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Inflation Perception and Anticipation Gaps in the Eurozone

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Abstract

Svatopluk Kapounek, Lubor Lacina: **Inflation Perception and Anticipation Gaps in the Eurozone**

There is significant empirical evidence that the introduction of the euro led to a significant increase of perceived inflation in most countries. Such an increase and persistence in the perceived inflation might then have an impact on inflation expectations and other macroeconomic variables. The authors have used the short-term Phillips curve to describe the difference between inflation expectations and its current values, subsequently to identify the impact of this difference on other economic indicators.

The paper is structured as follows: Section 1 provides an overview of the theory and empiricism on the gap between measured and perceived inflation. Section 2 then builds up the theoretical framework based on the short–term Phillips curve approach and derives two hypotheses, to be tested subsequently. Section 3 provides the methodology. Section 4 presents the modelling and results of the empirical analysis. In section 5 authors compare its results and used methodology with papers and studies on a similar topic. Finally, Section 6 concludes and provides recommendations for the economic policy.

Keywords

monetary integration, perceived and anticipated inflation, adaptive and rational expectations hypothesis, expectations-augmented Phillips curve, stationarity, ADF test

JEL Classification: E42

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1. Introduction

Gylfason (1980) states the following: “It is interesting to note that while an increase in the expected rate of inflation increases consumption by influencing intertemporal choice, an increase in the price level may at the same time reduce consumption through the Pigou effect. There is inconsistency between the argument that increased inflation stimulates consumption at the expense of savings and the fact that in the recession of 1974 – 1975 high inflation rates and high savings coincided in many industrial countries.” …. and continues …..“Even though increased inflation stimulates via increased consumption output and employment in the short run, it may still be detrimental to economic growth as time passes.”

The ECB (2007) provides the following interpretation of the link between perceived inflation, inflation expectations and other economic variables: “…..protracted divergences in the evolution of measured perceived inflation warrant close examination, given that perceived inflation might have an impact on inflation expectations and other macroeconomic variables.”

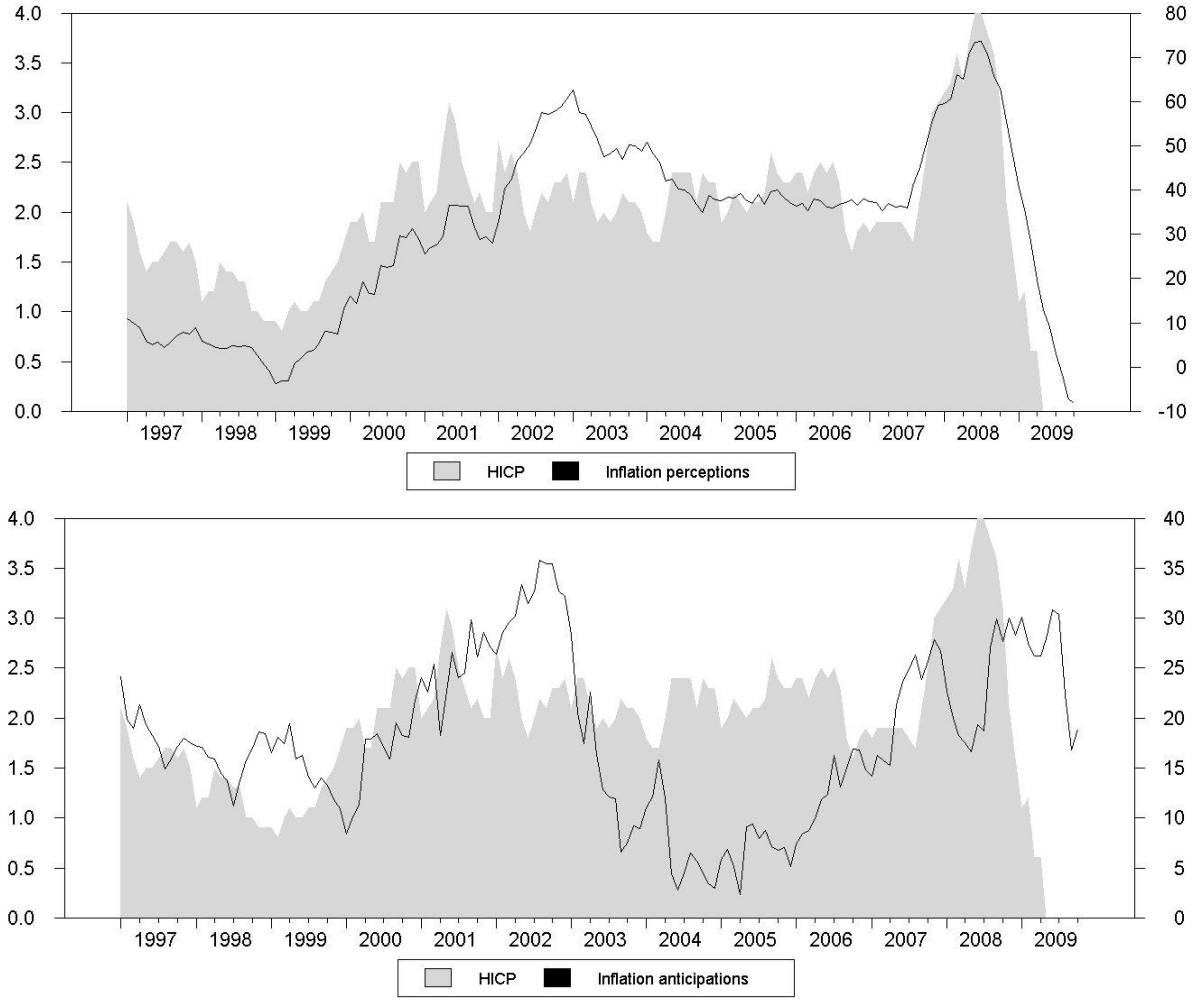
The authors of this article assume that exogenous negative shock to an individual wealth ceteris paribus reduces the expected future consumption, therefore increasing the marginal utility of future consumption. To maintain the equilibrium, the marginal utility of the current consumption has to rise – i.e. the current consumption has to be reduced. That is, the share of consumption in GDP declines and the personal savings rate increases. The latter, indeed, will mitigate the negative wealth shock, but it cannot eliminate it. The savings sufficient to increase wealth to its pre-shock levels – and hence to resume the original level of consumption – would violate the individual budget constraint. Because the consumption still remains exogenous of GDP – but not vice versa – the reduction in consumption reduces the GDP’s growth.

