ANALYSIS OF THE ECB MONETARY POLICY MATCH FOR THE NEEDS OF THE EURO AREA COUNTRIES NEEDS

Tomas Reichenbachas*
Vilnius University, Lithuania

Abstract. *In this paper, using the Taylor rule (Taylor, 1993), the European Central Bank (ECB) monetary policy in 2000–2012, as well as individual interest rate needs of the euro area (EA) countries are analysed. It is assumed that the estimated Taylor rule interest rates are optimal for individual members. We have analysed whether the actual ECB interest rates and the calculated rates are different and have become more balanced towards individual countries' needs. The work focuses attention on the last period (2008–2012) when the EA faced economic problems and an asymmetric shock. The analysis shows controversial results: on the one hand, the interest deviation mean decreases (just a little), but an increasing gap between individual needs can be seen: some countries are becoming increasingly divorced from the general EA needs. It makes them very vulnerable, and there is a risk that these countries in the face of asymmetric challenges can be "left behind" by the ECB focusing on the EA as a whole. Also, in this paper, the stationarity of the calculated deviations is analysed to help understand their nature. This approach is new, and the author is unaware of similar works. Analysis of the optimal interest rate dynamics has revealed that Germany needed the interest rates that were opposite to the needs of Spain and Greece and susceptible to divergence, so this led to the ECB difficulties in determining the proper interest for all countries' needs. The EA as a currency area is most optimal for Belgium, Cyprus, Finland, France, Italy, and the Netherlands from the interest rate setting perspective.*

Key words: *the Taylor rule, optimal monetary policy, asymmetric shocks, optimal currency area*

Introduction

Before creating the euro area, there had been a number of economic and political discussions about the euro zone as a monetary union to match with its individual member states' economic interests. The theoretical basis for creating the euro area was the optimal currency area (OCA) theory (Mundell, 1961, 1973), but it did not analyse the broader theory of the Central Bank activities in this new area. The sole purpose of the Central Bank was understood to stabilize the inflation. The first Mundell's (1961, 1973) works were based on the efficient market hypothesis, so inflation rate differences in individual regions were misunderstood (it shouldn't be a problem because of free trade

* *Corresponding author*:
Economic Policy Department, Faculty of Economics, Vilnius University, Saulėtekio Ave. 9–11, LT-10222 Vilnius, Lithuania;
e-mail.: treichenbachas@gmail.com

and movement of goods), and the Central Bank's problem of determining the suitable interest rates was ignored.

The single European currency project received large support of economic theorists and politicians: they thought that it would lead to a convergence of economic indicators and business cycles; the asymmetric shock risk will decline, or even disappear. However, critics (Krugman, 1993) believed that the national currencies disappearance could lead to bigger differences (as a result of higher specialization), and the risk of asymmetry in the new formation may increase. However, this criticism was ignored or even ridiculed (e. g., McKinnon's (2004) response to Krugman (1993)). After the first few years' data and the project's success, the critical opinions were virtually eliminated.

It is natural that the countries that share the same currency have also the same monetary policy. The main lever of the monetary policy is the base interest rates allowing the Central Bank to determine (indirectly) the cost of borrowing across the currency union member countries. However, the interest rate not necessarily will be optimal for a specific country, and it may even undermine a country's economy. If one country were in the phase of an economic boom while others are in an economic downturn, it would be difficult to find a single suitable base interest rate. This problem had been known as asymmetric shocks in the economy, but it was thought that a long-term convergence would solve it. The European economic and monetary union relied on the economic convergence idea, and this seemed to be the case in the 2000–2007 economic data.

However, in 2007–2008 the European economy faced "the mother of all asymmetric shocks" (Krugman, 2012a), and the single currency project encountered problems. During the asymmetric shock, the ECB faced a dilemma: some countries needed an expansionary monetary policy, while others faced the rising prices (inflation) and needed a contractionary monetary policy. These problems were especially noticeable in 2011 when the ECB raised interest rates from 1% to 1.25% in an attempt to fight the inflation, while some countries still faced a high unemployment and an economic recession.

This paper aims to analyse the ECB monetary policy match to the euro area and its individual countries' economic interests (2000–2012). This study is particularly relevant for the euro area in the face of an asymmetric shock, but also for the analysis of the role of the monetary policy in the economic boom period (2000–2007).

The paper is structured as follows: in the first section, we analyse the approach of optimal monetary policy and the Taylor rule use in economic researches; the second part of the article focuses on the methodological approach and deals with the suitability and ways of using the Taylor rule and unit root tests for the existing data; the third section contains a comparative analysis of the EA countries' optimal monetary policy, and the final part of the paper presents a brief discussion of results and their place in the nowadays' economic discussion about the Eurozone asymmetric problems.

1. Interest rates' match for country's needs: theoretical approach

In the scientific literature, to examine monetary policy and its relationship with the countries' macroeconomic development, the Taylor rule is mainly used both for the interest rate and the CB action forecast and for a historical analysis of monetary policy (McCallum, 2000; Orphanides, 2001). It is also used as part of complex economic models (e. g., DSGE) to determine the impact of economic shocks on interest rates (Davig et al., 2005).

In the literature, there are other ways to analyse monetary policy, for example, the Theil index calculation for inflation differences (Šidlauskaitė, 2008), or simply an analysis of macroeconomic indicators and interest rate dynamics (inflation and unemployment regression model (Fair, 2001), but these techniques are not based on the economic logic, are less flexible and rarely used. Therefore, in the next section we will discuss the use of the Taylor rule as a method to determine the optimal interest rates for a country.

The Taylor rule is understood as a simple monetary policy rule describing how the Central Bank should set its own interest rate to manage and systematically respond to macroeconomic developments (Davig et al., 2005). In other words, the Taylor rule shows how the Central Bank has to change its nominal interest rate in response to inflation, economic growth, and other economic conditions. Monetary policy rules based on inflation targets are widely used in the literature, in the context of both closed and open economy models, but the Taylor rule is the best known example.

This rule was first proposed by John B. Taylor in 1993 (Taylor, 1993) and is based on the principle that the Central Bank seeks to ensure price stability and full employment. If the inflation is rising, the CB is forced to raise interest rates. On the other hand, if the economy faces a decline in GDP or deflation, it should lower the interest rates to stimulate the economy.

