

# Linkages of New EU Country Currencies to the Euro<sup>\*</sup>

Eiji Ogawa<sup>a</sup> and Junko Shimizu

Graduate School of Commerce and Management, Hitotsubashi University,  
2-1, Naka, Kunitachi, Tokyo, 186-8601 Japan

First version: November 24, 2004

This version: February 24, 2005

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<sup>\*</sup> The authors are grateful to Claus Vastrup, Gyory Szell, and participants in a seminar held at the EU Institute in Japan (Hitotsubashi University), the Third University of Rome, and Bocconi University for their useful comments.

<sup>a</sup> Corresponding author. Tel: 81-42-580-8859, Fax: 81-42-580-8747, *E-mail address*: ogawa.eiji@srv.cc.hit-u.ac.jp.

## 1. Introduction

Ten Central and East European countries<sup>1</sup> have participated in the European Union (EU) on May 1, 2004. The new EU member countries have been proceeding with economic integration with the EU member countries. The economic integration should be accelerated after they joined the EU. The countries that have strong economic relations tend to have willingness of stabilizing their exchange rates. Economic agents will face trade barriers such as foreign exchange costs and foreign exchange risks after countries remove custom barriers. At first, the monetary authorities will tend to stabilize the exchange rates each other. In the case of the new EU member countries might have already stabilized the exchange rates against the euro in a process of joining the EU. They will stabilize the exchange rates after they join the EU. In addition, the new EU member countries are trying to join the euro area also in several years. The countries have to satisfy the convergence conditions for joining the euro area. One of the convergence conditions is to stabilize their exchange rates in terms of the euro.

In this paper we investigate how the new EU member countries have conducted the exchange rate policy against the euro in the process of joining the EU and how strong linkage their currencies have with the euro. For the purpose, we use the methodology of Frankel and Wei (1994) for sub-sample quarterly periods from 1999:Q1 to 2004:Q3 to the euro after a part of EU countries introduced the euro in 1999. We conduct the empirical analysis for not only all of the new EU member countries but also future EU member candidates (Rumania, Bulgaria, Croatia, and Turkey) and the three countries (Denmark, Sweden, and the United Kingdom) that have been already the EU members but have not yet joined the euro area.

## 2. Overviews of the East European currencies

We overview recent situations in Central and East European currencies before we identify what kind of exchange rate systems have been *de facto* adopted in the countries. At first we outline major trends of Central and East European currencies. Figure 1 shows movements in monthly data of Central and East European currencies studied in this paper vis-à-vis the euro in a whole sample period from

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<sup>1</sup> The new EU member countries include Poland, Czech, Slovakia, Hungary, Slovenia, Estonia, Latvia, Lithuania, Malta, and Cyprus.

December 1998 to September 2004.<sup>2</sup> It indicates that most of them are very stable against the euro except for the Turkish lira and the Romanian leu. For the former, the Turkish government is negotiating to enter the EU. For the latter, Romania is scheduled to enter the EU in 2007. Figure 2 shows movements in monthly data of the Central and East European currencies that have entered the EU since May 1, 2004. We find that most of them are fluctuating within a band of +/- 20 percents except for the Slovenian tolar and the Lithuanian lita. Especially the Estonian kroon and the Cyprus pound are moving within a very narrow band.

Next, we overview the countries' adopting exchange rate arrangements reported by the IMF. Table 1 shows their changes from December 1997 (before the starting of the euro) to June 2004 (immediately after the EU enlargement). In December 1997 a half of the sampled countries were reported to adopt the currency pegged arrangements while the rest of them were reported to adopt the managed floating and independently floating arrangements. In January 1999 when the euro has just started, some of currency pegging countries have moved to the currency board arrangement (the Estonian kroon, the Lithuanian lita, and the Bulgaria lev) and the other conventional fixed peg arrangements (the Maltese lira and the Latvian lat). Some of managed floating countries have set their crawling bands (within 2.25 percent for the Polish zloty and within 12.5 percents for the Hungarian forint). In December 2003, some of the managed floating countries have widen their band (within 15 percent for the Hungarian forint) or moved to independently floating (the Polish zloty and the Turkish lira). The fixed arrangement countries have not changed. In June 2004 when the EU has enlarged to 25 countries, there are no changes in their exchange rate arrangements. According to the report by the IMF, we can recognize that the Central and East European countries have been managing their exchange rates under their exchange rate arrangement.

The ERM II was established as a new Exchange Rate Mechanism to succeed the old European Monetary System (EMS) in order to maintain exchange rate stability between the euro and national currencies of non euro area countries.<sup>3</sup> Denmark and Greece initially participated in the ERM II while the UK did not join in the EMR II. Since Greece adopted the euro in January 2001, Denmark has been

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<sup>2</sup> We calculate every currency's index vis-à-vis the euro which equals to 1 on December 31, 1998 in order to compare their movement with each other.

<sup>3</sup> A central rate against the euro is defined for the currency of each country not participating in the euro area but participating in the exchange-rate mechanism if the country expresses a desire to participate in this system. There is one standard fluctuation band of 15% on either side of the central rate.

the only participant. The new member states that joined the European Union on May 1, 2004 will join the ERM II as their preparations for adopting the euro advance. On June 27, 2004, the Estonian kroon, the Lithuanian lita and the Slovenian tolar joined the ERM II. The levels of current fluctuation band are +/- 2.25% for Denmark and +/- 15% for Estonia, Lithuania and Slovenia. <sup>4</sup>

### 3. Methodology

According to the methodology of Frankel and Wei (1994) and Bénassy-Quéré and Coeuré (2000), we identify exchange rate regimes of Central and East European currencies through the estimation of an equation which relates the fluctuations of each East European currency to the fluctuation of three major currencies which include the euro, the US dollar and the Japanese yen as follows.

$$\dot{e}_{ikt} = a_0 + a_1 \dot{e}_{Eurokt} + a_2 \dot{e}_{USkt} + a_3 \dot{e}_{Jpykt} + \varepsilon_t \quad (1)$$

where  $\dot{e}_{ik}$  is rates of change in the exchange rate of currency  $i$  against currency  $k$ .

In the above equation, the constant term  $a_0$  is positive if the exchange rate of the relevant currency regularly depreciates (or is devalued) against the other currencies. The coefficients  $a_0, a_1, a_2$  are interpreted as weights of the three major currencies in an implicit basket peg system which include the euro peg system if  $a_1 = 1$ .

According to the estimated coefficients, we can classify the relevant currencies into the three types of actual exchange rate regime as follows:

1. If none of the coefficient is significant, then the exchange rate system is identified as a floating system.
2. If the coefficient  $a_1$  ( $a_2$ ) does not significantly differ from unity whereas all others are not significant, then it is identified that the currency is pegged to the euro (the US dollar).
3. If various coefficients  $a_1, a_2, a_3$  are significant and bound by zero and one, then the currency is pegged to a basket of the three major currencies.

While this method to identify the exchange rate regime is very simple to

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<sup>4</sup> Please see Appendix about the ERM II countries.

understand, it causes the serious problem how to decide a numeraire currency  $k$  of anchor currencies. It should be traded actively in the international currency market and should not be linked especially to each of anchor currencies. In the previous works, they used the Swiss francs, the Sterling pound, and the SDR as a numeraire currency.<sup>5</sup>

We compare the correlation between each of the numeraire currency candidates and the three major currencies plus all of the sampled European currencies.<sup>6</sup> Table 2-a shows a correlation matrix between each of the numeraire currency candidates and three explanatory variable currencies in equation (1). Among the three numeraire currency candidates, the Sterling pound has the smallest correlation coefficient with all of the three major currencies. Table 2-b, 2-b and 2-c show correlation matrixes between each of the numeraire currency candidates and the explained variable currencies in equation (1). Most of the sampled European currencies have the smallest correlation with the Sterling pound among the three numeraire currencies candidates, while the Maltese lira, the Latvian lat, and the Lithuanian lita have the smallest correlation with the Swiss francs. Accordingly, we choose the Sterling pound as a numeraire currency in the above regression equation.<sup>7</sup>

Then we estimate the following equation for all of the new EU member country (Poland, Czech, Slovakia, Hungary, Slovenia, Estonia, Latvia, Lithuania, Malta, and Cyprus). In addition, we estimate it for potential participants into the EU (Rumania, Bulgaria, Croatia, and Turkey). Moreover, we estimate some non-euro area EU countries which include Denmark, Sweden, and the United Kingdom for our concern. We use the Canadian dollar as a numeraire currency to estimate the regression equation for the Sterling pound.

$$\Delta \log e^{HOME/UK} = a_0 + a_1 \Delta \log e^{EURO/UK} + a_2 \Delta \log e^{USD/UK} + a_3 \Delta \log e^{JPY/UK} + \varepsilon_t \quad (2)$$

All foreign exchange data are downloaded from Datastream. The whole sample

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<sup>5</sup> Takagi(1996) and others who analyzes the coefficients of Asian currencies use the Swiss francs, while Frankel et al., use a basket currencies as the numeraire (the SDR in Frankel and Wei, 1995; a basket of five major currencies weighted by GDPs in Frankel et al., 1999).

<sup>6</sup> We use the Canadian dollar as a numeraire in order to calculate the correlation matrixes among all of the sampled currencies.

<sup>7</sup> We use the Swiss francs as a numeraire in the case of the Sterling pound as an explained variable.

period is 1/1/1999 to 9/30/2004. We divide the whole sample period into some sub-sample quarterly periods and estimate the coefficients on the three major currencies for each of the sub-sample quarterly periods. The movements in the coefficients show how linkage of the currency to the three major currencies has been changing in the total sample period.<sup>8</sup> It implies how the monetary authorities have been changing their exchange rate policy over time.

#### 4. Analytical Results

Table 3 to Table 19 shows the analytical results for the new EU country currencies, the potential participants in the EU, and the non-euro area EU country currencies. Figures 3 to 19 focus on the coefficient on the euro to summarize the regression results as shown in Tables 3 to 19. A solid line in the figures represents estimates of the coefficients for each quarter of the sample period. Broken lines represent estimates plus or minus 2 times standard deviations of the coefficients. A band between the two broken lines means a statistically significant interval at about 95%. From the analytical results, we describe the feature of each of the currencies as follows.

##### (1) New EU member countries

###### Polish zloty

Table 3 shows coefficients on the three major currencies for the Polish zloty. Coefficients on the euro and the US dollar are statistically significant in most of the sub-sample periods while figure 3 focuses on movements in coefficients on the euro. It means that the Polish zloty has been pegged to the euro and the US dollar. The coefficients on the US dollar were larger than the euro before the 3rd quarter of 2002. However, it has changed since the 2nd quarter of 2003. The coefficients on the euro have become larger than the US dollar (except the 4th quarter of 2003). In the 3rd quarter of 2004, the coefficients of the euro and the US dollar are 85.7 percent and 21.8 percent, respectively. The levels of the adjusted R-squared are mostly lower than 50 percent while it was 97.4 percent in the 3rd quarter of 2004. It means that there should be other factors in explaining the movements in the Polish zloty.

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<sup>8</sup> If one of the estimated coefficients is significantly negative, we re-estimate the equation without them.

### Czech koruna

Table 4 shows movements in the coefficient on the three major currencies for the Czech koruna while figure 4 focuses on movements in coefficients on the euro. It is remarkable feature for the Czech koruna that all of the coefficients on the euro are statistically significant. Most of the coefficients are higher than 80 percent. The coefficients on the US dollar are statistically significant in several periods. Especially in 2002, the coefficients on the US dollar are statistically significant and the coefficients on the euro are lower than 90 percent. However, the coefficients on the euro have become close to unity recently. The levels of the adjusted R-squared are not stable through the sample period. It might have an implication that the exchange rate policy stance of the monetary authorities has been not stable. In the 3rd quarter of 2004, the coefficient on the euro is close to unity and the level of adjusted R-squared is 98.8 percent. It implies that the monetary authorities have changed their exchange rate policy to a euro peg system.

### Slovak koruna

Table 5 shows movements in the coefficient on the three major currencies for the Slovak koruna while figure 5 focuses on movements in coefficients on the euro. Most of the coefficients on the euro are statistically significant and are above 50 percent except in the 1st quarter of 1999. The coefficients on the US dollar are statistically significant in several periods. From the 3rd quarter of 2001 to the 1st quarter of 2003, the coefficients are statistically significant and their levels were between 35 to 75 percent. However, only the coefficients on the euro have been statistically significant since the 2nd quarter of 2003. The coefficient is close to unity in the 2nd quarter of 2004. The levels of the adjusted R-squared are below 50 percent except in the last period while it is 98.7% in the 3rd quarter of 2004. The recent higher level of adjusted R-squared means that the monetary authorities have changed their exchange rate policy to a euro peg system.

