Monetary Policy in the Eurozone: Evaluating the European Central Bank's interest rate decisions and the needs of member states using a Taylor rule

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Abstract: The policies of the European Central Bank and its limitations have been at the core of a debate over the viability of the Eurozone that has only intensified during the area's current economic crisis. What is the significance of "one size does not fit all"? This paper studies the monetary policy decisions of the European Central Bank and how well they suit the needs of the member states using a basic Taylor Rule. It then investigates the impacts of these differentials on the various different crises that are plaguing the Euro area.

I.   Introduction

Since the creation of the Euro in 1999, there has been a longstanding debate about the effects of the monetary union on its member countries. The recent economic crisis has intensified this debate and the questioning of the long-term viability of the Eurozone as "the prospect of a breakup of the euro is increasingly viewed as possible."[1] While the potential fiscal and political causes of the Eurozone's current predicament are important in analyzing the state of Europe's economies, focusing on the arenas of monetary policy and European Central Bank decision making may also provide valuable insights regarding Europe's recent concerns.

One major question is whether the European Central Bank's policies are optimal for all the countries in the Eurozone or if they disproportionately favor certain countries in the monetary union at the expense of others. For example, last year's decision to increase the interest rate led to criticism that the ECB is "tightening when only Germany even arguably needs it."[2] It has also been argued that a recent increase in interest rates is what turned Greece's liquidity problem into an overall solvency issue.[3] These beliefs and other attacks have led many to target the European Monetary Union as the cause of Europe's problems, claiming it as the culprit for a number of woes such as "the sovereign debt crisis in several countries, the fragile condition of major European banks, the high levels of unemployment, and the large trade deficits that now exist in most Eurozone countries"[4].

The purpose of this study is to investigate the alignment between the interest rate set by the European Central Bank and the interest rate that may be considered "optimal" for specific

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[1] Shambaugh, Jay C. "The Euro's Three Crises." (Brookings Papers on Economic Activity 12 March 2012) 1.
[2] Krugman, Paul. "One Size Fits One, Redux (Wonkish)." (New York Times 15 June 2011).
[3] Feldstein, Martin S. "The Euro and European Economic Conditions." (NBER Working Paper Series 2011).
[4] Feldstein 2011 1.

members of the Eurozone using a Taylor rule as a model for optimal interest rate decisions. In addition to shedding some light on how well the ECB rate suits member states, making progress in the evaluation of the Eurozone's ability to provide a suitable solution best for all of Europe is of import because "the flaws in the euro zone are almost exactly analogous to the flaws in the international monetary system."[5]

As the European Central Bank is tasked with not only maintaining price stability, but also "supporting economic growth and preserving financial stability, provided price stability is achieved,"[6] the use of a Taylor rule function, "where the ECB responds to deviations from the inflation objective as well as economic activity," is to some extent an accurate reflection of the European Central Bank's goals and priorities.[7] It is through the concept of the Taylor rule and measuring the "stress" created by the central banks' decisions that this investigation aims to analyze Europe's predicament. These methods have been investigated in various alternative forms in recent literature.

II.   **Background and Literature Review**

The European Central Bank is "responsible for monetary policy in the euro area"[8] and began with its mission of controlling inflation in the Eurozone, with its target inflation rate set at below 2 percent. It should be noted that "The official policy stance of the ECB is that monetary

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[5] Eichengreen, Barry. "Implications of the Euro's Crisis for International Monetary Reform." (Allied Social Science Associated Meetings 2012) 1.

[6] Collignon, Stefan. "Despite past criticisms, the European Central Bank has prevented a meltdown of EU banks and helped to stave off a global depression." (LSE 14 January 2012).

[7] Collignon.

[8] Fendel, Ralf M. and Frenkel, Michael R. "FIVE YEARS OF SINGLE EUROPEAN MONETARY POLICY IN PRACTICE: IS THE ECB RULE-BASED?" (Contemporary Economic Policy Vol. 24 No. 1 January 2006) 106.

policy decisions are reflective of changing economic conditions of the euro area as a whole, and do not reflect the diversity among the national economies."[9]

When looking at the Euro area as a whole, some have found the European Central Bank effective and successful in this goal of price stability. Stefan Collignon suggests that the ECB under Trichet "was remarkably successful in achieving price stability"[10] with inflation (outside of food/energy in 2006/7) close to the ECB's target rate of 2%.[11] He also argues that Trichet's response to the global economic crisis has been effective and justified with its slashing of rates consistent with the "Trichet reaction function."[12] Another study of inflation in the Eurozone found that while Euro area inflation has mostly been close to 2%, some countries, such as Ireland, Greece, and Spain, experienced higher inflation after the creation of the Euro, exposing them to competitiveness issues.[13]

This look at inflation differentials between countries is critical to understanding the dynamics of the current Euro area situation as "in the absence of … nominal exchange rate adjustment and the presence of low labour mobility," inflation differentials play an important role as "a macroeconomic adjustment mechanism."[14] However, if these differentials are caused by "structural inefficiencies in factor markets," they could have "negative implications for the "competitiveness of high-inflation countries."[15] The causes of these inflation differentials generally fall into one of five categories, "(1) convergence, (2) business cycle differences, (3)

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[9] Lee, Jim and Crowley, Patrick M. "Evaluating the stresses from ECB monetary policy in the euro area." (Bank of Finland Research Discussion Papers 2009) 9.
[10] Collignon.
[11] Collignon.
[12] Collignon.
[13] Lopez, Claude and Papell, David H. "CONVERGENCE OF EURO AREA INFLATION RATES." (Bank of France Working Papers 2011) 4.
[14] De Haan, Jakob. "Inflation Differentials in the Euro Area: A Survey." (*The European Central Bank at Ten* 2010) 11.
[15] De Haan 12.

asymmetric demand and supply shocks …, (4) characteristics of domestic product, labor and other factor markets, and (5) wage and price rigidities. Additionally, inflation differentials in the euro area "have a destabilizing effect on monetary policymaking" as countries with 'high inflation rates experience relatively low real interest rates" which lead to even higher inflation rates by boosting aggregate demand.[16] Since these differentials "cannot be affected by monetary policy directly, since there cannot be any regionally oriented monetary policy in a currency union,"[17] national fiscal policy becomes quite important. De Haan Suggests that "governments should prevent discretionary policy measures from acting pro-cyclically over the business cycle, … exacerbating divergence across countries after asymmetric shocks," a concern related to the austerity issues to be investigated later.

Studying inflation differentials hints at the connection between inflation alignment and issues such as trade imbalances that exacerbated the 2008 crisis in Europe[18] and also provides some information regarding the differences in the Taylor Rule recommended rates of the Eurozone countries as they are driven by how "inflation rates and, more importantly, national economic output and unemployment vary significantly within the euro area."[19] These differences between member states are well noted – Kirkegaard indicates that "Europe's monetary union was launched in 1999 comprising of a set of countries that were far more diverse in their economic fundamentals and far less economically integrated than had been envisioned."[20] Because of these

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[16] De Haan 17.
[17] De Haan 28.
[18] Lopez and Papell 23.
[19] Nechio, Fernanda. "Monetary Policy When One Size Does Not Fit All." (FRSB Economic Letter 14 June 2011).
[20] Kirkegaard, Jacob Funk. "The Euro Area Crisis: Origin, Current Status, and European and US Responses." (Peterson Institute for International Economics 27 October 2011) 3. < http://www.piie.com/publications/testimony/kirkegaard20111027.pdf>.

differences among member states, "It appears likely that regional interests will play a role in a monetary union such as the EMU, which … consists of largely autonomous states."[21]

There is a robust literature base utilizing the concepts of the Taylor Rule to evaluate the efficacy of the European Central Bank's decision process and decisions themselves. The utility of using a Taylor rule to model central bank decision making is well documented as Nechio suggests that "The literature shows that this simple rule or close variations approximate fairly well the policy performance of several major central banks in recent years."[22] Other studies "find no evidence to reject the hypothesis that the ECB has been responding to inflationary pressures in line with the Taylor's original specification"[23] and report that "forecasters believe that the ECB responds to the expected inflation rate and the expected output gap in the way the Taylor rule suggests."[24] In addition, Nechio asserts that "Although Taylor rule recommendations for the euro area have been consistent with the ECB's target rate movements since 2005, the question remains as to what rates the Taylor rule recommends for individual euro-area member countries," indicating how this study and its focus on the Taylor recommended rates of individual euro area countries may be a useful supplement to the current literature base. It should be noted however, that even if Taylor rules are useful ways to analyze ECB behavior and proxy optimal rates, "this does not necessarily imply that the rules are optimal."[25] That is, the Taylor rule used for this analysis is not necessarily optimal for euro area policymaking (for reasons

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[21] Hayo, Bernd and Méon, Pierre-Guillaume. "Behind closed doors: Revealing the ECB's Decision Rule." (MAGKS Joint Discussion Paper Series in Economics 2011) 2.

[22] Nechio.

[23] Blattner, Tobias S. and Margaritov, Emil. "Towards a Robust Monetary Policy Rule for the Euro Area." (European Central Bank Working Paper Series June 2010) 15.

[24] Frenkel, Michael, Lis, Eliza M., and Rülke, Jan-Christoph. "Has the economic crisis of 2007-2009 changed the expectation formation process in the Euro area?" (Economic Modeling 28 2011) 1812.

[25] Fourçans, André and Vranceanu, Radu. "The ECB interest rate rule under the Duisenberg presidency." (European Journal of Political Economy Vol. 20 Issue 3 September 2004).

mentioned in "risks"), but rather used as a tool to observe fit with a previous study (Nechio 2011) as a benchmark and guide.

Nechio's own conclusion, when grouping euro zone countries into the "core" and the "periphery," is that from mid-2008 onward, "the ECB's actual policy rate is well above the rate recommended by the Taylor rule for the periphery, but below the Taylor rule recommendation for the core" because "the peripheral countries are still struggling to recover from the sovereign debt crisis."[26] From this she asserts that "When members of a monetary union are experiencing different macroeconomic conditions, a single policy rate is unlikely to fit circumstances in all countries."[27] Previous studies have found similar results. Heinemann and Huefner refer to a study by Faust et al. in which they "simulate individual interest rates across EMU countries using a Taylor rule with estimated coefficients for the Bundesbank and national data. In this way they show large discrepancies across EMU countries."[28]

If it is the case that the European Central Bank's rates cannot adequately address the economic situations in all the member states, a number of concerns arise. Unlike the United States, high labor mobility and fiscal policy "may not be fully available to the euro area's heavily indebted peripheral countries."[29] These differences have implications on EMU expansion as well as "While today most of the members of Euroland probably find that the interest rate decisions of the ECB are consistent with their national economic conditions most of the time, this may no longer be the case in an enlarged EMU."[30] Further implications of these differences and the

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[26] Nechio.
[27] Nechio.
[28] Heinemann, Friedrich and Huefner, Felix P. "Is the View from the Eurotower Purely European? National Divergence and ECB Interest Rate Policy" (Centre for European Economic Research October 2002) 4.
[29] Nechio.
[30] De Grauwe, Paul. "The Challenge of the Enlargement of Euroland." (HM Treasury 2002) 66. <(http://62.164.176.164/d/adkent03_678910_418.pdf)>.

additional concerns of the structure of the Economic and Monetary Union are discussed in "implications" section.