In most cases, this rule is simplified and simply states that a rise in inflation by 1% above the target should lead to the CB raising its nominal interest rate by more than 1% (this is called the Taylor principle), but the Taylor rule is a much broader and more comprehensive concept. This principle was confirmed by empirical studies (e. g., Clarida et al., 1999 and Woodford, 2001).

The concept of the Taylor rule (1) is shown below (Davig et al., 2005, Leith et al., 2002, Kohn, 2007):

$$r_{it} = \rho + \pi_{it} + \theta(\pi_{it} - \pi^*) + (1 - \theta)y_{it}, \tag{1}$$

where

r_{it} – Central Bank's base interest rate;

ρ – equilibrium interest rate in the country;

π_{it} – current inflation rate;

π^* – inflation target;

y_{it} – output gap;
θ – the coefficient indicating the inflation rate and the GDP growth importance as the CB goals (0 < θ <1), the higher θ means a higher priority in inflation.

The equilibrium interest rate (ρ) is commonly used as 2%; this was offered by Tailor (1993), but it was not as widely discussed as other components of the rule. This case is not an issue of theoretical studies (Davig et al., 2005, Leith et al., 2002), and a well-established tradition in empirical analysis (Taylor, 1993, Nikolsky-Rzhevskyy 2012, Poeck 2010); on the other hand, some authors propose to use a long-term government bond yield (e. g, the 30-year bond for the USA) as a better reflection of countries' equilibrium interest rates (Davig et al., 2005).

Measurement of inflation has also become a subject of scientific debate (Davig et al., 2005, Leith et al., 2002). Taylor (1993) proposed to use the GDP deflator which is widely used in empirical studies (Fair, 2000, McCallum, 2000 and Orphanides, 2001); on the other hand, for example, Leith et al. (2005) argue that the consumer price index (CPI) can react more rapidly to economic shocks than the GDP and inflation. Therefore, central banks should focus on the consumer price index-based inflation. There are also many empirical works based upon the CPI (Clarida et al., 1998, Gerlach et al., 2000, and Altavilla, 2000). Since the object of this paper is to analyse historical data, we will use the GDP deflator.

Analysing the θ coefficient, Taylor (1993) proposed the θ = 0.5 value, and it is used by the vast majority of empirical studies (Clarida et al., 1998, Gerlach et al., 2000, Altavilla, 2000). Analysing the Taylor rule, Poeck (2010) argues that it can be understood just as a weight sum of inflation and output gap variables. However, such an assessment is not appropriate, because the Taylor rule analyses also the inflation target and the equilibrium interest rate. Also, weights can vary depending on the CB priority changes; so, the Taylor rule can help determine the CB priorities' changes (e. g., in Davig, 2005 the θ coefficient change can mean a change in the CB policy priorities).

Some authors analysed also other potential values of the θ coefficient, which contribute to a better prediction of the CB economic policy (e. g., Breuss, 2002, Poeck, 2010). However, this search has raised a dilemma: a better coefficient θ for a short-term analysis can be found, but it is difficult to interpret this new rule whether it is really optimal. Some authors consider it as a change of the CB priorities (Davig et al., 2005), while others (Taylor, 2012, Nikolsky-Rzhevskyy, 2012) think that the CB interest rate deviations from the Taylor rule are economic policy mistakes, and the θ coefficient of variation distorts the sense of the Taylor rule this paper also supports this opinion).

Output gap measurement also had a lot of discussion; Taylor (1993) proposed to use the deviations from the linear trend, which are applied to this day. However, this method is open to criticism because severe economic downturns can change the past GDP cycles.

One of the ways to deal with it is to rely on moving averages based trend techniques such as the Hodrick–Prescott filter (Hodrick et al., 1997), which is used by Poeck (2010) and Arghyrou (2009) to replace the linear trend, but it also received some criticism: this technique is not appropriate for serious economic downturns (at deep downturns, it is difficult to evaluate whether the HP filter is appropriate, because its slope can be negative, which is against the economic logic). Others (Weidner et. al., 2009) use the unemployment data or other labour market indicators to measure the output gap. So, there is no consensus on this matter. This issue is especially relevant when using it in real time (Garratt, 2009), trying to predict interest rate changes. While using the Taylor rule for historical data analysis, this problem is not as urgent .

The Taylor rule is widely used to analyse the European Union: Breuss (2002), Fourcans et al., (2002), Sauer et al. (2003), Ullrich (2003); Gerlach-Kristen (2003)) examine the common euro zone monetary policy and its compliance with the EA interests as a whole. The EA-country differences were analysed by Poeck (2010), and national monetary policy developments before and after accession to the euro zone were analysed by Arghyrou (2009). However, these authors are rather declarative; the different countries' rate deviations are not seen from the optimum currency area theory perspective.

In summary, one can say that the Taylor rule as a monetary policy assessment system is adequately developed and used in economic studies, and it is widely seen in the optimal CB monetary policy terms. However, the authors do not hold a consensus on the Taylor rule coefficients' eligibility and often interpret them differently. According to Taylor (2012), "they say they‘re using the Taylor Rule, but they're not." In this paper, we will use Taylor's (1993) proposed rule to identify the differences between the EA countries' needs and the ECB monetary policy reality, i.e. whether the ECB can fulfil different countries' needs.

2. Methods and data

2.1. The Taylor rule and deviations from optimal interest rates

The Taylor rule as a concept is shown in equation (1); for the further study, an option proposed by Taylor (1993) in equation (2) will be used, where equilibrium interest rates in the country are set as (ρ) 2%, the CB preference coefficient as (θ) 0.5, and the CB target inflation rates as (π*) 2% (the ECB‘s target). In this case, the Taylor rule can be simplified as (3), often simply called the simplified Taylor rule, and it will be used for the further calculations:

$$r_{it} = 2 + \pi_{it} + 0.5(\pi_{it} - 2) + 0.5y_{it} \tag{2}$$

$$r_{it} = 1 + 1.5\pi_{it} + 0.5y_{it} \tag{3}$$

The output gap will be understood as deviations (y_{it}):

$$y_{it} = 100\frac{(\mathrm{Y_{it}}-Y_{it}^{*})}{Y_{it}^{*}}. \tag{4}$$

As a trend, a simple linear trend of real GDP will be used as proposed by Taylor (1993):

$$Y_{it}^{*} = a_0 + a_1 t. \tag{5}$$

To analyse the ECB's monetary policy and individual countries' needs, the deviations will be calculated ((6) as the actual ECB interest rates and optimal for countries' needs and (8) as the optimal ECB rates and optimal countries' rates)) (r_{ECBt} – the actual ECB interest rates[1]; r_{EUt} – the calculated optimal EA interest rates). However, both positive and negative deviations from the optimal rate are perceived as economic policy mistakes, but when calculating the averages they may not be noticed, so the absolute value (modulus) of the following deviations will be analysed[2] ((7) and (9)):

$$\varphi_{it} = (r_{ECBt} - r_{it}), \quad (6) \qquad ABS\varphi_{it} = ABS(r_{ECBt} - r_{it}), \quad (7)$$

$$\omega_{it} = (r_{EUt} - r_{it}), \quad (8) \qquad ABS\omega_{it} = ABS(r_{EUt} - r_{it}). \quad (9)$$