Significant exogenous negative shocks that lead to the expected future consumption reduction are a positive gap between the current and perceived inflation. To clarify the term “perceived inflation” we have to look at psychological terminology. In psychology and cognitive sciences perception is defined as “the process of acquiring, interpreting, selecting and organizing sensory information” (Federal Statistical Office of Germany, 2006).

As will be discussed later, the above-mentioned definition is in line with the methodology of the perceived inflation survey conducted by the European Commission. The indicator of perceived inflation is not constructed with the use of empirical price monitoring. It surveys the feelings of consumers about the past and future price development. Consumer opinions on inflation are collected through the Consumer Survey of the European Commission (Directorate General for Economic and Financial Affairs). As the indicator derived from this survey differs in nature from the

HICP, it is not possible to make a direct comparison between the two measures. In order to interpret its dynamics, it is important to gain a better understanding of the methodology used to calculate the European Commission indicator. More details are provided in the methodological part of the paper. Figure 1 shows the development of HICP, perceived and anticipated inflation evaluation in the Eurozone between 1997 and 2009.

Figure 1: HICP, inflation perceptions and anticipation in the Eurozone (1997 – 2009)



Source: Eurostat, European Commission Consumer Survey

There are many arguments why a gap between measured (HICP) and perceived inflation may have occurred in the aftermath of the euro changeover. The inflation perceptions are mostly based on the price changes of frequently purchased products, different perceptions of price increases and decreases, price shocks and asymmetries in perceptions between the lower priced items and in sectors where price transparency and market concentration are low. For the next part of this paper it is important that *"...since 2002 consumers have tended to perceive that inflation is high, while in*

reality it was relatively low, albeit slightly above the quantified definition of price stability for the euro area." (Aucremann, Collin, Stragier, 2007, p.24)

Kichler, E. (2006) provides the following argument: "*Dealing with the new currency essentially depends on the understanding of the nominal euro values, which can be derived from two different sources*". On the one hand, euro amounts can be evaluated on the basis of an interaction of nominal and real representations, which leads to a bias toward nominal valuation (Shafir, Diamond and Tversky, 1997). This bias is influenced, inter alia, by the salience of nominal values as well as simple and careful mental calculation processes and is referred to as money illusion (Dimand, 2002). In the context of the influence of the respective former currencies and conversion factors on the perception of euro amounts also the term "euro illusion" was coined (Burgoyne, Routh and Ellis, 1999; Gamble, Gärling, Västfjäll and Marell, 2003). On the other hand, the evaluation of euro amounts can be influenced by specific other values, such as the price one remembers in the former currency or random values. Finally, it is questionable to which periods persons relate estimated inflation rates and to what extent time leads to distorted perceptions. Kemp and Willetts (1996), for example, showed that inflation rates tend to be overestimated by far for the more recent past, while subjective estimates for longer periods lead to a gross underestimation of inflation rates."

Studies of Döhring, B., Mordonu, A. (2007) and Lacina (2008) provide sets of factors that attempted to explain the existence and persistence of a perceived inflation indicator and its deviation from HICP. The following part of the paper describes some of most frequently mentioned factors in both studies.

In most of the euro-area countries the prices of day-to-day purchases of so called "out-of-the-pocket" items (for example food, dinners in restaurants) were growing faster than the prices of less frequent purchases (like cars, refrigerators, etc.). The prices of some products even declined while increasing their utility (for example computers, electronic devices). Due to the fact that consumers are more "sensitive" to changes of day-to-day purchases than to the products with long term utility, they transfer their feelings about price increases in this group of products to their opinion about overall inflation (the whole consumer basket). At the same time psychological studies show that consumers are more sensitive to the price increases in comparison to price decreases. While evaluating the development of prices in the past the surveyed consumers were giving significantly higher weight to the products with price increases compared with those with price decreases.