III.   Methodology

This paper uses a method based on Fernanda Nechio's "Monetary Policy When One Size Does Not Fit All" in order to investigate how well the European Central Bank's interest rate matches the Taylor Rule optimum of each individual country. The same basic Taylor Rule structure is utilized:

Target policy interest rate = 1 + 1.5 x Inflation – 1 x Unemployment gap.

However, rather than using the unemployment gap, this study uses the output gap, an alternate measure of resource slack for which policy rules must "incorporate a sufficiently strong response."[31] The policy rule's general form ($i_t = \pi_t + r_{t*} + a_\pi (\pi_t - \pi_t^*) + a_y(y_t - \underline{y}_t)$) yields the coefficients and constant (of 1) stated above through the assumption that the natural rate of interest is 2%, using $a_\pi = .5$ and $a_y = 1$. In addition, rather than grouping countries into the core and peripheral, I attempt to isolate the Taylor Rule rates for a number of individual countries in the Eurozone to better identify those with significant stress levels during the Euro period and investigate trends that may have affected the direction of the Taylor recommended rate.

Data were gathered through the OECD's statistics database. Inflation numbers were available on a quarterly basis. Quarterly GDP data were obtained from the same OECD source and had already been seasonally adjusted by the OECD. To estimate potential output, I used a Hodrick-Prescott filter on quarterly GDP from 1998-2011 with a λ of 1600. These output gap and inflation numbers are used to calculate quarterly Taylor rates for each of the countries. The

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[31] Yellen, Janet L. "The Economic Outlook and Monetary Policy." (Speech at Money Marketeers of New York University, New York 11 April 2012).

quarterly rates were then compared to the ECB's interest rates during the corresponding periods

in which the Taylor rule decisions would have been made. To account for the different temporal

spacing of the quarterly Taylor rates and the monthly Central Bank interest rate decisions, the

rates are laid out on a continuous timeline for comparison and stress levels are also calculated at

each ECB decision date as per the ECB website. This paper draws on Lee and Crowley's

interpretation that ""policy 'stress' refers to the extent to which actual policy deviates from the

recommended policy. In the case of the ECB, its policy at a given period may not necessarily be

appropriate for each of the euro area member states or what they individually would prefer."[32]

IV.   Results and Analysis

An introductory inspection of the ECB interest rate and the European countries' Taylor

rates shows the interest rate lower than recommended for many countries during a large portion

of the initial Euro era. A paired t-test was performed to check the probability that the difference

between the ECB rate and Taylor recommended rates for each country was 0. The results

suggested that the differences were statistically significant in all cases except that of Switzerland

(included to provide a reference of a country not in the EU or EMU), a member of the European

Free Trade Association but not the European Union or Monetary Union.[33] The specific cases of

Germany, Greece, Ireland, Spain, Italy, Portugal, Finland, France, the Netherlands, the Czech

Republic, and the UK are explored in more detail. It should be noted that due to the concerns

about the accuracy of the HP filter towards the end of data sets (an issue to be discussed in more

detail in the "risks" section), the qualitative analysis of each of the trends in the Taylor rates of

each of these important example countries will put a limited amount of weight on the late 2010-

2011 results and will mention conclusions with some concern for those issues. For the purpose of

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[32] Lee and Crowley 2009 10.
[33] "Eurozone." http://en.wikipedia.org/wiki/

this analysis, the magnitude of the stress levels refers to the absolute value of the deviation of the Taylor recommended rate from the ECB rate.

A. Germany
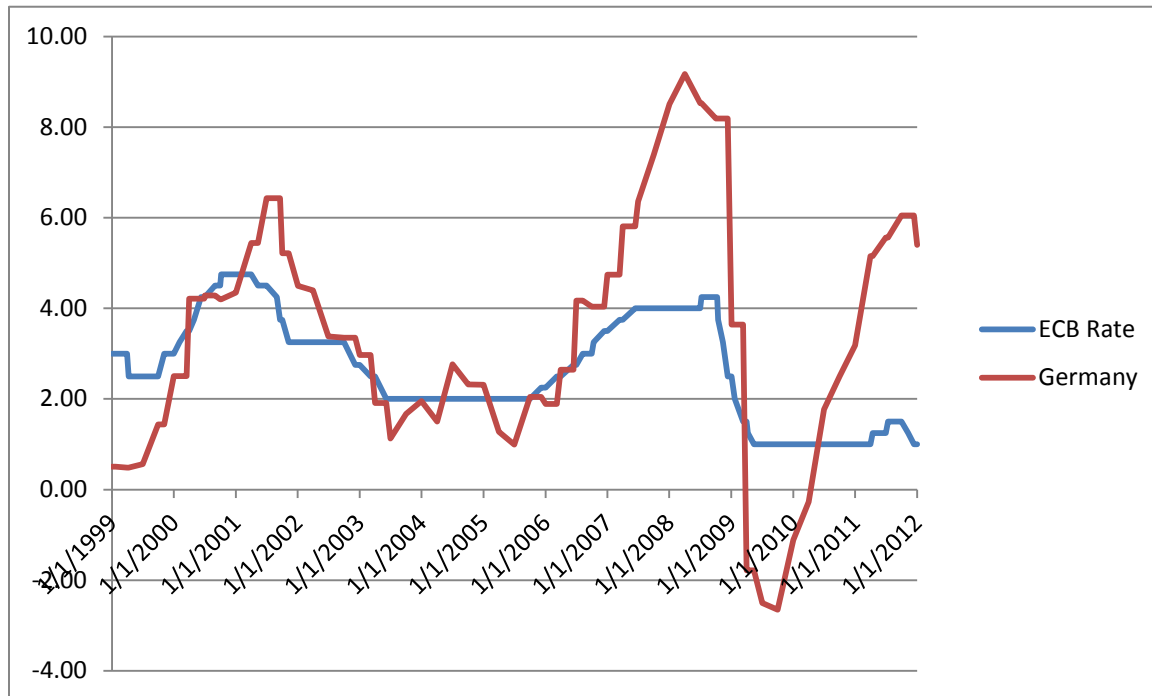
For Germany, the ECB interest rate was generally close to the Taylor recommended rate until 2006, when the magnitude of stress levels became substantially larger. A calculation of the mean of the magnitudes of the stress levels at each European Central Bank decision point showed an average difference of 2% (measured to be below or above the ECB rate). The Figure shows the nature of the closeness between the ECB rate and the Taylor recommended rate for Germany. The recommended rate is generally close to the ECB rate for the first 7 years of the Euro period. From 1999 until late 2007, Germany can be characterized as having low inflation (almost always below 2% during this period) and an output level higher than the potential output estimated by the Hodrick-Prescott filters. After this period, the recommended rate falls

dramatically as output falls below potential, possibly as a result of the global economic recession during this time. The recommended rate again rises above the ECB rate towards late 2010 and 2011, about the time in which the ECB raised its interest rate "for the first time since the 2008 financial crisis."[34]

B. Greece
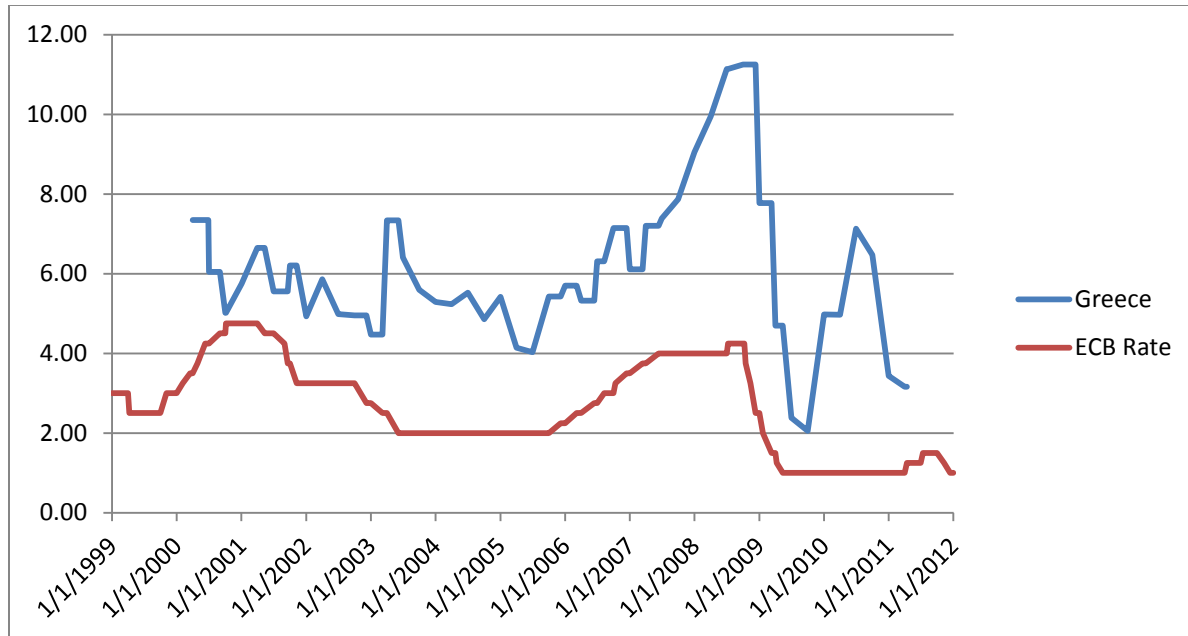
After studying the "anchor" of the European Central Bank, Germany and its generally "strong and stable" economy, we turn to a look at Greece, a country with some noted troubles during the recent financial crisis. It should be noted that while Greece joined the Eurozone in 2001, the graph shows data for the country starting from 2000. The rationale for this is to provide a look into how the ECB rate "would have fit" had Greece been a part of the Eurozone during this time, with the assumption that the ECB rate would not have changed due to that inclusion. The graph for Greece shows a recommended Taylor rate universally higher than the ECB interest rate with an average magnitude of deviation of 3.80 (and 4.09 after entry into the euro area).

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[34] Nechio 1.

While this may be plausible when considering the trend of high inflation reflected in the data set, there is almost universal consensus that the Greek rate should have been at or lower than the ECB rate during the financial crisis as "the Greek crisis has delayed and complicated the ECB's exit from the current low interest rate stance in several crucial ways."[35] These tensions raise the possibility that the Taylor rule used may not accurately depict the ideal rate for Greece, potentially partially due the use of the HP filter. However, the directional trend of the recommended rate seems to follow the generally accepted trajectory of Europe's "peripheral countries" during the financial crisis period. One potential change that may optimize the Taylor recommended rate for Greece may be a lower coefficient for Greece's inflation, as it is possible that in times of economic crisis banks worry less about inflation and more about other economic trends (output, etc.). When evaluating the fit of Greece within the euro area, Bergsten and Kirkegaard suggest that while "Italy has previously achieved dramatic adjustment, notably to qualify for the euro in the first place … Greece never did so and its ability to remain within the zone is clearly more problematic."[36]

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[35] Gerlach, Stefan. "The Greek Sovereign Debt Crisis and ECB Policy." (European Parliament Committee on Economic and Monetary Affairs 8 June 2010) 5.