### Hungary forint

Table 6 shows movements in coefficients on the three major currencies for the Hungary forint while figure 6 focuses on movements in coefficients on the euro. The Hungary forint had had linkage to both the euro and the US dollar before the 4th quarter of 1999. The coefficients on the euro and the US dollar were almost 70 percent and 30 percent, respectively while the coefficient on the Japanese yen was statistically significant and 10percent in the 1st quarter of 2000. Then the

coefficients on the euro have been close to unity since the 1st quarter of 2000. The coefficients on the US dollar are statistically significant in several periods. However, the Hungary forint has been pegged to only the euro since the 4th quarter of 2002. The levels of the adjusted R-squared have been not stable over the sub-sample period. It means that the Hungarian monetary authorities have not had any stable stance of exchange rate policy. In the 3rd quarter of 2004, the coefficient of the euro is close to unity and the level of adjusted R-squared is very high.

#### Slovenia tolar

The Slovenian tolar has joined the ERM II with fluctuation band of +/- 15% on June 27, 2004. Table 7 shows movements in coefficients on the three major currencies for the Slovenia tolar while figure 7 focuses on movements in coefficients on the euro. The coefficients on the euro are statistically significant and close to unity since the 3rd quarter of 1999 although they were not statistically significant in the 1st and 2nd quarters of 1999. The coefficients on the US dollar were sometimes statistically significant especially in the 1st and 2nd quarters of 1999. The coefficients were from 36% to 38% in the 1st and 2nd quarters of 1999. The coefficients on the euro have become almost close to unity and the levels of the adjusted R-squared also are close to 100 percent since the 2nd quarter of 2003. It means that the Slovenia tolar has been strictly pegged to the euro since the 2nd quarter of 2003.

#### Estonian kroon

The Estonian kroon has joined the ERM II with fluctuation band of +/- 15% on June 27, 2004. Table 8 shows movement in coefficients on the three major currencies for the Estonian kroon while figure 8 focuses on movements in coefficients on the euro. The feature of the Estonian kroon is that the coefficients on the euro are statistically significant and close to unity in all of the sub-sample periods and that levels of the adjusted R-squared are nearly 100 percent in most of the sub-sample periods. The coefficients on the US dollar also are statistically significant in some periods although they are very small. The coefficients on the euro have been unity and the levels of the adjusted R-squared have been 100 percent since the 4th quarter of 2003. It means that the Estonian kroon has perfectly pegged to the Euro from the 4th quarter of 2003.

#### Latvian lat



Table 9 shows movements in coefficients on the three major currencies for the Latvian lat while figure 9 focuses on movements in coefficients on the euro. The remarkable feature of the Latvian lat is that it has been pegged to a currency basket of the three major currencies in all of the sub-sample periods. It means that the monetary authorities in Latvia have adopted a currency basket peg system. However, the coefficients on the three major currencies have been changing over time in the sample period. The coefficients on the euro had been below 25 percent and those of the US dollar were mostly above 50 percent before the 2nd quarter of 2001. The coefficients on the euro have become around 30 percent while those on the US dollar have become below 50 percent since the 3rd quarter of 2001. The coefficients on the Japanese yen are kept at around 10 to 15 percents in all of the sub-sample periods. The levels of the adjusted R-squared are above 90 percent. In the 3rd quarter of 2004, the coefficients of the euro, the US dollar and the Japanese yen are 45 percent, 40 percent and 15 percent, respectively.

#### Lithuanian lita

The Lithuanian lita has joined the ERM II with fluctuation band of +/- 15% on June 27, 2004. Table 10 shows movements in coefficients on the three major currencies for the Lithuanian lita while figure 10 focuses on movements in coefficients on the euro. The interesting feature of the Lithuanian lita is that it has clearly changed from the US dollar peg to the euro peg in the 1st and 2nd quarters of 2002. The monetary authorities had almost perfectly pegged the Lithuanian lita to the US dollar before the 4th quarter of 2001. The coefficients on the US dollar were nearly unity and the levels of the adjusted R-square were 100 percents. They pegged it to a currency basket of the three major currencies in the 1st quarter of 2002. The coefficients on the euro, the US dollar and the Japanese yen were 33 percents, 39 percents and 13 percents, respectively. After the 2nd quarter of 2002, the coefficients on the euro have been nearly unity. Levels of the adjusted R-squared have been near 100%. It means that the Lithuanian monetary authorities have adopted the euro peg system since the 2nd quarter of 2002.

#### Maltese lira

Table 11 shows movements in coefficient on the three major currencies for the Maltese lira while figure 11 focuses on movements in coefficients on the euro. The feature of the Maltese lira is that it had linkages to both the euro and the US dollar in all of the sub-sample periods. However, the coefficients on the two major

currencies have changed over time. The coefficients on the euro had been around 50 percent and those on the US dollar had been mostly above 20 percent before the 3rd quarter of 2002. The coefficients on the euro have increased above 60 percent while those of the US dollar have become around 10 percent since the 4th quarter of 2003. The levels of the adjusted R-square are close to 100 percent in the 2nd quarter of 2004. In the 3rd quarter of 2004 the coefficient of the euro is 86 percent which is the highest in the whole periods while the coefficient of the US dollar is 13 percent.

### Cyprus pound

Table 12 shows movements in coefficients on the three major currencies for the Cyprus pound while figure 12 focuses on movements in coefficients on the euro. The Cyprus pound had had linkage to both the euro and the US dollar before the 2nd quarter of 2000. Coefficients on the euro and the US dollar are almost 95 percent and 5 percent, respectively. However, only the coefficients on the euro have been statistically significant and nearly unity since the 1st quarter of 2001 except the 2nd quarter of 2002. The levels of the adjusted R-square are constantly close to 100 percent over time. It means that the monetary authorities in Cyprus have adopted the euro peg system since the 2nd quarter of 2002.

## (2) Potential participants into the EU

### Rumanian lew

Table 13 shows movements in coefficients on the three major currencies for the Rumanian leu while figure 13 focuses on movements in coefficients on the euro. The coefficients on the US dollar had been close to unity before the 4th quarter of 2002. However since the 2nd quarter of 2003 the Rumanian leu has had linkages to both the euro and the US dollar. The coefficients have been around 80 percents and around 20 percents, respectively. In the 3rd quarter of 2004, the Romanian leu has linkage to the euro only and the coefficient on the euro is close to unity. The level of the adjusted R-squared is close to 100 percents. It means that the monetary authorities have adopted the euro peg system in 2004.

### Bulgarian lev

Table 14 shows movements in coefficients on the major the three currencies for the Bulgarian lev while figure 14 focuses on movements in coefficients on the euro. The feature of the Bulgarian lev is that the coefficients on the euro are statistically significant and close to unity in all of the sub-sample periods. The levels of the

adjusted R-squared are close to 100 percent in most of the sub-sample periods. The coefficients on the US dollar and the Japanese yen are statistically significant in several periods although they are very small.

#### Croatian kuna

Table 15 shows movements in coefficients on the three major currencies for the Croatian kuna while figure 15 focuses on movements in coefficients on the euro. Similar to the Bulgarian lev, the coefficients on the euro are statistically significant and mostly close to unity. Levels of the adjusted R-squared were above 80 percent except in some of sub-sample periods. The coefficients on the US dollar were significant and their weights were around 10 percents in some periods. In the 4th quarter of 2004, the coefficient on the euro is unity and the levels of the adjusted r-squared are 100 percent. It means that the monetary authorities in Croatia have adopted the euro peg system.

#### Turkish lira

Table 16 shows movements in coefficients on the three major currencies for the Turkish lira while figure 16 focuses on movements in coefficients on the euro. The Turkish lira had had linkages to both the euro and the US dollar before the 4th quarter of 2000. The coefficients on the euro and the US dollar are from 50 percent: 50 percent to 40 percent: 60 percent in 1999 and 2000. Levels of the adjusted R-squared in the period were relatively high. However, the Turkish lira had linkages only to the US dollar since the 2nd quarter of 2001 although the adjusted R-squared decreased to very low levels. The Turkish lira has linkages to both the euro and the US dollar since the 4th quarter of 2003. The Turkish monetary authorities have started to peg to a currency basket of both the euro and the US dollar again while it pegged to the basket of three major currencies only in the 2nd quarter of 2004. It seems that the exchange rate policy in Turkey has not been stable yet.

### (3) Non-euro area EU countries

#### Danish krone

Denmark has joined the ERM II with fluctuation band are +/- 2.25% since 1999. The Denmark National Bank is conducting exchange rate targeting monetary policy under the ERMII where it has officially announced to peg the Danish krone to the euro. Table 17 shows movements in coefficients on the three major currencies for

the Danish krone while figure 17 focuses on movements in coefficients on the euro. The feature of the Danish krone is that the coefficients on the euro are statistically significant and close to unity. The levels of the adjusted R-squared are nearly 100 percent in most of the sub-sample periods. The coefficients on the US dollar are statistically significant in some of the sub-sample periods although they are very small. It means that the Denmark National Bank have actually pegged the Danish krone to the euro in the whole sample period under the EMR II.

### Swedish krona

Table 18 shows movements in coefficients on the three major currencies for the Swedish krona while figure 18 focuses on movements in coefficients on the euro. The coefficients on the euro are significant in the whole sample period and are in a wide range between 46 percent to unity. On one hand, the coefficients on the US dollar are statistically significant in a half of the whole period and are in a range between 20 and 40 percents. The coefficients on the Japanese yen are statistically significant in some sub-sample periods although they are around 10 percents. The levels of the adjusted R-squared are between 40 and 70 percents while it is 99.6 percents in the 3rd quarter of 2004. These indicate that the Swedish monetary authorities had partially pegged the Swedish krona to the euro before 2004 and have perfectly pegged it to in 2004..

### Sterling pound

Table 19 shows movements in coefficients on the three major currencies for the Sterling pound while figure 19 focuses on movements in coefficients on the euro. The coefficients on the US dollar are statistically significant in the whole sample period. The coefficients are between 20 and 60 percents. The coefficients on the euro are statistically significant in several sub-sample periods. Most of the coefficients on the Japanese yen are significantly negative and we get rid of the significantly negative coefficients on the Japanese yen from the estimated regression equation as we explained in the previous section. The coefficients on the euro have been larger than those on the US dollar since the 4th quarter of 2001. It means that the Sterling pound has been affected by the euro more strongly than the US dollar. However, the linkages are relatively weaker because the levels of the adjusted R-squared are small in comparison with the other countries studied here.

## (4) Summary

As we described above, we recognized that there are some differences in the exchange rate systems among the non-euro-area countries in Europe. We summarize our analytical results for new EU member countries in Table 19. According to the estimated coefficients on equation (2), we classify four types of exchange rate system according to Bénassy-Quéré and Coeuré (2000). The four types of exchange rate system are classified as follows:

A. Rigid peg to a single currency

Only one of the estimated coefficients is statistically significant and its estimate is unity.

B. Partial peg to a single currency

Only one of the estimated coefficients is statistically significant and its estimate is smaller than unity.

C. Peg to a currency basket

Some of the estimated coefficients are statistically significant and a sum of the coefficients is close to unity. There are four types of currency basket.

(a) Peg to a currency basket of US dollar/euro

The home currency is pegged to a currency basket of the US dollar and the euro. The coefficient on the US dollar is larger than that on the euro.

(b) Peg to a currency basket of euro/US dollar

The home currency is pegged to a currency basket of the euro and the US dollar. The coefficient on the euro is larger than that on the US dollar.

(c) Peg to a currency basket of euro/Japanese yen

The home currency is pegged to a currency basket of the euro and the Japanese yen. The coefficient on the euro is larger than that on the Japanese yen.

(d) Peg to a currency basket of euro/US dollar/Japanese yen

The home currency is pegged to a currency basket of the euro, the US dollar, and the Japanese yen.

D. Free floating

None of the estimated coefficients are statistically significant.

Table 20 shows the changes in exchange rate systems of the new EU member countries during a period from 1999 to 2004. In 1999 a share of the peg to a currency basket of euro/US dollar is 30 percents, which is the highest among exchange rate systems in 1999. The partial peg to the euro has the second share which is 22.5 percents. Total of the shares of the peg to currency baskets is 62.5 percents. These show that most of the countries adopted a partial peg to the euro or a peg to currency baskets in 1999. A share of the unitary peg to the US dollar is 10

percents while a share of unitary peg to the euro is zero.

However, a share of the rigid peg to the euro has started to increase gradually since 2000. It was 10 percents in 2000 and it becomes 30 percents in 2004. On one hand, a share of the rigid peg to the US dollar has become to zero since 2002. A share of the partial peg to the euro also has increased from 22.5 percents in 1999 to 40 percents in 2004. On the other hand, shares of the peg to currency baskets have decreased from 62.5 percents in 1999 to 30 percents in 2004.

These results indicate that the new EU member countries have changed their exchange rate systems to the rigid peg to the euro or the partial peg to the euro from the rigid peg to the US dollar or the partial peg to the US dollar and the peg to currency basket. The changes were made immediately before the participation into the EU in May 2004. Especially Estonia, Lithuania, and Slovenia before their currencies joined the ERM II in June 2004.