According to public opinion surveys (Eurobarometers) even 6 years after the euro introduction (cash form) there was still a high percentage of respondents that convert the euro prices to the former

national currency. But doing so they are comparing current prices with prices that existed 6 years prior (at the end of the year 2001);

An important role is also played by expectations. While the consumers (due to media information, conversations with neighbours, declarations of europessimistic politicians, etc.) acquire the strong believe that the introduction of the euro will lead to price increases, they have a tendency to increase their opinion about future development of inflation by their expectations and acquired information in the past. Once expectations about the development of prices after the euro's introduction are set, they have the tendency to be transformed to the long-term increase in perceived inflation compared to the inflation measured by standard price indices like HICP.

Any household is an "ideal" consumer according to the weighted structure of the consumer basket. Logically the higher is the weight in consumption given to the groups of products with higher increases of prices than average (during the euro changeover – like food products), and the higher is then an increase in the indicator of perception inflation.

One of the most mentioned causes of a significant opening of scissors between perceived inflation and inflation measured by HICP is the unawareness of consumers about the structure of the consumer basket and calculation of the consumer price index.

An important fact why the consumer may feel that prices went significantly up after the euro introduction is the statistically observed increase of houses prices after the year 2001 (which has nothing to do with the euro introduction). However, therefore the prices of houses are not included in the calculation of HICP, the people that do not know the structure of the consumer basket that is used for HICP calculation, may feel the cost of living is growing. They can then wrongly transform their feelings about the decrease in their purchasing power to the fact that prices went up.

The feeling that "costs of living are increasing" may be influenced not just by increases of prices included (or excluded – real estate) in HICP, but also by the slower growth of wages compared with past developments before euro introduction (due to the attempt of the national government to control inflation growth during the euro changeover, as in Slovenia) or other factors that do not have any direct relation to the euro introduction. Again the people have a tendency to transform their feeling about the decline of purchasing power of their incomes due to the slowdown in nominal wage growth to the introduction of the euro.

An important role in the formation, growth and long-term persistence of perceived inflation are played by information provided by mass media. In countries implementing the euro in the past there was, according to media monitoring, a significant increase in the number of papers covering the topic of inflation. As far as the media have a tendency to choose more "sensational" information (in

contrast with rational arguments) in the context of euro changeover, they preferred to be alert mainly to price increases. The media also increased the number of papers analyzing the problem of the official price statistics' credibility (as perceived inflation significantly deviated from HICP before and after euro introduction) and thus creating the opinion that official statistics (like HICP) are providing wrong information about price development for the decisions of consumers.

The following table describes the development of HICP and the perceived inflation indicator in individual eurozone member countries after euro adoption.

Table 1: Evolution of HICP and the perceived inflation indicator in selected Eurozone member countries after euro adoption

	HICP inflation			Perceptions of price changes		
	Average annual percentage changes			Percentage balances, seasonally adjusted		
	1999 - 2001	2002 - 2004	2005 - 2006	1999 - 2001	2002 - 2004	2005 - 2006
Belgium	2,1	1,6	2,4	29	44	53
Germany	1,3	1,4	1,9	23	48	27
Ireland	3,9	3,7	2,4	40	53	38
Greece	2,9	3,5	3,4	18	57	66
Spain	2,8	3,2	3,5	20	52	52
France	1,4	2,1	3,2	5	45	47
Italy	2,2	2,6	2,1	25	52	37
Luxembourg	2,4	2,6	2,6	-	38	41
Netherlands	3,2	2,5	2,5	28	61	25
Austria	1,6	1,6	1,6	-1	36	35
Portugal	3,1	3,1	3,1	29	46	42
Finland	2,3	1,2	1,2	-11	-5	-4

Source: Eurostat and European Commission Consumer Survey

Note: Data on inflation perceptions for Luxembourg are only available from January 2002 onwards

As we can see there was no significant increase in HICP in any observed country. The opposite is true for the indicator of perceived inflation. In all countries except Finland there was a significant increase in the perceived inflation indicator. What is interesting is that in some countries after the dramatic increase of indicator after euro introduction in cash form (period 2002 – 2004), the value of the indicator started decreasing. In some countries the indicator remained fixed at a high level. In no country did the indicator of a perceived inflation come back to its former level until the end of 2006.

The significance of the gap between the current and perceived inflation is discussed in the next parts of the paper.