[36] Bergsten, C. Fred and Kirkegaard, Jacob Funk. "The Coming Resolution of the European Crisis." (Peterson Institute for International Economics Policy Brief January 2012) 10.

C. Ireland
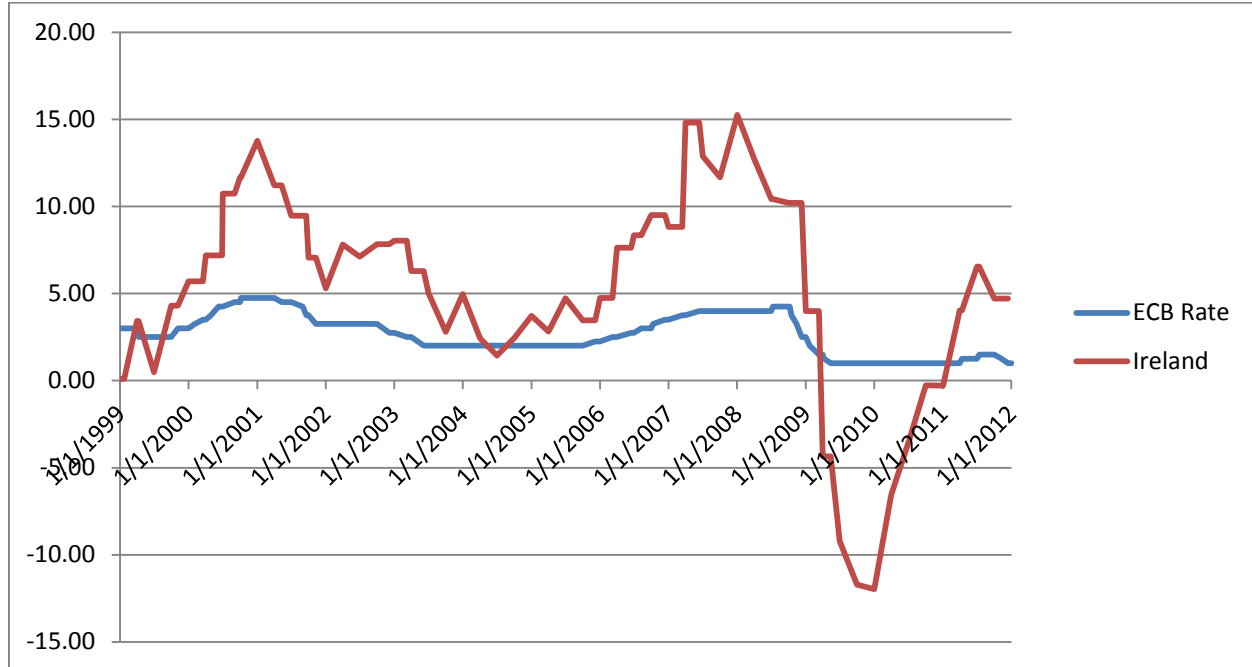
Ireland's graph shows a significantly higher deviation of the Taylor recommended rate from the ECB rate than Germany at 4.50. This can be attributed to high levels of inflation in Ireland during the early parts of the EMU era. In addition, the global economic crisis seems to have caused significant problems in Ireland, which explains the dramatic dip in the Taylor recommended rate during those years. This inflation difference and higher recommended rate is noted in other studies.[37] One study suggests that the "the fitted interest rate for Ireland was on average over six percentage points higher than the actual ECB interest rate."[38] Evidence of Irish authorities' opinions on the matter are presented as one official suggests ""It's no secret that we would prefer higher interest rates," adding that apart from being the fastest growth economy in the eurozone, Ireland also has the third highest inflation rate. However, he went on to state that Ireland "must conform with what is good for the euro area." (Irish Independent, May 9, 2001)."[39]

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[37] Lee and Crowley 21.
[38] Heinemann and Huefner 4.
[39] Heinemann and Huefner 5.

D. Spain
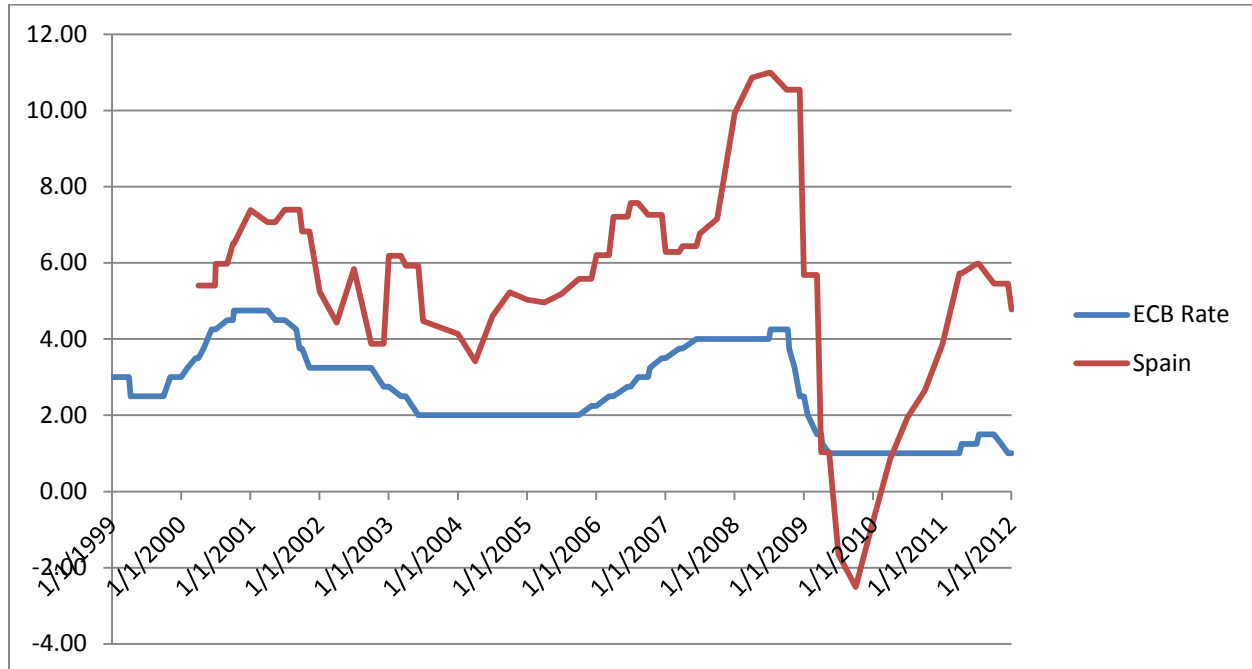
Spain, another country noted to be under duress as a result of the global economic crisis,

has its Taylor recommended rate above the ECB rate for most of the EMU era. This is consistent

with other studies of the Euro that indicate that "the economic conditions in…Spain would have

dictated higher interest rates than those set by the ECB"[40] (note: this source does assume that

Spain uses a Taylor rule of its own creation from the period before the monetary union, but the

direction of the stress is confirmed by the graph above). With an average stress level magnitude

of 3.59, Spain's stress levels place it very much in the "peripheral" country category. This

difference between the interest rate set by the ECB and the Taylor recommended rate for the

country has a number of implications.

Martin Feldstein argues, with claims based on 1999 data, that "monetary policy that was

too expansionary for Spain and Ireland, causing a substantial acceleration of their inflation and

threatening their competitiveness. Such disparities of demand conditions will undoubtedly persist

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[40] Lee and Crowley 20.

in the future because European countries differ substantially in industrial composition and in a variety of economic policies."[41] This trend seems to have persisted for a large part of the start of the EMU era. However, these effects were somewhat mitigated since Spain was "enjoying very strong growth rather than high cyclical unemployment."[42]

In the reverse situation, such as what might have occurred in late 2009 and 2010, where the ECB interest rate is higher than the Taylor recommended rate for Spain, the effect may be higher unemployment. Feldstein predicted this and argues that the EMU prevents the natural, stabilizing responses to trends in a country's economy as "the time will come when the ECB will set a policy that is too tight for the outliers, leading to substantially higher unemployment than if they were free to set their own monetary policies. Even without discretionary monetary policies, the interest rates in countries with weak demand would naturally decline, and the external values of their currencies would fall, both acting as offsetting stabilizers of the countries weak demand. But this will not be possible within the EMU, where a single interest rate and a single exchange rate prevail. Result: higher average cyclical unemployment."[43]

These conjectures about the compounded negative effects of these stress levels during times in which Spain's economy is suffering from high unemployment have been supported by recent commentaries on the economic events of the late 2000s. Wolfgang Munchau recently argued that "The clear and present danger to the eurozone is Spain" as "Spain, like Greece, has suffered from an extreme loss of competitiveness during a period in which it relied on a housing

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[41] Feldstein, Martin. "Europe Can't Handle the Euro." (Wall Street Journal 2000).
[42] Feldstein 2000.
[43] Feldstein 2000.

bubble to generate prosperity."[44] Munchau continues by indicating that imbalances were the main reason for problems in countries such as Greece.[45]

E. Italy
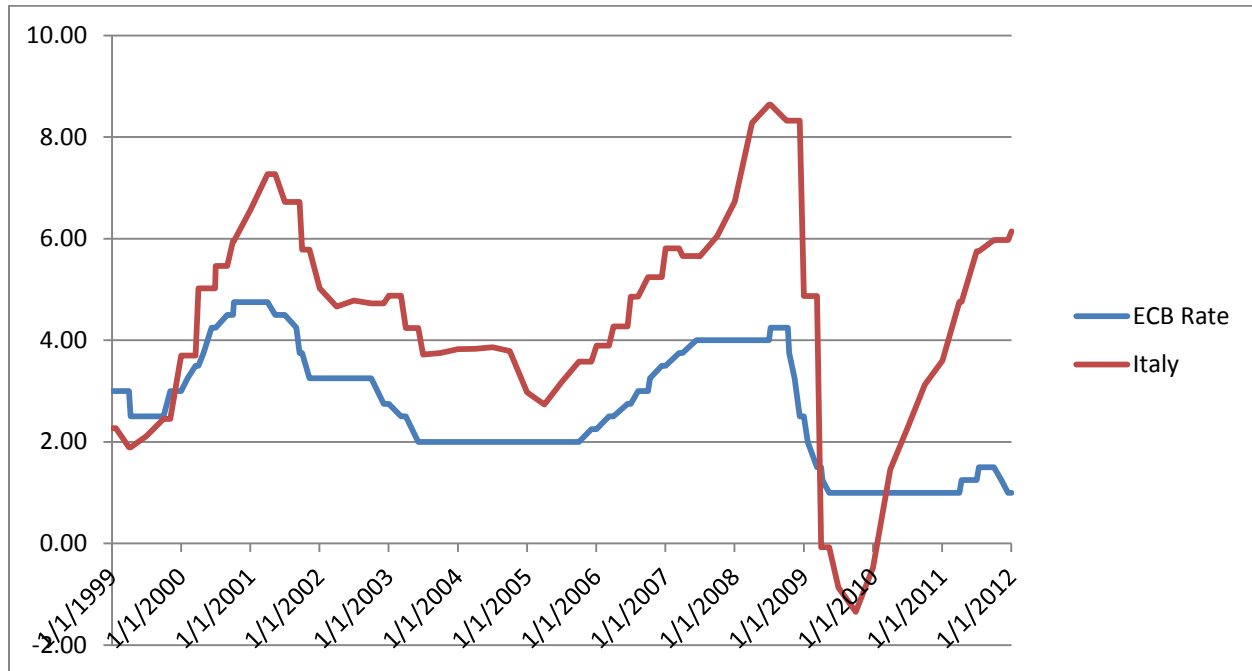
In her discussion of how well the European Central Bank's policy fit the various countries in the monetary union, Fernanda Nechio groups Italy with the core countries (Austria, Belgium, France, Finland, Germany, and the Netherlands) as "its inflation rate and unemployment gap are more comparable to the euro area's core countries."[46] This assertion is supported by the comparable stress levels of the two countries, as the average magnitude of the stress levels for Italy is 2.25, closer to the 2.00 of Germany than the 3.80 or 4.50 of Greece and Ireland. Indeed, Feldstein also groups Italy with the core euro area countries, as he suggests that while the ECB claims to make monetary policy for all EMU countries, this "in practice means