The ECB set interest rates and the estimated EA optimal interest rate differences would be considered as CB policy mistakes. However, these inconsistencies may hinder the ability to determine if it is possible to find optimal ECB rates for all EA countries, so differences between the optimal EA and the EA countries' interest rate needs (ω) (8) and absolute values (9) will be calculated.

2.2. The unit root hypothesis in economics

Economists debate whether various economic statistics, especially output, have a unit root or are trend-stationary (e.g., Lucke (2005) analyses output stationarity). A unit root process with a drift can be shown as in the first-order case:

$$z_t = z_{t-1} + c + e_t, \tag{10}$$

where c is a constant term referred to as the "drift", and e_t is the white noise. Any non-zero value of the noise term, occurring for only one period, will permanently affect the value of z_t as shown in Fig. 1b, so deviations from the line $z_t = z_{t-1} + c$ are non-stationary; there is no reversion to any trend line. In contrast, a trend stationary process is given:

$$z_t = ht + u_t, \tag{11}$$

---

[1] Average actual ECB interest rates at that time.

[2] In this case, we analyse the absolute deviation mean $AVG_t\varphi_i = \frac{\sum_t^{t=1} ABS(r_{EUt}-r_{it})}{t}$.

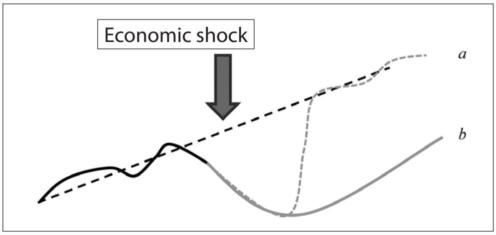


FIG. 1. **Unit root, economic shock, and trend**
Source: composed by author.

This is an example of a potential unit root. The black line represents an observed drop in a time series: *b* shows the path of recovery if the series has a unit root; *a* shows the recovery if there is no unit root and the series is trend-stationary. The grey line returns to meet and follow the dashed trend line while the *b* line remains permanently below the trend. The unit root hypothesis also holds that a spike in a time series will lead to higher data levels than the past trend.

where h is the slope of the trend, and u_t is the noise (white noise in the simplest case). Here, any transient noise will not alter the long-run tendency for z_t to be on the trend line as shown also in Fig. 1a. This process is regarded as trend–stationary, because deviations from the trend line are stationary.

To analyse a unit root, there are many tests (Elliott et al., 1996), but in our case we will use two tests: the augmented Dickey–Fuller (ADF) test and the Phillips–Perron (PP) test for the optimal ECB interest rate and optimal countries' interest rate differences (ω) (8). It would be preferable not to have a unit root, and it would mean that an individual shock to an individual country would lead to a return to the EA interest rate trend. The author of this paper does not know whether this approach has been ever used before.

In summary, it can be said that the EA countries will be divided into four groups (based on whether their differences (($ABS\omega$) (9)) during the period were higher than the EA average, and on unit root test results). It can be argued that from the interest rate setting perspective, the best suitable countries for a single currency are those that have deviations smaller than the average and have no unit root (*a*).

3. Results and their analysis

In Fig. 2, the ECB's benchmark interest rate and the estimated EA (12 countries) interest rates are shown. As we can see, in 2001–2008, the optimal interest rate was higher by almost 2% points, so in this case we can say that it was the ECB's mistake. On the other hand, if we use the output trend with GDP data only up to 2008, we can see that the situation is different, and the current ECB policy rates are considered to be too high. In this case, it is worth noting that the estimated rates of 2007 trend dynamics partially justify the need for an expansionary monetary policy, while the general trend shows that the 2011–2012 rates were optimal and consistent with the EA requirements. This issue held an extensive discussion in the U.S. (e. g., Nikolsky-Rzhevskyy et al., 2012 and Bernanke, 2010).

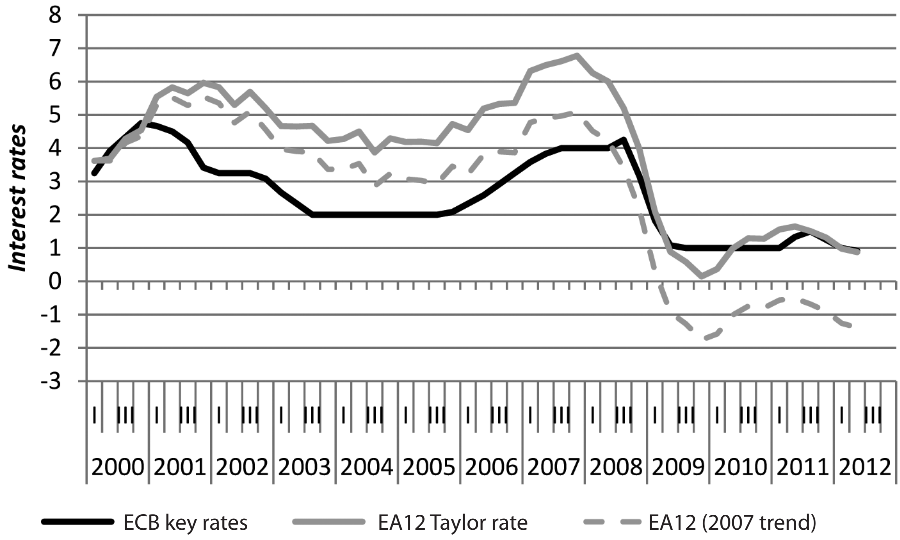


FIG. 2. **ECB monetary policy match of EA needs**

Source: composed by the author from calculations using the Eurostat (2012) and ECB (2012) data.

