaction surplus. Our theory emphasises that this process of discrimination depends on the degree of error associated with perceptions of value. Little is known about how accurately humans perceive value, yet there is much evidence regarding the process of perceptual discrimination in general, which leads to three straightforward psychophysical assumptions. First, agents perceive the value of items and monetary amounts with substantial stochastic error. Second, the error associated with the perceived value of monetary amounts is higher in a less familiar currency. Third, agents estimate the extent of their own perceptual error and take it into account when considering exchanges. The relevant psychophysical evidence that supports these three assumptions is discussed in detail in Lunn and Lunn (2009), which advances a computational theory (cf. Marr, 1982) of simple economic exchanges designed to explain gaps between willingness-to-accept and willingness-to-pay. It is outlined briefly here.

⁵ Throughout this paper we prefer to use (private) 'value' rather than 'utility' when referring to an agent's desire for a consumer item. Hence, 'perceived value' refers to an agent's assessment of what a given item is worth *to them*. We do not use 'utility' in this context, not because it would necessarily be inaccurate to do so, but because of the term's connotations. We do not wish to imply either that consumers represent the worth of items via an ordered set of preferences, or that the relativities between such representations determine choices. Also, we are primarily interested in what the agent perceives, not what the agent chooses.

In perceptual science, forced-choice discrimination experiments reveal the precision, or degree of stochastic error, in our internal representations of the external world. When subjects are asked to discriminate between two stimuli differing according to a perceptual primitive such as size or weight, in a controlled environment with task-specific practice, a difference of 5% (the “Weber fraction” or “threshold”) is usually the minimum required for subjects to discriminate between two stimuli reliably. For more complex perceptions, discrimination thresholds are considerably higher, implying a higher degree of perceptual error. Considered in this context, the values of goods and services are complex perceptions. They require not only consideration of perceptual primitives such as size, weight, colour, etc., but also perception of higher order properties such as fashionability, taste or durability, or even properties like promptness, courtesy and skill. It is therefore likely that human perception of the value of goods and services is subject to substantial error. The error associated with the perceived value of monetary amounts is likely to be smaller, at least *when using a familiar currency*.⁶ Estimates of Weber fractions for discriminating between pay rises are of the order of 5 – 7 % (Mitra, Gupta and Jenkins, 1997), which is similar to that for discriminating perceptual primitives such as size. The existence of such perceptual error when valuing items and monetary amounts is our first assumption.

In intuitive terms, our second assumption is that while consumers would have had a good feel for what seven marks, seven francs or seven gilder etc. was worth, they would have been less sure what seven Euro was worth (and may still be). We know of no study that directly addresses people’s accuracy when valuing monetary amounts in unfamiliar currencies. But practice generally improves performance in psychophysical discrimination considerably, so we assume that familiarity and experience reduces perceptual error.

⁶ It is crucial to note that the fact that monetary amounts can be represented numerically does not imply that their value is perceived without error. While forced-choice discrimination between two monetary amounts can be performed with perfect accuracy, by simply choosing the larger or smaller number, the comparison of the value of a monetary amount with the value of an item requires a common mental representation. There is evidence that the brain processes rewards using a sort of “internal currency” (e.g., Montague and Berns, 2002). In doing so, the mapping from monetary values into the internal representation will be subject to a degree of error, or noise, which will limit the precision of subsequent discriminations. An intuitive example is provided by the fact that the private value a five Euro note may change when our wealth or access to cash changes. Monetary amounts do not have a consistent one-to-one mapping with our internal representations of value.

Our third assumption is that agents consider the extent of their own perceptual error when making decisions. This assumption is supported by evidence for perceptual systems generally and by findings from exchange experiments and contingent valuation studies. The gap between willingness-to-pay and willingness-to-accept appears to be greater the more difficult a good is to value (Horowitz and McConnell, 2002), implying that individuals respond to the extent of uncertainty surrounding their own valuation. More generally, experiments show that when more than one perception must be combined to make an overall judgement, subjects can inversely weight their judgements according to the associated degree of perceptual error, such as when information from vision and touch is combined into an overall assessment of shape (Ernst and Banks, 2002).

3.2 Potential Impact of Currency Changeover on Exchange

Consider the impact of these three assumptions on a simple exchange. Figure 2 presents a schematic account of a transaction incorporating significant perceptual error. The horizontal axis corresponds to the agent's internal representation of value. The agent compares their perception of an amount of money, P , with their perception of the value of an item, A . Perceptual error is reflected in the variability of the probability density functions that form the representations, which are relatively large with respect to expected values, in line with our first assumption. We assume for now that perceptual errors are normally distributed.⁷

Suppose that, in exchange for A , the agent is just willing to pay money in the old currency that they perceive to be worth P_c . Prior to the introduction of the Euro, the agent's perceptions were (Figure 2, top) $A \sim N(\mu_a, \sigma_a^2)$ and $P_c \sim N(\mu_p, \sigma_c^2)$.

Assuming no covariance between the perceptual errors, the agent was willing to trade to realise an expected surplus (Figure 2, bottom) of $A - P_c$, which is distributed according to $N(\mu_a - \mu_p, \sigma_a^2 + \sigma_c^2)$. Following the introduction of the Euro, our second psychophysical assumption implies that the internal representation of the equivalent

⁷ This assumption is made for illustrative purposes and is not essential to the logic of our theory. It is nevertheless well supported by psychophysical evidence for many types of perceptual stimuli.

monetary amount changed from P_c to P_ϵ , where $P_\epsilon \sim N(\mu_p, \sigma_\epsilon^2)$ and $\sigma_\epsilon^2 > \sigma_c^2$.⁸ Hence, the perceived surplus from the transaction, $A - P_\epsilon$, became $N(\mu_a - \mu_p, \sigma_a^2 + \sigma_\epsilon^2)$ where $\sigma_a^2 + \sigma_\epsilon^2 > \sigma_a^2 + \sigma_c^2$.

Combining this analysis with our third assumption, that agents take into consideration both the expectation and variability of the perceived transaction surplus, the introduction of the Euro would have changed the nature of everyday transactions. Specifically, there are three possible rationales for the agent reducing willingness to pay in response to the increased uncertainty: risk aversion, loss aversion and the agent's assessment of likely price dispersion. Straightforwardly, a risk-averse agent previously just willing to pay the monetary amount perceived as P_c , may have been unwilling to pay the equivalent Euro amount perceived as P_ϵ , because the level of risk increased. Similarly, the currency change increased the probability of loss, so an agent averse to loss might also revise willingness to pay downwards. Yet even an agent who is neutral over risk and loss would be likely to reduce willingness to pay. Lunn and Lunn (2009) show that an optimising agent will decrease willingness to pay in response to greater error in perceived value, given the plausible assumption that the extent of their own perceptual error is correlated with price dispersion across the market. That is, if agents employ their own extent of perceptual error as a signal regarding price dispersion, optimal willingness to pay is lower. The underlying logic here is that greater price dispersion alters the trade-off between the costs of delaying the purchase and the benefit of holding out for a better price, in favour of the latter.

For present purposes, the relative influences of these three rationales is secondary. Our primary conjecture is that increased perceptual error surrounding monetary amounts reduced willingness to pay. Returning to Figure 2, the agent may have become willing to pay only up to the amount perceived as worth P'_ϵ . Consequently, in terms of willingness to make purchases, our assumptions imply that the Euro lost value relative to the currency it replaced. Provided that risk, loss and delay are

⁸ It is possible the changeover produced some systematic biases in the perception of value, i.e. a change in μ_p , especially where consumers used an approximate rule of thumb for making the conversion. For instance, there is evidence that German consumers employed the conversion $\text{€}1 \rightarrow 2\text{DM}$, but the exact conversion rate was $\text{€}1=1.95583 \text{DM}$, so using the rule of thumb overestimates euro prices by 2.26%. For other countries, similar rules of thumb produce biases ranging from -2.23% to 6.71%. Ehrmann (2006) discusses this aspect of the changeover and how it might have related to inflation perceptions.

considered to be dimensions within the household consumption bundle, fewer goods could be purchased for a given budget. Given our assumptions, the Euro changeover therefore produced a *genuine* loss of purchasing power, even where consumers experienced no loss of income and prices of goods and services were converted to Euro unaltered.

We now employ the final assumption that agents equate such loss of purchasing power to higher inflation or, at the level of an individual transaction, that consumers do not distinguish between reduction in willingness to pay and higher price. Given this, the agent in Figure 2 perceives inflation equivalent to the difference between P_c and P'_ϵ . We know of no direct evidence that consumers, for a given level of income, equate a reduction in willingness to pay with higher inflation. However, it is in keeping with the body of evidence concerning the formation of inflation perceptions in normal times (reviewed in Ranyard et al., 2008). Consumers are rarely able to recall specific prices or price changes, or to evaluate prices independently of income, yet they nevertheless form judgements of overall inflation based on their experiences of value for money in the marketplace.

4. Empirics

4.1 Relationship to the Time-course of the PEPI

The perceptual error theory implies that when consumers began to use the Euro, they would have immediately experienced decreased purchasing power. Thus, the perfect synchrony of the PEPI with January 2002 is consistent with our account. Additionally, since it would have taken time for consumers to experience transactions across a range of items, as well as those purchased frequently, the theory fits well with the six-month period over which the PEPI emerged fully. Moreover, according to the theory, the persistence of the PEPI would have been determined by two factors: the extent to which consumers continued to compare Euro prices with reference prices in the old currency and the speed of learning to value Euro amounts accurately. As long as the value of current prices was perceived with greater error than the value of reference prices, willingness to pay in Euro would have been affected, producing an upward bias in perceived inflation.

4.2 Subjective Difficulty Hypothesis

We derive two original empirical hypotheses to test the perceptual error theory. First and most obviously, there should be a positive relationship between the PEPI and any variable that provides a reasonable proxy for perceptual error valuing Euro amounts. We employ the following question from the Eurobarometer surveys:

It's X months/years since we have been using the euro instead of (nat. currency). Today would you say the Euro continues to cause you a lot of difficulty, some difficulty or no difficulty at all?

Of course, consumers' subjective difficulty using the Euro could include more than the challenge of assessing value, such as difficulty recognising or handling the notes and coins. Nevertheless, the primary force of this question relates to how difficult consumers find it to make purchases in Euro and answers should therefore be influenced by how difficult consumers find it to value Euro amounts. We thus consider the responses to this question to be a reasonable but imperfect proxy for perceptual error.⁹ Data are available for all countries and nine dates: January, March, May, September and November 2002, November 2003, November 2004, October 2005 and September 2006. We convert the responses into a balance statistic at the country level, in similar fashion to the balance statistic for perceptions, and we refer to this as the "subjective difficulty" variable.¹⁰ Our first empirical hypothesis is that the extent of the PEPI across countries and time should have a positive relationship with subjective difficulty using the Euro. We test this using panel regressions.