[44]Munchau, Wolfgang. "What the Eurozone must do if it is to survive" (Financial Times 31 January 2010) . <http://iei.uv.es/javierandres/TEACHING/ADVANCED%20MACROECONOMICS/M%C3%9CNCHAU_Eurozone_surviving.pdf>.
[45]Munchau.
[46] Nechio 3.

doing what is appropriate for Germany, France and Italy, the euro zone's three largest

countries."[47] The data analyzed generally support these assertions.

F. Portugal
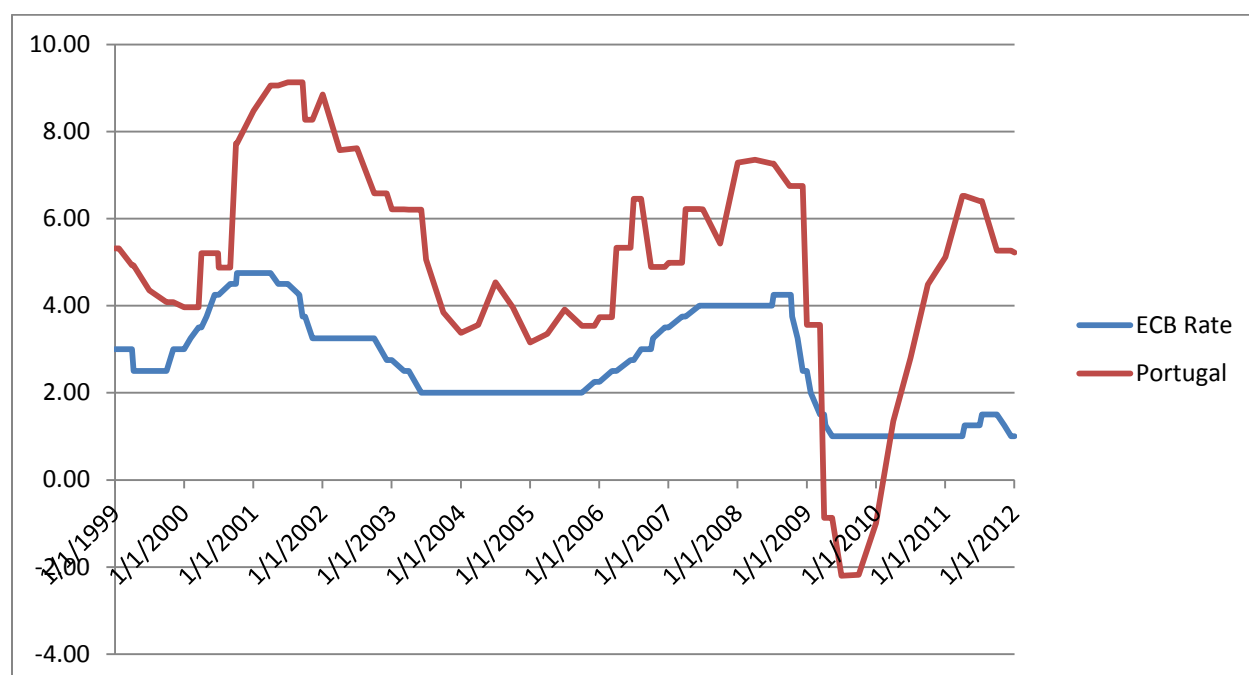
Until late 2009, the Taylor recommended rate for Portugal was higher than the ECB rate

during that time. The average magnitude of these stress levels for Portugal is 2.68. Portugal's

situation during the post-2003 era has often been compared to that of Greece, as "the ECB

'target' rates beginning 2003 were more accommodative for such member states as Portugal and

Greece, than the target rates warranted by the economic conditions of these individual member

states."[48] Like Greece, Portugal is one of the countries rumored to be considering leaving the

Eurozone. Paul Krugman recently said that "it was clear that the accession to the Euro zone was

a mistake for Greece and Portugal."Without the Euro there would have been fewer cars on the

streets, but more working people. If nothing else works, then the exit from the Euro zone is the

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[47] Feldstein 2000.
[48] Lee and Crowley 20.

only feasible option," said Krugman."[49] In addition, it has been argued that Portugal's current condition makes exit likely as "Portugal's future debt capacity will be extremely low, as it has negligible potential growth and, assuming it stays in the euro, no inflation either – yet market interest rates are likely to be quite high."[50]

G. Finland
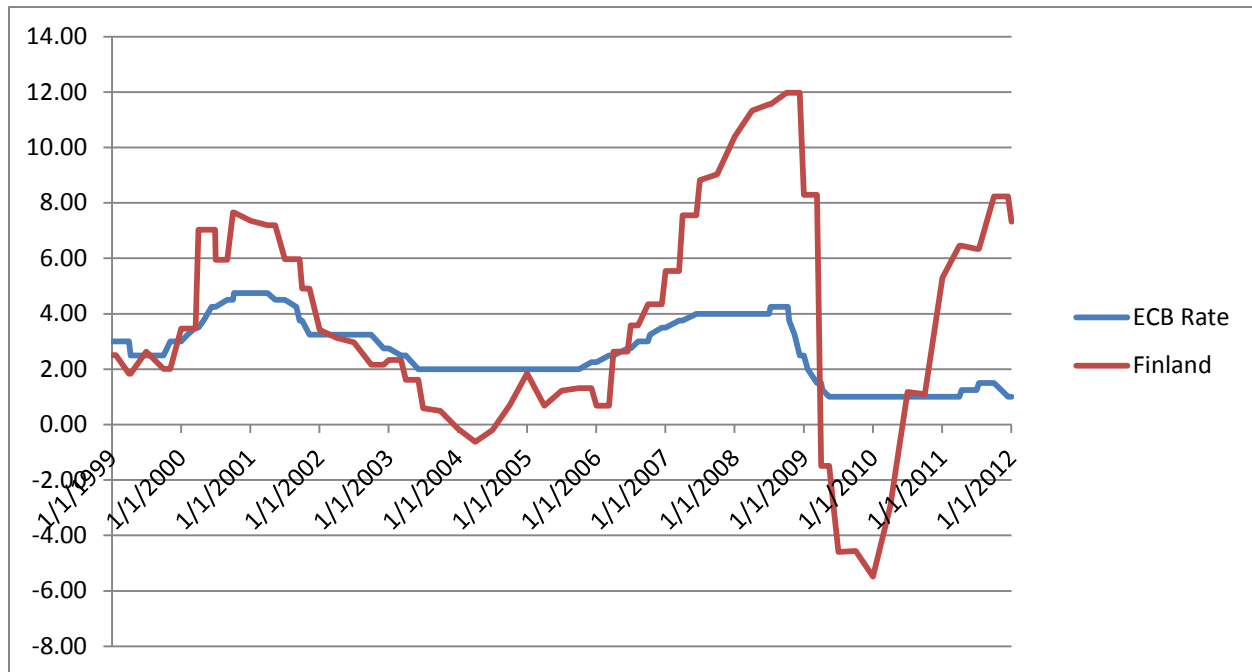
Finland's case appears to be somewhat unique when considering the above graph of the ECB rate and the Taylor recommended rate for the country as its recommended rate dips below the ECB rate during the mid-2000s. The country has had an average stress level magnitude of 3.02, not quite as high as that of the peripheral countries previously mentioned, yet not as low as the average of Germany. Nechio nevertheless classifies Finland as a core country. This

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[49] "Will Portugal pull out from Eurozone?" (The European Union Times 5 April 2012).
<http://english.pravda.ru/business/finance/04-04-2012/120986-portugal_euro_zone-0/>
[50] "Report Shows Netherlands Would Benefit by Leaving Eurozone." (Howestreet.com 5 March 2012).
<http://howestreet.com/2012/03/report-shows-netherlands-would-benefit-by-leaving-eurozone-country-by-country-aggregate-costs-dutch-freedom-party-wants-euro-exit-referendum-critical-juncture-for-eurozone/>

classification is appropriate as its stress levels are generally quite low outside of the periods in

which Taylor recommended rate is below 0 (where the target rate cannot reach).