The output gap calculation and interpretation is a fairly controversial issue, so for the further study we will use all the available data (1995–2012 second quarter). On the other hand, we see that an analysis of the different countries' deviations is needed to compare them with not only the actual ECB interest rates, but also with the optimum (calculated). In other words, the φ_{it} and ω_{it} time series are different. However, if in Fig. 2 the ECB base and the calculated rates show no difference, the two time series would be equal ($\varphi_{it} = \omega_{it}$).

3.1. Analysis of interest rate differences

Table 1 shows that in the whole period (2000-2012Q2) actual ECB base interest rates did not correspond to interest rates of Estonia, Luxembourg, Slovakia, and Spain (were too low), while it was most suitable for interest rates of Austria, Finland, France, Germany, and Malta. It is important to note that in 2008–2012 the average deviation was the lowest, and this should indicate that the interest rate was most appropriate, but it is important to realize that in fact both the positive and negative deviations are the same mistakes of the ECB, so it is important to calculate the absolute values (Table 2). In 2008–2012Q2, the average (AVG12) deviation was -0.05, so it was close to 0, but the individual country deviations vary from 0, for example, Ireland (-6.07), Slovakia (5.39), so it just indicates asymmetry increase and the need of absolute deviations analysis.

It is also worth noting (Table 1) that the actual interest rate average was too high only for Germany in 2000–2007 and during the whole period (2000–2012Q2), while the 2008–2012Q2 interest rate average was too low. Such trends are exceptional, while in

TABLE 1. **Differences among the countries (estimated) and the euro area interest rates (actual and estimated)**

Country	ECB actual and countries' optimum				ECB optimal and countries' optimum			
	2000–2004	2005–2007	2008–2012Q2	2000–2012Q2	2000–2004	2005–2007	2008–2012Q2	2000–2012Q2
Austria	0.20	1.98	1.53	1.10	–1.51	–0.55	1.18	–0.31
Belgium	1.32	2.55	1.57	1.71	–0.39	0.02	1.22	0.29
Cyprus	2.68	4.57	1.94	2.87	0.97	2.04	1.59	1.45
Estonia	5.06	17.81	–0.09	6.26	3.35	15.28	–0.44	4.85
Finland	0.81	2.72	1.04	1.35	–0.90	0.19	0.69	–0.07
France	1.56	2.81	0.52	1.48	–0.15	0.28	0.17	0.07
Germany	–0.67	–0.33	0.48	–0.17	–2.38	–2.86	0.13	–1.59
Greece	2.35	4.59	1,60	2.77	0.22	2.06	1.14	1.05
Ireland	6.15	5.95	-5.72	1.83	4.45	3.42	-6.07	0.41
Italy	2.97	2.84	0.38	2.00	1.26	0.30	0.03	0.59
Luxembourg	2.50	8.00	3.28	4.12	0.79	5.47	2.91	2.67
Malta	-0.59	1.48	3.49	1.55	-2.72	-1.05	3.14	0.01
Netherlands	3.52	2.03	0.27	1.99	1.81	-0.50	-0.08	0.58
Portugal	4.69	3.39	-0.65	2.46	2.98	0.86	-1.00	1.04
Slovakia	6.75	10.82	5.74	7.36	5.04	8.29	5.39	5.95
Slovenia	0.77	4.86	1.07	1,86	-0.94	2.33	0.72	0.44
Spain	4.82	6.50	-0.62	3.27	3.11	3.97	-0.97	1.85
Euro area (EA12)	1.67	2.44	0.31	1.37	-0.04	-0.09	-0.04	-0.05
Euro area (EA17)	1.71	2.53	0.35	1.42	0.00	0.00	0.00	0.00
AVG (EA12)	2.52	3.59	0.31	1.99	0.77	1.06	-0.05	0.55
AVG (EA17)	2.64	4.86	0.93	2.58	0.88	2.33	0.57	1.13

Source: composed by the author from calculations (formulas 6 and 7) using the Eurostat (2012) and ECB (2012) data (output gap results are given in Appendix 1).
A minus (plus) sign indicates that ECB desired interest rate is too high (low) for the country concerned.

many countries the opposite trend was observed: in 2000–2007 interest rates were too low, while in 2008–2012Q2 they were too high (Estonia, Ireland, Portugal, and Spain).

Analysing Table 2, one can see that the policy of 2008–2012 was not optimal: it was becoming increasingly asymmetrical and did not meet the interests of many countries (the average of 1.94, while the whole period average was 2.09), so the improvement observed in the analysis of Table 1 is explained by the asymmetric shock; some countries required smaller interest rates while others higher ones. So, even if the average seems more optimal (Table 1), actually it is not (Table 2).

It is important to note the difference between the EA (12) and the EA (17). The newly joined (after 2001) euro-zone countries do not form a significant part of the EA economy, but they significantly worsen the mean interest rate (AVG (EA12) was 2.09, while AVG (EA17) was 2.72), so the ECB interest rates significantly failed to meet the economic interests of these new members (Fig. 3).

TABLE 2. **The differences between the countries' (estimated) and the euro area's interest rates (actual and estimated) (Absolute values)**

Country	ECB actual and countries' optimum (modulus)				ECB optimal and countries' optimum (modulus)			
	2000–2004	2005–2007	2008–2012Q2	2000–2012Q2	2000–2004	2005–2007	2008–2012Q2	2000–2012Q2
Austria	0.54	1.98	1.53	1.24	1.51	0.59	1.32	1.22
Belgium	1.36	2.55	1.57	1.72	0.92	0.68	1.41	1.04
Cyprus	3.12	4.57	2.29	3.17	2.13	2.04	1.90	2.02
Estonia	5.06	17.81	5.23	8.18	3.38	15.28	4.81	6.75
Finland	1.58	2.72	2.41	2.15	2.33	1.57	1.86	1.98
France	1.56	2.81	0.94	1.64	0.36	0.38	0.38	0.37
Germany	1.13	1.00	1.00	1.05	2.38	2.86	1.39	2.14
Greece	3.29	4.59	2.67	3.47	2.27	2.06	2.34	2.23
Ireland	6.15	6.05	5.77	5.99	4.45	3.98	6.11	4.93
Italy	2.97	2.84	1.08	2.26	1.26	0.60	0.80	0.94
Luxembourg	3.71	8.00	4.23	4.94	2.80	5.47	3.79	3.80
Malta	3.06	2.10	3.49	2.98	4.09	1.22	3.14	2.97
Netherlands	3.54	2.03	1.35	2.39	2.99	0.71	0.91	1.69
Portugal	4.69	3.39	1.13	3.10	2.98	1.07	1.41	1.96
Slovakia	7.65	10.82	6.02	7.82	7.00	8.29	5.53	6.78
Slovenia	2.10	4.86	3.82	3.38	1.69	2.57	3.54	2.57
Spain	4.82	6.50	2.04	4.22	3.11	3.97	1.61	2.78
Euro area (EA12)	1.72	2.44	0.55	1.47	0.07	0.09	0.05	0.07
Euro area (EA17)	1.73	2.53	0.60	1.52	0.00	0.00	0.00	0.00
AVG (EA12)	2.95	3.71	2.14	2.85	2.28	2.00	1.94	2.09
AVG (EA17)	3.31	4.98	2.74	3.51	2.68	3.14	2.48	2,72