An extension of this hypothesis is that we also predict a significant negative interaction between subjective difficulty and time. According to our theory, the extent

⁹ One might argue that this proxy variable could be subject to reverse causality, such that a consumer who perceives that the Euro caused inflation considers this to be a "difficulty". We do not find this argument persuasive, however, because the thrust of the question is clearly about the ease or otherwise of *using* the Euro.

¹⁰ Flash Eurobarometer surveys are conducted in each country via telephone with a representative national sample aged 15 years and over, with a mean country-level sample for the period of approximately 780 respondents. But because the surveys are used by the European Commission to obtain results quickly, when required, data collection can be uneven and questions are sometimes changed. From January 2002 – September 2002, the subjective difficulty question had four response categories: a lot of difficulty (r_1), some difficulty (r_2), a bit of difficulty (r_3), no difficulty at all (r_4). From November 2002 – November 2006, response r_3 was removed. To cope with this change, we calculate the balance statistic as $[(r_1 + \frac{1}{2}r_2) - \frac{1}{2}r_4]$ throughout, adding 50 to make the statistic positive.

of perceptual error in valuing monetary amounts only determines the size of the PEPI while the reference price is held in the old currency. Hence, it should become a weaker influence over time, as consumers develop reference prices in Euro for a greater proportion of items

What do the previous theories of the PEPI predict with respect to the relationship between the PEPI and subjective difficulty using the Euro? Theories based on aggregation biases assume accurate perception of specific price changes and thus predict no relationship. With respect to the expectations-led theory, Traut-Mattausch et al. (2007) propose that consumers who expected prices to go up might have been less inclined to notice mental conversion errors that erred in the direction of their expectation; after mistakenly converting to a higher price, they would have been less likely to spot and correct the error. Hence, if people with a higher likelihood of making arithmetic mistakes also expressed greater subjective difficulty using the Euro, a correlation between subjective difficulty and the PEPI might result. However, the primary implication of the expectations-led theory is that the PEPI should have a strong positive relationship with lagged expectations. We test this directly in the econometric model.

4.3 Expectations Hypothesis

Our second empirical hypothesis relates to inflation expectations after January 2002. There is a strong temporal pattern in the subjective difficulty variable (see below), which implies that consumers were aware of changes in their own ability to use the new currency. Given such awareness, consumers may well have linked their own difficulty valuing Euro amounts to their perception that the currency was effectively worth less, i.e. to higher inflation. If so, they should have expected the effective value of the Euro to improve as they learned to value Euro amounts more accurately. Our second hypothesis, therefore, is that anticipated learning should have been a *downward* influence on expectations of future inflation, mirroring the upward influence on perceptions. Furthermore, this downward force on expectations should have been similarly persistent, because as well as dictating the strength of the PEPI, the increased perceptual error when valuing Euro amounts would also have dictated the scope for learning.

This hypothesis of a downward shift in expectations is distinctive and hence empirically appealing. Yet it does require a stronger form of the assumption that consumers equate reduced willingness to pay with higher inflation, because it further requires that consumers equate an *anticipated* increase in willingness to pay with lower *future* inflation. The common assumption here is that consumers do not generally conceive of inflation as a comparison of numerical prices over time, but instead conceive of it as a comparison of value for money over time, which may be affected by more than numeric prices. Again, this view is supported by evidence that specific prices are neither accurately recalled nor evaluated independently of income (Ranyard et al., 2008).

What do other theories of the PEPI imply for inflation expectations following 2002? While biased aggregation theories offer no obvious inference regarding expectations, the expectations-led theory makes a concrete prediction. If the PEPI was driven by high inflation expectations, then its time-course should have been foreshadowed by a similar temporal pattern of expectations, i.e. unusually high in 2001 and continuing so for years thereafter. Thus, the different theories produce contrasting, testable hypotheses.

4.4 PEPI Panel Regressions

The top charts of Figure 3 plot the time-course of the mean of the subjective difficulty variable alongside the mean PEPI (z-score difference between perceived and recorded inflation) for the 12 original Euro Area countries minus Luxembourg. This descriptive analysis reveals that the two time-courses, which are derived from separate EU-wide surveys, are strikingly similar. The bottom charts repeat the analysis with the countries divided into two groups, defined by the persistence of the PEPI. Comparing two periods, January 2002-June 2004 and July 2004-December 2006, the extent of the PEPI declined in Austria, Belgium, Germany, the Netherlands and Spain (the “declining five”), while in the other six countries (the “persistent six”) the phenomenon continued unabated.¹¹ This pattern is again well matched by mean subjective difficulty.

¹¹ The one nation that is hard to classify is Italy, where the decline was marginal. Repeating the analysis with Italy in the declining group makes no discernable difference to the results.

*** Figure 3 ***

We conduct country-level panel regressions with the z-score difference between perceptions and the HICP as the dependent variable and subjective difficulty as the main independent variable of interest. The basic panel consists of 57 monthly observations (January 2002-September 2006) for 11 countries, with subjective difficulty linearly interpolated between its nine point-estimates for each.¹² Given the panel dimensions, with more periods than groups, we employ estimation methods suitable for long panels. Time, t , and (significant) higher powers of time are included as independent variables, which we interact with subjective difficulty in line with the hypothesis above. As country-level controls we also include several other time-varying independent variables. All specifications include inflation itself (HICP), since movements in inflation are systematically misperceived during normal times. Most models employ monthly data, but we also report a specification based on 19 quarterly periods. In the monthly models we include the change in the unemployment rate as a harmonised monthly proxy for economic growth, while in the quarterly models we include quarter-on-quarter GDP growth itself. Data for monthly HICP, the unemployment rate and GDP are taken from the Eurostat database. Expected inflation data are taken from the EU Consumer Survey, which offers respondents six qualitative response categories to describe how they expect prices to change over the next 12 months. As with perceptions (see footnote 3), we convert this into a balance statistic and standardise it at the country level, based on the mean and standard deviation from 1997-2001. We employ the z-score difference between standardised expectations and the HICP, lagged by 12 months, as an independent variable designed to test the expectations-led hypothesis. Given that expectations usually shadow current inflation (see Section 4.3 below), this variable should capture the extent to which the previous year's inflation expectations were unusually high.

Table 2 presents models estimated by pooled OLS with country fixed-effects. We employ Driscoll-Kraay standard errors, which allow for serial correlation, heteroskedasticity and cross-sectional dependence (Driscoll and Kraay, 1998), as recommended for conservative estimation with long panels (Cameron and Trivedi,

¹² We experimented with several other interpolation methods, none of which altered estimated coefficients significantly.

2010). Models 1 and 3 employ monthly data for January 2002–September 2006. Model 2 uses quarterly data over the same period. Model 4 is based on monthly data for January–December 2002 only.

*** Table 2 ***

We first consider Models 1 and 2, across which coefficients are stable. The results reveal that the PEPI was significantly reduced by higher recorded inflation and higher economic growth (proxied by falling unemployment in Model 1). While the first of these associations is easily understood, the second is less straightforward to interpret.¹³ Time is significant up to the third power.^{14,15} Turning to the main independent variable of interest, our hypothesis of a positive relationship between the PEPI and subjective difficulty using the Euro is confirmed. The subjective difficulty variable is significant in all specifications, as is its interaction with time (Difficulty*Period), which as hypothesised is negative. Interactions of subjective difficulty with the higher powers are also marginally significant. Given that perceived inflation and subjective difficulty using the Euro are measured at the country level from categorical questions asked via separate sample surveys, we find the strength of this estimated relationship to be quite compelling.¹⁶

Adding the lagged expected inflation variable directly to the monthly specification (Model 3) initially suggests the possibility of a modest positive relationship, although

¹³ One intriguing possibility here is reverse causality. In line with the concern of the European Central Bank, described in Section 1, the PEPI may have dampened consumer demand and thereby reduced growth. Note that omitting either the unemployment or growth variables from the specification does not significantly affect the coefficients on subjective difficulty or its interactions with time.

¹⁴ The squared and cubed terms are scaled by one and three orders of magnitude for ease of interpretation of the coefficients.

¹⁵ The cubic specification of the time trend captures the time-course of the PEPI reasonably well, however it is possible that an alternative method of modelling the time trend would alter the results. With this in mind, we conducted further econometric analyses in which the time trend was modelled as a shock plus exponential decay of the form $\text{Perception-HICP} = t^\alpha e^{-\beta t}$, which we estimated using a Generalised Linear Model (GLM). The results, which are closely similar to those with the cubic trend, are supplied as supplementary material.

¹⁶ A potential alternative explanation of the positive relationship between the PEPI and the subjective difficulty variable is that both survey responses might be influenced by political attitudes towards the European Union, i.e. those with pro-European attitudes might have been less inclined to perceive inflation following the changeover and less likely to express difficulty using the Euro. Note, however, that the perceived inflation survey question was unchanged from before 2002 and made no reference to the Euro. Nevertheless, we repeated the analysis with a time-varying country-level control variable included in the specification, which was derived from answers to a question about whether EU membership was a good or a bad thing. The models, supplied in supplementary material, reveal the coefficients on the subjective difficulty variable to be unchanged.

the marginal statistical significance does not support the contention that prior expectations of inflation were the primary cause of the PEPI. However, further investigation reveals that the coefficient on expected inflation is unstable. Model 4 is estimated for January-December 2002 only, i.e. the first year after the introduction of the Euro when the PEPI rose to its full magnitude. While the coefficients on the subjective difficulty variable and its interaction with time are essentially unaffected by limiting the estimation to 2002, the coefficient on expected inflation changes sign and loses significance. This implies that, first, expectations in 2001 did not drive the PEPI in 2002 and, second, there was a structural break in the relationship between the PEPI and lagged expectations. We offer an explanation in the following subsection.

Taken as a whole, the results of the panel regressions provide strong support for the first hypothesis derived from the perceptual error theory. The PEPI appears to be linked to the difficulty consumers experienced using the new currency.

4.3 Expected Inflation Following 2002

Figure 4 presents monthly mean standardised inflation expectations across countries (unweighted) for 1997-2006, together with the equivalent time-series for perceived inflation and the HICP (identical to Figure 1). The standardised balance statistic for expected inflation tracked both recorded and perceived inflation closely prior to January 2002. Following the changeover, however, there was an abrupt decline in expected inflation which, while not as dramatic or consistent as the PEPI, was nevertheless substantial and exactly coincident with January 2002. The introduction of the Euro was hence synchronous with breaks in the relationships between all three variables (perceived inflation, expected inflation and recorded inflation) and it seems extremely unlikely that the phenomena of higher perceived inflation and lower expected inflation are unconnected. The impact on inflation expectations was also persistent, continuing until 2006. Our second hypothesis based on the perceptual error theory is therefore also confirmed by the descriptive data. A persistent downward shift in expected inflation coincided with the Euro changeover.