The period in which Finland's Taylor recommended rate is lower than the ECB rate is

most likely the result of a period of low inflation in Finland. This view is supported by Lee and

Crowley, who indicate that ""For Finland, the fitted 'target' rate is persistently lower than the

actual ECB rate, reflecting the lower inflation that was sustained over much of the post-1999

period. The opposite is true of Ireland."[51]

H. France
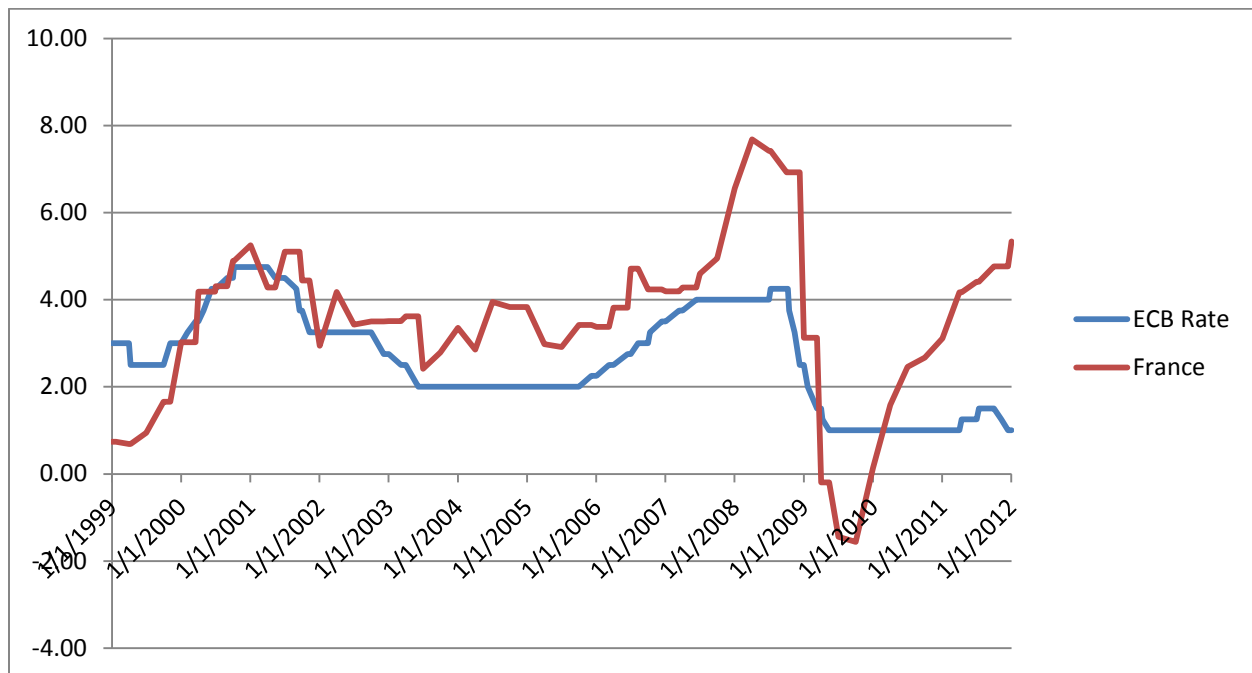
France, along with Germany, is considered a leader of the Eurozone. It too is part of the

core of euro area countries[52] and boasts an average stress level magnitude of only 1.54. Lee and

Crowley's analysis lends credence to France's low stress levels, as they argue that "ECB

monetary policy best reflects the economic conditions of the larger members, and most notably

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[51] Lee and Crowley 21.
[52] Nechio.

Germany and France. The divergence between the fitted ECB 'target' rate and the rate implied by a country's economic conditions is more pronounced for smaller euro area members."[53] Indeed, ""Under the hypothetical condition that the ECB responded to the economic conditions of individual euro area members, the 'target' interest rates for most member states except France and Germany would have been quite different from those predicted by the area-wide data."[54]

I. The Netherlands
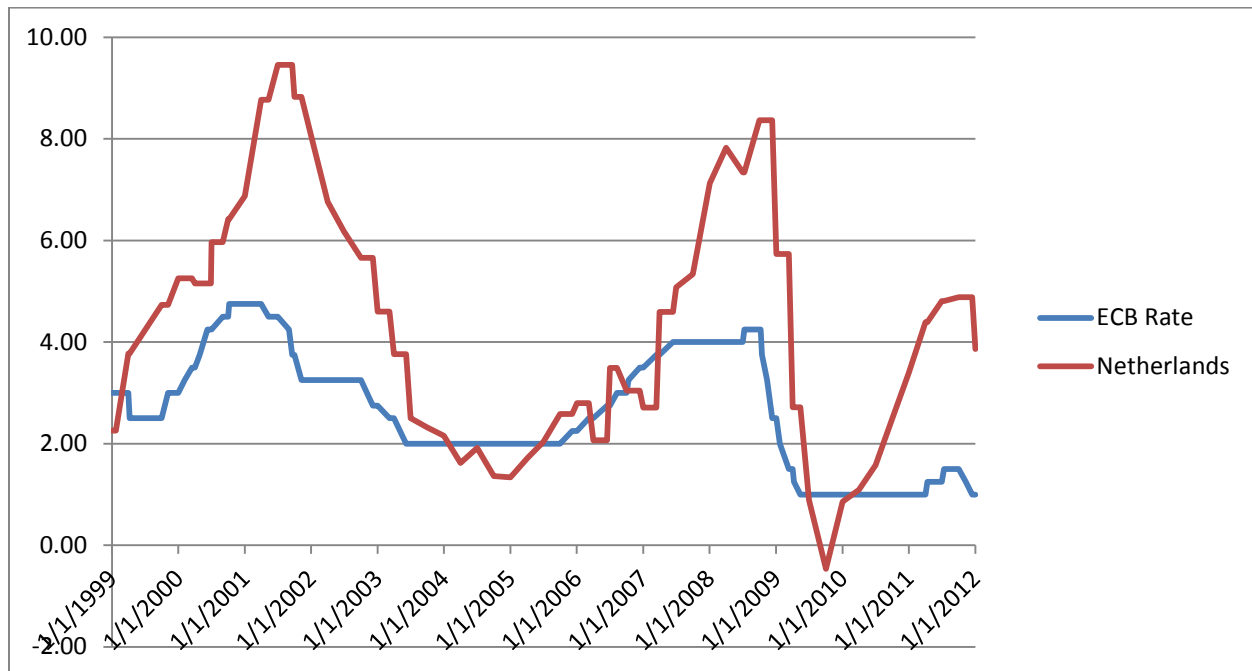
Another core euro area country, the Netherlands, has had an average stress level magnitude of 2.37. However, there are some periods of fluctuation, notably between 2005 and 2008, in which the direction of the stress (with the ECB rate being set too high at certain points, and too low at others) changes multiple times. It is interesting to note also the level of stress appears much greater during times of higher inflation.

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[53] Lee and Crowley 20.
[54] Lee and Crowley 22.

However, it appears that a lack of growth is of a greater concern to the Netherlands than inflation. One recent study argues that "just as the Spanish and Irish saw a construction boom in 2002-07 because real interest rates were set at too low a level for their economies, the Dutch may have suffered from real rates that were too high" (note: there is also mention of potential gains such as "reduced transactions costs" that may have offset some of those issues).[55] This slow growth may be the reason why the Taylor recommended rate falls below the ECB rate on a number of occasions during the aforementioned period. Interestingly enough, the earlier referenced study calls for a change in the ECB's tolerance, indicating that "growth can only be enjoyed in the euro-zone as a whole if the surplus countries, notably the Netherlands and Germany, accept the need for consumption growth faster than GDP, and higher inflation than the eurozone average, presumably at least 3-4%."[56]

J. Czech Republic

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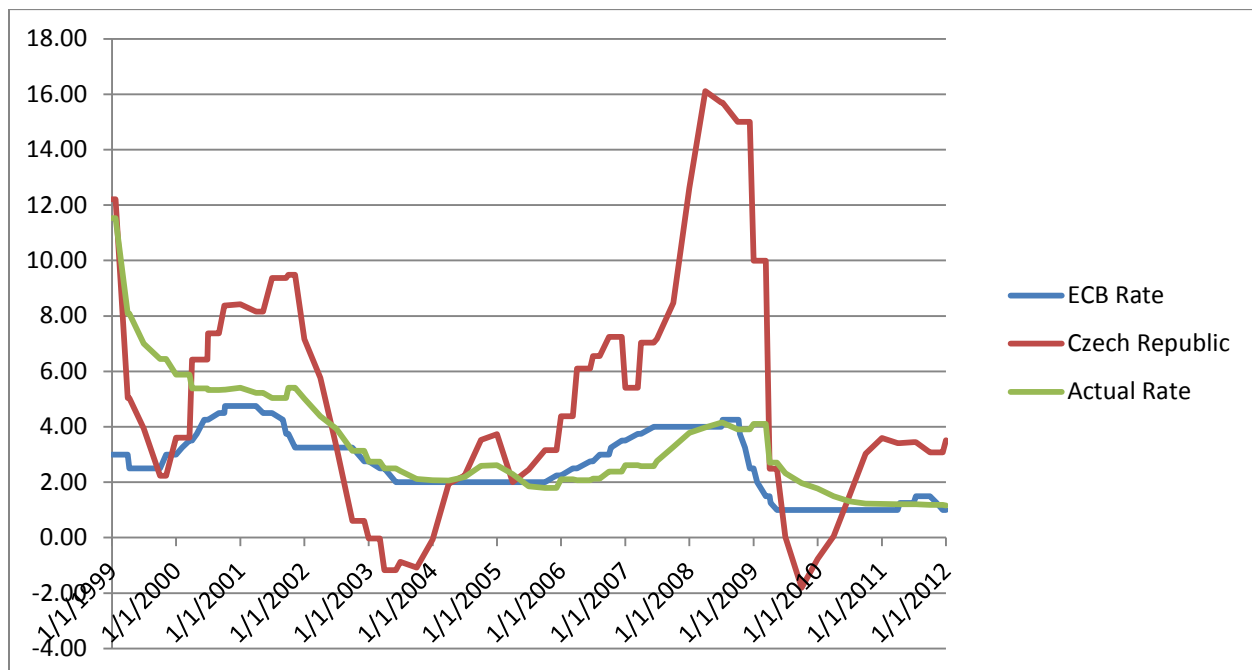
[55] "A Dutch exit?" (The Economist 5 March 2012). http://www.economist.com/node/21549215.
[56] "A Dutch Exit?'

After investigating the general trends affecting some of the major (in size or in recent dynamics) euro area countries, an investigation of the Czech Republic may provide some insight into the level of fit between the ECB rate and countries that either are interested in, or at one point were interested in, becoming a part of the monetary union.[57] It should be noted that since the Czech Republic is not yet a part of the monetary union, these comparisons do not account for how the ECB's monetary policy decisions would change by including the Czech Republic's economic data into its decision metrics.

The Czech Republic, when considering economic data from 1999 onwards, has an average stress level magnitude of 4.51, putting it closer to the "peripheral" countries group (It should be noted, however, that the stress levels seem lower from mid-2009 onward, with the caveat of the HP filter). This seems mostly driven by various instances of higher inflation pushing the Taylor rate above the ECB rate. In addition, the graph highlights a number of instances over the decade in which stress levels change sign and vary dramatically in magnitude. When comparing these stress levels to those of the actual rate for the country, one finds that its actual stress level magnitudes are smaller, yet still substantial at an average of 3.22 (a number that seems to have been influenced by the large stress levels from 2006-2009). While the data provide some insight into how the ECB's rates *would have* suited the Czech Republic, a more accurate picture would be provided if the country were to participate in the ERM II program.