As for the potential participants into the EU, the monetary authorities in Rumania, Bulgaria, and Croatia have been adopted a rigid peg to the euro while the authorities in Rumania had been adopting a rigid peg to the US dollar before 2002. On one hand, the monetary authorities in Turkey have adopted a partial peg to a currency basket of the euro and the US dollar recently. Lastly, we can find a rigid peg to the euro for the Danish krone and the Swedish krona among the non-euro area EU countries. On one hand, we can find somewhat linkages to the euro and the US dollar.

The stronger linkage of the new EU country currencies and the EU candidate currencies to the euro might have adverse effects on their economy under the current situation where the euro has been appreciating against the US dollar. Table 21 shows trade shares with the euro area countries and rest of the EU countries for each of the countries. Some of the New EU member countries which includes Czech, Hungry, Poland, Slovak, and Slovenia have larger than a half of trade with the euro area countries. On one hand, all of the new EU member countries have larger than a half of trade with rest of the EU25 counties. The new EU member countries have as strong trade relationship with the euro area countries and rest of the EU25 countries as the euro area countries.

## 5. Convergence of interest rates

Next, we investigate whether interest rates in the new EU member countries

have converged to those in the euro area in response to their changes of their exchange rate policies. In order to analyze how much the interest rate in the new EU member countries have converged to those in the euro area, we use three kinds of interest rates which include an overnight money market interest rate as a very short-term interest rate, a 3 month money market interest rate as a short-term interest rate, and a 10 year government bond yield as a long-term interest rate. We investigate how their interest rate differentials between each sampled country and the euro area have decreased during a sample period from January 1999 to September 2004.<sup>9</sup>

#### 5-1. Interest rate differentials

##### (1) Very short-term interest rate differentials

Figure 20 shows movements in monthly data of overnight interest rate differentials between the new EU member countries (Poland, Czech, Slovakia, Latvia, Lithuania, Cyprus, and Hungary) and the euro area. In 1999, three of them were moving outside of  $\pm 5$  percent band of the interest rate differentials. Especially, the interest differentials between Poland and the euro area were fluctuating between 10 to 20 percent during a period from 1999 to 2001. However they have been moving within  $\pm 5$  percent band since December 2002. In 2004, the very short-term interest rate differentials have been fluctuating within  $\pm 5$  percent band except for Hungary. The interest rates in the new EU member countries except for Hungary have converged to those in the euro area.

Figure 21 shows movements in monthly data of overnight interest rate differentials between the future EU member candidates (Rumania, Croatia, and Turkey) and the euro area. We find that the interest rate differentials are far wider than those between new EU member countries and the euro area. In 2004, the very short-term interest rate differentials between Rumania, Turkey, and the euro area are still around 20 percent. Those between Croatia and the euro area have been fluctuating within  $\pm 5$  percent band since March 2000. The movements are similar to the case of new EU member countries.

Figure 22 shows movements in monthly data of overnight interest rate differentials between the non-euro area EU countries (Denmark, United Kingdom, and Sweden) and the euro area. We find that the interest rate differentials between

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<sup>9</sup> We check monthly interest rate differentials here. Due to the constraint of data, we apply the month end rate for short-term and medium-term interest rate differentials and the monthly average rate for long-term government bond yield.

the United Kingdom and the euro area are fluctuating almost within  $\pm 3$  percent band. On one hand, those between Denmark, Sweden, and the euro area are moving almost within  $\pm 1$  percent band in the whole sample period. Especially, the Denmark National Bank has to change its interest rates so as to keep the same level with the euro denominated interest rates for its exchange rate targeting under the ERMII. It shows that the very short-term interest differentials between these countries and the euro area have been converging into a narrow range regardless of their nonparticipation to the euro area.

## (2) Short-term interest rate differentials

Figure 23 shows movements in monthly data of 3 month money market interest rate differentials between the new EU member countries and the euro area. In 1999, most of them were fluctuating outside of  $\pm 5$  percent band. However, the interest rate differentials have been moving within 5 percent except for Poland and Hungary since March 2000. The interest rate differentials between Poland and the euro area were gradually decreasing and have been moving within 5 percent since September 2002. In 2004, only the interest rate differentials between Hungary and the euro area are still outside of  $\pm 5$  percent band.

Figure 24 shows movements in monthly data of 3 month money market interest rate differentials between the future EU member candidates and the euro area. Similar to the very short-term interest differentials, the short-term interest rate differentials between Rumania, Turkey, and the euro area have been very wide and they are still around 20 percent in 2004. On the other hand, the interest rate differentials between Bulgaria and the euro area have been moving within a narrow range of  $\pm 2$  percent since 2003. The interest rate differentials between Croatia and the euro area are around 5 percent in 2004.

Figure 25 shows movements in monthly data of 3 month money market interest rate differentials between the non-euro area EU countries and the euro area. The interest rate differentials between the United Kingdom and the euro area have been fluctuating within  $\pm 3$  percent band. On one hand, the interest rate differentials between Denmark, Sweden, and the euro area have been moving within  $\pm 1.5$  percent band during the whole sample period.

## (3) Long-term interest rate differentials

Figure 26 shows movements in monthly data of the long-term (10 years) government bond yield differentials between the new EU member countries and



euro area from February 2003 to September 2004 due to the data constraints.<sup>10</sup> We find that the long-term government bond yield differentials between the new EU member countries and euro area are moving within 5 percent throughout the whole sample period. We can classify the new EU member countries into two groups. One group includes the countries (Czech, Slovakia, Latvia, Lithuania and Malta) whose interest rate differentials are narrowing and moving within +/-1 percent band in 2004. Another group includes the countries (Hungary, Poland and Cyprus) whose differentials are widening to above 2 percent in 2004.

Figure 27 shows movements in monthly data of the long-term government bond yield differentials between the non-euro area EU countries and the euro area. Their interest rate differentials are moving within +/-1 percent band throughout the whole sample period. Among the three countries, the movements in long term government bond yield differentials between the United Kingdom and the euro area are fluctuating. On one hand, the movements in long-term interest rate differentials between Denmark and euro area are most stable and moving within a very narrow range (0.4 percent).

## 5-2. The relationship between the change of exchange rate system and the interest rate differentials

According to the analytical results in sections 4 and 5-1, we find that the interest rates in the new EU member countries have been converging to those while their exchange rate policies have been changing into pegging or targeting the home currencies into the euro. The interest rate convergences are related with their exchange rate regime switching. Regarding the very short-term and short-term interest rate differentials, the countries who have applied the euro-peg system have higher degrees of interest rate convergence than the other countries. For example, the interest rate differentials in Czech, Estonia, and Cyprus are moving within a narrower range than the others. Additionally, the interest rate differentials in Latvia who has applied currency basket system also are stable within a narrow range. In the case of Latvia, the interest rate differentials are becoming narrower as the weights on the euro become larger than ever.

On the other hand, the interest rate differentials in the countries who have applied US dollar peg system or peg to a currency basket of US dollar/euro in the

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<sup>10</sup> As for the data of Estonia, there are few government bond issued in Estonia.

early part of the sample period were wider than the others and outside range of +/- 5 percent. However, their interest rates have converged with those in the euro area as they have changed their exchange rate policies from the US dollar peg system to the euro peg system. For example, the interest rate differentials between Lithuania and euro area have been moving within +/-5 percent range since April 2000 and moving within around +/- 2 percent range since 2001:Q2. They have changed their exchange rate system from the US dollar peg system to the euro peg system since 2001:Q4.

According to the analytical results on the long-term government bond yield differentials between the new EU member countries and the euro area, we can find no clear relationship between the long-term interest rate convergences and the changes in exchange rate system for the new EU member countries.

## 6. Conclusion

The new EU member countries have changed their exchange rate system to the euro peg system or have increased a weight on the euro in their currency basket peg system in recent years. It reflects a fact that they have joined the EU and have begun to prepare for joining the ERM II and, in turn, joining the euro area in the near future. At the same time, the very short-term and short-term interest rates in the new EU member countries have tendencies to converge into those in the euro area. The exchange rate regime switching is consistent with the interest rate convergences in the new EU member countries.

The stronger linkage of the new EU country currencies and the EU candidate currencies to the euro might have adverse effects on their economy under the current situation where the euro has been appreciating against the US dollar. The appreciation of the euro against the US dollar should weaken their international price competitiveness of their domestic products while it should improve their terms of trade. We should investigate what effects the new EU member countries and the EU member candidate countries will have on their economy after they have changed the exchange rate system to prepare for their joining the euro area in the near future.

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Table 1. The East European countries' reported Exchange Rate Arrangements to IMF

	as of Dec 1997	as of Jan 1999	as of Dec 2003	as of June 2004
Polish zloty	Managed floating	Exchange rates within crawling bands(2.25%)	Independently floating	Independently floating
Hungarian forint	Managed floating	Exchange rates within crawling bands(12.5%)	Pegged exchange rates within horizontal bands (15%)	Pegged exchange rates within horizontal bands (15%)
Czech koruna	Managed floating	Managed floating *	Managed floating *	Managed floating *
Slovak koruna	Currency pegged to other composite	Managed floating *	Managed floating *	Managed floating *
Slovenian tolar	Managed floating	Managed floating *	Exchange rates within crawling bands(unannounced)	Pegged exchange rates within horizontal bands (15%)
Cyprus pound	Currency pegged to other composite	Pegged exchange rates within horizontal bands	Pegged exchange rates within horizontal bands	Pegged exchange rates within horizontal bands
Maltese lira	Currency pegged to other composite	Other conventional fixed peg arrangements	Other conventional fixed peg arrangements	Other conventional fixed peg arrangements
Estonian kroon	Currency pegged to DM	Currency board arrangements	Currency board arrangements	Currency board arrangements
Latvian lat	Currency pegged to SDR	Other conventional fixed peg arrangements	Other conventional fixed peg arrangements	Other conventional fixed peg arrangements
Lithuanian lita	Currency pegged to USD	Currency board arrangements	Currency board arrangements	Currency board arrangements
Bulgaria lev	Currency pegged to DM	Currency board arrangements	Currency board arrangements	Currency board arrangements
Turkish lira	Managed floating	Crawling pegs	Independently floating	Independently floating
Croatian kuna	Managed floating	Pegged exchange rates	Managed floating *	Managed floating *
Rumanian leu	Independently floating	Managed floating *	Exchange rates within crawling bands(unannounced)	Exchange rates within crawling bands(unannounced)

Source: International Financial Statistics, IMF

Managed floating \* means Monaged floating with no predetermined path for the exchange rate.

Table 2. Correlation matrix between Sampled currencies and the candidates of numeraire\*

a. Explanatory variables

	US dollar	Euro	Japanese yen
Swiss francs*	0.303	0.839	0.397
SDR*	0.781	0.816	0.597
UK pound*	0.537	0.713	0.364
US dollar	1.000	0.377	0.374
Euro	0.377	1.000	0.326
Japanese yen	0.374	0.326	1.000

b. explained variable (new-EU currencies)

	Polish zloty	Hungarian forint	Czech koruna	Slovak koruna	Slovenian tolar	Cyprus pound	Maltese lira	Estonian kroon	Latvian lat	Lithuanian lita	Bulgarian lev
Swiss francs*	0.406	0.683	0.715	0.656	0.792	0.841	0.806	0.829	0.666	0.604	0.836
SDR*	0.547	0.696	0.715	0.616	0.789	0.819	0.905	0.811	0.973	0.791	0.819
UK pound*	0.457	0.600	0.627	0.521	0.699	0.714	0.845	0.710	0.789	0.653	0.714
US dollar	0.416	0.339	0.341	0.358	0.382	0.383	0.545	0.375	0.787	0.574	0.385
Euro	0.524	0.836	0.860	0.674	0.953	0.997	0.951	0.992	0.782	0.681	0.997
Japanese yen	0.221	0.276	0.285	0.275	0.295	0.333	0.382	0.325	0.569	0.407	0.331

c. explained variable (future EU currencies)

	Turkish lira	Croatian kuna	Rumanian leu
Swiss francs*	0.100	0.799	0.315
SDR*	0.207	0.787	0.531
UK pound*	0.130	0.681	0.415
US dollar	0.214	0.385	0.485
Euro	0.170	0.949	0.377
Japanese yen	0.060	0.317	0.251

d. explained variable (non-euro EU currencies)

	Danish krone	Swedish krona	Sterling pound
Swiss francs*	0.836	0.694	0.621
SDR*	0.815	0.715	0.813
UK pound*	0.713	0.626	1.000
US dollar	0.380	0.354	0.537
Euro	0.997	0.845	0.713
Japanese yen	0.323	0.289	0.364

Data: All foreign exchange data are from Datastream. Sample period is 1/1/1999 to 9/30/2004.