*** Figure 4 ***

The empirical analysis presented thus far is difficult to reconcile with the theory that the PEPI was caused by expectations determining subsequent perceptions. This

descriptive analysis shows, additionally to the panel regression results above, that expected inflation was not especially high during 2001. While there is some suggestion of an increase during the final four months of the year, expectations actually fell in October and November and, more importantly, at no point prior to the changeover was the gap between these series more than one standard deviation. By the middle of 2002, however, perceived inflation outstripped recorded inflation by more than 2.5 standard deviations. Furthermore, by mid-2002, expected inflation was between one and two standard deviations below recorded inflation and over four standard deviations below perceived inflation. If inflation perceptions during this period were determined by consumers perceiving what they expected to perceive, then not only should expected inflation have been unusually high in 2001, but perceived inflation should have fallen sharply in 2003, which it did not.

Figure A2 in the Appendix presents the standardised perceived inflation and expected inflation time-series separately for each of the 11 countries. The results confirm that every country experienced a substantial fall in inflation expectations. Yet it is notable that in two countries, Finland and Belgium, expected inflation in 2001 did reach the sort of historically high levels that would be required to explain the jump in perceptions that followed.¹⁷ Thus, it may be that high expected inflation contributed to the PEPI to some extent in these two countries. However, even in Belgium and Finland the changeover was followed by a sharp fall in expected inflation, which was not matched by a subsequent fall in perceptions.

The structural break in the estimated PEPI-expectations relationship, which was apparent from the unstable coefficient for lagged expected inflation in Table 2 and is confirmed by the descriptive analysis, suggests that rather than expectations driving the PEPI, a common cause was responsible for higher perceptions and lower expectations, beginning in January 2002. The perceptual error theory proposes just such a cause. With this in mind, Table 3 presents a second set of panel regressions in which the dependent variable is the contemporaneous z-score difference between expected inflation and the HICP. Model 1 employs monthly data; model 2 quarterly

¹⁷ This finding for Finland is therefore consistent with Koskimäki (2005), which is sometimes cited as evidence in support of the theory that expectations drove perceptions. Finland, however, appears to be an exception.

data. This time, the coefficient on subjective difficulty is significant and negative, in line with our second hypothesis. The coefficient is smaller than its equivalent in the perception regressions of Table 2, which is to be expected given that the hypothesised relationship is mediated by anticipated learning, i.e. consumers' expectations of improving the accuracy of their perceptions regarding the value of monetary amounts expressed in Euro.¹⁸

*** Table 3 ***

Overall, these results confirm the second hypothesis derived from our perceptual error theory, namely that anticipated learning exerted a downward influence on inflation expectations, coincident with the upward influence on inflation perceptions.

5. Discussion

The empirical findings lend initial support to the perceptual error theory. There is a strong association between the strength of the PEPI and consumers' subjective difficulty using the Euro. The relationship weakens over time, in keeping with the idea that an increasing proportion of reference prices were converted to Euro over time. The PEPI was accompanied by a simultaneous downward movement in expected inflation, which has a significant and negative association with subjective difficulty using the Euro.

While these findings are encouraging from the perspective of the perceptual error theory, some caution is appropriate. Subjective difficulty using the Euro is a proxy variable and its positive relationship with the PEPI could perhaps be explained by an alternative mechanism. Furthermore, the simultaneous downward movement of inflation expectations would be consistent with any theory based on a perceptual or cognitive challenge that consumers expected to overcome in time – our conjecture is only one such theory. Nevertheless, the assumptions of our perceptual error theory are grounded in existing psychophysical evidence and, furthermore, the hypotheses it generates are strongly supported.

¹⁸ The interactions of the subjective difficulty variable with time fall short of significance and are omitted from Table 3 for parsimony.

We find it difficult to reconcile our empirical findings with previous theories of the PEPI. Biases in the way consumers aggregate otherwise accurately perceived price rises do not explain the temporal pattern of the PEPI, its ongoing positive relationship with consumers' difficulty using the currency, nor the substantial fall in inflation expectations that accompanied it. Meanwhile, the theory that perceptions were driven by prior expectations is not supported by the pattern of inflation expectations in 2001, nor the failure of inflation perceptions to mirror the large drop in expected inflation during 2002.

If there does turn out to be truth in the perceptual error theory, then there may be implications for how economic theory deals with inflation and also lessons for policy. Dealing first with theoretical issues, consumers do not appear to encode inflation as economic models generally do; as a proportional change in prices over a given time period. Models that assume such calculations on behalf of households may hence be awry. The PEPI may be instructive on this point, but there is pre-existing evidence that even in normal times people's quantitative estimates of inflation, both perceived and expected, display systematic inaccuracies (e.g., Bates and Gabor, 1986; Jonung and Laidler, 1988; Thomas, 1999; Duffy and Lunn, 2009). A better characterisation may be that consumers monitor changes in the value for money they get for their income over time, perhaps reliably, but do not distinguish between factors that affect it. The present analysis suggests that familiarity with the currency is one such factor.

A broader theoretical issue is whether the PEPI implies limits to the assumption of consumer rationality. Objectively speaking, consumers perceived price rises that were not there. Furthermore, from the same perspective, the simultaneous fall in inflation expectations was also at odds with objective reality. On the other hand, the perceptual error theory to some extent rationalises consumers' perceptions. As Section 3.2 argues, consumers were responding to a genuine loss of purchasing power, resulting from additional costs that the currency changeover effectively imposed. Thus, while responses to survey questions about price rises may have been inaccurate, adjustments in household decision-making associated with the illusory perception may have represented a reasoned response, for a given set of preferences. If so, while

perceptions and expectations were certainly mistaken and arguably irrational, behaviour in the market may not have been.¹⁹

With respect to policy, the perceptual error theory and the evidence presented suggest that the ECB's concerns about the PEPI were, at least in part, merited. Although the simultaneous downward shift in expectations may have negated any impact on wage demands, the possibility that the PEPI had a dampening effect on consumption seems real and the possibility that currency changeovers can have such effects is an area ripe for further research. Our perceptual error theory suggests that reduced consumption was, in fact, a reasonable response to the situation consumers faced. In the event, the period after 2002 was one of low interest rates, expanding credit and high asset prices, so any consequences of the PEPI were perhaps mitigated. Yet the potential for dampening consumption might be something to be considered by any country joining the Euro later, or countries contemplating other currency changeovers.

Finally, given that currency changeovers of one sort or another are not uncommon and usually entail considerable political debate, it is worth noting the potential implications for managing them. Certainly, the PEPI suggests that they are not simple matters of learning to use a numerical conversion rate. Indeed, the perceptual error theory implies that currency changeovers have associated costs and policymakers considering changeovers should note the potential difficulties they appear to cause consumers. The PEPI is an illusion, but its consequences may be real.

Acknowledgements

This work is supported by a Research Development Initiative grant from the Irish Research Council for the Humanities and Social Sciences (IRCHSS). The authors are grateful especially to Dan Lunn for assistance with econometrics, to Mary Lunn and John Fitz Gerald for helpful comments, and to various attendees at the 2010 European Economic Association Conference (Glasgow, U.K.), the 2010 IAREP Economic Psychology workshop (Bolton, U.K.), an Economic and Social Research Institute

¹⁹ One caveat to this argument is clearly whether one considers loss aversion itself (or indeed risk aversion in small transactions) to be irrational – a debate that goes beyond the scope of this paper.

seminar (Dublin, Ireland) and the 2010 Irish Economic Association conference (Belfast, U.K.) for helpful comments and suggestions.

References

- Antonides, G., 2008, How is Perceived Inflation Related to Actual Price Changes in the European Union? *Journal of Economic Psychology*, 29, 417-432.
- Aucremanne, L., M. Collin and E. Dhyne, 2005, Is there a Discrepancy Between Measured and Perceived Inflation in the Euro Area Since the Euro Cash Changeover? OECD Seminar paper, 15.1.10 at <http://www.oecd.org/dataoecd/54/49/35011554.pdf>
- Bates, J.M., and Gabor, A., 1986, "Price perception in creeping inflation: Report on an enquiry", *Journal of Economic Psychology*, 7, 291-314.
- Burgoyne, C.B., Routh, D.A., and Ellis, A-M., 1999, The transition to the euro: Some perspectives from Economic Psychology, *Journal of Consumer Policy*, 22, 91-116.
- Brachinger, H.W., 2008, "A New Index of perceived Inflation: Assumptions, Method, and Application to Germany" *Journal of Economic Psychology*, Vol. 29, pages 433-457.
- Cameron, A.C. and Trivedi, P.K. (2010). *Microeconometrics using Stata* (Revised Edition). Texas: Stata Press.
- Carlson J.A., 1977, "A Study of Price Forecasts", *Annals of Economic and Social Measurement*, Vol. 6, pages 27-56.
- Cestari, V., Del Giovane, P., and Rossi-Arnaud, C., 2007, Memory for Prices and the Euro Cash Changeover: An Analysis for Cinema Prices in Italy, Banca D'Italia Temi di discussione Number 619, February.
- Del Giovane, P and Sabbatinti, R., 2006, Perceived and Measured Inflation after the launch of the Euro: Explaining the Gap in Italy. *Giornale delgi Economisti e Annali di Economia*, Volume 65, No. 2, November.
- Dohring, B. and Mordonu, A., 2007, What Drives Inflation perceptions? A Dynamic Panel Data Analysis. *European Economy Economic Papers*, No. 284. Brussels: The European Commission.
- Driscoll, J.C. and Kraay, A.C (1998). Consistent covariance matrix estimation with spatially dependent panel data. *Review of Economics and Statistics*, 80, 549-560.
- Duffy, D and Lunn, P., 2009, The Misperception of Inflation by Irish Consumers, *The Economic and Social Review* Volume 40, No.2 Summer.
- Dziuda, W., and Mastrobuoni, G., 2009, The Euro Changeover and its Effects on price Transparency and Inflation, *Journal of Money, Credit and Banking*, Volume 41, Issue 1, 101-129.
- ECB, 2002, Box 2: Recent developments in consumers' inflation perceptions, *Quarterly Bulletin*, July.