Source: composed by the author from calculations (formulas 8 and 9) using the Eurostat (2012) data (output gap results are given in Appendix 1).
A minus (plus) sign indicates that the ECB desired interest rate is too high (low) for the country concerned.

Analysis of Fig. 3 shows that the spread maximums among the EA countries (maximum and minimum value differences) in 2001–2009 were similar. This is a clear trend of convergence, but in 2010 a divergence can be seen: the spread among the countries' demands for interest rates diverged. The absolute mean trend was different, and the asymmetric shock was felt less; the maximum value in 2011 was lower than in 2006. The conflicting data may be explained by the fact that convergence tendencies (mean) can be felt among many countries, but the "side" values increase and deviate from average (in 2010Q4, the maximum value was in Luxembourg and the minimum in Ireland).

Such trends are not favourable for the EA: small countries, potentially facing an adverse ECB policy, make no significant part of the EA economy and in this case may remain ignored, because the ECB will respond to the whole euro area needs where the biggest countries have the greatest influence. So, in 2011 the interest rates were raised in most unfavourable times, and the EA needs were most diverse in all the EA history.

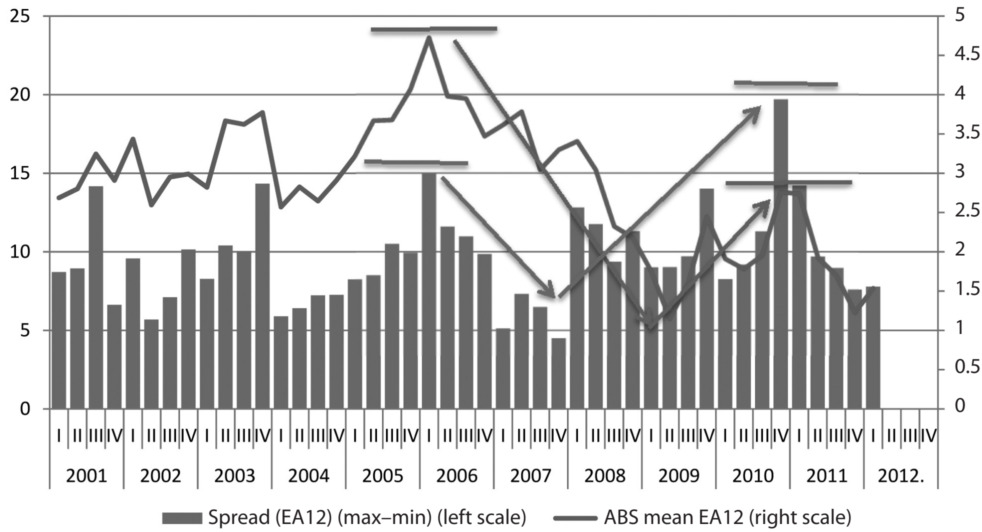


FIG. 3. **Absolute deviation mean values and differences (2001–2012Q1)**
Source: composed by the author.

3.2. Deviation unit root analysis

However, just an analysis of the existing differences is not sufficient to understand the ECB policy and the possibility to set "optimal" interest rates appropriate for all EA countries. Unit root tests show whether these deviations are random and tend to converge towards a common value or are affected by other economic processes (e.g., deviations have a long-term trend, impact, etc.). Naturally, the optimal situation would be if the deviations between a country's and the EA interest rates were random and tended to converge at 0 (the countries' needs of a particular interest rate would move to the optimal EA interest rate).

The ADF test for some data revealed an autocorrelation, so it was set to 0 in most cases and ignored.

Table 3 shows the ADF and PP test results of the calculated deviations between optimal national needs and the optimal interest for the EA (ω_{it} time series). Based on the data of Table 3 and Table 2, the countries were divided into four groups (Table 4).

Table 4 shows all the analysed countries divided into four quarters:

- **1st quarter**. Deviations below the mean of the EA12 countries, and these deviations are stationary. This is the "good" quarter: six countries (Belgium, Cyprus, Finland, France, Italy, and the Netherlands).
- **2nd quarter.** Deviations below the EA12 mean, but the processes are not stationary (Austria and Portugal).

TABLE 3. **Deviations of unit root test results**

Country	ADF test Critical value (10%) τ = −1.612573	Lag order	Phillips–Perron test Critical value (10%) τ = −1.612573	bandwidth	H_0 hypothesis was rejected by two tests
Austria	−0.638524	0	−0.726111	1	
Belgium	−1.910252*	0	−1.889352*	3	+
Cyprus	−2.657073**	0	−2.732588***	2	+
Estonia	−1.884493 −1.245000	4 0	−1.560400	5	
Finland	−1.750793*	0	−2.103333***	4	+
France	−1.190326 −3.493857***	4 0	−3.578878***	3	+
Germany	−1.324733 −0.861786	1 0	−1.007883	3	
Greece	−0.930260 −0.862914	4 0	−1.360431	3	
Ireland	−1.602182 −2.074499**	1 0	−1.843408*	4	+
Italy	−0.980267 −2.726964***	4	−2.594535**	5	+
Luxembourg	−1.265167 −3.016628***	4 0	−3.043544***	3	+
Malta	−2.407334**	0	−2.333162**	3	+
Netherlands	−2.263411**	0	−2.285206**	2	+
Portugal	−1.086902	0	−1.037339	4	
Slovakia	−2.282594**	0	−2.269069**	1	+
Slovenia	−1.673032* −1.770483*	5 0	−2.021113**	4	+
Spain	−0.836619 −0.409221	3 0	−0.511167	5	

Source: calculations by the author (no trend, no drift).
*** Confirmed with a 1% confidence interval.
** Confirmed with a 5% confidence interval.
* Confirmed with a 10% confidence interval.