1. To calculate each correlation, we use the Canadian dollar as a numeraire.

Appendix: EU countries who join ERM II

Country	Date to join	Central rate (for 1 euro)	Fluctuation band
Denmark	1-Jan-99	7.46038	+/-2.25%
Estonia	27-Jun-04	15.6466	+/-15%
Lithuania	27-Jun-04	3.4528	+/-15%
Slovenia	27-Jun-04	239.64	+/-15%

Source: the portal site of the European Union

Table 3. POLISH ZLOTY

	Constant	euro	US dollar	Japanese yen	DW	Adj.R2
1999 : 1Q	0.0014 (0.0009)	0.6988 *** (0.2201)	0.9239 ** (0.2335)	-0.0257 (0.1009)	1.9589	0.3344
1999 : 2Q	-0.0008 * (0.0004)	0.5987 *** (0.0904)	0.6102 *** (0.1171)	-0.0413 (0.0620)	1.9549	0.5711
1999 : 3Q	0.0008 (0.0007)	0.1073 (0.1428)	0.7081 *** (0.1560)	-0.0455 (0.0855)	1.6158	0.2434
1999 : 4Q	-0.0004 (0.0007)	0.6557 (0.1809)	0.7287 *** (0.1932)	-0.0928 (0.1079)	1.8806	0.2717
2000 : 1Q	-0.0004 (0.0005)	0.5438 ** (0.0998)	0.5442 *** (0.1311)	0.0572 (0.0691)	2.0130	0.5068
2000 : 2Q	0.0006 (0.0012)	0.3624 ** (0.1697)	0.4433 * (0.2542)	-0.1309 (0.1589)	2.1960	0.1065
2000 : 3Q	0.0002 (0.0006)	0.3264 *** (0.1071)	0.7173 *** (0.1989)	-0.0689 (0.1290)	1.7200	0.3737
2000 : 4Q	-0.0010 * (0.0006)	0.5259 *** (0.0950)	0.7238 *** (0.1011)	- -	2.0048	0.6376
2001 : 1Q	-0.0010 (0.0006)	0.6376 *** (0.0944)	0.1720 (0.1327)	0.0783 (0.0895)	2.2825	0.4362
2001 : 2Q	-0.0005 (0.0005)	0.3389 *** (0.1073)	0.5009 *** (0.1452)	0.0115 (0.0891)	1.7726	0.3158
2001 : 3Q	0.0005 (0.0011)	0.0081 (0.2308)	1.4146 *** (0.2756)	-0.0124 (0.1823)	1.2905	0.2939
2001 : 4Q	-0.0013 ** (0.0005)	0.3555 ** (0.1373)	0.6521 *** (0.1317)	0.1127 (0.1349)	2.1998	0.4727
2002 : 1Q	0.0005 (0.0007)	0.2349 (0.1753)	0.6146 *** (0.2441)	0.1008 (0.1164)	1.9120	0.1205
2002 : 2Q	0.0003 (0.0005)	0.4616 *** (0.1522)	0.8870 *** (0.1415)	- -	1.9567	0.3779
2002 : 3Q	0.0003 (0.0006)	0.3449 * (0.1925)	0.7074 *** (0.1188)	-0.0577 (0.1291)	1.8973	0.3443
2002 : 4Q	-0.0006 (0.0005)	0.5253 *** (0.1643)	0.3157 ** (0.1284)	0.0509 (0.0976)	2.0533	0.3115
2003 : 1Q	0.0011 (0.0007)	0.1422 (0.2127)	0.6017 *** (0.1721)	0.0469 (0.1693)	2.1491	0.2137
2003 : 2Q	-0.0002 (0.0008)	0.5965 *** (0.1663)	0.2264 (0.1592)	- -	2.4895	0.2256
2003 : 3Q	0.0003 (0.0005)	0.8133 *** (0.1191)	0.1029 (0.1316)	-0.0266 (0.1089)	1.8924	0.4198
2003 : 4Q	-0.0005 (0.0005)	0.5952 *** (0.1319)	0.7561 *** (0.1563)	0.1716 (0.1049)	2.1968	0.5175
2004 : 1Q	0.0005 (0.0006)	0.3651 ** (0.1529)	0.3368 *** (0.1086)	-0.1172 (0.1153)	1.5819	0.2243
2004 : 2Q	-0.0009 (0.0005)	0.6747 *** (0.1173)	0.0960 (0.0900)	0.1454 * (0.0847)	2.1606	0.4750
2004 : 3Q	-0.0004 (0.0005)	0.8573 *** (0.1135)	0.2183 * (0.1129)	-0.0769 (0.1251)	2.2249	0.9739

1. Calculated by authors. All foreign exchange data are from Datastream.

2. If the estimated coefficient is significantly negative, we re-estimate the equation without them.

3. Standard deviations are in parenthesis. \*, \*\* and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 4. CZECH KORUNA

	Constant	euro	US dollar	Japanese yen	DW	Adj.R2
1999 : 1Q	0.0014 (0.0007)	1.0501 *** (0.1629)	0.2383 (0.1728)	-0.0042 (0.0747)	1.5151	0.4408
1999 : 2Q	-0.0009 ** (0.0003)	0.9368 *** (0.0798)	-0.0485 (0.1034)	0.0159 (0.0548)	1.9682	0.6948
1999 : 3Q	-0.0003 (0.0004)	0.9190 ** (0.0785)	0.0773 (0.0858)	-0.0076 (0.0470)	2.0979	0.6863
1999 : 4Q	0.0004 (0.0005)	0.7640 *** (0.1285)	-0.0312 (0.1372)	0.1302 * (0.0766)	2.2393	0.3374
2000 : 1Q	0.0001 (0.0004)	0.8979 *** (0.0680)	0.1959 ** (0.0893)	0.0094 (0.0471)	2.1860	0.7469
2000 : 2Q	-0.0003 (0.0003)	0.9346 *** (0.0481)	-0.0009 (0.0721)	0.0359 (0.0450)	1.8055	0.8707
2000 : 3Q	0.0001 (0.0002)	0.9156 *** (0.0437)	0.0327 (0.0812)	0.0385 (0.0527)	2.3055	0.8735
2000 : 4Q	-0.0002 (0.0004)	0.8423 *** (0.0732)	0.3061 *** (0.1133)	-0.0713 (0.0965)	2.0619	0.7362
2001 : 1Q	-0.0002 (0.0004)	0.9087 *** (0.0562)	0.1059 (0.0790)	0.0441 (0.0533)	2.2318	0.8088
2001 : 2Q	-0.0003 (0.0003)	0.9244 *** (0.0508)	0.0564 (0.0688)	-0.0073 (0.0422)	2.2934	0.8405
2001 : 3Q	-0.0002 (0.0003)	0.8329 *** (0.0634)	0.1751 ** (0.0757)	0.0390 (0.0501)	1.9955	0.7414
2001 : 4Q	-0.0008 (0.0006)	0.9277 *** (0.1621)	0.1680 (0.1555)	-0.1405 (0.1592)	2.2693	0.3306
2002 : 1Q	-0.0003 (0.0004)	0.9378 *** (0.1095)	0.1606 (0.1524)	-0.0070 (0.0727)	2.0999	0.5487
2002 : 2Q	-0.0013 (0.0007)	0.8843 ** (0.2263)	0.2275 * (0.1937)	-0.1389 (0.1338)	1.9302	0.1677
2002 : 3Q	0.0007 (0.0007)	0.5877 *** (0.2048)	0.1530 * (0.1264)	-0.0650 (0.1374)	1.7446	0.0895
2002 : 4Q	0.0004 (0.0004)	0.7065 * (0.1410)	0.1402 * (0.1102)	-0.0898 (0.0838)	1.6913	0.3354
2003 : 1Q	0.0002 (0.0005)	0.8835 ** (0.1561)	0.1026 (0.1263)	0.0117 (0.1242)	2.2119	0.4352
2003 : 2Q	-0.0002 (0.0003)	0.9987 *** (0.0706)	0.0455 (0.0677)	0.0032 (0.0654)	1.9942	0.8333
2003 : 3Q	0.0002 (0.0005)	0.7814 *** (0.1042)	- -	0.0577 (0.0774)	1.6464	0.4663
2003 : 4Q	0.0001 (0.0004)	0.9894 *** (0.0908)	0.0952 (0.1077)	-0.0785 (0.0723)	1.7949	0.6650
2004 : 1Q	0.0003 (0.0005)	0.9617 *** (0.1288)	-0.0709 (0.0915)	0.1012 (0.0971)	2.2353	0.4970
2004 : 2Q	-0.0005 (0.0005)	1.0170 *** (0.1131)	-0.0386 (0.0868)	0.0157 (0.0817)	2.0706	0.5911
2004 : 3Q	-0.0001 (0.0004)	1.0424 *** (0.0695)	-0.0479 (0.0697)	- -	1.8501	0.9882

1. Calculated by authors. All foreign exchange data are from Datastream.

2. If the estimated coefficient is significantly negative, we re-estimate the equation without them.

3. Standard deviations are in parenthesis. \*, \*\* and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.



Table 5. SLOVAK KORUNA

	Constant	euro	US dollar	Japanese yen	DW	Adj.R2
1999 : 1Q	0.0019 ** (0.0008)	0.3585 * (0.1820)	0.6905 *** (0.1930)	0.0871 (0.0834)	2.3290	0.2790
1999 : 2Q	0.0003 (0.0009)	0.7650 *** (0.2174)	0.3433 (0.2817)	0.2613 * (0.1492)	2.5899	0.2616
1999 : 3Q	-0.0006 (0.0007)	0.5522 *** (0.1386)	0.2509 * (0.1514)	0.1453 * (0.0830)	3.0259	0.2839
1999 : 4Q	-0.0003 (0.0005)	0.8844 *** (0.1385)	0.0099 (0.1480)	-0.0457 (0.0826)	2.4441	0.3821
2000 : 1Q	0.0000 (0.0006)	0.7520 *** (0.1163)	0.0078 (0.1527)	0.1117 (0.0805)	2.3774	0.3980
2000 : 2Q	0.0001 (0.0008)	0.5361 *** (0.1213)	0.1054 (0.1817)	-0.1239 (0.1135)	2.4542	0.2368
2000 : 3Q	0.0005 (0.0006)	0.7872 *** (0.1088)	0.0451 (0.2020)	0.2208 * (0.1311)	2.3953	0.4795
2000 : 4Q	-0.0005 (0.0008)	0.6606 *** (0.1340)	0.2065 (0.2075)	0.3046 * (0.1768)	2.7100	0.4619
2001 : 1Q	0.0001 (0.0006)	0.6137 *** (0.0895)	0.1022 (0.1258)	0.0092 (0.0849)	2.4174	0.4234
2001 : 2Q	-0.0005 (0.0005)	0.6975 *** (0.1051)	0.2284 (0.1422)	-0.0761 (0.0872)	2.5198	0.4103
2001 : 3Q	-0.0001 (0.0012)	0.8563 *** (0.2520)	0.7497 ** (0.3009)	-0.1400 (0.1990)	2.9076	0.1555
2001 : 4Q	-0.0002 (0.0006)	0.6383 *** (0.1537)	0.3670 ** (0.1474)	-0.0061 (0.1510)	2.7052	0.3054
2002 : 1Q	-0.0002 (0.0006)	0.8625 *** (0.1384)	0.5241 *** (0.1927)	-0.0022 (0.0919)	2.8140	0.4444
2002 : 2Q	-0.0005 (0.0007)	0.2007 (0.2441)	0.4756 ** (0.2089)	-0.0750 (0.1443)	2.5176	0.0330
2002 : 3Q	-0.0009 (0.0007)	1.0143 *** (0.2162)	0.4394 *** (0.1334)	-0.0330 (0.1450)	2.3386	0.3132
2002 : 4Q	-0.0003 (0.0005)	0.8598 *** (0.1755)	0.3684 ** (0.1419)	- -	2.2395	0.4123
2003 : 1Q	0.0000 (0.0008)	0.9559 *** (0.2343)	0.3506 * (0.1896)	-0.0792 (0.1866)	2.7563	0.2876
2003 : 2Q	-0.0001 (0.0007)	0.9479 *** (0.1437)	0.1463 (0.1376)	- -	2.9227	0.4559
2003 : 3Q	-0.0001 (0.0006)	0.7324 *** (0.1321)	0.0286 (0.1460)	0.0327 (0.1209)	2.5607	0.3127
2003 : 4Q	-0.0002 (0.0005)	0.8019 *** (0.1279)	0.1532 (0.1516)	0.0996 (0.1017)	2.9295	0.4532
2004 : 1Q	-0.0001 (0.0009)	0.5301 (0.2310)	0.1445 (0.1640)	0.0711 (0.1742)	2.9139	0.1130
2004 : 2Q	-0.0001 (0.0005)	1.0474 *** (0.1238)	-0.0188 (0.0950)	-0.0358 (0.0894)	2.6999	0.5528
2004 : 3Q	0.0000 (0.0004)	0.8875 *** (0.0801)	0.0472 (0.0796)	0.0703 (0.0882)	2.5850	0.9870

1. Calculated by authors. All foreign exchange data are from Datastream.

2. If the estimated coefficient is significantly negative, we re-estimate the equation without them.

3. Standard deviations are in parenthesis. \*, \*\* and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 6. HUNGARIAN FORINT