- ECB, 2005, Box 3: Consumers' inflation perceptions: still at odds with official statistics?, Quarterly Bulletin, April.
- Eife, T.A., and Maier, S., 2007, Costly Inflation Misperceptions, University of Heidelberg Department of Economics Discussion Paper Series no. 455, October.
- Ehrmann, M., 2006, Rational Inattention, Inflation Developments and Perceptions after the Euro Cash Changeover, ECB Working Paper No. 588, February.
- Ernst, M.O., and Banks, M.S., 2002, Humans Integrate Visual and Haptic Information in a Statistically Optimal Fashion, *Nature*, 415, 429-433.
- Fluch, M., and Stix, H., 2007, The Development of Euro Prices – Subjective Perception and Empirical Facts, Monetary Policy and The Economy Q1/07. OeNB.
- Greitemeyer, T., Schulz-Hardt, S., Traut-Mattausch, E., and Frey, D., 2005, The influence of price trend expectations on price trend perceptions: Why the Euro seems to make life more expensive? *Journal of Economic Psychology*, 26.
- Hoffmann, J., Leifer, H-A., and Lorenz, A., 2006, Index of Perceived Inflation or EU Consumer Surveys? *Intereconomics*, 41, 1-9.
- Hofmann, E., Kirchler, E., and Kamleitner, B., 2007, Consumer Adaptation Strategies: From Austrian Shilling to the Euro, *Journal of Consumer Policy*, 30.
- Horowitz, J.K., and McConnell, K.E., 2002 "A Review of WTA/WTP Studies," *Journal of Environmental Economics and Management*, 44, 426-447.
- Jonung, L., 1981, "Perceived and Expected rates of Inflation in Sweden" *The American Economic Review*, Vol. 71, No. 5, pages 961-968.
- Jonung, Lars and Laidler, D. E, 1988, "Are Perceptions of Inflation Rational? Some Evidence for Sweden," *American Economic Review*, American Economic Association, vol. 78(5), pages 1080-87, December.
- Katona, G., 1975, *Psychological economics*, New York, Elsevier
- Koskimäki, T., 2005, How the Finnish Consumer Price Index Survived the Euro Change-over. OECD Seminar paper, 15.1.10 at <http://www.oecd.org/dataoecd/12/62/34975683.pdf>
- Lamla, M.J., and Lein, S.M., 2010, The Euro Cash Changeover, Inflation Perceptions and the Media, KOF Working Paper No.254, KOF Swiss Economic Institute, February.
- Lunn, P. D. and Lunn, M., 2009, A computational Theory of Exchange: Willingness-to-accept, Willingness-to-pay and the Endowment Effect. ESRI Working Paper No. 327.

- Marr, D. (1982) *Vision: A computational investigation into the human representation and processing of visual information* (New York: W.H. Freeman).
- Mazumdar, T., Raj, S.P. and Sinha, I., 2005, Reference Price Research: Review and Propositions. *Journal of Marketing*, 69, 84-102.
- Mitra, A., Gupta, N., and Jenkins, G.D., 1997, A Drop in the Bucket: When Is a Pay Raise a Pay Raise? *Journal of Organizational Behavior*, Vol. 18, No. 2, 117-137.
- Montague, P.R. and Berns, G.S., 2002, Neural Economics of the Biological Substrates of Valuation, *Neuron*, 36, 265-284.
- Ranyard, R., 2007, Euro stories: The Irish Experience of Currency Change, *Journal of Consumer Policy*, 30.
- Ranyard, R., Burgoyne, C.B., Saldanha, G., and Routh, D.A., 2005, A Qualitative Study of Adaptation to the Euro in the Republic of Ireland: I. Attitudes, the “Euro illusion” and the perception of prices. *Journal of Community and Applied Social Psychology*, 15, 95-107.
- Ranyard, R., Del Missier, F., Bonini, N., Duxbury, D., and Summers, B., 2008, “Perceptions and Expectations of Price Changes and Inflation: A Review and Conceptual Framework”, *Journal of Economic Psychology*, Vol. 29, 378-400.
- Soroka, S.N. 2006, “Good News and Bad News: Asymmetric Responses to Economic Information” *The Journal of Politics*, Vol. 68, pages 372-385.
- Stix, H, 2009, "Perceived inflation and the euro: Evidence from an Austrian Survey," *European Journal of Political Economy*, Elsevier, vol. 25(4), pages 547-561, December.
- Thomas, L.B., 1999 “Survey Measures of Expected U.S. Inflation” *Journal of Economic Perspectives*, Volume 113, Number 4, Fall, pages 125-144.
- Traut-Mattausch, S. Schulz-Hardt, E., Greitemeyer, T., and Frey, D., 2004, 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.
- Traut-Mattausch, E., Greitemeyer, T., Frey, D., and Schulz-Hardt, S., 2007, Illusory Price Increases after the Euro changeover in Germany: An Expectancy-Consistent Bias, *Journal of Consumer Policy*, 30.

Appendix

Figure A1: The perceived Euro price increase (PEPI) for 11 Euro Area countries. Vertical axes correspond to the z-score difference between perceived inflation and the HICP, standardised according to the mean and standard deviation of the respective series from 1997-2001.

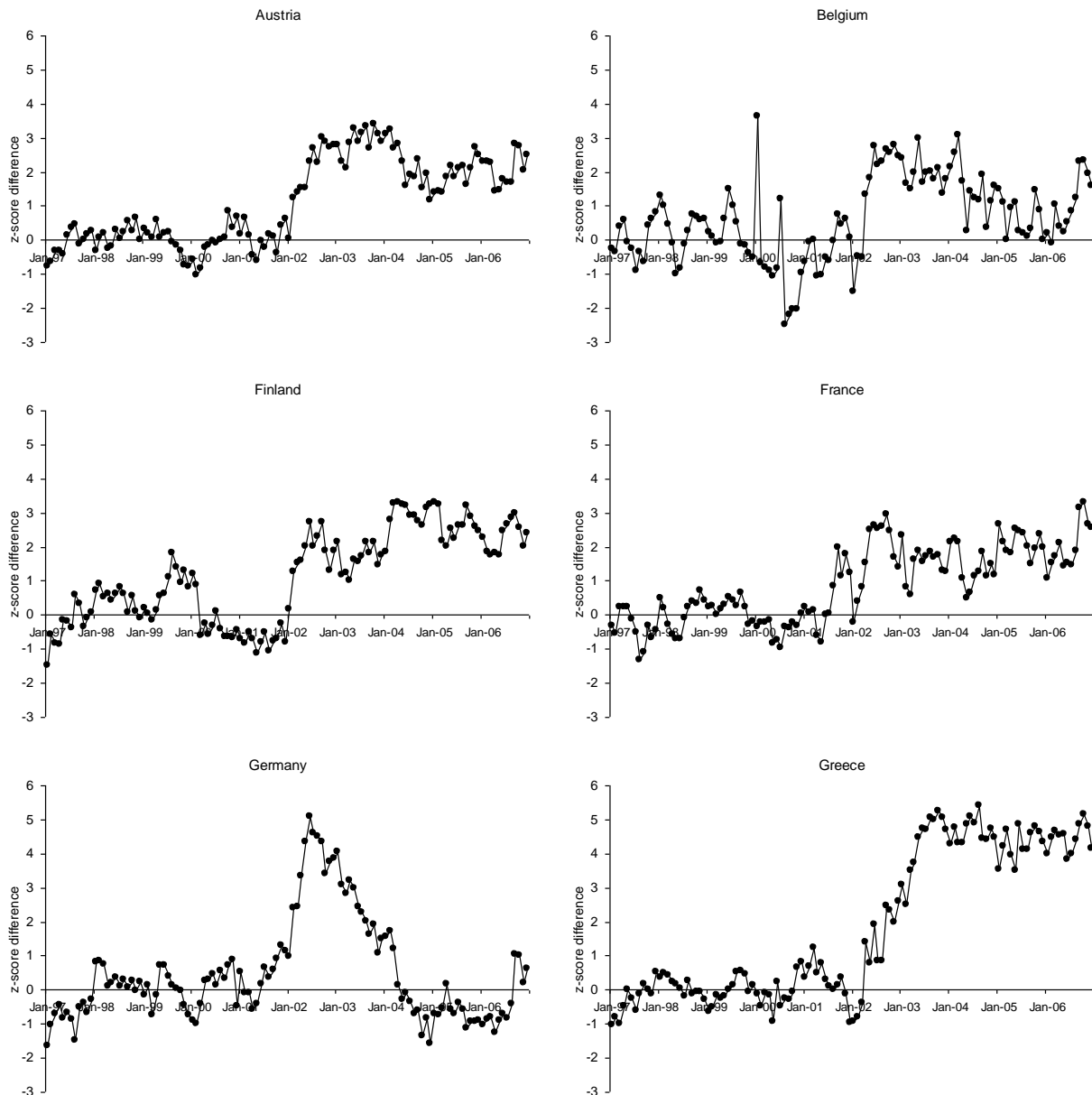


Figure A1 cont...

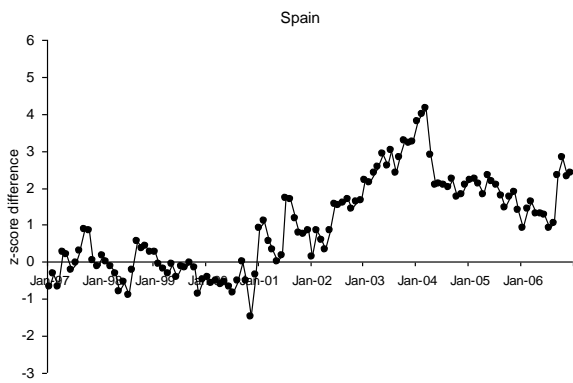
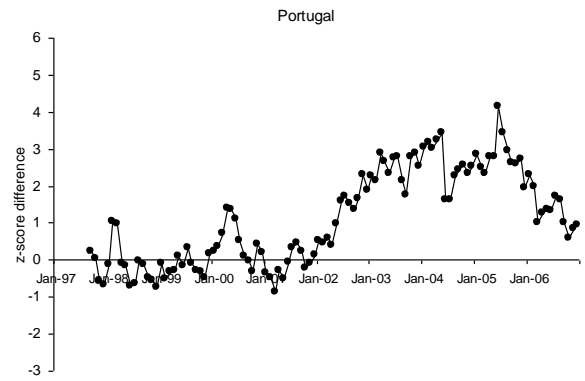
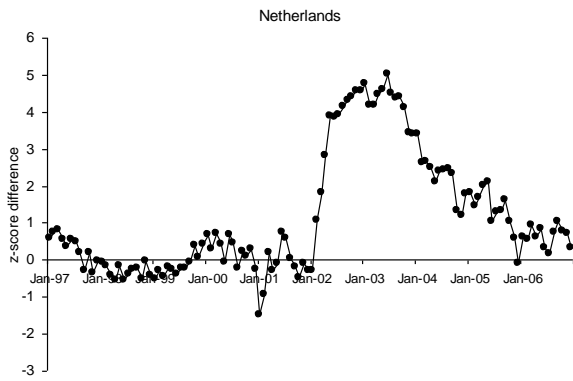
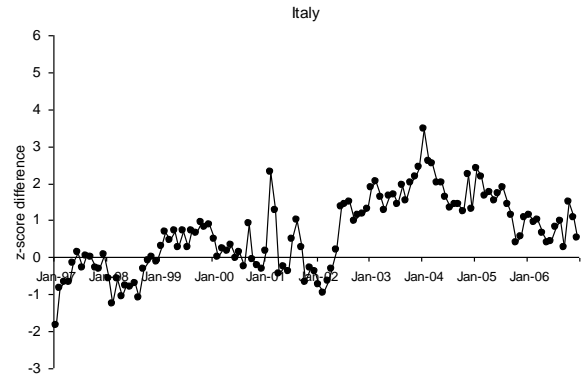
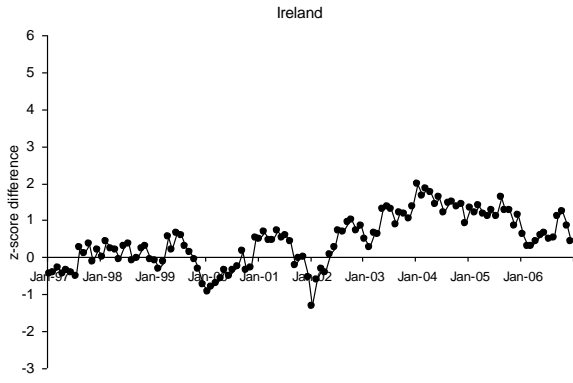


Figure A2: The structural break between inflation perceptions and expectations for 11 Euro Area countries. Vertical axes correspond to z-scores, standardised according to the mean and standard deviation of the respective series from 1997-2001.