- **3rd quarter**. Deviations are higher than the mean of the EA12, but the process is stationary (Ireland, Luxembourg, Malta, Slovakia, and Slovenia). It is worth noting that most (Malta, Slovakia, and Slovenia) of the newly joined countries are in this quarter.
- **4th quarter.** Deviations are higher than the mean of the EA12 countries, and these deviations are not stationary. This is the "bad" quarter (Germany, Greece, Spain, and Estonia). (In this case, it should be noted that for Estonia long-term data were used, even though it joined the bEA only in 2011).

TABLE 4. **Optimal countries for single currency area from the interest setting perspective**

	Unit root hypothesis was rejected (stationary data)	**Unit root hypothesis was not rejected**
Deviations are ***lower*** than the EA12 absolute deviation mean	Belgium *Cyprus* Finland France Italy Netherlands	Austria Portugal
Deviations are ***higher*** than the EA12 absolute deviation mean	Ireland Luxembourg *Malta* *Slovakia* *Slovenia*	Germany Greece Spain *Estonia*

–"good" quarter.

Source: composed by the author.
The countries that joined the EA after 2002 are in italics.

In summary, we can say that if the ECB would set its rates according to the Taylor rule, it would be optimal for six countries (Belgium, Cyprus, Finland, France, Italy, and the Netherlands), but for the rest it would not be appropriate in one way or another.

4. "Two-speed" Europe and the ECB policy issues (brief discussion)

In this section, we shall discuss the results, their relationship with the current situation in the euro area (2000–2012), and their influence on the academic discussion about the euro area crisis.

At a first glance, it may seem strange that Germany, which in 2008 survived the financial crisis relatively easily, is placed along with Greece and Spain which face difficulties (Estonia joined the euro area after the financial crisis). Explanations of this phenomenon can be seen as the "internal balance of payments crisis" (see, e.g., Krugman, 2012a, 2012b). In this paper, we do not analyse the body of this problem; we just see its shadows.

When analysing their economic growth (of course, this was associated with inflation and thus with optimal interest rates) the countries may be divided into two groups:

1. Countries that grew too slowly and at the same time faced a lower than average EA inflation (this is reflected in the ω time series). The interest rates for these countries were too high in 2000–2007, while the rate in 2008–2012Q2 was too low (Austria, Germany, partly Belgium, Finland, Malta, and France) (***Group I***).
2. Countries that grew faster but at the same time faced a higher than the average EU inflation (this is reflected in the ω time series). Interest rates for these countries from 2000 to 2007 were too high, while the rates in 2008–2012Q2 were too low (Greece, Ireland, Spain, Portugal) (***Group II***).

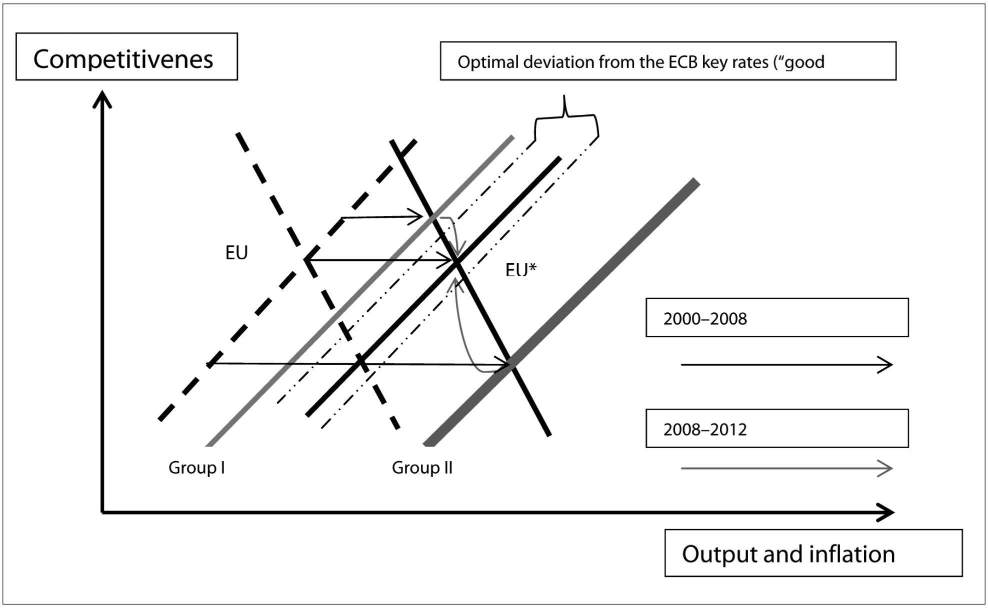


FIG. 4. **Inflation and competition dynamics in the EA**
Source: composed by author, lines represent supply and demand curves

The processes that took place over the whole period in these groups are different.

Group I countries (2000–2008) of the EA grew slower (and this led to lower inflation rates), which in turn led to the need for lower interest rates. In ***group II,*** countries (2000–2008) grew faster than the other eurozone countries, and they needed higher interest rates. Because of a higher growth and inflation rates, ***group II*** countries lost their relative price advantage (competitiveness), while ***group I*** countries took on the relative competitive advantage. The trends changed in 2008, bursting bubbles which led to the economic growth by 2008. ***Group II*** countries experienced a sharp economic downturn and needed an expansionary monetary policy. Meanwhile, ***group I*** countries' declines were less significant, and they were followed by a recovery (due to a relative price advantage). If these trends continue, the ECB role will be very complex. This confrontation was especially noticeable in mid-2011 when interest rates were raised (on April 13, 2011 the ECB, to fight the inflation, raised interest rates from 1% to 1.25% and on July 13, 2011 to 1.5%), although some countries (such as Greece, Spain) were (and are now) still facing a severe economic slump and high unemployment. This ECB policy trend changed in 2011, and at the end of 2012 the interest rates were gradually reduced to 0.75%.