2. Theoretical framework

For the purpose of this paper authors use the short-term Phillips curve to describe the difference between the inflation expectations and its current values, subsequently to identify the impact of this difference on the other economic indicators. The common theoretical argument explaining the difference is based on the slow adjustment of prices in the short-term. This limit in the adjustment mechanism is used by monetary and fiscal policy makers in the process of inflation and unemployment determination in the real economy in the short-term. *Friedman (1968)* gives a theoretical framework for the Phillips curve, in which he introduces the adaptive expectations. The adaptive expectation hypothesis states that price level is given in the short-run, but moves slowly to correct for past expectational errors:

$$P_{t+1}^{e} = P_t + (1-\lambda)\left(P_t^{e} - P_t\right) \qquad 0 < \lambda < 1 \qquad (1)$$

"This equation says that households expect the price in the future period t+1 to be equal to the actual price in the current period t if their expectations proved correct in the current period. If, instead, they have mis-estimated the price level in the current period $(P_t^{e} \neq P_t)$*, they incorporate part of the expectational error in the revision of their expectation in the current period, where λ represents the speed with which households update their price expectations."(Heijdra, Ploeg, 2002, pp.8)* The authors of this article substitute the expectational errors from the formula (1) with the perception errors that represent the gap between perceived and current inflation.

Under the adaptive expectation hypothesis and neo-Keynesian assumptions, expansion of the nominal money supply lowers the interest rate and pushes up aggregate demand in the short-run. With the aggregate demand and national income increasing, the price level rises too. Over time the expected price level is revised upwards and aggregate supply shifts back until the equilibrium of employment and output are reached again. The final recommendation for the policy-makers leads to an assumption of neutrality money in the long-run but not in the short-run. Concurrently, Milton Friedman and other monetarists assumed that there is a temporary effect of nominal money supply expansion on the real output under the adaptive expectation hypothesis.

The problem of expectations was further discussed by *Muth (1961).* He argues that "expectations, since they are informed predictions of future events, are essentially the same as the predictions of the relevant economic theory." *(Muth, 1961, pp.316)* According to this assumption, the agents can calculate a future correct price level for the new money supply after the monetary policy expansion is implied. The expectational error $(P_t^{e} - P)$ from the form (1) disappeared. The rational expectations hypothesis defines an expectational equilibrium as follows:

$$P_{t+1}^{e} = P_{t+1}. \qquad (2)$$

From the supply side view, the suppliers must decide on the production capacity before knowing exactly what will be the price at which they can sell their goods. The agents make their decisions on the basis of all information that is available to them. They know prices in the period t-1 and t. According to the rational expectations hypothesis, there is no significant and permanent gap between the future, past and current inflation rates and its perceptions. However, there is not direct substitution between the rational and adaptive expectation hypothesis. Formula (1) which represents adaptive expectational error could be rewritten in the form:

$$P_{t}^{e} = P_{t-1} + (1-\lambda)\left(P_{t-1}^{e} - P_{t-1}\right) \quad 0 < \lambda < 1. \qquad (3)$$

Obviously, while the rational expectation hypothesis is forward-looking, the adaptive expectation hypothesis is backward-looking. Assume that expectations play a crucial role in economic reality. If the current price level is different from perceived prices:

$$P_{t}^{P} \neq P_{t} \qquad (4)$$

there is a significant causality between the physical magnitudes of inflation and its perceived intensity. This idea is based on the Weber-Fechner law (Gerrit, 2008). Although the differences between the inflation and its perceptions disappear in the long-run, the short-term Phillips curve is impacted. In this paper, the empirical analysis focuses on the inflation perceptions and its relationship with the rational and adaptive expectation hypothesis.

The expectations-augmented Phillips curve indicates that when expectations of future inflation (the future price level) are totally accurate, so that current unemployment equals to its natural level:

$$\pi_{it} - \pi_{it}^{e} = -d(U_{it} - U_{it}^{n}) + v_{it} \qquad (5)$$

where π_{it}^{e} represents inflation expectations, π_{it} current inflation, U_{it}^{n} is the natural rate of unemployment[1], U_{it} its current level and v_{it} unexpected exogenous supply shocks. On the opposite site of the original version of the Phillips curve (Phillips, 1958), where only one Phillips curve exists, the expectation-augmented Phillips curve supposes an infinite number of the curves for each expected inflation rate. In the empirical analysis, the authors test the hypothesis to see if there is a significant expectational error between the current inflation and its perceptions $(P_{t}^{P} \neq P_{t})$ or anticipations $(P_{t+1}^{P} \neq P_{t+1})$.

[1] In the empirial analysis to estimate the natural level of unemployment the Hodrick-Prescott filter is used.

3. Methodological background

The perceived inflation indicator is based on inflation perceptions in the consumer survey of the standardized balance statistic conducted by the European Commission. This statistic is the result of the question: "How do you think that consumer prices have developed over the last 12 months?" There are six possible answers to the question on inflation perceptions: A(1), "risen a lot", A(2), "risen moderately", A(3), "risen slightly", A(4), "stayed about the same", A(5), "fallen" and A(6), "do not know". The balance statistic is computed as follows:

$$B_{it} = A_{it}(1) + 0{,}5A_{it}(2) - 0{,}5A_{it}(4) - A_{it}(5). \qquad (6)$$

The statistic B_{it} is in the scale range from -100 to 100. For the empirical analysis a quantified measure of perceived inflation is needed. The transformation of balance statistic data is based on the harmonized index of consumer prices and B_{it} statistic standardization:

$$\frac{\pi_{it}^{P} - \overline{\pi}_i}{s_{\rho_i}} = \frac{B_{it} - \overline{B}_i}{s_{B_i}} \qquad (7)$$

where π_{it}^{P} represents a quantified measure of perceived inflation, $\overline{\pi}_i$ mean of current inflation (harmonized index of consumer prices) and s_{ρ_i} its standard deviation. Correspondently statistic B_{it}, $\overline{B}_i$ and s_{B_i}. The equation (7) is reversed in the following form *(Aucremanne, Collin, Stragier, 2007)*:

$$\pi_{it}^{P} = \frac{(B_{it} - \overline{B}_i)}{s_{B_i}} s_{\rho_i} + \overline{\pi}_i. \qquad (8)$$

Inflation anticipation is based on the consumer survey of the standardized balance statistic, which is the result of the question on the prices development over the next 12 months. Anticipated inflation is quantified by the same way (8) as the perceived inflation.

In the second part of the empirical analysis will be test of whether there are significant expectational errors $(P_t^P \neq P_t)$ and $(P_{t+1}^P \neq P_{t+1})$, represented by the inflation gap (GAP_{it}):

$$GAP_{it} = \pi_{it}^{P} - \pi_{it} \qquad (9)$$

If the current price level is permanently different from perceived prices, the GAP_{it} sequence is not stationary *(Enders, 2003, p.185-195).* To test the stationarity the empirical analysis uses the Augmented Dickey-Fuller test.

GAP between the current and perceived/anticipated inflation could contains various noises[2], therefore level stationarity is tested. The Augmented Dickey-Fuller test is used in the form:

$$GAP_{i,t} = c_i + \rho_i GAP_{i,t-1} + \sum_{j=1}^{p_i-1} \beta_{i,j} \Delta GAP_{i,t-j} + \varepsilon_{i,t} . \qquad (10)$$

where ρ_i is the sum of the autoregressive coefficients in an AR-model or order p_i, and ε_{it} is white noise. The optimal lag length of the AR-model is obtained on the basis of Akaike´s and Schwarz´s Bayesian information criterion under the null hypothesis, GAP_{it} is assumed to have a unit root.

Because the ADF test does not say anything about the deterministic parameters c_i and ρ_i, a joint test of a unit root and constant is used. The joint test hypothesis is the following *(Seddighi, Lawler, Katos, 2000, p.262-272)*:

$$H_0 : c_i = \rho_i = 0 \text{ , if } F < \Phi_1 \qquad (11)$$

$$H_a : \text{not both } c_i \text{ and } \rho_i = 0, \text{ if } F > \Phi_1 .$$

4. Data and Empirical analysis results

Tests are applied on monthly data of the harmonized index of consumer prices and consumer surveys in the Eurozone and its 12 member states for the estimation period 1997:01-2008:12. The unit-root tests are reported in Tables 2, 3, 4 and 5. The ADF test applied in tables 2 and 4 use Akaike´s information criterion to identify lag order, tables 3 and 5 Schwarz´s Bayesian information criterion. Both of these information criteria determine the appropriate number of lagged differences by adding lags until the Ljung-Box test fails to reject any serial correlation at a defined level. The difference between these approaches is that Schwarz´s Bayesian information criterion gives a more parsimonious lag structure.

[2] Permanent noises in the gap between the perceived/anticipated inflation and HICP price level could be caused by measurement errors in inflation perceptions or perceived/anticipated inflation quantification methodology.

Table 2: Augmented Dickey-Fuller unit root test for perceived inflation gap (GAP_{it}^{p})

Country	Lag Order (p_i)[b]	t statistic	Φ_1 statistic[c]	observations
EA 12	12	-2,1053	2,2380	120
Austria	16	-2,1225	2,3315	144
Belgium	1	-3,1637 **	5,0553 **	144
Finland	1	-1,9858	2,0672	144
France	12	-2,5182	3,2920	144
Germany	1	-2,1428	2,4693	144
Greece	9	-1,5065	1,5397	144
Ireland	0	-2,7502 *	3,8048	136
Italy	0	-4,2381 ***	9,0842 ***	144
Luxembourg	0	-3,5365 ***	6,4103 **	84
Netherlands	8	-2,7778 *	3,8633 *	144
Portugal	0	-2,4134	2,9955	144
Spain	19	-1,3502	1,0319	144

Notes:

[a] Critical values at 1%, 5%, and 10% are -3,46, -2,88, and -2,57.

[b] Lag order is chosen using Akaike´s information criterion.

[c] Joint test of a unit root and no constant. Critical values at 1%, 5%, and 10% are 6,52, 4,63, and 3,81.

From the Augmented Dickey-Fuller unit root test point of view, for Italy and Luxembourg, the unit root can be rejected at a 1% significance level. On a 5% significance level this hypothesis is rejected for Belgium and a 10% significance level for the Netherlands and Ireland. Similar results are presented by the joint test. For Italy in the sample, the null of the unit root and no constant is accepted at 1%, for Belgium and Luxembourg at 5% and for the Netherlands at a 10% significance level.