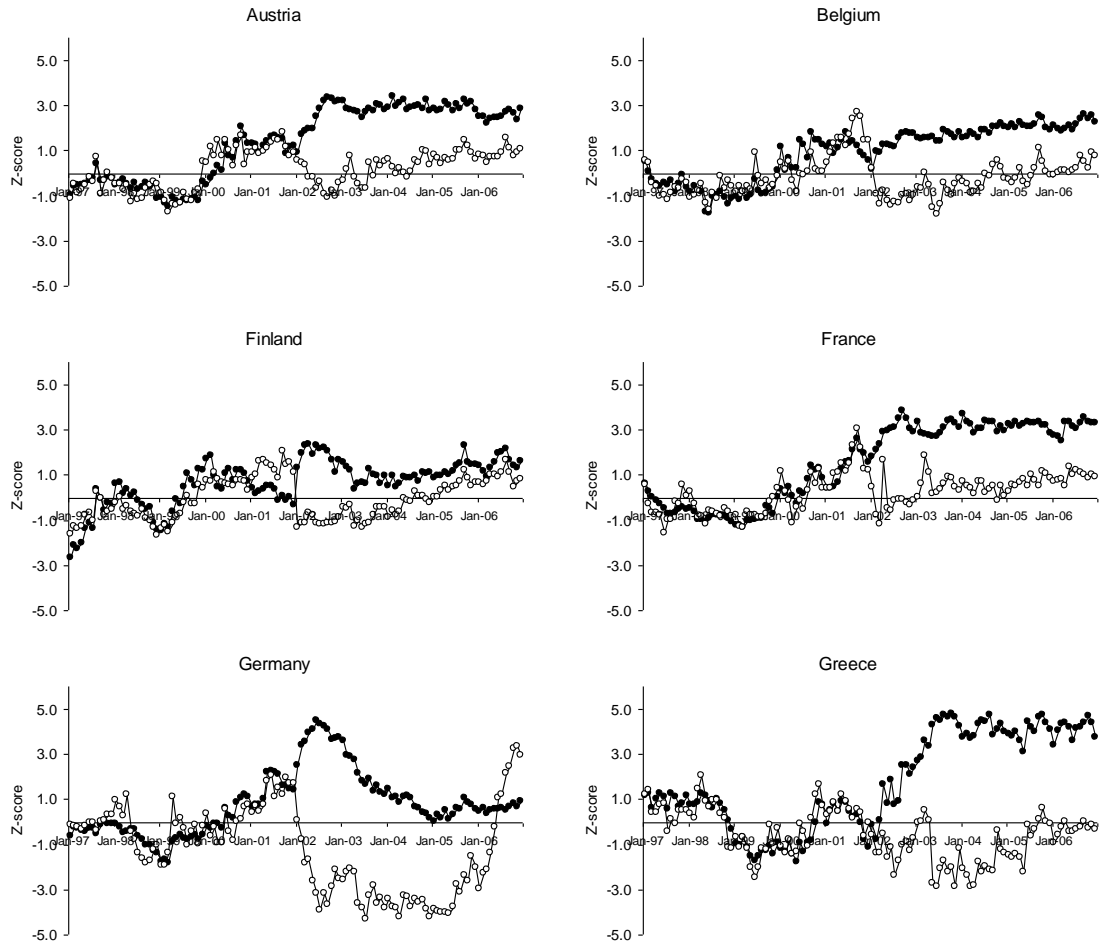


Figure A2 cont...

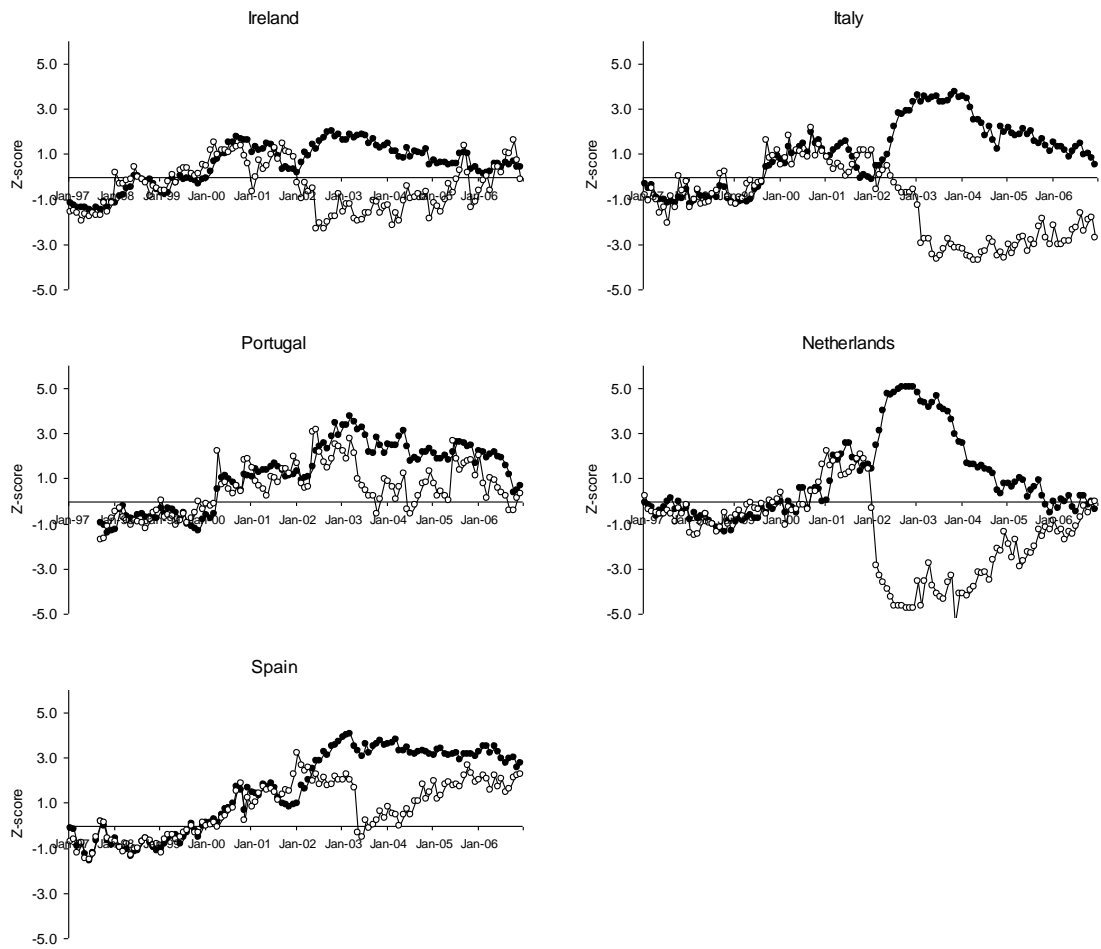


Table 1: Extent of price conversion into the old currency in 2006. Responses across Euro Area to survey question: *When purchasing, do you count mentally...?*

	Exceptional purchases*	Day-to-day shopping
	%	%
Most often in euro	31.7	61.2
Most often in national currency	41.3	20.4
As often in euro as in national currency	26.9	18.4
	100.0	100.0

* For example the purchase of a house or a car

Source: Flash Eurobarometer 193, September 2006

Table 2: Panel regressions for Perceptions-HICP, estimated by pooled OLS

	(1)	(2)	(3)	(4)
HICP	-0.628*** (0.055)	-0.662*** (0.071)	-0.616*** (0.058)	-0.757*** (0.062)
Δ Unemployment	0.500* (0.272)		0.497* (0.269)	-0.288 (0.237)
GDP Growth		-0.135** (0.060)		
Expectations-HICP _{t-12}			0.122* (0.060)	-0.071 (0.060)
Subjective Difficulty	0.696*** (0.197)	0.616** (0.197)	0.680*** (0.186)	0.707*** (0.111)
t	0.450*** (0.098)	0.443*** (0.109)	0.442*** (0.100)	0.516*** (0.021)
t ² /10	-0.144*** (0.037)	-0.143*** (0.040)	-0.142*** (0.038)	
t ³ /1000	0.134*** (0.037)	0.135*** (0.040)	0.131*** (0.038)	
Difficulty*t	-0.065** (0.025)	-0.063** (0.026)	-0.060** (0.024)	-0.083*** (0.008)
Difficulty*t ² /10	0.018* (0.008)	0.018* (0.009)	0.017* (0.009)	
Difficulty*t ³ /1000	-0.015* (0.008)	-0.016* (0.009)	-0.015 (0.009)	
Constant	-2.161*** (0.671)	-1.646* (0.813)	-2.168*** (0.681)	-2.544*** (0.277)
Country Fixed Effects	Yes	Yes	Yes	Yes
R ²	0.613	0.600	0.623	0.909
Obs.	627	209	627	132
No. Groups	11	11	11	11

Driscoll-Kraay standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3: Panel regressions for Expectations-HICP, estimated by pooled OLS

	(1)	(2)
HICP	-0.996*** (0.055)	-0.964*** (0.064)
Δ Unemployment	-0.340 (0.229)	
GDP Growth		0.061 (0.051)
Subjective Difficulty	-0.347*** (0.076)	-0.318** (0.103)
t	-0.057*** (0.011)	-0.057*** (0.010)
t ² /10	0.013*** (0.002)	0.013*** (0.002)
Constant	1.214*** (0.255)	0.883*** (0.271)
Country Fixed Effects	Yes	Yes
R ²	0.794	0.815
Obs.	627	209
Number of groups	11	11

Driscoll-Kraay standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Figure 1: Comparison of perceived inflation and the HICP, standardised according to the mean and standard deviation of the respective series from 1997-2001. Means for 11 Euro Area countries (not Luxembourg) (left) and 3 countries that remained outside the Euro (right).