	Constant	euro	US dollar	Japanese yen	DW	Adj.R2
1999 : 1Q	0.0008 (0.0005)	0.5675 *** (0.1268)	0.6993 *** (0.1345)	0.1062 * (0.0581)	2.0337	0.5494
1999 : 2Q	-0.0001 (0.0002)	0.6226 *** (0.0481)	0.2888 *** (0.0623)	-0.0229 (0.0330)	2.2337	0.7745
1999 : 3Q	0.0003 (0.0001)	0.7159 *** (0.0296)	0.3045 *** (0.0323)	-0.0071 (0.0177)	1.7806	0.9231
1999 : 4Q	0.0001 (0.0001)	0.7120 *** (0.0320)	0.3183 *** (0.0341)	-0.0056 (0.0191)	2.2413	0.8990
2000 : 1Q	0.0002 (0.0001)	0.9649 *** (0.0274)	0.0435 (0.0359)	-0.0117 (0.0189)	2.2882	0.9521
2000 : 2Q	0.0001 (0.0002)	0.9921 *** (0.0246)	0.0242 (0.0327)	-	2.5480	0.9666
2000 : 3Q	0.0002 (0.0001)	0.9874 *** (0.0139)	0.0065 (0.0257)	0.0134 (0.0167)	2.7821	0.9877
2000 : 4Q	0.0001 (0.0001)	0.9950 *** (0.0226)	0.0741 ** (0.0350)	-0.0146 (0.0298)	2.3673	0.9725
2001 : 1Q	0.0001 (0.0001)	1.0012 *** (0.0170)	-0.0142 (0.0239)	0.0212 (0.0161)	2.8507	0.9822
2001 : 2Q	-0.0014 *** (0.0005)	0.9813 ** (0.0962)	-0.1033 (0.1302)	-0.0147 (0.0798)	1.6409	0.6152
2001 : 3Q	0.0005 (0.0010)	1.0763 *** (0.2140)	0.5061 * (0.2554)	-0.1321 (0.1690)	1.6596	0.2664
2001 : 4Q	-0.0007 (0.0004)	0.6523 *** (0.1147)	0.2769 ** (0.1100)	0.0468 (0.1127)	2.1634	0.4397
2002 : 1Q	-0.0001 (0.0004)	0.8848 *** (0.0894)	0.0427 (0.1245)	0.0187 (0.0594)	2.0500	0.6135
2002 : 2Q	-0.0003 (0.0003)	0.9398 *** (0.1085)	0.2857 *** (0.0929)	-0.0888 (0.0642)	2.2392	0.5541
2002 : 3Q	-0.0001 (0.0005)	1.0387 *** (0.1381)	0.1709 ** (0.0852)	-0.0799 (0.0927)	1.7483	0.4790
2002 : 4Q	-0.0005 (0.0003)	0.9527 *** (0.1046)	0.0046 (0.0817)	0.0712 (0.0621)	1.7916	0.6522
2003 : 1Q	0.0006 (0.0007)	0.8287 *** (0.1983)	0.0421 (0.1604)	0.1042 (0.1578)	1.2861	0.3206
2003 : 2Q	0.0012 (0.0009)	1.0661 *** (0.2186)	0.0220 (0.2095)	-0.0410 (0.2023)	1.7685	0.3360
2003 : 3Q	-0.0006 (0.0004)	0.9105 *** (0.0987)	-0.0206 (0.1090)	0.0677 (0.0902)	1.7509	0.5702
2003 : 4Q	0.0005 (0.0009)	0.8916 *** (0.2206)	-0.1242 (0.2616)	0.2102 (0.1755)	2.1291	0.2592
2004 : 1Q	-0.0008 (0.0006)	0.9818 *** (0.1630)	0.0058 (0.1158)	0.0158 (0.1229)	1.9160	0.3723
2004 : 2Q	0.0001 (0.0005)	0.8797 *** (0.1148)	-	0.1020 (0.0801)	1.7590	0.5371
2004 : 3Q	-0.0003 (0.0004)	0.9948 *** (0.0927)	0.0012 (0.0922)	-0.0171 (0.1021)	1.7413	0.9818

1. Calculated by authors. All foreign exchange data are from Datastream.

2. If the estimated coefficient is significantly negative, we re-estimate the equation without them.

3. Standard deviations are in parenthesis. \*, \*\* and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 7. SLOVENIAN TOLAR

	Constant	euro	US dollar	Japanese yen	DW	Adj.R2
1999 : 1Q	0.0007 (0.0006)	0.4134 (0.2861)	0.3846 *** (0.1203)	- -	2.7064	0.2829
1999 : 2Q	0.0006 (0.0005)	0.6525 (0.3487)	0.3567 *** (0.1278)	-0.0365 (0.0735)	2.7163	0.1623
1999 : 3Q	-0.0001 (0.0003)	1.0741 *** (0.3590)	0.0939 (0.0739)	-0.0296 (0.0369)	2.8850	0.2214
1999 : 4Q	0.0003 (0.0002)	0.9455 *** (0.1623)	0.0657 * (0.0371)	- -	2.4434	0.4162
2000 : 1Q	0.0003 *** (0.0001)	0.9822 *** (0.0474)	0.0128 (0.0158)	-0.0068 (0.0080)	2.2404	0.8763
2000 : 2Q	0.0003 * (0.0002)	0.9928 *** (0.0714)	-0.0348 (0.0404)	0.0334 (0.0229)	2.6592	0.7585
2000 : 3Q	0.0002 (0.0003)	0.9177 *** (0.1245)	0.0006 (0.0970)	-0.0134 (0.0522)	2.9824	0.4784
2000 : 4Q	0.0003 *** (0.0001)	1.0154 *** (0.0408)	0.0048 (0.0231)	-0.0076 (0.0143)	2.8221	0.9096
2001 : 1Q	0.0002 * (0.0001)	0.9390 *** (0.0454)	-0.0144 (0.0240)	0.0003 (0.0136)	2.5204	0.8740
2001 : 2Q	0.0002 (0.0001)	1.0390 *** (0.0682)	0.0217 (0.0286)	0.0030 (0.0154)	2.6738	0.7829
2001 : 3Q	0.0001 (0.0001)	1.0202 *** (0.0298)	0.0026 (0.0229)	0.0073 (0.0175)	2.6871	0.9613
2001 : 4Q	-0.0001 (0.0002)	1.0205 *** (0.0926)	0.0172 (0.0660)	0.0063 (0.0440)	2.5629	0.7720
2002 : 1Q	0.0003 (0.0003)	1.3958 *** (0.1796)	0.0097 (0.0947)	-0.0336 (0.0565)	2.8269	0.4979
2002 : 2Q	0.0000 (0.0001)	0.9418 *** (0.0972)	0.0147 (0.0341)	-0.0190 (0.0268)	0.9445	0.6368
2002 : 3Q	0.0002 (0.0002)	1.0137 *** (0.1035)	-0.0409 (0.0463)	0.0576 (0.0373)	2.1785	0.6676
2002 : 4Q	0.0001 (0.0002)	0.7802 *** (0.1802)	0.0582 (0.0687)	0.0002 (0.0396)	2.9523	0.3436
2003 : 1Q	-0.0001 (0.0005)	0.4665 (0.4131)	0.2467 * (0.1278)	-0.1348 (0.0881)	2.5213	0.0731
2003 : 2Q	0.0001 *** (0.0000)	0.9825 *** (0.0121)	0.0106 ** (0.0051)	- -	2.2796	0.9921
2003 : 3Q	0.0001 ** (0.0000)	1.0091 *** (0.0226)	-0.0069 (0.0149)	-0.0029 (0.0091)	2.4420	0.9756
2003 : 4Q	0.0001 ** (0.0000)	0.9797 *** (0.0161)	0.0148 *** (0.0053)	- -	2.1434	0.9911
2004 : 1Q	0.0001 ** (0.0000)	0.9708 *** (0.0235)	0.0105 (0.0126)	-0.0065 (0.0074)	2.2423	0.9707
2004 : 2Q	0.0001 ** (0.0000)	0.9789 *** (0.0202)	0.0080 (0.0096)	-0.0036 (0.0062)	2.4297	0.9842
2004 : 3Q	0.0000 (0.0001)	0.9406 *** (0.0442)	0.0217 (0.0187)	0.0067 (0.0120)	3.1577	0.9327

1. Calculated by authors. All foreign exchange data are from Datastream.

2. If the estimated coefficient is significantly negative, we re-estimate the equation without them.

3. Standard deviations are in parenthesis. \*, \*\* and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 8. ESTONIAN KROON

	Constant	euro	US dollar	Japanese yen	DW	Adj.R2
1999 : 1Q	0.0001 (0.0002)	0.9594 *** (0.0493)	0.0586 (0.0523)	-0.0262 (0.0226)	2.9420	0.8686
1999 : 2Q	0.0000 (0.0002)	0.9707 *** (0.0487)	- -	-0.0197 (0.0314)	2.8749	0.8673
1999 : 3Q	0.0001 (0.0002)	0.9880 *** (0.0327)	-0.0212 (0.0357)	0.0291 (0.0196)	2.9210	0.9355
1999 : 4Q	0.0001 (0.0002)	0.9564 *** (0.0520)	- -	0.0375 (0.0292)	2.9761	0.8388
2000 : 1Q	0.0000 (0.0001)	0.9852 *** (0.0134)	0.0368 ** (0.0176)	-0.0122 (0.0093)	2.9080	0.9886
2000 : 2Q	0.0000 (0.0001)	1.0221 *** (0.0133)	-0.0174 (0.0200)	-0.0040 (0.0125)	3.0534	0.9903
2000 : 3Q	0.0000 (0.0000)	1.0045 *** (0.0068)	0.0047 (0.0126)	-0.0128 (0.0082)	2.5836	0.9971
2000 : 4Q	0.0000 (0.0000)	0.9912 *** (0.0074)	-0.0182 (0.0114)	0.0084 (0.0097)	2.5832	0.9969
2001 : 1Q	0.0000 (0.0001)	1.0043 *** (0.0080)	0.0158 (0.0112)	-0.0056 (0.0076)	3.0030	0.9961
2001 : 2Q	0.0000 (0.0001)	0.9537 *** (0.0227)	0.0858 *** (0.0307)	-0.0194 (0.0188)	2.8553	0.9660
2001 : 3Q	0.0000 (0.0001)	1.0071 *** (0.0108)	0.0272 ** (0.0129)	-0.0013 (0.0085)	3.0229	0.9932
2001 : 4Q	0.0000 (0.0001)	1.0097 *** (0.0214)	-0.0252 (0.0206)	0.0058 (0.0211)	2.9495	0.9738
2002 : 1Q	0.0000 (0.0001)	0.9894 *** (0.0266)	-0.0358 (0.0370)	-0.0087 (0.0176)	3.0659	0.9572
2002 : 2Q	0.0000 (0.0001)	1.0107 *** (0.0263)	0.0057 (0.0225)	-0.0060 (0.0155)	2.8803	0.9688
2002 : 3Q	0.0000 (0.0001)	0.9502 *** (0.0324)	-0.0074 (0.0200)	0.0293 (0.0217)	2.9190	0.9429
2002 : 4Q	0.0000 (0.0001)	0.9951 *** (0.0237)	-0.0161 (0.0185)	0.0105 (0.0141)	3.1069	0.9731
2003 : 1Q	0.0000 (0.0001)	0.9942 *** (0.0384)	0.0025 (0.0311)	0.0285 (0.0306)	2.9919	0.9427
2003 : 2Q	0.0000 (0.0001)	0.9964 *** (0.0139)	-0.0010 (0.0133)	0.0084 (0.0129)	2.6663	0.9921
2003 : 3Q	0.0000 (0.0000)	0.9971 *** (0.0092)	0.0019 (0.0101)	-0.0037 (0.0084)	3.0040	0.9947
2003 : 4Q	0.0000 (0.0000)	0.9999 *** (0.0001)	0.0001 ** (0.0001)	- -	2.8381	1.0000
2004 : 1Q	0.0000 (0.0000)	1.0001 *** (0.0001)	0.0000 (0.0001)	0.0000 (0.0001)	3.0439	1.0000
2004 : 2Q	0.0000 (0.0000)	1.0000 *** (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	2.7235	1.0000
2004 : 3Q	0.0000 (0.0000)	1.0000 *** (0.0001)	0.0000 (0.0001)	-0.0001 (0.0001)	2.9769	1.0000

1. Calculated by authors. All foreign exchange data are from Datastream.

2. If the estimated coefficient is significantly negative, we re-estimate the equation without them.

3. Standard deviations are in parenthesis. \*, \*\* and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 9. LATVIAN LAT