The level stationarity of inflation gap between the perceived and current inflation is expected only in Belgium, the Netherlands, Italy and Luxembourg. In other Eurozone member countries the assumption of significant expectational error $(P_t^e \neq P_t)$ in the analyzed period.

Table 3: Augmented Dickey-Fuller unit root test for perceived inflation gap (GAPitp)

Country	Lag Order (p_i)[b]	t statistic	Φ_1 statistic[c]	observations
EA 12	0	-3,3884 ***	5,8390 **	120
Austria	0	-3,0796 ***	4,8529 **	144
Belgium	0	-3,7773 ***	7,1677 ***	144
Finland	0	-2,4893	3,2115	144
France	0	-3,4485 **	6,0973 **	144
Germany	0	-2,5863 *	3,4987	144
Greece	0	-2,4387	3,8224 *	144
Ireland	0	-2,7502 **	3,8048	136
Italy	0	-4,2381 ***	9,0842 ***	144
Luxembourg	0	-3,5365 ***	6,4103 **	84
Netherlands	0	-1,8180	1,6529	144
Portugal	0	-2,4134	2,9955	144
Spain	1	-3,1383 **	5,0916 **	144

Notes:

[a] Critical values at 1%, 5%, and 10% are -3,46, -2,88, and -2,57.

[b] Lag order is chosen using Schwarz´s Bayesian information criterion.

[c] Joint test of a unit root and no constant. Critical values at 1%, 5%, and 10% are 6,52, 4,63, and 3,81.

Table 3 presents the ADF stationarity test, where lag order was chosen using the Schwarz´s Bayesian criterion. The unit root can be rejected at a 1% significance level for EA12, Austria, Belgium, Italy and Luxembourg. At a 5% significance level for France, Ireland and Spain, for Germany at a 10% significance level. The expectational error $(P_t^e \neq P_t)$ is not rejected at a 10% significance level in Finland, Greece, the Netherlands and Portugal. In the Eurozone as a whole region there is not a significant (or stable) gap between the perceived and current inflation.

The stationarity test in the level for the gap between the anticipated and current inflation is present in tables 3 and 4.

Table 4: Augmented Dickey-Fuller unit root test for anticipated inflation gap (GAPita)

Country	Lag Order (p_i)[b]	t statistic	Φ_1 statistic[c]	observations
EA 12	12	-1,9247	1,9458	132
Austria	11	-5,4371 ***	14,8987 ***	144
Belgium	0	-3,6237 ***	6,5799 ***	144
Finland	11	-3,409 **	4,9819 **	144
France	0	-4,1789 ***	8,7447 ***	144
Germany	0	-2,3714	2,8128	144
Greece	0	-3,3728 **	5,8324 **	144
Ireland	0	-3,4029 **	5,8646 **	144
Italy	0	-2,6691 *	3,562	144
Luxembourg	0	-2,3332	2,8515	72
Netherlands	0	-2,2399	2,5337	144
Portugal	1	-2,9727 **	4,5561 *	144
Spain	12	-2,4187	3,0292	144

Notes:

[a] Critical values at 1%, 5%, and 10% are -3,46, -2,88, and -2,57.

[b] Lag order is chosen using Akaike´s information criterion.

[c] Joint test of a unit root and no constant. Critical values at 1%, 5%, and 10% are 6,52, 4,63, and 3,81.

Table 5: Augmented Dickey-Fuller unit root test for anticipated inflation gap (GAPita)

Country	Lag Order (p_i)[b]	t statistic	Φ_1 statistic[c]	observations
EA 12	0	-2,5025	3,1637	132
Austria	0	-3,6167 ***	6,7334 ***	144
Belgium	0	-3,6237 ***	6,5799 ***	144
Finland	0	-3,0047 **	4,5944 *	144
France	0	-4,1789 ***	8,7447 ***	144
Germany	0	-2,3714	2,8128	144
Greece	0	-3,3728 ***	5,8324 **	144
Ireland	0	-3,4029 **	5,8646 **	144
Italy	0	-2,6691 *	3,562	144
Luxembourg	0	-2,3332	2,8515	72
Netherlands	0	-2,2399	2,5337	144
Portugal	0	-2,9072 **	4,4572 *	144
Spain	0	-2,5447	3,3622	144

Notes:

[a] Critical values at 1%, 5%, and 10% are -3,46, -2,88, and -2,57.

[b] Lag order is chosen using Schwarz´s Bayesian information criterion.