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[57] "UPDATE 2-Czechs, Poles cooler to euro as they watch debt crisis." (Reuters 15 June 2010). <http://www.reuters.com/article/2010/06/16/czech-election-euro-idUSLDE65F15Z20100616>

K. United Kingdom
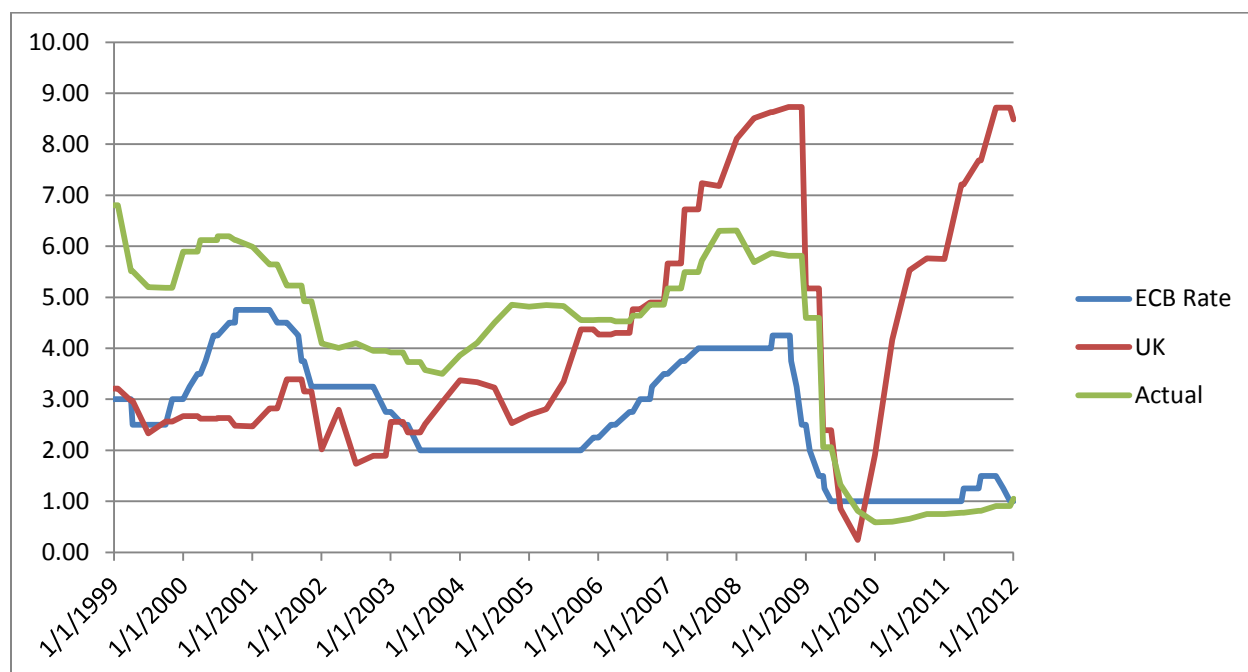
The United Kingdom is an interesting case, as the country exercised its option to not enter the monetary union. Unlike many of the member states previously analyzed, the country's Taylor rate is below the ECB rate during the beginning years of the euro area. The country has an average stress level magnitude of 2.32, with much of the greater stresses coming after 2008 and the start of economic troubles on the continent. When calculating the actual stress levels, the average stress level magnitude is 2.43, seemingly affected by the data's end point issue as when taking data only until 2010, the average magnitude is 1.86. The question of whether the UK would fit well in the euro area has often been raised. Paul de Grauwe argues that "it is not clear that all countries in the sample are part of an optimal currency area with the rest of the European Union. This is most evident for the UK. Its trade with the Euro area is rather low … and it seems to be subjected to more asymmetric shocks than other large members of the union."[58]In addition,

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[58] De Grauwe 2002 3.

the UK has "been able to introduce monetary stability on its own," making the stabilizing influence of the monetary union less appealing.[59]

L. Summary

Overall, the concern that the ECB rate aligns more with the Taylor recommended rates of the core countries than with the peripheral countries appears to be supported by the data, as they support the view that "ECB policy actions, which might be adequate for the euro area as a whole, might have been too loose for such faster growing member states as Greece and Ireland but too tight for slower growing member states, such as Italy"[60]. One interesting dynamic that the above data do not necessarily support, but is mentioned in other studies in the literature, is that the stress levels seem to be decreasing over time. Lee and Crowley find that "the overall monetary policy stress in the euro area declined gradually in the first two years of the ECB operation and hovered around 2% over the rest of the observation period. The pattern in the early years of the ECB can be interpreted as evidence of convergence among EMU members. From around the middle of 2005 the stress indicator decreased to around 1.5%, but in more recent years (since roughly the 2nd quarter of 2007), however, the monetary policy stress has clearly shown an increase." While the convergence to stress levels of 2% does not necessarily apply to all the euro area countries, it does seem that the stress levels have increased since mid-2007.

V.   Risks and Mitigations

One major risk is the use of the Hodrick-Prescott filter to calculate potential GDP from the existent quarterly GDP data. Lee and Crowley list some key concerns, citing that "Laubach and Williams (2003) argue that these univariate filters ignore information from movements in inflation and thus provide a misleading picture of the recent trends in such variables as interest

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[59] De Grauwe 2002 5.
[60] Lee and Crowley 22.

rates and output. These filters are also inappropriate from a conceptual perspective. As Muscatelli, Tirelli, and Trecroci (2002) point out, they are commonly executed using the full sample of estimation data, meaning that policymakers are assumed to possess information about future GDP data that they in fact do not know in real time."[61] However, in the case of this analysis, the focus is not on normative questions ("what decision should the ECB have made given the information they had") but rather on what how well the ECBs rate fit the economic situation of the country at that time. In this way, the additional information provides a more accurate picture of the Taylor rate, even if the policymakers at that time would not be aware of that information.

There are also a number of concerns related to the use of the Taylor Rule itself. One is of "data uncertainty," as "It is not at all clear whether the estimation of monetary policy rules using data that could not possibly be known to policy-makers at the time of the decision are informative for describing actual interest-rate setting."[62] The issue of accuracy here is improved through the use of ex post data as the data available at the time of this investigation, March 2012, are late enough to represent the revised versions of many of the numbers used. The issue of the "timings" of the data is addressed again by the nature of this study as observational rather than normative. In addition, Peersman and Smets find that the "estimation error in the output gap does not significantly affect the performance of the Taylor rule" and that "the Taylor rule is robust to small changes in the parameters of the model,"[63] addressing a few of the other concerns raised earlier.

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[61] Lee and Crowley 2009 13.
[62] Blattner and Margaritov 6.
[63] Peersman, Gert and Smets, Frank. "The Taylor Rule: A Useful Monetary Policy Benchmark for the Euro Area?" (International Finance 2:1 1999) 107.

More broadly, there are questions regarding the use of a monetary policy rule to model central bank decisions. Fendel and Frenkel voice their concerns that "following a monetary policy rule mechanically is not a very realistic description of practical monetary policy because it is too simplistic. A simple rule is incapable of processing the entire information set that a central bank has and that can describe macroeconomic developments. Moreover, the practical implementation of such rules is difficult because some of the variables entering the rule are not directly observable (e.g., the output gap and the equilibrium interest rate) or are likely to be prone to real-time measurement errors."[64] However, these issues do not preclude the potential utility of using a Taylor rule to study ECB decisions as "the ECB itself does not seem to totally reject the usefulness of monetary policy rules" and the central bank's statement affirming this "by itself provides enough motivation for the search of the monetary policy rule of the ECB."[65] The Taylor rule provides utility as it "explicitly links the current policy rate to current economic conditions" and thus can be used as "a benchmark to assess policy decisions."[66]

VI. Implications

One of the major potential implications of these various stress levels and lasting differences between the Taylor recommended rates and ECB rate is that of constant imbalances. "The imbalances that are poisoning the Eurozone economies cannot be acknowledged because their cure, once they are acknowledged, clearly requires major exits from the euro, or its disbandment. Unacknowledged, they remain unaddressed, so continued financial deterioration is likely, unless the core Eurozone countries step in and provide … subsidies."[67]

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[64] Fendel and Frenkel 109.
[65] Fendel and Frenkel 109.
[66] Peersman and Smets 86-87.
[67] "Report Shows Netherlands Would Benefit by Leaving Eurozone."

In addition, the issue of the ECB raising interest rates when only a few countries need it may have negatives effects on the debt dynamics of the burdened euro area states as "Higher interest rates make it more difficult to reduce debt-to-GDP ratios since debt-servicing costs rise, real GDP growth slows and primary budget deficits increase. Attention needs to be paid to the euro area as a whole but also to its most highly indebted members for whom the need for restructuring remains an issue."[68] In this way, since "Ireland, Greece, and Spain relax their efforts shortly after the adoption of the single currency, ending up with noticeably higher inflation rates than other countries," they found themselves "in a strong disadvantage in terms of price competitiveness and susceptible to current account deficits and bubbles (real estate: Spain, Ireland, public debt: Greece)."[69] This competitiveness problem has negative effects on other economic issues in the euro area as "without improving external competitiveness and increasing exports/reducing imports, euro area periphery will not be able to restore domestic economic growth during their own prolonged period of fiscal consolidation."[70]

If "Fine–tuning of the interest rate to cater for different national economic conditions is made impossible,"[71] how can Europe respond? The dynamics outlined above have far-reaching implications for the area as Europe currently finds itself in "the midst of multiple, frequently overlapping, and mutually reinforcing crises."[72] "A fiscal crisis is centered on Greece but visible across the southern euro area and Ireland. A competitiveness crisis is manifest in large and persistent pre-crisis current account deficits in the euro area periphery and even larger intra-euro-area current account imbalances. A banking crisis was first evident in Ireland but is not spreading

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[68] Gerlach 5.
[69] Lopez and Papell 4.
[70] Kirkegaard 2011 7.
[71] De Grauwe 2002 4.
[72] Bergsten and Kirkegaard 2012 1.

throughout the area via accelerating concerns over sovereign solvencies."[73] The "one size does

not fit all" dilemma has an effect on all of these arenas. Addressing these challenges is

particularly difficult because of the status of the EMU as a "monetary union of somewhat

disparate economies without political and economic institutions to manage various shocks."[74]

      Firstly, Shambaugh highlights the nature of the macroeconomic crisis "where slow

growth and relative uncompetitiveness in the periphery add to the burden of some of the indebted

nations," a crisis that is based on the "level and distribution of growth within the euro area."[75]

This growth crisis affects the banking crisis as "low growth can doom an otherwise solvent

country to insolvency."[76] The trend of how "distribution of growth across the area is

unbalanced" is also disturbing as "regardless of what is done to meet their liquidity and funding

needs and even if the banking system avoids collapse, without growth in the GIPSIs, the overall

crisis cannot end."[77] Growth affects the sovereign debt markets in that "some countries face …

very bad growth dynamics in the near future," "have borrowed too much in the private sector and

are not cost competitive with the rest of the currency union," so that "without very low interest

rates, their debt burden is likely to grow."[78] In addition, the fiscal policy lever which would

generally be used to combat the competitiveness issues is no longer available due to the

sovereign debt crisis.[79] What is surprising is that the growth developments may have more to do

with the crisis than fiscal responsibility.[80] In fact, austerity hurts countries' efforts as "countries

making cuts are shrinking rapidly, enough to cause debt to GDP to rise even with budget cuts."[81]

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[73] Bergsten and Kirkegaard 2012 1.
[74] Shambaugh 3.
[75] Shambaugh 1.
[76] Shambaugh 9.
[77] Shambaugh 11.
[78] Shambaugh 17.
[79] Shambaugh 13.
[80] Shambaugh 17.
[81] Shambaugh 29.