	Constant	euro	US dollar	Japanese yen	DW	Adj.R2
1999 : 1Q	0.0001 (0.0003)	0.2415 *** (0.0611)	0.5365 *** (0.0648)	0.1072 *** (0.0280)	1.9418	0.7111
1999 : 2Q	0.0001 (0.0002)	0.2404 *** (0.0381)	0.5751 *** (0.0493)	0.1081 *** (0.0261)	2.1109	0.8286
1999 : 3Q	0.0000 (0.0001)	0.2880 *** (0.0182)	0.4344 *** (0.0199)	0.1372 *** (0.0109)	1.9458	0.9539
1999 : 4Q	0.0000 (0.0001)	0.2319 *** (0.0387)	0.4663 *** (0.0413)	0.1229 *** (0.0231)	1.4898	0.7871
2000 : 1Q	-0.0001 (0.0002)	0.2369 *** (0.0351)	0.4688 *** (0.0461)	0.1698 *** (0.0243)	2.0165	0.8665
2000 : 2Q	0.0000 (0.0001)	0.2318 *** (0.0133)	0.5350 *** (0.0199)	0.1433 *** (0.0124)	1.8382	0.9749
2000 : 3Q	0.0001 * (0.0001)	0.2103 *** (0.0122)	0.5621 *** (0.0226)	0.1476 *** (0.0147)	2.2340	0.9831
2000 : 4Q	0.0001 (0.0001)	0.2193 *** (0.0151)	0.5104 *** (0.0235)	0.1769 *** (0.0200)	1.3621	0.9771
2001 : 1Q	-0.0001 (0.0001)	0.2464 *** (0.0171)	0.5443 *** (0.0241)	0.1002 *** (0.0162)	1.8448	0.9517
2001 : 2Q	-0.0001 (0.0001)	0.2496 *** (0.0203)	0.5470 *** (0.0274)	0.1206 *** (0.0168)	2.0748	0.9511
2001 : 3Q	0.0000 (0.0001)	0.2598 *** (0.0294)	0.4923 *** (0.0351)	0.1279 *** (0.0232)	1.9779	0.8451
2001 : 4Q	-0.0001 (0.0001)	0.2844 *** (0.0177)	0.4822 *** (0.0170)	0.1491 *** (0.0174)	1.7743	0.9738
2002 : 1Q	0.0000 (0.0001)	0.2907 *** (0.0361)	0.4849 *** (0.0502)	0.1053 *** (0.0239)	1.7739	0.7879
2002 : 2Q	0.0000 (0.0001)	0.3173 *** (0.0404)	0.4795 *** (0.0346)	0.0906 *** (0.0239)	1.6750	0.8152
2002 : 3Q	0.0000 (0.0001)	0.2910 *** (0.0305)	0.4636 *** (0.0188)	0.1230 *** (0.0205)	1.9284	0.9270
2002 : 4Q	-0.0001 (0.0001)	0.2712 *** (0.0426)	0.4750 *** (0.0333)	0.1464 *** (0.0253)	1.8413	0.8954
2003 : 1Q	0.0000 (0.0001)	0.3265 *** (0.0309)	0.4794 *** (0.0250)	0.1330 *** (0.0246)	1.8525	0.9443
2003 : 2Q	0.0000 (0.0001)	0.3374 *** (0.0212)	0.4549 *** (0.0203)	0.1123 *** (0.0197)	1.9996	0.9702
2003 : 3Q	0.0000 (0.0001)	0.3077 *** (0.0244)	0.4242 *** (0.0270)	0.1206 *** (0.0223)	2.3832	0.9287
2003 : 4Q	-0.0001 (0.0001)	0.3666 *** (0.0178)	0.4373 *** (0.0211)	0.1291 *** (0.0142)	2.0094	0.9593
2004 : 1Q	0.0000 (0.0000)	0.3444 *** (0.0128)	0.3878 *** (0.0091)	0.1253 *** (0.0096)	2.4541	0.9919
2004 : 2Q	0.0000 (0.0001)	0.3342 *** (0.0201)	0.3884 *** (0.0155)	0.1634 *** (0.0146)	2.2129	0.9709
2004 : 3Q	0.0001 (0.0001)	0.4514 *** (0.0183)	0.4052 *** (0.0182)	0.1498 *** (0.0202)	2.4713	0.9993

1. Calculated by authors. All foreign exchange data are from Datastream.

2. If the estimated coefficient is significantly negative, we re-estimate the equation without them.

3. Standard deviations are in parenthesis. \*, \*\* and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 10. LITHUANIAN LITA

	Constant	euro	US dollar	Japanese yen	DW	Adj.R2
1999 : 1Q	0.0000 (0.0000)	-0.0003 (0.0054)	1.0005 *** (0.0057)	0.0016 (0.0025)	2.6473	0.9982
1999 : 2Q	0.0000 (0.0000)	-0.0022 (0.0033)	0.9967 *** (0.0043)	0.0018 (0.0023)	2.0119	0.9990
1999 : 3Q	0.0000 (0.0000)	-0.0026 (0.0040)	0.9990 *** (0.0043)	-0.0017 (0.0024)	1.9920	0.9989
1999 : 4Q	0.0000 (0.0000)	-0.0032 (0.0038)	0.9976 *** (0.0040)	0.0004 (0.0023)	2.0491	0.9991
2000 : 1Q	0.0000 (0.0000)	-0.0001 (0.0039)	1.0013 *** (0.0041)	- -	2.3432	0.9989
2000 : 2Q	0.0000 (0.0000)	0.0020 (0.0023)	0.9973 *** (0.0034)	-0.0022 (0.0022)	1.9174	0.9995
2000 : 3Q	0.0000 (0.0000)	0.0029 (0.0025)	0.9972 *** (0.0046)	0.0015 (0.0030)	2.0963	0.9995
2000 : 4Q	0.0000 (0.0000)	-0.0012 (0.0035)	1.0089 *** (0.0054)	-0.0064 (0.0046)	2.4885	0.9992
2001 : 1Q	0.0000 (0.0000)	-0.0011 (0.0034)	0.9920 *** (0.0048)	0.0069 ** (0.0032)	2.2803	0.9990
2001 : 2Q	0.0000 (0.0000)	-0.0036 (0.0043)	1.0056 *** (0.0058)	-0.0030 (0.0035)	2.1373	0.9987
2001 : 3Q	0.0000 (0.0000)	0.0004 (0.0048)	1.0005 *** (0.0057)	-0.0015 (0.0038)	3.1490	0.9981
2001 : 4Q	0.0000 (0.0000)	0.0135 (0.0088)	0.9994 *** (0.0084)	-0.0040 (0.0086)	2.5538	0.9971
2002 : 1Q	-0.0003 (0.0003)	0.3305 *** (0.0638)	0.3885 *** (0.0889)	0.1285 ** (0.0424)	1.7047	0.5293
2002 : 2Q	0.0000 (0.0000)	0.9995 *** (0.0070)	0.0101 * (0.0060)	-0.0040 (0.0041)	2.7914	0.9977
2002 : 3Q	0.0000 (0.0000)	0.9949 *** (0.0075)	0.0012 (0.0046)	0.0019 (0.0050)	2.7784	0.9970
2002 : 4Q	0.0000 (0.0000)	0.9948 *** (0.0070)	0.0026 (0.0055)	-0.0013 (0.0041)	2.6319	0.9976
2003 : 1Q	0.0000 (0.0000)	0.9909 *** (0.0089)	-0.0012 (0.0072)	0.0044 (0.0071)	3.0157	0.9966
2003 : 2Q	0.0000 (0.0000)	1.0030 *** (0.0037)	0.0021 (0.0035)	- -	2.4012	0.9992
2003 : 3Q	0.0000 (0.0000)	1.0048 *** (0.0032)	0.0046 (0.0035)	-0.0004 (0.0029)	2.2637	0.9994
2003 : 4Q	0.0000 (0.0000)	0.9992 *** (0.0029)	-0.0055 (0.0035)	0.0020 (0.0023)	2.4328	0.9995
2004 : 1Q	0.0000 (0.0000)	0.9984 *** (0.0040)	0.0016 (0.0020)	- -	2.8225	0.9990
2004 : 2Q	0.0000 (0.0000)	0.9978 *** (0.0020)	- -	0.0024 * (0.0014)	2.8574	0.9998
2004 : 3Q	0.0000 (0.0000)	0.9984 *** (0.0009)	0.0001 (0.0009)	0.0011 (0.0010)	2.7075	1.0000

1. Calculated by authors. All foreign exchange data are from Datastream.

2. If the estimated coefficient is significantly negative, we re-estimate the equation without them.

3. Standard deviations are in parenthesis. \*, \*\* and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 11. MALTESE LIRA

	Constant	euro	US dollar	Japanese yen	DW	Adj.R2
1999 : 1Q	0.0000 (0.0001)	0.4893 *** (0.0261)	0.2240 *** (0.0277)	0.0120 (0.0120)	2.4083	0.8988
1999 : 2Q	0.0000 (0.0001)	0.5208 *** (0.0214)	0.2841 *** (0.0278)	-0.0104 (0.0147)	2.7945	0.9293
1999 : 3Q	0.0000 (0.0001)	0.5469 *** (0.0144)	0.2313 *** (0.0157)	-0.0024 (0.0086)	1.9633	0.9674
1999 : 4Q	0.0000 (0.0000)	0.5290 *** (0.0092)	0.2373 *** (0.0098)	-0.0065 (0.0055)	2.5752	0.9834
2000 : 1Q	0.0000 (0.0000)	0.5211 *** (0.0059)	0.2516 *** (0.0077)	-0.0056 (0.0041)	2.4355	0.9937
2000 : 2Q	0.0000 (0.0001)	0.5111 *** (0.0082)	0.2531 *** (0.0109)	- -	2.9131	0.9896
2000 : 3Q	0.0000 (0.0000)	0.5195 *** (0.0047)	0.2509 *** (0.0088)	0.0059 (0.0057)	2.6359	0.9958
2000 : 4Q	0.0000 (0.0000)	0.5021 *** (0.0060)	0.2662 *** (0.0093)	-0.0078 (0.0079)	2.8046	0.9947
2001 : 1Q	0.0000 (0.0000)	0.5273 *** (0.0076)	0.2623 *** (0.0106)	0.0007 (0.0072)	2.8685	0.9897
2001 : 2Q	0.0000 (0.0000)	0.5053 *** (0.0086)	0.2614 *** (0.0117)	0.0106 (0.0072)	2.9822	0.9864
2001 : 3Q	0.0000 (0.0001)	0.5306 *** (0.0108)	0.2637 *** (0.0129)	-0.0128 (0.0085)	2.6314	0.9764
2001 : 4Q	0.0000 (0.0001)	0.5563 *** (0.0194)	0.2460 *** (0.0186)	-0.0135 (0.0191)	2.6114	0.9509
2002 : 1Q	0.0000 (0.0000)	0.5138 *** (0.0077)	0.2452 *** (0.0108)	0.0001 (0.0051)	2.9214	0.9889
2002 : 2Q	0.0000 (0.0000)	0.4910 *** (0.0140)	0.2564 *** (0.0120)	0.0039 (0.0083)	2.7416	0.9628
2002 : 3Q	0.0000 (0.0001)	0.5380 *** (0.0218)	0.2074 *** (0.0134)	0.0080 (0.0146)	1.7853	0.9324
2002 : 4Q	0.0000 (0.0000)	0.6878 *** (0.0077)	0.1027 *** (0.0060)	-0.0012 (0.0046)	2.7324	0.9949
2003 : 1Q	0.0000 ** (0.0000)	0.7144 *** (0.0087)	0.0902 *** (0.0070)	-0.0038 (0.0069)	2.8450	0.9941
2003 : 2Q	0.0000 (0.0000)	0.7272 *** (0.0062)	0.1048 *** (0.0059)	-0.0091 (0.0057)	2.5202	0.9973
2003 : 3Q	0.0000 (0.0000)	0.7381 *** (0.0065)	0.0836 *** (0.0071)	0.0031 (0.0059)	2.2270	0.9954
2003 : 4Q	0.0000 (0.0001)	0.6917 *** (0.0216)	0.1390 *** (0.0257)	-0.0240 (0.0172)	2.7173	0.9492
2004 : 1Q	0.0000 (0.0000)	0.7241 *** (0.0073)	0.0820 *** (0.0052)	-0.0022 (0.0055)	2.7123	0.9948
2004 : 2Q	0.0000 (0.0003)	0.5777 *** (0.0763)	0.1340 *** (0.0585)	-0.0419 (0.0551)	3.0934	0.5604
2004 : 3Q	0.0000 (0.0001)	0.8609 *** (0.0176)	0.1287 *** (0.0175)	0.0102 (0.0194)	2.3108	0.9994

1. Calculated by authors. All foreign exchange data are from Datastream.

2. If the estimated coefficient is significantly negative, we re-estimate the equation without them.

3. Standard deviations are in parenthesis. \*, \*\* and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 12. CYPRUS POUND