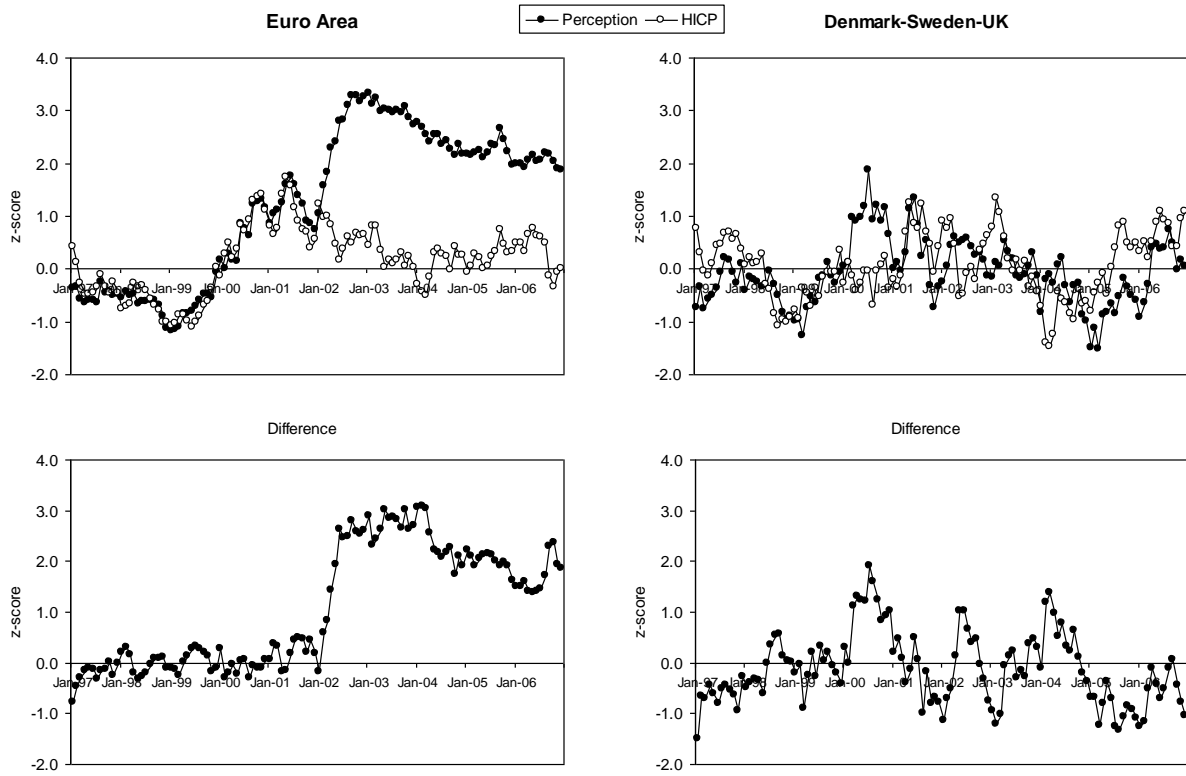


Figure 2: Schematic account of the perceptual error theory. The agent compares the perception of an amount of money, P , with the perception of the value of an item, A (top). The Euro changeover increased perceptual error and thus increased the variability of the perceived surplus, $A - P$ (bottom). An agent willing to pay P_c in the old currency may thus have been unwilling to pay P_ϵ and willing to pay only P'_ϵ .

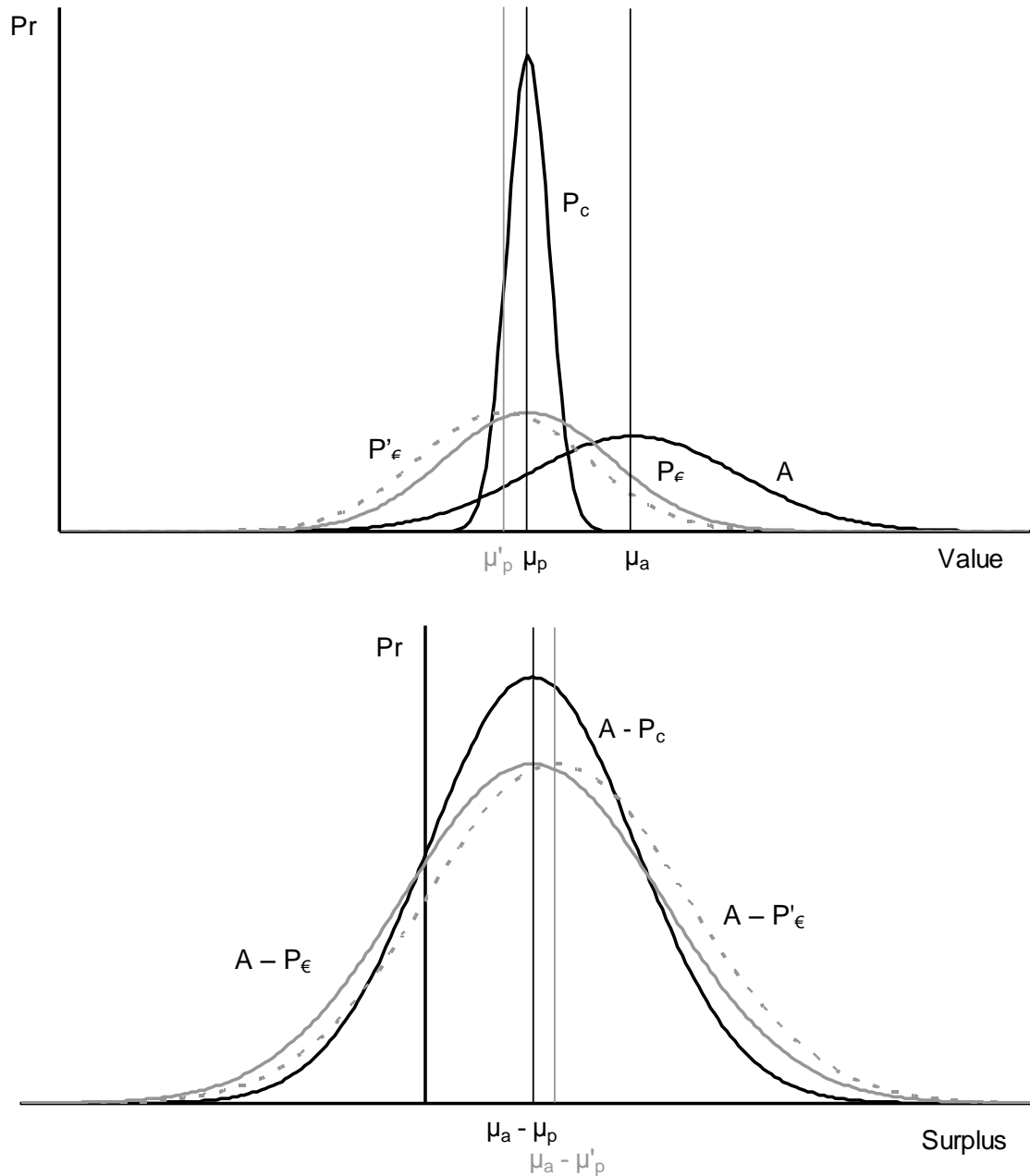


Figure 3: Comparison of the time-course of the PEPI (left) and subjective difficulty using the Euro (right). Top panels provide means for 11 Euro Area countries; bottom panels for five countries where the PEPI abated after 2004 and six where it persisted.

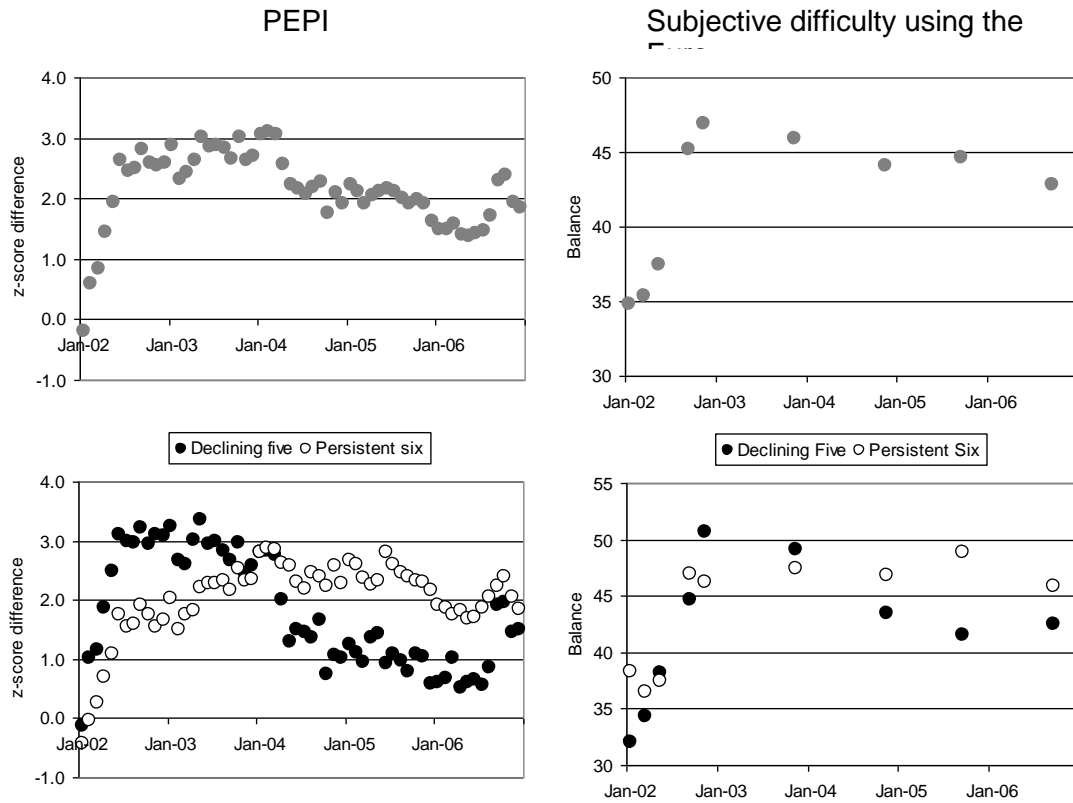
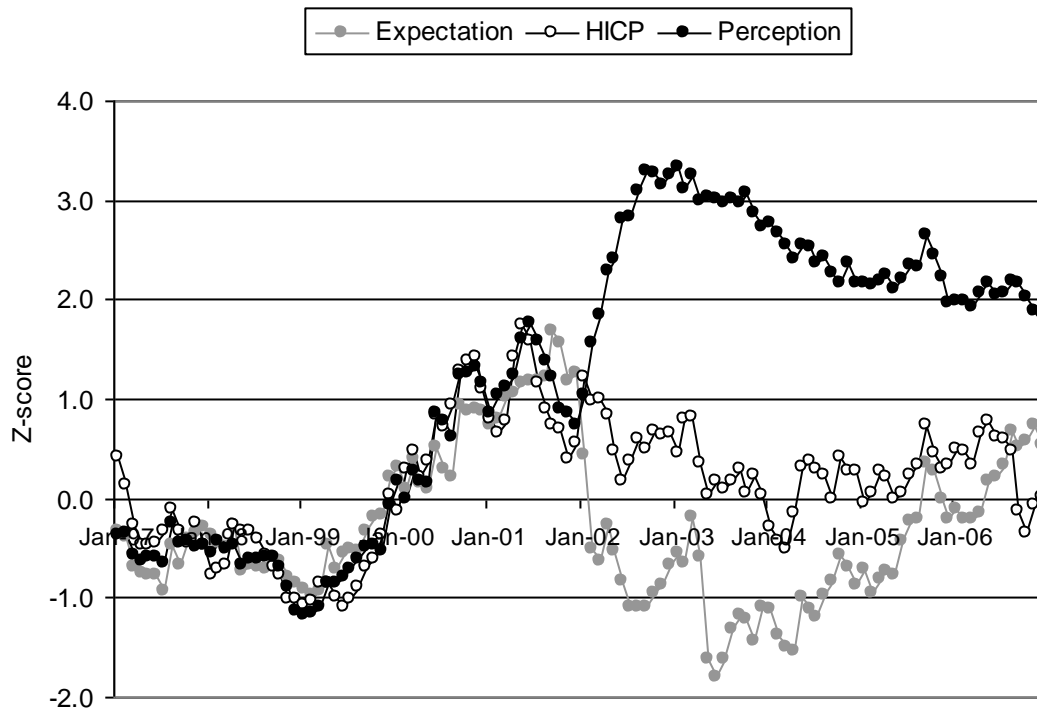