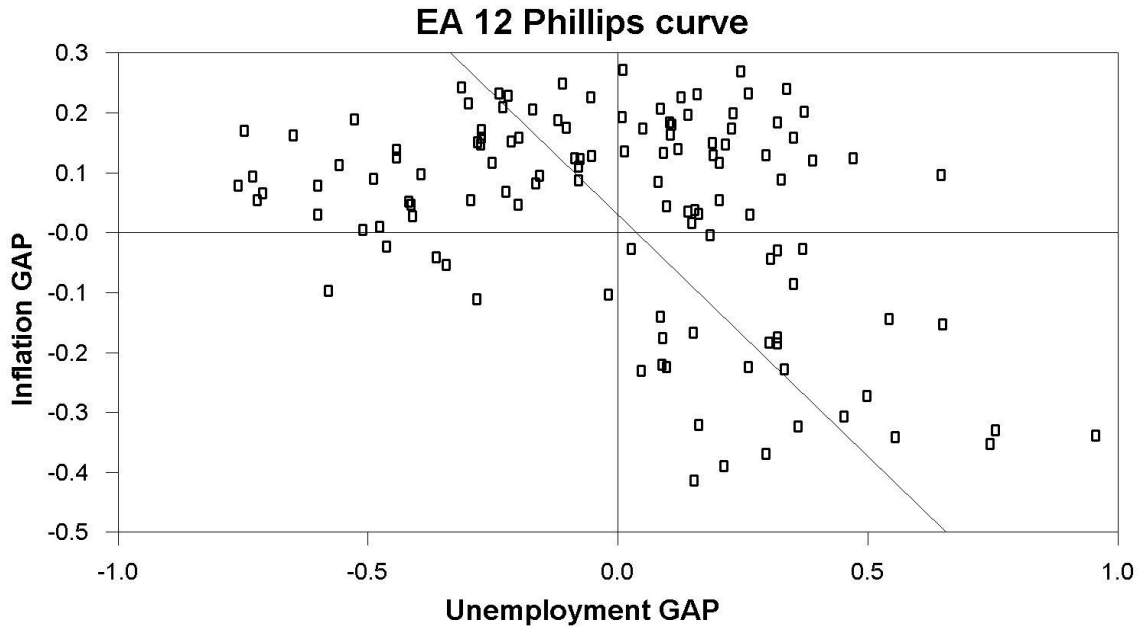
[c] Joint test of a unit root and no constant. Critical values at 1%, 5%, and 10% are 6,52, 4,63, and 3,81.

In a contrast with the perceived inflation gap, the anticipated inflation is not so different from the HICP level in the Eurozone member states. A significant gap between anticipated inflation and HICP is obvious only in Germany, Luxembourg, the Netherlands, Spain and EA12 at a 10% significance level.

From the empirical analysis follows that the rational expectation hypothesis was not rejected in the major Eurozone member states, excluding the aforementioned Germany, Luxembourg, Netherlands and Spain. It is possible to conclude that the expectational error $(P_t^e - P)$ disappeared because the economic agents are able to calculate all disposable information to form their rational expectations about the future price level. On the contrary, the adaptive expectation error was not rejected by most Eurozone members, like in the whole Eurozone, with a lag chosen using Akaike´s information criterion.

The expectation-augmented Philips curve assumptions could be applied only in the case of inflation perceptions, especially in all the tested Eurozone countries, excluding Belgium, Italy, Luxembourg and the Netherlands. Except for the aforementioned countries, there is a possibility for an infinite number of the Philips curves to exist for each one perceived inflation rate. The gap between the perceived inflation and its HICP level on the one side and unemployment gap on the other (the gap between the natural level of unemployment and the current level of unemployment) is negatively correlated. This relationship is presented in figure 2.

Figure 2: Short-term Phillips curve



Source: Eurostat, own calculation

A significant relationship between the unemployment and inflation gap, represented by the short-term Phillips curve is questionable. Even if in the presented figure a negative slope of Phillips curve is identified, it is difficult to understand this result. The presented variables are full of noise. This noise exceeds the inflation gap where the unit root test was not rejected clearly. There are only a few percent of differences between the current and perceived inflation. The inflation and unemployment gap relationship is caused by shocks that come mostly from the unexpected exogenous supply shocks (formula 5).

5. Discussion

Heinemann and Ullrich (2006) based their analysis of the impact of EMU on inflation expectations on the representation of an expectations formation suggested, among others, by *Carlson and Valev (2002) and Gerberding (2001).* These take in account the empirical fact that the expectations formation can only partially be characterized to be fully rational and that backward looking and adaptive expectations play a role at least for a subset of economic agents[3]. Furthermore, authors incorporate a term capturing the regressive part of expectations formation and the possibility that the expected inflation rate can change in reaction to a changing current inflation rate *(Pesaran, 1985, p. 951).* They also stress that expectations tend to underpredict the inflation rate during periods of rising inflation and overpredict this rate during periods of decreasing inflation. This finding is the frequent result of studies on inflation expectations (e.g. *Andolfatto et al., 2002).*

Traut-Mattausch et al. (2004) highlighted the importance of psychological factors, and especially the role of a prior expectations. Based on an experiment, they show a bias towards a perception of price increases as a result of a previously held expectation, even when the latter was not confirmed by the evidence[4]. A completely different factor relates to the fact that consumers may have incorrectly interpreted the loss of purchasing power incurred at the time of the changeover as being caused by higher inflation rather than by the general slowdown in economic activity at that time. *Del Giovane and Sabbatini (2006)* have found some evidence in favour of this argument in the case of Italy, but in principle this argument should also have led to inflation misperceptions in other periods characterized by an economic downturn.