	Constant	euro	US dollar	Japanese yen	DW	Adj.R2
1999 : 1Q	0.0000 (0.0000)	0.9603 *** (0.0066)	0.0471 *** (0.0070)	0.0012 (0.0030)	2.5000	0.9974
1999 : 2Q	0.0000 (0.0000)	0.9497 *** (0.0074)	0.0586 *** (0.0092)	- -	2.9127	0.9963
1999 : 3Q	0.0000 (0.0000)	0.9512 *** (0.0079)	0.0454 *** (0.0086)	0.0036 (0.0047)	2.9312	0.9958
1999 : 4Q	0.0000 (0.0000)	0.9517 *** (0.0103)	0.0439 *** (0.0110)	0.0086 (0.0061)	2.8322	0.9926
2000 : 1Q	0.0000 (0.0000)	0.9395 *** (0.0051)	0.0624 *** (0.0067)	-0.0018 (0.0035)	2.7003	0.9982
2000 : 2Q	0.0000 (0.0000)	0.9380 *** (0.0068)	0.0540 ** (0.0103)	0.0016 (0.0064)	3.2864	0.9971
2000 : 3Q	0.0000 (0.0001)	0.9639 *** (0.0134)	- -	0.0208 ** (0.0093)	2.8285	0.9879
2000 : 4Q	0.0000 (0.0000)	0.9827 *** (0.0057)	0.0152 * (0.0088)	0.0039 (0.0075)	2.2205	0.9981
2001 : 1Q	0.0001 * (0.0001)	0.9801 *** (0.0099)	0.0024 (0.0139)	0.0008 (0.0094)	1.6445	0.9937
2001 : 2Q	-0.0001 * (0.0001)	0.9858 *** (0.0115)	0.0224 (0.0156)	0.0104 (0.0096)	2.4900	0.9916
2001 : 3Q	0.0000 (0.0001)	1.0173 *** (0.0131)	-0.0065 (0.0156)	0.0011 (0.0103)	2.4231	0.9904
2001 : 4Q	0.0000 (0.0001)	0.9788 *** (0.0145)	0.0023 (0.0139)	0.0156 (0.0143)	1.7861	0.9872
2002 : 1Q	0.0000 (0.0001)	1.0236 *** (0.0184)	0.0033 (0.0257)	0.0074 (0.0122)	2.2605	0.9806
2002 : 2Q	0.0000 (0.0001)	0.9770 *** (0.0291)	0.0370 * (0.0270)	- -	2.3354	0.9497
2002 : 3Q	-0.0001 (0.0001)	0.9565 *** (0.0298)	-0.0142 (0.0184)	0.0211 (0.0200)	2.9705	0.9514
2002 : 4Q	0.0000 (0.0001)	0.9915 *** (0.0227)	0.0081 (0.0184)	- -	2.2721	0.9719
2003 : 1Q	0.0003 *** (0.0001)	1.0042 *** (0.0272)	0.0097 (0.0220)	0.0004 (0.0217)	2.1126	0.9698
2003 : 2Q	0.0000 (0.0001)	0.9786 *** (0.0172)	- -	0.0196 (0.0136)	1.8566	0.9878
2003 : 3Q	0.0000 (0.0001)	1.0311 *** (0.0187)	0.0195 (0.0207)	0.0011 (0.0171)	2.0879	0.9796
2003 : 4Q	0.0000 (0.0001)	0.9847 *** (0.0147)	0.0097 (0.0174)	0.0041 (0.0117)	2.2926	0.9880
2004 : 1Q	0.0000 (0.0000)	1.0014 *** (0.0108)	0.0020 (0.0077)	0.0015 (0.0081)	2.5200	0.9933
2004 : 2Q	-0.0001 * (0.0001)	1.0032 *** (0.0169)	-0.0002 (0.0129)	0.0165 (0.0122)	2.3812	0.9854
2004 : 3Q	-0.0001 (0.0001)	1.0115 *** (0.0199)	-0.0300 (0.0198)	0.0229 (0.0219)	2.1914	0.9992

1. Calculated by authors. All foreign exchange data are from Datastream.

2. If the estimated coefficient is significantly negative, we re-estimate the equation without them.

3. Standard deviations are in parenthesis. \*, \*\* and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.



Table 13. RUMANIAN LEU

	Constant	euro	US dollar	Japanese yen	DW	Adj.R2
1999 : 1Q	0.0055 ** (0.0027)	-0.8888 (1.2281)	1.3225 ** (0.5748)	0.2908 (0.2768)	1.4966	0.1434
1999 : 2Q	0.0009 (0.0008)	0.2755 (0.1803)	1.1582 *** (0.2336)	-0.0870 (0.1237)	1.3883	0.3091
1999 : 3Q	0.0006 *** (0.0002)	0.0152 (0.0404)	1.0006 *** (0.0442)	0.0069 (0.0242)	2.3183	0.9015
1999 : 4Q	0.0016 *** (0.0004)	0.0328 (0.1010)	1.1137 *** (0.1079)	0.0519 (0.0603)	1.6798	0.6589
2000 : 1Q	0.0010 *** (0.0003)	-0.0497 (0.0516)	0.9810 *** (0.0678)	0.0201 (0.0357)	2.3461	0.8375
2000 : 2Q	0.0014 *** (0.0001)	0.0486 *** (0.0158)	1.0202 *** (0.0236)	-0.0237 (0.0148)	2.6123	0.9768
2000 : 3Q	0.0019 *** (0.0001)	-0.0057 (0.0261)	1.0187 *** (0.0484)	-0.0345 (0.0314)	2.2503	0.9503
2000 : 4Q	0.0011 *** (0.0001)	-0.0050 (0.0166)	0.9579 *** (0.0256)	0.0078 (0.0218)	2.3493	0.9814
2001 : 1Q	0.0009 *** (0.0001)	-0.0095 (0.0182)	0.9824 *** (0.0255)	0.0151 (0.0172)	2.7922	0.9715
2001 : 2Q	0.0009 *** (0.0001)	-0.0161 (0.0208)	1.0296 *** (0.0282)	-0.0277 (0.0173)	2.7174	0.9694
2001 : 3Q	0.0007 *** (0.0001)	0.0157 (0.0237)	0.9818 *** (0.0283)	0.0182 (0.0187)	1.8425	0.9555
2001 : 4Q	0.0006 ** (0.0003)	-0.0271 (0.0732)	0.9295 *** (0.0702)	0.0372 (0.0719)	1.7529	0.8158
2002 : 1Q	0.0005 (0.0005)	0.1891 (0.1255)	0.8117 *** (0.1723)	- -	2.1468	0.2872
2002 : 2Q	0.0004 (0.0003)	0.1406 * (0.0776)	0.9386 *** (0.0721)	- -	2.2973	0.7287
2002 : 3Q	-0.0001 (0.0003)	-0.0006 (0.0885)	0.8471 *** (0.0546)	0.0255 (0.0594)	2.0663	0.7958
2002 : 4Q	0.0002 (0.0003)	-0.0129 (0.0887)	0.9565 *** (0.0693)	0.0876 (0.0527)	2.1470	0.7981
2003 : 1Q	0.0000 (0.0004)	0.1934 (0.1216)	0.6050 *** (0.0984)	0.1013 (0.0968)	1.9882	0.5298
2003 : 2Q	0.0004 (0.0004)	0.8355 *** (0.0868)	0.1722 ** (0.0832)	0.0342 (0.0803)	2.5771	0.7372
2003 : 3Q	0.0003 (0.0004)	0.7175 *** (0.0833)	0.3137 *** (0.0920)	0.0372 (0.0762)	2.3199	0.6223
2003 : 4Q	0.0009 (0.0004)	1.0803 *** (0.0894)	0.1184 (0.1060)	-0.1137 (0.0711)	1.8732	0.7060
2004 : 1Q	0.0001 (0.0004)	0.7583 *** (0.1028)	0.1489 ** (0.0730)	-0.0285 (0.0775)	1.7029	0.5258
2004 : 2Q	-0.0001 (0.0003)	0.8910 *** (0.0637)	0.1463 *** (0.0489)	-0.0091 (0.0460)	2.3128	0.8122
2004 : 3Q	0.0001 (0.0003)	0.9858 *** (0.0713)	-0.0459 (0.0709)	0.0578 (0.0786)	2.9866	0.9895

1. Calculated by authors. All foreign exchange data are from Datastream.

2. If the estimated coefficient is significantly negative, we re-estimate the equation without them.

3. Standard deviations are in parenthesis. \*, \*\* and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 14. BULGARIAN LEV

	Constant	euro	US dollar	Japanese yen	DW	Adj.R2
1999 : 1Q	-0.0001 (0.0000)	0.9892 *** (0.0105)	0.0132 (0.0111)	-0.0010 (0.0048)	2.2080	0.9937
1999 : 2Q	0.0000 (0.0001)	1.0006 *** (0.0161)	0.0242 (0.0209)	-0.0044 (0.0111)	1.4979	0.9849
1999 : 3Q	0.0000 (0.0000)	0.9913 *** (0.0086)	0.0084 (0.0094)	0.0030 (0.0052)	1.8616	0.9953
1999 : 4Q	0.0000 (0.0000)	1.0077 *** (0.0078)	-0.0050 (0.0083)	0.0032 (0.0046)	1.7723	0.9962
2000 : 1Q	0.0000 (0.0001)	0.9752 *** (0.0117)	0.0058 (0.0154)	0.0227 *** (0.0081)	2.1930	0.9910
2000 : 2Q	0.0000 (0.0000)	0.9890 *** (0.0052)	-0.0015 (0.0078)	0.0116 ** (0.0049)	2.2610	0.9984
2000 : 3Q	0.0000 (0.0000)	0.9937 *** (0.0083)	-0.0200 (0.0155)	0.0114 (0.0101)	2.1420	0.9955
2000 : 4Q	0.0001 (0.0001)	0.9716 *** (0.0162)	0.0296 (0.0252)	-0.0106 (0.0214)	1.9983	0.9846
2001 : 1Q	-0.0001 (0.0001)	0.9890 *** (0.0114)	-0.0031 (0.0161)	0.0303 ** (0.0109)	2.0779	0.9916
2001 : 2Q	0.0000 (0.0000)	0.9828 *** (0.0081)	0.0066 (0.0110)	0.0119 * (0.0067)	2.1235	0.9958
2001 : 3Q	0.0000 (0.0000)	0.9910 *** (0.0088)	0.0053 (0.0105)	0.0041 (0.0069)	2.1094	0.9954
2001 : 4Q	0.0000 (0.0000)	0.9946 *** (0.0074)	0.0160 * (0.0071)	-0.0041 (0.0073)	2.0378	0.9967
2002 : 1Q	0.0000 (0.0001)	0.9167 *** (0.0153)	0.0005 (0.0213)	0.0207 ** (0.0101)	1.7228	0.9835
2002 : 2Q	0.0000 (0.0001)	0.9511 *** (0.0221)	-0.0039 (0.0189)	0.0140 (0.0131)	1.7376	0.9757
2002 : 3Q	0.0000 (0.0000)	0.9639 *** (0.0146)	0.0159 * (0.0090)	0.0153 (0.0098)	1.9918	0.9879
2002 : 4Q	0.0001 (0.0001)	0.9729 *** (0.0343)	0.0439 (0.0268)	-0.0022 (0.0204)	0.7300	0.9448
2003 : 1Q	-0.0002 (0.0001)	0.9440 *** (0.0322)	0.0447 ** (0.0261)	-0.0031 (0.0257)	1.9973	0.9534
2003 : 2Q	0.0000 (0.0000)	1.0040 *** (0.0089)	0.0150 * (0.0085)	0.0044 (0.0082)	2.3243	0.9968
2003 : 3Q	0.0000 (0.0000)	0.9996 *** (0.0045)	0.0031 (0.0040)	-	2.4234	0.9987
2003 : 4Q	0.0000 (0.0002)	0.9235 *** (0.0375)	0.0555 * (0.0444)	0.0011 (0.0298)	2.9370	0.9178
2004 : 1Q	-0.0001 * (0.0000)	0.9964 *** (0.0109)	0.0080 (0.0077)	-0.0095 (0.0082)	1.3710	0.9931
2004 : 2Q	0.0001 (0.0001)	1.0024 *** (0.0162)	-0.0035 (0.0124)	0.0077 (0.0117)	2.1836	0.9864
2004 : 3Q	0.0000 (0.0001)	0.9735 *** (0.0162)	0.0302 ** (0.0162)	-0.0027 (0.0179)	2.9235	0.9995

1. Calculated by authors. All foreign exchange data are from Datastream.

2. If the estimated coefficient is significantly negative, we re-estimate the equation without them.

3. Standard deviations are in parenthesis. \*, \*\* and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 15. CROATIAN KUNA