As these crisis are in some way linked to the differences between euro area countries, it is important to take into consideration that the magnitude of some of these differences occurred because "membership was not objectively determined by the fundamental economic strengths and reform record[s]"[82] of the countries in question. However, although membership may not have been optimal, one should not consider the breakup of the euro area inevitable Bergsten and Kirkegaard argue that "Once Germany and the ECB feel they have … run out of alternatives, they will pay whatever it takes to hold the euro together."[83] One potential option to address some of these issues is increasing labor market flexibility, which "is probably the only instrument available that allows Eurozone countries to adjust to asymmetric shocks."[84] In addition, Kirkegaard suggests that "supply-side structural reforms" may be necessary to address the competitiveness crisis.[85]

When considering other potential responses to these interrelated crises, one must keep in mind that the euro zone includes "virtually no economic union: no fiscal union, no economic governance institutions, and no meaningful coordination of structural economic policies."[86] The lack of a fiscal authority has denied the EMU the ability to "counter region-specific (asymmetric) economic shocks, or re-instill confidence through the deployment of large fiscal resources to private market participants in the midst of a crisis."[87] However, there are still a number of policy options available at the both the national and EMU level. Firstly, structural reforms that "raise potential growth" would have positive effects on at least two of the three crises.[88] In addition, fiscal devaluation through using tax law changes to mimic depreciation would also be a positive

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[82] Bergsten and Kirkegaard 2012 3.
[83] Bergsten and Kirkegaard 2012 7.
[84] De Grauwe 2002 5.
[85] Kirkegaard 2011 7.
[86] Bergsten and Kirkegaard 2012 1.
[87] Bergsten and Kirkegaard 2012 3.
[88] Shambaugh 34.

step towards addressing the competitiveness imbalances.[89] When considering options available

to the ECB, the bank could "lower long term interest to spur growth" and pursue more

aggressive monetary policy to stimulate the economy.[90] Ultimately, in the long run, to address

the issue of differences between euro area countries, "strengthened fiscal and economic

convergence rules in the euro area …is the tool with which the euro area will ensure that its "too-

big-to-bail-out" countries of Italy and Spain will implement the required economic reforms to

ensure solvency."[91]

VII.   Conclusion

To study how well the European Central Bank's interest rate decisions "fit" each of the

member states, a basic Taylor rule was used to calculate the "optimal" rates for each of the

individual countries in the euro area. The data for these countries highlighted the changing

magnitudes and directions of the stress levels of each of these, with many peripheral countries

experiencing larger stress levels than core countries such as Germany, France, and the

Netherlands. The implications of these differences were investigated specifically for each

country, with references to how the data align with other observed trends and studies.

The differences in economic fundamentals, and thus Taylor rates, between the euro area

countries have implications on various additional economic issues such as competitiveness and

debt dynamics. These issues, and the implications of the ECB's interest rate decisions, were

explained with regards to the multiple crises affecting the Eurozone. Finally, various potential

policy actions and responses to both the issue of different optimal rates and the aforementioned

overall crises were explored. This study finds various differences between countries in the euro

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[89] Shambaugh 35.
[90] Shambaugh 36.
[91] Kirkegaard 2011 10.

area, raising crucial questions and issues that must be addressed by the ECB and the euro area as

a whole.

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Appendix A – Quarterly Taylor Recommended Rates vs. ECB Rates of various euro area and select non-euro area countries
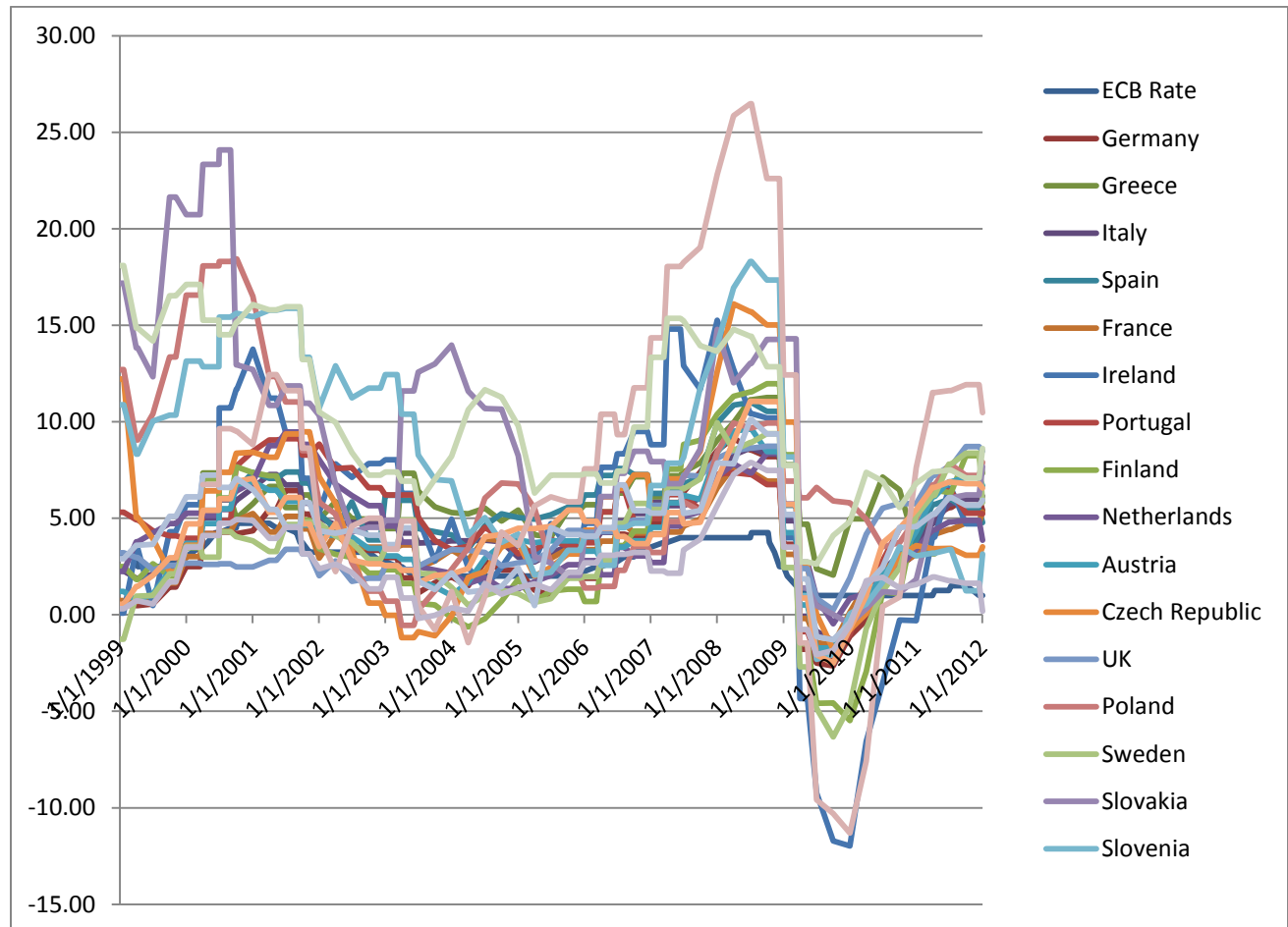
Appendix B – Taylor Rule Recommended Rates

Year	Quarter	Austria	Belgium	Czech	Denmark	Estonia	Finland	France
1998	1	1.57	1.78	23.14	4.26	#N/A	2.42	1.16
1998	2	2.01	2.82	21.59	1.78	#N/A	2.71	1.83
1998	3	1.72	1.15	16.13	3.60	#N/A	2.84	1.21
1998	4	1.21	0.54	12.21	2.90	#N/A	2.50	0.74
1999	1	0.75	1.47	5.04	3.59	#N/A	1.84	0.69
1999	2	1.08	2.04	3.94	3.65	#N/A	2.64	0.95
1999	3	2.27	2.94	2.23	5.10	#N/A	2.01	1.66
1999	4	3.70	4.71	3.61	6.10	#N/A	3.47	3.02
2000	1	4.73	5.41	6.42	7.23	6.74	7.04	4.18
2000	2	5.49	6.02	7.38	6.59	9.64	5.94	4.31
2000	3	6.76	6.91	8.37	7.05	9.51	7.66	4.89
2000	4	6.88	7.08	8.43	6.48	8.82	7.36	5.25
2001	1	6.46	5.31	8.16	5.46	12.44	7.20	4.28
2001	2	5.86	6.08	9.37	4.57	11.62	5.97	5.10
2001	3	4.65	4.71	9.48	5.82	8.64	4.90	4.44
2001	4	4.15	3.52	7.16	4.36	4.20	3.42	2.94
2002	1	4.10	4.73	5.77	4.23	2.23	3.13	4.18
2002	2	4.04	2.83	3.29	4.40	4.60	2.97	3.42
2002	3	3.44	2.64	0.60	4.12	5.00	2.16	3.50
2002	4	3.04	2.54	-0.02	3.63	3.41	2.34	3.51
2003	1	2.87	2.30	-1.18	4.49	4.85	1.61	3.62
2003	2	1.83	1.66	-0.87	1.73	0.46	0.58	2.42
2003	3	1.45	2.04	-1.08	1.30	-0.77	0.50	2.79
2003	4	1.00	2.11	-0.07	2.16	1.21	-0.16	3.36
2004	1	1.69	2.39	1.95	1.18	-1.44	-0.63	2.85
2004	2	2.91	4.05	2.24	1.27	0.96	-0.20	3.95
2004	3	3.62	4.15	3.52	1.46	4.28	0.71	3.83
2004	4	3.89	4.49	3.74	2.43	3.59	1.84	3.83
2005	1	3.74	4.47	2.01	0.47	5.63	0.68	2.98
2005	2	3.84	4.58	2.46	4.52	6.12	1.22	2.91
2005	3	3.83	5.43	3.15	4.15	5.85	1.32	3.42
2005	4	3.30	4.84	4.39	4.08	7.56	0.68	3.38
2006	1	2.84	4.48	6.10	4.51	10.40	2.64	3.82
2006	2	3.51	4.05	6.55	6.73	9.34	3.58	4.71
2006	3	3.83	3.68	7.24	5.40	11.76	4.34	4.24
2006	4	4.53	4.16	5.41	5.26	14.35	5.54	4.19
2007	1	5.80	5.29	7.04	6.30	18.05	7.55	4.28
2007	2	6.19	4.71	7.18	5.25	18.25	8.82	4.59
2007	3	5.98	4.79	8.47	5.39	19.04	9.03	4.95
2007	4	8.40	6.98	12.61	7.87	22.82	10.39	6.56
2008	1	9.50	9.01	16.11	7.81	25.86	11.32	7.68
2008	2	9.62	11.06	15.70	10.11	26.47	11.55	7.42
2008	3	8.45	11.05	15.01	9.36	22.61	11.97	6.93
2008	4	4.25	5.73	9.99	5.20	12.43	8.29	3.13
2009	1	0.51	0.87	2.49	1.87	-1.46	-1.49	-0.19
2009	2	-1.72	-2.08	0.03	-1.14	-9.59	-4.59	-1.44
2009	3	-1.72	-2.50	-1.80	-1.29	-10.30	-4.57	-1.56