In this case, the ECB faces the dilemma of whether to do as required by the aggregated EA data (as it was done in 2011) or take into account the difficulties of individual countries, but by doing so the ECB should partly ignore the inflation threat. A huge problem is the "out of touch" countries, especially in the case when their economic weight in the EA is low. The fact that the individual countries' problems and spreads increase while the overall EA gravitates towards convergence (Fig. 3) shouldn't be ignored. Over time, these problems may be aggravated, and countries facing these problems may be left "stranded".

The possibility of asymmetric Europe problems is not new in the academic literature (e g., Krugman in 1993 had identified the potential problems long before the creation of the EA). The European Union officials tend to fiscal rules which in the long term should resolve these problems, although it does not receive an explicit support in academic circles. Krugman (2012b) raised the idea that the inflation target in the euro area should be above 4%; this would leave more room for the ECB manoeuvrability, especially given the deep underlying problems in the EU (e.g., the problem of labour market rigidities, which is practically impossible to solve). Meanwhile, a higher inflation target in the long run may help "grow out" of the current differences in competitiveness (4% inflation target instead of 2% would lead to 1% lower optimal interest rates for the EA, and this would support problematic countries).

Conclusions

In this paper, the individual EA countries' monetary policy needs and the actual and optimal ECB policy in 2000–2012Q2 are analysed. The interest rates calculated by the Taylor rule are considered to be optimal for individual countries. The analysis of individual countries' needs revealed that in (2000–2012Q2) most in line with the actual ECB benchmark rates were the needs of Austria, Finland, France, Germany, Malta, while most out of line were the needs of Estonia, Luxembourg, Slovakia, Spain, Greece, and Portugal.

The analysis of the optimal EA's and individual members' interests has shown that the ECB faces the problem of setting the optimal interest rates for the needs of all EA members, because their need tend to be asymmetrical. Separate countries' needs deviations increase (extreme values), which leads to the ECB dilemma (like the mid-2011 interest rate rise, while some countries still faced the economic slump). If in the long term the needs of individual countries differ significantly from the EA needs, they are likely to be ignored, and the ECB will set the interest rates that suit the EA but not its countries' needs.

In this paper, a way to measure the individual countries' suitability for the EA is proposed from the interest rate setting perspective: the calculated interest rate should be below the EA12 mean, and the deviation from the optimal EA12 rates should be stationary. In individual countries, needs of interest rates differ, and an analysis of these deviations' unit root has revealed that countries most suitable for a single currency are Belgium, Cyprus, Finland, France, Italy, and the Netherlands. Meanwhile, Greece, Spain, Germany, and Estonia did not meet any criteria. Also, Germany had the needs of interest rates that were opposite in nature from the needs of Spain and Greece (Spain and Greece during 2000–2008 had to have a higher interest rate, while during 2008–2012 the interest rate should have been lower, and for Germany *vice versa*).

REFERENCES

Arghyrou, G. M. (2009). Monetary policy before and after the euro: evidence from Greece. Empirical Economics, Vol. 36, p. 621–643.

Bernanke, B. (2010). Monetary policy and the housing bubble. Speech delivered at the American Economic Association Meetings, January 3.

Breuss, F. (2002). Was ECB's monetary policy optimal? Atlantic Economic Journal, Vol. 30, issue 1, p. 298–319.

Clarida, R., Gali J., Gertler M. (1999). The science of monetary policy: A new Keynesian perspective. Journal of Economic Literature, Vol. 47, p. 1661–1707.

Davig, T., Leeper E. (2005). Generalizing the Taylor principle. NBER working paper series, Working Paper No. 11874.

ECB (2012). Key ECB interest rates [accessed 2013-01-19]. Eurostat website. Available online: <http://www.ecb.int/stats/monetary/rates/html/index.en.html>

Elliott, G., Rothenberg, T. J., Stock J. H. (1996). Efficient tests for an autoregressive unit root. Econometrica, Vol. 64, issue 4, p. 813–836.

Eurostat (2012). Eurostat Statistics Database [online], [accessed 2013-01-19]. Eurostat website. Available online: < http://epp.eurostat.ec.europa.eu>.

Fair, C. R. (2001), Actual Federal Reserve Policy behavior and interest rate rules. Economic Policy Review, Vol. 7, issue 1, p. 61–72.

Fourcans, A., Vranceanu, R., (2002). ECB Monetary policy rule: Some theory and empirical evidence, ESSEC, Working paper, No. 02008.

Garratt, A., Mitchell J., Vahey P. Sh. (2009). Measuring output gap uncertainty. ECB [online], [accessed 2013-03-10]. Available on-line: <http://www.ecb.int/events/conferences/shared/pdf/mitchell_measuring_output_gap.pdf?9001be3562673bf36aaa5180ae97c813>

Gerlach-Kristen, P. (2003). Interest rate reaction functions and the Taylor rule in the Euro area. ECB Working paper No. 258.

Hodrick, R., Prescott C. E. (1997), Postwar U.S. business cycles: An empirical investigation. Journal of Money, Vol. 29, Issue 1, p. 1–16.

Kohn, D. L. (2007). John Taylor rules. BIS Review, No. 116, p. 1–7.

Krugman, P. (1993). Lessons of Massachusetts for EMU. In: F.Torres, F. Giavazzi (eds.). Adjustment for Growth in the European Monetary Union. Cambridge University Press, New York, p. 241–261.

Krugman, P. (2012a). End This Depression Now! New York: WW Norton & Co.

Krugman, P. (2012b). Revenge of the Optimum Currency Area. In: NBER Macroeconomics Annual Conference, Volume 27, p. 1–15.

Leith C., Wren-Lewis S. (2002). Taylor rules in the open economy. Oxford Bulletin of Economics and Statistic. Vol. 63, issue 2, p. 209–231.

Lucke, B. (2005) Is Germany's GDP trend-stationary? A measurement-with-theory approach. Journal of Economics and Statistics, Vol. 225, issue 1, p. 60–76.

McCallum, B. T. (2000). Alternative monetary policy rules: A comparison with historical settings for the United States, the United Kingdom, and Japan. NBER Working Paper No. 7725.

McKinnon, R. (2004). Optimum currency areas and key currencies: Mundell I versus Mundell II. Journal of Common Market Studies. Vol. 42, issue 4, p. 689–715.

Mundell, R. A. (1961). A theory of optimum currency areas. American Economic Review, Vol. 51, p. 509–517.

Mundell, R. A. (1973). A Plan for a European currency. In: H.G. Johnson and A.K. Swoboda, The Economics of Common Currencies, Allen and Unwin, p. 143–172.