Figure 4: Mean expected inflation, HICP and perceived inflation for 11 Euro Area countries, standardised according to the mean and standard deviation of the respective series from 1997-2001.



Year	Number	Title/Author(s) ESRI Authors/Co-authors <i>Italicised</i>
2010	337	Returning to the Question of a Wage Premium for Returning Migrants <i>Alan Barrett and Jean Goggin</i>
2009	336	What Determines the Location Choice of Multinational Firms in the ICT Sector? <i>Iulia Siedschlag, Xiaoheng Zhang, Donal Smith</i>
	335	Cost-benefit analysis of the introduction of weight-based charges for domestic waste – West Cork’s experience <i>Sue Scott and Dorothy Watson</i>
	334	The Likely Economic Impact of Increasing Investment in Wind on the Island of Ireland <i>Conor Devitt, Seán Diffney, John Fitz Gerald, Seán Lyons and Laura Malaguzzi Valeri</i>
	333	Estimating Historical Landfill Quantities to Predict Methane Emissions <i>Seán Lyons, Liam Murphy and Richard S.J. Tol</i>
	332	International Climate Policy and Regional Welfare Weights <i>Daiju Narita, Richard S. J. Tol, and David Anthoff</i>
	331	A Hedonic Analysis of the Value of Parks and Green Spaces in the Dublin Area <i>Karen Mayor, Seán Lyons, David Duffy and Richard S.J. Tol</i>
	330	Measuring International Technology Spillovers and Progress Towards the European Research Area <i>Iulia Siedschlag</i>
	329	Climate Policy and Corporate Behaviour <i>Nicola Commins, Seán Lyons, Marc Schiffbauer, and Richard S.J. Tol</i>
	328	The Association Between Income Inequality and Mental Health: Social Cohesion or Social Infrastructure <i>Richard Layte and Bertrand Maître</i>
	327	A Computational Theory of Exchange: Willingness to pay, willingness to accept and the endowment effect <i>Pete Lunn and Mary Lunn</i>

- 326 Fiscal Policy for Recovery
John Fitz Gerald
- 325 The EU 20/20/2020 Targets: An Overview of the EMF22 Assessment
Christoph Böhringer, Thomas F. Rutherford, and *Richard S.J. Tol*
- 324 Counting Only the Hits? The Risk of Underestimating the Costs of Stringent Climate Policy
Massimo Tavoni, *Richard S.J. Tol*
- 323 International Cooperation on Climate Change Adaptation from an Economic Perspective
Kelly C. de Bruin, Rob B. Dellink and *Richard S.J. Tol*
- 322 What Role for Property Taxes in Ireland?
T. Callan, C. Keane and J.R. Walsh
- 321 The Public-Private Sector Pay Gap in Ireland: What Lies Beneath?
Elish Kelly, Seamus McGuinness, Philip O'Connell
- 320 A Code of Practice for Grocery Goods Undertakings and An Ombudsman: How to Do a Lot of Harm by Trying to Do a Little Good
Paul K Gorecki
- 319 Negative Equity in the Irish Housing Market
David Duffy
- 318 Estimating the Impact of Immigration on Wages in Ireland
Alan Barrett, Adele Bergin and Elish Kelly
- 317 Assessing the Impact of Wage Bargaining and Worker Preferences on the Gender Pay Gap in Ireland Using the National Employment Survey 2003
Seamus McGuinness, Elish Kelly, Philip O'Connell, Tim Callan
- 316 Mismatch in the Graduate Labour Market Among Immigrants and Second-Generation Ethnic Minority Groups
Delma Byrne and Seamus McGuinness
- 315 Managing Housing Bubbles in Regional Economies under EMU: Ireland and Spain
Thomas Conefrey and John Fitz Gerald
- 314 Job Mismatches and Labour Market Outcomes

- Kostas Mavromaras, *Seamus McGuinness*, Nigel O'Leary,
Peter Sloane and Yin King Fok
- 313 Immigrants and Employer-provided Training
*Alan Barrett, Séamus McGuinness, Martin O'Brien
and Philip O'Connell*
- 312 Did the Celtic Tiger Decrease Socio-Economic
Differentials in Perinatal Mortality in Ireland?
Richard Layte and Barbara Clyne
- 311 Exploring International Differences in Rates of Return to
Education: Evidence from EU SILC
*Maria A. Davia, Seamus McGuinness and Philip, J.
O'Connell*
- 310 Car Ownership and Mode of Transport to Work in
Ireland
Nicola Commins and Anne Nolan
- 309 Recent Trends in the Caesarean Section Rate in Ireland
1999-2006
Aoife Brick and Richard Layte
- 308 Price Inflation and Income Distribution
Anne Jennings, Seán Lyons and Richard S.J. Tol
- 307 Overskilling Dynamics and Education Pathways
Kostas Mavromaras, Seamus McGuinness, Yin King Fok
- 306 What Determines the Attractiveness of the European
Union to the Location of R&D Multinational Firms?
*Iulia Siedschlag, Donal Smith, Camelia Turcu, Xiaoheng
Zhang*
- 305 Do Foreign Mergers and Acquisitions Boost Firm
Productivity?
Marc Schiffbauer, Iulia Siedschlag, Frances Ruane
- 304 Inclusion or Diversion in Higher Education in the
Republic of Ireland?
Delma Byrne
- 303 Welfare Regime and Social Class Variation in Poverty
and Economic Vulnerability in Europe: An Analysis of
EU-SILC
Christopher T. Whelan and Bertrand Maître
- 302 Understanding the Socio-Economic Distribution and
Consequences of Patterns of Multiple Deprivation:
An Application of Self-Organising Maps
Christopher T. Whelan, Mario Lucchini, Maurizio Pisati

and *Bertrand Maître*

- 301 Estimating the Impact of Metro North
Edgar Morgenroth
- 300 Explaining Structural Change in Cardiovascular Mortality
in Ireland 1995-2005: A Time Series Analysis
Richard Layte, Sinead O'Hara and Kathleen Bennett
- 299 EU Climate Change Policy 2013-2020: Using the Clean
Development Mechanism More Effectively
Paul K Gorecki, Seán Lyons and Richard S.J. Tol
- 298 Irish Public Capital Spending in a Recession
Edgar Morgenroth
- 297 Exporting and Ownership Contributions to Irish
Manufacturing Productivity Growth
Anne Marie Gleeson, Frances Ruane
- 296 Eligibility for Free Primary Care and Avoidable
Hospitalisations in Ireland
Anne Nolan
- 295 Managing Household Waste in Ireland:
Behavioural Parameters and Policy Options
John Curtis, Seán Lyons and Abigail O'Callaghan-Platt
- 294 Labour Market Mismatch Among UK Graduates;
An Analysis Using REFLEX Data
Seamus McGuinness and Peter J. Sloane
- 293 Towards Regional Environmental Accounts for Ireland
*Richard S.J. Tol, Nicola Commins, Niamh Crilly, Sean
Lyons and Edgar Morgenroth*
- 292 EU Climate Change Policy 2013-2020: Thoughts on
Property Rights and Market Choices
Paul K. Gorecki, Sean Lyons and Richard S.J. Tol
- 291 Measuring House Price Change
David Duffy
- 290 Intra-and Extra-Union Flexibility in Meeting the
European Union's Emission Reduction Targets
Richard S.J. Tol
- 289 The Determinants and Effects of Training at Work:
Bringing the Workplace Back In
Philip J. O'Connell and Delma Byrne
- 288 Climate Feedbacks on the Terrestrial Biosphere and the

- Economics of Climate Policy: An Application of *FUND*
Richard S.J. Tol
- 287 The Behaviour of the Irish Economy: Insights from the HERMES macro-economic model
Adele Bergin, Thomas Conefrey, John FitzGerald and Ide Kearney
- 286 Mapping Patterns of Multiple Deprivation Using Self-Organising Maps: An Application to EU-SILC Data for Ireland
Maurizio Pisati, Christopher T. Whelan, Mario Lucchini and Bertrand Maître
- 285 The Feasibility of Low Concentration Targets: An Application of FUND
Richard S.J. Tol
- 284 Policy Options to Reduce Ireland's GHG Emissions Instrument choice: the pros and cons of alternative policy instruments
Thomas Legge and Sue Scott
- 283 Accounting for Taste: An Examination of Socioeconomic Gradients in Attendance at Arts Events
Pete Lunn and Elish Kelly
- 282 The Economic Impact of Ocean Acidification on Coral Reefs
Luke M. Brander, Katrin Rehdanz, Richard S.J. Tol, and Pieter J.H. van Beukering
- 281 Assessing the impact of biodiversity on tourism flows: A model for tourist behaviour and its policy implications
Giulia Macagno, Maria Loureiro, Paulo A.L.D. Nunes and Richard S.J. Tol
- 280 Advertising to boost energy efficiency: the Power of One campaign and natural gas consumption
Seán Diffney, Seán Lyons and Laura Malaguzzi Valeri
- 279 International Transmission of Business Cycles Between Ireland and its Trading Partners
Jean Goggin and Iulia Siedschlag
- 278 Optimal Global Dynamic Carbon Taxation
David Anthoff
- 277 Energy Use and Appliance Ownership in Ireland
Eimear Leahy and Seán Lyons
- 276 Discounting for Climate Change