2009	4	-0.31	-0.71	-0.77	-0.40	-11.30	-5.48	0.13
2010	1	0.77	1.00	0.05	1.52	-7.59	-2.95	1.59
2010	2	2.09	3.72	1.53	2.46	0.43	1.17	2.46
2010	3	2.95	4.49	3.03	4.53	0.92	1.09	2.67
2010	4	4.33	5.44	3.59	4.57	7.62	5.30	3.11
2011	1	6.13	6.60	3.42	5.22	11.51	6.46	4.17
2011	2	6.89	6.88	3.44	6.07	11.62	6.33	4.41
2011	3	7.12	6.79	3.08	5.67	11.92	8.24	4.76
2011	4	6.67	6.57	3.51	5.93	10.47	7.32	5.33

Taylor Rule Recommended Rates (cont'd)

Year	Quarter	Germany	Greece	Hungary	Ireland	Italy	Luxembourg	Netherlands
1998	1	2.92	#N/A	27.79	3.73	4.29	-0.40	2.74
1998	2	2.38	#N/A	25.04	4.36	4.05	1.59	2.84
1998	3	1.23	#N/A	21.82	4.86	3.78	1.51	2.14
1998	4	0.51	#N/A	18.09	0.09	2.27	-0.76	2.26
1999	1	0.48	#N/A	14.86	3.43	1.89	0.49	3.78
1999	2	0.56	#N/A	14.18	0.47	2.11	2.75	4.24
1999	3	1.44	#N/A	16.53	4.30	2.45	4.22	4.73
1999	4	2.50	#N/A	17.12	5.71	3.70	2.85	5.26
2000	1	4.21	7.34	15.26	7.20	5.02	11.07	5.16
2000	2	4.28	6.04	14.50	10.72	5.46	7.99	5.97
2000	3	4.20	5.02	15.14	11.68	5.95	7.45	6.42
2000	4	4.35	5.75	16.07	13.77	6.57	8.11	6.87
2001	1	5.44	6.65	15.80	11.22	7.27	7.54	8.77
2001	2	6.43	5.55	15.95	9.47	6.72	5.00	9.46
2001	3	5.22	6.21	13.23	7.07	5.78	5.07	8.83
2001	4	4.50	4.93	10.51	5.29	5.02	4.46	8.04
2002	1	4.39	5.86	9.97	7.81	4.66	5.18	6.76
2002	2	3.38	4.99	8.40	7.11	4.78	5.17	6.17
2002	3	3.35	4.95	7.24	7.83	4.72	4.20	5.66
2002	4	2.97	4.47	7.39	8.04	4.88	3.56	4.60
2003	1	1.91	7.34	6.93	6.29	4.24	0.07	3.76
2003	2	1.13	6.40	5.76	5.01	3.72	1.20	2.50
2003	3	1.67	5.60	7.02	2.79	3.75	1.52	2.32
2003	4	1.95	5.29	8.21	4.96	3.82	3.26	2.15
2004	1	1.50	5.23	10.62	2.43	3.83	1.02	1.62
2004	2	2.77	5.52	11.65	1.43	3.86	1.94	1.92
2004	3	2.32	4.85	11.27	2.46	3.79	3.48	1.36
2004	4	2.31	5.42	9.79	3.71	2.98	2.64	1.34
2005	1	1.27	4.14	6.30	2.82	2.74	5.41	1.71
2005	2	0.99	4.03	7.23	4.73	3.17	3.31	2.04
2005	3	2.05	5.43	7.23	3.46	3.58	4.22	2.59
2005	4	1.89	5.70	7.30	4.74	3.90	3.20	2.80
2006	1	2.65	5.32	6.82	7.64	4.27	5.28	2.07
2006	2	4.17	6.31	7.45	8.35	4.86	4.61	3.49
2006	3	4.04	7.15	9.73	9.50	5.24	4.49	3.04
2006	4	4.74	6.11	13.34	8.82	5.81	6.36	2.71
2007	1	5.81	7.20	15.36	14.81	5.66	7.16	4.59
2007	2	6.36	7.39	15.23	12.89	5.65	8.78	5.08
2007	3	7.39	7.87	13.94	11.68	6.05	8.09	5.34
2007	4	8.50	9.05	13.65	15.26	6.73	10.63	7.13
2008	1	9.17	9.95	14.79	12.72	8.27	10.41	7.82
2008	2	8.53	11.14	14.43	10.42	8.64	12.20	7.34
2008	3	8.19	11.25	12.84	10.19	8.32	11.25	8.37
2008	4	3.64	7.77	7.73	3.99	4.87	2.93	5.73
2009	1	-1.78	4.70	2.74	-4.35	-0.08	-0.62	2.72
2009	2	-2.50	2.38	2.63	-9.22	-0.87	-3.12	0.89
2009	3	-2.65	2.05	4.10	-11.71	-1.34	-2.11	-0.47

2009	4	-1.11	4.97	4.83	-11.97	-0.48	-0.42	0.86
2010	1	-0.27	4.96	7.37	-6.56	1.46	2.03	1.09
2010	2	1.77	7.13	6.92	-3.55	2.27	3.48	1.58
2010	3	2.50	6.47	5.56	-0.27	3.13	3.60	2.49
2010	4	3.18	3.44	6.81	-0.30	3.60	4.98	3.40
2011	1	5.15	3.16	7.40	4.03	4.75	6.29	4.39
2011	2	5.56	#N/A	7.50	6.55	5.75	5.19	4.81
2011	3	6.05	#N/A	7.09	4.71	5.97	5.62	4.88
2011	4	5.40	#N/A	8.61	#N/A	6.14	#N/A	3.86

Taylor Rule Recommended Rates (cont'd)

Year	Quarter	Poland	Portugal	Slvk Rep,	Slovenia	Spain	Sweden	Switzerland	UK
1998	1	21.24	1.69	13.63	15.67	#N/A	0.80	0.91	3.39
1998	2	20.06	3.32	13.02	13.70	#N/A	0.88	1.15	3.52
1998	3	17.85	4.56	10.65	10.88	#N/A	-0.41	0.98	2.87
1998	4	12.71	5.31	17.17	10.88	#N/A	-1.26	0.31	3.21
1999	1	9.06	4.93	13.83	8.32	#N/A	0.96	0.71	2.97
1999	2	10.41	4.35	12.33	10.03	#N/A	0.99	0.56	2.33
1999	3	13.36	4.08	21.65	10.34	#N/A	2.13	1.70	2.57
1999	4	16.56	3.96	20.73	13.15	#N/A	3.54	3.50	2.67
2000	1	18.08	5.20	23.34	12.86	5.40	2.99	4.11	2.62
2000	2	18.31	4.87	24.08	15.42	5.98	4.30	4.74	2.64
2000	3	18.44	7.73	12.95	15.61	6.50	4.05	4.94	2.48
2000	4	16.50	8.48	12.70	15.43	7.38	3.83	4.89	2.47
2001	1	12.35	9.06	10.84	15.78	7.06	3.27	3.96	2.82
2001	2	11.03	9.13	11.85	15.87	7.39	4.68	4.53	3.39
2001	3	8.50	8.27	10.96	13.34	6.83	4.81	3.17	3.16
2001	4	5.83	8.85	10.33	10.72	5.25	4.76	2.38	2.02
2002	1	5.21	7.58	6.75	12.90	4.43	4.07	2.63	2.80
2002	2	2.69	7.62	4.29	11.24	5.84	3.75	2.18	1.73
2002	3	1.22	6.58	4.53	11.74	3.87	2.86	1.34	1.89
2002	4	0.70	6.21	4.89	12.45	6.19	3.41	1.94	2.56
2003	1	-0.55	6.20	11.59	10.39	5.93	4.92	0.86	2.35
2003	2	0.24	5.06	12.58	8.28	4.47	2.14	-0.20	2.51
2003	3	1.24	3.85	13.00	7.01	4.30	2.13	-0.04	2.95
2003	4	2.35	3.38	13.96	6.94	4.14	1.42	0.36	3.37
2004	1	3.46	3.56	11.59	4.13	3.41	0.49	0.18	3.33
2004	2	6.05	4.54	10.69	5.03	4.60	1.00	1.62	3.23
2004	3	6.82	3.96	10.65	3.75	5.23	1.27	1.06	2.53
2004	4	6.78	3.16	8.24	4.19	5.04	1.09	1.41	2.69
2005	1	5.50	3.35	3.02	2.06	4.96	0.64	1.60	2.81
2005	2	2.70	3.92	2.68	2.21	5.19	0.83	1.29	3.35
2005	3	1.98	3.54	2.04	3.34	5.58	1.90	2.20	4.37
2005	4	1.39	3.73	4.08	4.04	6.20	1.97	2.70	4.27
2006	1	1.46	5.33	6.13	2.55	7.21	2.82	3.08	4.30
2006	2	2.30	6.46	7.33	4.51	7.57	4.72	3.13	4.76
2006	3	3.54	4.89	8.48	4.74	7.26	5.77	3.23	4.90
2006	4	3.23	4.99	7.94	6.70	6.29	5.45	2.27	5.66
2007	1	4.83	6.22	6.80	7.85	6.44	6.63	2.16	6.72
2007	2	5.85	6.21	7.11	8.15	6.77	6.51	3.36	7.24
2007	3	5.38	5.43	8.58	11.76	7.15	7.04	3.92	7.18
2007	4	8.43	7.28	14.79	14.00	9.93	9.94	5.65	8.11
2008	1	9.94	7.35	12.02	16.94	10.87	8.52	7.27	8.51
2008	2	9.68	7.26	13.02	18.30	10.99	8.92	7.88	8.63
2008	3	9.94	6.75	14.27	17.33	10.54	9.39	7.47	8.73
2008	4	6.92	3.56	14.30	8.17	5.68	2.44	3.50	5.17
2009	1	6.06	-0.87	1.38	0.98	1.02	-2.70	-0.75	2.39
2009	2	6.60	-2.20	0.48	-2.31	-1.65	-4.85	-2.06	0.85
2009	3	5.89	-2.18	0.02	-2.07	-2.51	-6.32	-1.86	0.24

2009	4	5.80	-1.00	-0.47	0.05	-0.78	-4.71	-0.54	1.91
2010	1	4.95	1.35	0.31	0.57	0.86	-0.71	1.77	4.17
2010	2	3.52	2.80	1.20	1.69	1.94	1.20	1.94	5.53
2010	3	3.74	4.49	1.15	3.52	2.65	2.42	1.39	5.76
2010	4	5.00	5.11	1.83	3.05	3.86	5.13	1.57	5.75
2011	1	6.72	6.52	5.19	3.20	5.72	6.20	1.95	7.21
2011	2	7.78	6.41	6.06	3.37	5.97	7.81	1.77	7.68
2011	3	7.21	5.27	6.21	1.23	5.46	8.38	1.63	8.72
2011	4	7.89	5.22	7.67	3.15	4.78	5.82	0.18	8.48