Nikolsko-Rzhevskyy, A., Papell, H. P. (2012). Taylor's Rule versus Taylor Rules. International Finance, Vol. 16, issue 3.

Orphanides, A. (2001). Monetary policy rules, macroeconomic stability and inflation: A view from the Trenches". European Central Bank Working Paper No. 115.

Phillips, C.B, Perron P. (1988). Testing for a unit root in time series regression. Biometrika, Vol. 75, issue 2, p. 335–346.

Poeck, A. (2010). One money and sixteen needs: has the ECB's monetary policy become more balanced towards the needs of the member states?. *De Economist*, Vol. 158, issue 1, p. 43–60.

Sauer, S., Sturm, E. (2003). Using Taylor rules to understand ECB monetary policy. CESifo, Woriking paper No. 1110.

Šidlauskaitė B., Šeputienė J. (2008). BVP ir infliacijos kitimo skirtumų ir bendros pinigų politikos optimalumo sąryšis. Ekonomika ir vadyba: aktualijos ir perspektyvos, Vol. 13, issue 4, p. 367–373.

Taylor, J. (1993). Discretion versus policy rules in practice. Carnegie-Rochester Conference Series on Public Policy, p. 195–214.

Taylor, J., Williams, J. (2010a). Simple and robust rules for monetary policy. In: Benjamin Friedman and Michael Woodford (eds.), Handbook of Monetary Economics, volume 3, p. 829–859.

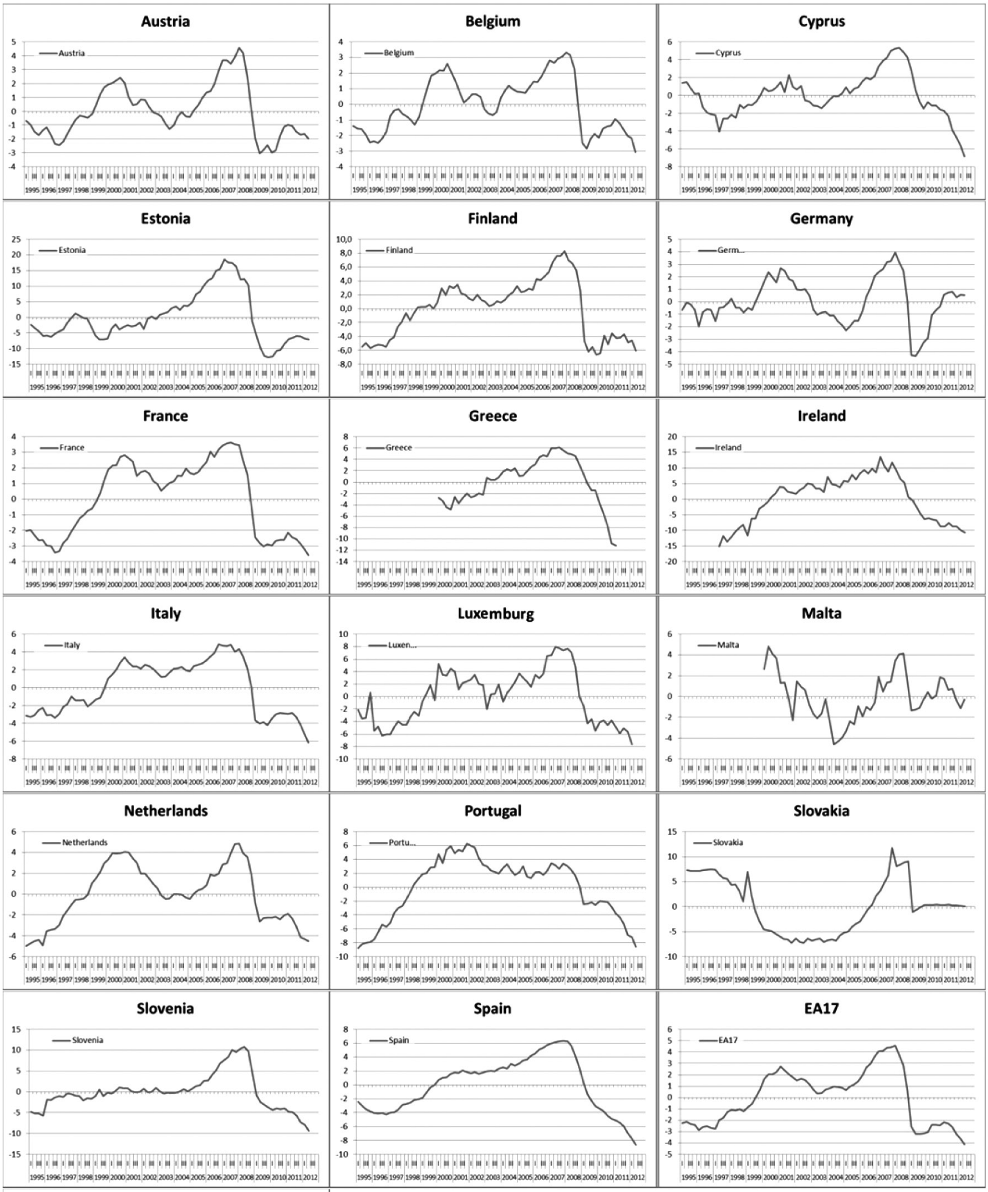
Taylor, J. (2010b). Getting back on track: Macroeconomic policy lessons from the financial crisis. Federal Reserve Bank of St. Louis Review, May/June, 165–176.

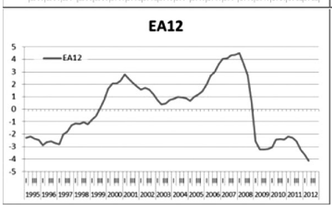
Ulrich, K. (2003). A comparison between the Fed and the ECB: Taylor rules. ZEW Discusion Paper, No. 03–19.

Weidner, J., Williams, C. J. (2009). How big is the output gap? FRBSF Economic letter[accessed 2013-03-10]. Available online: <http://www.frbsf.org/publications/economics/letter/2009/el2009-19.pdf>

Woodford, M. (2001). The Taylor rule and optimal monetary policy". American Economic Review, Vol. 91, issue 2, p. 232–237.

APPENDIX 1. **Authors' estimated output gaps**





Source: composed by the author from calculations using the Eurostat (2012) data.