David Anthoff, Richard S.J. Tol and Gary W. Yohe

- 275 Projecting the Future Numbers of Migrant Workers in the Health and Social Care Sectors in Ireland
Alan Barrett and Anna Rust
- 274 Economic Costs of Extratropical Storms under Climate Change: An application of FUND
Daiju Narita, Richard S.J. Tol, David Anthoff
- 273 The Macro-Economic Impact of Changing the Rate of Corporation Tax
Thomas Conefrey and John D. Fitz Gerald
- 272 The Games We Used to Play
An Application of Survival Analysis to the Sporting Life-course
Pete Lunn
- 2008**
- 271 Exploring the Economic Geography of Ireland
Edgar Morgenroth
- 270 Benchmarking, Social Partnership and Higher Remuneration: Wage Settling Institutions and the Public-Private Sector Wage Gap in Ireland
Elish Kelly, Seamus McGuinness, Philip O'Connell
- 269 A Dynamic Analysis of Household Car Ownership in Ireland
Anne Nolan
- 268 The Determinants of Mode of Transport to Work in the Greater Dublin Area
Nicola Commins and Anne Nolan
- 267 Resonances from *Economic Development* for Current Economic Policymaking
Frances Ruane
- 266 The Impact of Wage Bargaining Regime on Firm-Level Competitiveness and Wage Inequality: The Case of Ireland
Seamus McGuinness, Elish Kelly and Philip O'Connell
- 265 Poverty in Ireland in Comparative European Perspective
Christopher T. Whelan and Bertrand Maitre
- 264 A Hedonic Analysis of the Value of Rail Transport in the Greater Dublin Area
Karen Mayor, Seán Lyons, David Duffy and Richard S.J. Tol

- 263 Comparing Poverty Indicators in an Enlarged EU
Christopher T. Whelan and Bertrand Maitre
- 262 Fuel Poverty in Ireland: Extent,
Affected Groups and Policy Issues
*Sue Scott, Seán Lyons, Claire Keane, Donal McCarthy
and Richard S.J. Tol*
- 261 The Misperception of Inflation by Irish Consumers
David Duffy and Pete Lunn
- 260 The Direct Impact of Climate Change on Regional
Labour Productivity
Tord Kjellstrom, R Sari Kovats, Simon J. Lloyd, Tom
Holt, *Richard S.J. Tol*
- 259 Damage Costs of Climate Change through Intensification
of Tropical Cyclone Activities:
An Application of FUND
Daiju Narita, *Richard S. J. Tol* and *David Anthoff*
- 258 Are Over-educated People Insiders or Outsiders?
A Case of Job Search Methods and Over-education in UK
Aleksander Kucel, *Delma Byrne*
- 257 Metrics for Aggregating the Climate Effect of Different
Emissions: A Unifying Framework
Richard S.J. Tol, Terje K. Berntsen, Brian C. O'Neill, Jan
S. Fuglestedt, Keith P. Shine, Yves Balkanski and Laszlo
Makra
- 256 Intra-Union Flexibility of Non-ETS Emission Reduction
Obligations in the European Union
Richard S.J. Tol
- 255 The Economic Impact of Climate Change
Richard S.J. Tol
- 254 Measuring International Inequity Aversion
Richard S.J. Tol
- 253 Using a Census to Assess the Reliability of a National
Household Survey for Migration Research: The Case of
Ireland
Alan Barrett and Elish Kelly
- 252 Risk Aversion, Time Preference, and the Social Cost of
Carbon
David Anthoff, Richard S.J. Tol and Gary W. Yohe
- 251 The Impact of a Carbon Tax on Economic Growth and

- Carbon Dioxide Emissions in Ireland
Thomas Conefrey, John D. Fitz Gerald, Laura Malaguzzi Valeri and Richard S.J. Tol
- 250 The Distributional Implications of a Carbon Tax in Ireland
Tim Callan, Sean Lyons, Susan Scott, Richard S.J. Tol and Stefano Verde
- 249 Measuring Material Deprivation in the Enlarged EU
Christopher T. Whelan, Brian Nolan and Bertrand Maître
- 248 Marginal Abatement Costs on Carbon-Dioxide Emissions: A Meta-Analysis
Onno Kuik, Luke Brander and Richard S.J. Tol
- 247 Incorporating GHG Emission Costs in the Economic Appraisal of Projects Supported by State Development Agencies
Richard S.J. Tol and Seán Lyons
- 246 A Carbon Tax for Ireland
Richard S.J. Tol, Tim Callan, Thomas Conefrey, John D. Fitz Gerald, Seán Lyons, Laura Malaguzzi Valeri and Susan Scott
- 245 Non-cash Benefits and the Distribution of Economic Welfare
Tim Callan and Claire Keane
- 244 Scenarios of Carbon Dioxide Emissions from Aviation
Karen Mayor and Richard S.J. Tol
- 243 The Effect of the Euro on Export Patterns: Empirical Evidence from Industry Data
Gavin Murphy and Iulia Siedschlag
- 242 The Economic Returns to Field of Study and Competencies Among Higher Education Graduates in Ireland
Elish Kelly, Philip O'Connell and Emer Smyth
- 241 European Climate Policy and Aviation Emissions
Karen Mayor and Richard S.J. Tol
- 240 Aviation and the Environment in the Context of the EU-US Open Skies Agreement
Karen Mayor and Richard S.J. Tol
- 239 Yuppie Kvetch? Work-life Conflict and Social Class in Western Europe
Frances McGinnity and Emma Calvert

- 238 Immigrants and Welfare Programmes: Exploring the Interactions between Immigrant Characteristics, Immigrant Welfare Dependence and Welfare Policy
Alan Barrett and Yvonne McCarthy
- 237 How Local is Hospital Treatment? An Exploratory Analysis of Public/Private Variation in Location of Treatment in Irish Acute Public Hospitals
Jacqueline O'Reilly and Miriam M. Wiley
- 236 The Immigrant Earnings Disadvantage Across the Earnings and Skills Distributions: The Case of Immigrants from the EU's New Member States in Ireland
Alan Barrett, Seamus McGuinness and Martin O'Brien
- 235 Europeanisation of Inequality and European Reference Groups
Christopher T. Whelan and Bertrand Maître
- 234 Managing Capital Flows: Experiences from Central and Eastern Europe
Jürgen von Hagen and Iulia Siedschlag
- 233 ICT Diffusion, Innovation Systems, Globalisation and Regional Economic Dynamics: Theory and Empirical Evidence
Charlie Karlsson, Gunther Maier, Michaela Trippl, Iulia Siedschlag, Robert Owen and Gavin Murphy
- 232 Welfare and Competition Effects of Electricity Interconnection between Great Britain and Ireland
Laura Malaguzzi Valeri
- 231 Is FDI into China Crowding Out the FDI into the European Union?
Laura Resmini and Iulia Siedschlag
- 230 Estimating the Economic Cost of Disability in Ireland
John Cullinan, Brenda Gannon and Seán Lyons
- 229 Controlling the Cost of Controlling the Climate: The Irish Government's Climate Change Strategy
Colm McCarthy, Sue Scott
- 228 The Impact of Climate Change on the Balanced-Growth-Equivalent: An Application of *FUND*
David Anthoff, Richard S.J. Tol
- 227 Changing Returns to Education During a Boom? The Case of Ireland
Seamus McGuinness, Frances McGinnity, Philip O'Connell

- 226 'New' and 'Old' Social Risks: Life Cycle and Social Class Perspectives on Social Exclusion in Ireland
Christopher T. Whelan and Bertrand Maître
- 225 The Climate Preferences of Irish Tourists by Purpose of Travel
Seán Lyons, Karen Mayor and Richard S.J. Tol
- 224 A Hirsch Measure for the Quality of Research Supervision, and an Illustration with Trade Economists
Frances P. Ruane and Richard S.J. Tol
- 223 Environmental Accounts for the Republic of Ireland: 1990-2005
Seán Lyons, Karen Mayor and Richard S.J. Tol
- 2007** 222 Assessing Vulnerability of Selected Sectors under Environmental Tax Reform: The issue of pricing power
J. Fitz Gerald, M. Keeney and S. Scott
- 221 Climate Policy Versus Development Aid
Richard S.J. Tol
- 220 Exports and Productivity – Comparable Evidence for 14 Countries
The International Study Group on Exports and Productivity
- 219 Energy-Using Appliances and Energy-Saving Features: Determinants of Ownership in Ireland
Joe O'Doherty, Seán Lyons and Richard S.J. Tol
- 218 The Public/Private Mix in Irish Acute Public Hospitals: Trends and Implications
Jacqueline O'Reilly and Miriam M. Wiley
- 217 Regret About the Timing of First Sexual Intercourse: The Role of Age and Context
Richard Layte, Hannah McGee
- 216 Determinants of Water Connection Type and Ownership of Water-Using Appliances in Ireland
Joe O'Doherty, Seán Lyons and Richard S.J. Tol
- 215 Unemployment – Stage or Stigma? Being Unemployed During an Economic Boom
Emer Smyth
- 214 The Value of Lost Load
Richard S.J. Tol
- 213 Adolescents' Educational Attainment and School

- Experiences in Contemporary Ireland
Merike Darmody, Selina McCoy, Emer Smyth
- 212 Acting Up or Opting Out? Truancy in Irish Secondary Schools
Merike Darmody, Emer Smyth and Selina McCoy
- 211 Where do MNEs Expand Production: Location Choices of the Pharmaceutical Industry in Europe after 1992
Frances P. Ruane, Xiaoheng Zhang
- 210 Holiday Destinations: Understanding the Travel Choices of Irish Tourists
Seán Lyons, Karen Mayor and Richard S.J. Tol
- 209 The Effectiveness of Competition Policy and the Price-Cost Margin: Evidence from Panel Data
Patrick McCloughan, *Seán Lyons* and William Batt
- 208 Tax Structure and Female Labour Market Participation: Evidence from Ireland
Tim Callan, A. Van Soest, J.R. Walsh