Lindén, S. (2005) gives the following opinion on the role of expectations and perceptions on price level: “Expectations about the future course of the price level are important to decision-makers in all

[3] This argument supports the close relation between the evaluation of the past development of prices (an indicator of perceived inflation) and expected inflation (future price development).
[4] This is exactly the case of pereceived inflation and its significant deviation form HICP.

markets: for goods, labour, money, financial assets and currencies. Decisions on these markets determine the current rate of inflation, nominal wage rates, interest rates, exchange rates as well as real variables such as the rate of unemployment. Expectations actually determine all types of economic behaviour, as human action is forward-looking. Such information, however, is difficult to compile for the simple reason that inflationary expectations are not directly measurable in a way similar to variables such as interest rates, monetary aggregates, rates of unemployment, consumer and producer prices, etc. The expectations of the future behavior of prices are held by individuals in their minds. A straight forward way to measure the inflation expectations of the public is to ask people about their expectations, and in fact, a few surveys do exactly that. In November 2002, it was decided to introduce two new questions into the Harmonized Consumer Survey for the European Union, thus adding to the number of surveys that explicitly ask a selection of respondents (representing the public at large) about their inflation perceptions and expectations. The two new questions were introduced on a voluntary and experimental basis. They aimed at obtaining point estimates of the perception and expectation, using a quantitative formulation on past (perceived) and future (expected) inflation." …….and *Lindén, S. (2005)* continues: "One obvious problem with these surveys is that the questions asked concern variables that are difficult to assess, or even understand. Inflation, for example, is a macro-variable measuring the aggregate price level, but as respondents' consumption baskets do not necessarily correspond to the one used for calculating the consumer price indices, the answers obtained with the surveys can differ substantially from the official inflation rates. This is often the case; surveys do in general result in showing perceptions and expectations that are very different from the actual rates".

The unit root test is made for each member country of the Eurozone individually. *Aucremann, Collin and Stragier (2007)* in their empirical analysis use the panel unit root test because of low power of unit root tests in short samples since in such cases they tend not to reject the null hypothesis, even if the latter is not true. The authors of this paper assume that there is a different economy structure and transmission mechanism affecting the agent behaviour in each Eurozone member state. The problem of an insufficient number of observations and unit root test robustness could be solved by individually estimated critical values based on the Monte Carlo simulation methodology, but the time series used cover 144 observations. Critical values used in this paper are sourced from *Hamilton (1994)* and depend on a sample size of 25, 50, 100, 250 and 500 observations.

6. Conclusions

The negative trade-off between inflation expectation errors and the unemployment gap is well known as the dilemma of monetary authorities´ expectations if the monetary policy is credible. Therefore, changes in monetary policies can be fully anticipated and have no effect on unemployment because the Phillips curve stays in its long-term vertical state. There could be a significant impact of credible monetary policy on anticipated inflation when the Phillips curve is stable with the nature of the unemployment level. This assumption is based on the classical hypothesis of perfect inflation expectations, in a rational expectations sense.

The rational expectation hypothesis and Lucas´s critique of the negative slope Phillips curve is a very strong argument for economic policy recommendations. Of course, the authors distinguish the rational expectation hypothesis from the adaptive expectation hypothesis. While the rational expectation hypothesis is based on the forward-looking expectations, the adaptive expectation hypothesis is associated with backward-looking expectations. In the empirical analysis the authors use inflation perceptions as well as anticipations and test if the current price level is different from the perceived and anticipated prices. The results presented in tables 3, 4 and 5 validate this hypothesis. Perceived or anticipated inflation differs from its current level (HICP) but returns back in the long-run. The adaptive expectation error does not vanish in the case of unit root / stationarity test, where lags are identified by Akaike´s information criterion.

The authors ask whether there is an impact on the differences between the current and perceived inflation on the other economic variables. The theoretical framework provided by the expectations-augmented Phillips curve indicates that if expectations of future inflation are totally accurate the current unemployment equals its natural level. The theoretical concept of rational expectations hypothesis then implies that the authority cannot expect to be able to systematically fool the public. If the economy is in a steady state, the agents understand that economic policy instruments' implementation and expansion of the nominal money supply does not push up aggregate demand in the short-run. There is a significant dichotomy between the real and nominal sector of the economy. The final conclusion of the rational expectations hypothesis leads to a assumption of the neutrality of money. The short term Phillips curve (Figure 2) identified in the Eurozone confirms the negative relationship between inflation and the unemployment gap, but its robustness is questionable. The argument for non-significant results or conclusions is based on the noise in the presented variables, caused by unexpected exogenous supply shocks.

In most of the Eurozone member countries (as well as in the Eurozone region) the gap between the current and perceived or anticipated inflation is not significant. This conclusion leads to the idea of

overrating the impact of inflation perceptions or anticipations on the economies. The role of the perceived inflation, like the exogenous shock that leads to the expected future consumption reduction, was rejected because the gap between its current and perceived level is not significant.

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