	Constant	euro	US dollar	Japanese yen	DW	Adj.R2
1999 : 1Q	0.0007 ** (0.0003)	0.9982 *** (0.0774)	0.1199 (0.0821)	-0.0036 (0.0355)	3.1300	0.7535
1999 : 2Q	0.0001 (0.0002)	0.9289 *** (0.0406)	0.0668 (0.0526)	0.0076 (0.0278)	2.0229	0.9007
1999 : 3Q	0.0000 (0.0001)	0.9616 *** (0.0199)	0.0214 (0.0218)	-0.0088 (0.0119)	2.8064	0.9737
1999 : 4Q	0.0001 (0.0001)	1.0124 *** (0.0223)	0.0356 (0.0239)	0.0032 (0.0133)	2.6965	0.9699
2000 : 1Q	0.0001 (0.0001)	1.0491 *** (0.0283)	0.0372 (0.0371)	-0.0152 (0.0196)	2.3564	0.9565
2000 : 2Q	-0.0002 (0.0002)	0.9527 *** (0.0230)	0.0606 * (0.0344)	-0.0171 (0.0215)	2.5868	0.9687
2000 : 3Q	-0.0002 (0.0001)	0.9695 *** (0.0221)	0.0643 (0.0411)	-0.0360 (0.0267)	2.6882	0.9682
2000 : 4Q	0.0002 (0.0002)	0.9858 *** (0.0343)	0.1111 ** (0.0531)	-0.0564 (0.0453)	2.8179	0.9370
2001 : 1Q	0.0002 (0.0002)	0.9801 *** (0.0353)	-0.0155 (0.0496)	-0.0121 (0.0335)	1.5734	0.9246
2001 : 2Q	-0.0007 (0.0002)	0.9534 *** (0.0452)	0.0904 (0.0612)	-0.0198 (0.0375)	1.2187	0.8768
2001 : 3Q	0.0003 (0.0007)	0.8035 *** (0.1412)	0.0157 (0.1685)	0.0529 (0.1115)	1.6552	0.3421
2001 : 4Q	-0.0004 (0.0004)	0.7468 *** (0.0946)	-0.0109 (0.0908)	0.0728 (0.0930)	1.8311	0.5197
2002 : 1Q	0.0001 (0.0003)	0.9518 *** (0.0830)	-	0.0046 (0.0547)	1.9118	0.6752
2002 : 2Q	-0.0002 (0.0002)	1.0534 *** (0.0719)	0.1058 (0.0668)	-	2.5662	0.7754
2002 : 3Q	-0.0001 (0.0002)	1.1274 *** (0.0538)	0.0870 ** (0.0332)	0.0149 (0.0361)	2.1402	0.8901
2002 : 4Q	0.0003 (0.0002)	1.0065 *** (0.0755)	-0.0178 (0.0590)	-0.0261 (0.0448)	2.1721	0.7733
2003 : 1Q	0.0004 (0.0003)	0.9623 *** (0.0806)	0.0996 (0.0652)	0.0300 (0.0641)	2.1665	0.7862
2003 : 2Q	-0.0005 (0.0003)	0.9199 *** (0.0634)	0.1795 *** (0.0608)	-0.0024 (0.0587)	1.5144	0.8559
2003 : 3Q	0.0000 (0.0003)	1.0764 *** (0.0583)	0.1587 ** (0.0645)	-0.0551 (0.0534)	2.1528	0.8484
2003 : 4Q	0.0001 (0.0002)	0.9869 *** (0.0505)	0.1142 * (0.0599)	-0.0216 (0.0402)	1.8813	0.8734
2004 : 1Q	-0.0004 (0.0003)	1.0048 *** (0.0761)	0.0494 (0.0540)	-0.0081 (0.0573)	1.8590	0.7546
2004 : 2Q	-0.0003 (0.0003)	0.9979 *** (0.0674)	-0.0537 (0.0518)	-0.0463 (0.0487)	2.0186	0.7886
2004 : 3Q	0.0006 (0.0003)	1.0280 *** (0.0610)	-0.0360 (0.0607)	0.0258 (0.0672)	1.8098	0.9926

1. Calculated by authors. All foreign exchange data are from Datastream.

2. If the estimated coefficient is significantly negative, we re-estimate the equation without them.

3. Standard deviations are in parenthesis. \*, \*\* and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 16. TURKISH LIRA

	Constant	euro	US dollar	Japanese yen	DW	Adj.R2
1999 : 1Q	0.0020 *** (0.0005)	0.5043 *** (0.1086)	0.5332 *** (0.1152)	-0.0115 (0.0498)	2.5553	0.4683
1999 : 2Q	0.0016 *** (0.0002)	0.4459 *** (0.0373)	0.6024 *** (0.0483)	-0.0342 (0.0256)	2.4670	0.8539
1999 : 3Q	0.0017 *** (0.0002)	0.4637 *** (0.0325)	0.4883 *** (0.0355)	0.0332 (0.0195)	2.6655	0.8889
1999 : 4Q	0.0020 *** (0.0002)	0.5470 *** (0.0576)	0.5022 *** (0.0615)	-0.0132 (0.0344)	2.4830	0.7036
2000 : 1Q	0.0010 *** (0.0001)	0.4146 *** (0.0226)	0.5321 *** (0.0296)	-0.0111 (0.0156)	2.7326	0.9329
2000 : 2Q	0.0008 *** (0.0001)	0.3858 *** (0.0137)	0.5948 *** (0.0205)	0.0006 (0.0128)	2.4922	0.9775
2000 : 3Q	0.0006 *** (0.0001)	0.3964 *** (0.0146)	0.6388 *** (0.0270)	-0.0243 (0.0175)	2.6069	0.9733
2000 : 4Q	0.0005 *** (0.0001)	0.3701 *** (0.0233)	0.6585 *** (0.0360)	-0.0239 (0.0307)	2.4847	0.9530
2001 : 1Q	0.0069 (0.0073)	2.3438 ** (1.1604)	1.4037 (1.6315)	-0.0801 (1.1007)	1.5865	0.0372
2001 : 2Q	0.0029 (0.0032)	-0.3524 (0.6306)	1.7602 ** (0.8535)	-0.3714 (0.5233)	1.6766	0.0301
2001 : 3Q	0.0029 (0.0026)	0.1539 (0.5388)	1.2946 ** (0.6299)	- -	2.1497	0.0337
2001 : 4Q	-0.0007 (0.0016)	-0.2661 (0.4115)	1.4498 *** (0.3947)	0.0466 (0.4044)	2.1506	0.2255
2002 : 1Q	-0.0013 (0.0012)	-0.3832 (0.3027)	0.7635 * (0.4214)	0.3130 (0.2009)	2.0711	0.0690
2002 : 2Q	0.0010 (0.0017)	-0.3687 (0.5565)	2.0962 *** (0.4763)	-0.3780 (0.3291)	1.9252	0.2687
2002 : 3Q	0.0006 (0.0012)	0.2972 (0.3577)	1.1229 *** (0.2208)	-0.1324 (0.2400)	2.3809	0.2621
2002 : 4Q	0.0002 (0.0011)	0.2039 (0.3753)	0.8379 *** (0.2932)	0.1791 (0.2229)	1.4037	0.1622
2003 : 1Q	0.0011 (0.0018)	0.5889 (0.5454)	1.3237 *** (0.4414)	0.0154 (0.4342)	2.8773	0.1652
2003 : 2Q	-0.0031 (0.0010)	0.0174 (0.2351)	1.2908 *** (0.2253)	-0.0610 (0.2176)	2.5713	0.4138
2003 : 3Q	-0.0001 (0.0009)	0.0526 (0.2057)	0.7852 *** (0.2273)	0.1857 (0.1882)	2.4494	0.2699
2003 : 4Q	0.0005 (0.0010)	0.4031 * (0.2296)	0.7192 ** (0.2721)	- -	1.7867	0.1145
2004 : 1Q	-0.0012 (0.0008)	0.4395 ** (0.2035)	0.6301 *** (0.1446)	-0.0100 (0.1535)	2.3169	0.4258
2004 : 2Q	0.0016 (0.0010)	0.6181 *** (0.2226)	0.3850 *** (0.1709)	0.3971 * (0.1609)	1.9065	0.3731
2004 : 3Q	0.0003 (0.0007)	0.6026 *** (0.1534)	0.2936 * (0.1526)	0.0878 (0.1691)	1.8415	0.9516

1. Calculated by authors. All foreign exchange data are from Datastream.

2. If the estimated coefficient is significantly negative, we re-estimate the equation without them.

3. Standard deviations are in parenthesis. \*, \*\* and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 17. DANISH KRONE

	Constant	euro	US dollar	Japanese yen	DW	Adj.R2
1999 : 1Q	-0.0001 (0.0001)	1.0170 *** (0.0164)	-0.0192 (0.0174)	0.0054 (0.0075)	2.5262	0.9854
1999 : 2Q	0.0000 (0.0001)	0.9894 *** (0.0147)	0.0111 (0.0190)	-0.0065 (0.0101)	2.2466	0.9872
1999 : 3Q	0.0000 (0.0001)	0.9989 *** (0.0117)	0.0002 (0.0128)	-0.0047 (0.0070)	1.8672	0.9914
1999 : 4Q	0.0000 (0.0000)	0.9940 *** (0.0071)	- -	0.0051 (0.0040)	2.7768	0.9967
2000 : 1Q	0.0000 (0.0001)	0.9896 *** (0.0141)	0.0179 (0.0151)	- -	2.9815	0.9873
2000 : 2Q	0.0000 (0.0001)	0.9945 *** (0.0181)	0.0242 (0.0270)	-0.0210 (0.0169)	2.9017	0.9817
2000 : 3Q	0.0000 (0.0000)	0.9952 *** (0.0063)	-0.0024 (0.0117)	-0.0033 (0.0076)	2.2391	0.9975
2000 : 4Q	0.0000 (0.0000)	0.9891 *** (0.0076)	0.0032 (0.0118)	0.0002 (0.0100)	2.3663	0.9967
2001 : 1Q	0.0000 (0.0001)	0.9766 *** (0.0102)	-0.0045 (0.0143)	0.0049 (0.0097)	3.1140	0.9932
2001 : 2Q	0.0000 (0.0002)	0.9220 *** (0.0429)	0.0612 (0.0463)	- -	2.5087	0.8797
2001 : 3Q	0.0000 (0.0000)	0.9928 *** (0.0049)	0.0116 * (0.0059)	0.0010 (0.0039)	2.0560	0.9985
2001 : 4Q	0.0000 (0.0000)	0.9949 *** (0.0082)	0.0137 * (0.0079)	-0.0093 (0.0081)	1.3436	0.9960
2002 : 1Q	0.0000 (0.0000)	0.9793 *** (0.0053)	0.0170 * (0.0074)	0.0026 (0.0035)	2.4698	0.9982
2002 : 2Q	0.0000 (0.0000)	0.9810 *** (0.0080)	-0.0053 (0.0068)	0.0063 (0.0047)	1.9658	0.9969
2002 : 3Q	0.0000 (0.0000)	0.9988 *** (0.0048)	0.0056 * (0.0030)	0.0044 (0.0033)	2.0273	0.9987
2002 : 4Q	0.0000 (0.0000)	0.9933 *** (0.0056)	0.0033 (0.0044)	0.0007 (0.0033)	2.5614	0.9985
2003 : 1Q	0.0000 (0.0000)	1.0017 *** (0.0067)	0.0013 (0.0055)	0.0042 (0.0054)	1.9485	0.9981
2003 : 2Q	0.0000 (0.0000)	0.9956 *** (0.0023)	-0.0030 (0.0022)	0.0011 (0.0021)	1.7427	0.9998
2003 : 3Q	0.0000 (0.0000)	1.0067 *** (0.0058)	0.0002 (0.0064)	0.0031 (0.0053)	2.1494	0.9979
2003 : 4Q	0.0000 (0.0000)	0.9976 *** (0.0049)	0.0135 ** (0.0058)	-0.0046 (0.0039)	1.8632	0.9987
2004 : 1Q	0.0000 (0.0000)	1.0017 *** (0.0033)	-0.0008 (0.0023)	0.0027 (0.0025)	1.8865	0.9994
2004 : 2Q	0.0000 (0.0000)	1.0013 *** (0.0039)	0.0015 (0.0030)	-0.0003 (0.0028)	1.8053	0.9992
2004 : 3Q	0.0000 (0.0000)	0.9959 *** (0.0033)	0.0017 (0.0033)	0.0011 (0.0036)	2.2197	1.0000

1. Calculated by authors. All foreign exchange data are from Datastream.

2. If the estimated coefficient is significantly negative, we re-estimate the equation without them.

3. Standard deviations are in parenthesis. \*, \*\* and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 18. SWEDISH KRONA

	Constant	euro	US dollar	Japanese yen	DW	Adj.R2
1999 : 1Q	-0.0006 (0.0005)	0.5824 *** (0.1243)	0.2739 *** (0.1318)	0.1003 * (0.0570)	1.2077	0.3993
1999 : 2Q	0.0000 (0.0003)	0.7858 *** (0.0716)	0.3124 *** (0.0928)	0.0112 (0.0491)	1.7681	0.7105
1999 : 3Q	-0.0002 (0.0003)	0.6435 *** (0.0552)	0.3059 *** (0.0603)	-0.0020 (0.0331)	1.5517	0.7423
1999 : 4Q	-0.0001 (0.0004)	0.6920 *** (0.0981)	0.3162 *** (0.1048)	-0.0714 (0.0585)	2.1334	0.4686
2000 : 1Q	-0.0004 (0.0004)	0.7833 *** (0.0693)	0.0909 (0.0910)	0.1399 ** (0.0479)	1.8068	0.6983
2000 : 2Q	0.0002 (0.0005)	0.6660 *** (0.0709)	0.3262 *** (0.1062)	-0.0065 (0.0663)	1.7951	0.6760
2000 : 3Q	0.0005 (0.0004)	0.6985 *** (0.0652)	0.1832 (0.1211)	-0.0714 (0.0786)	1.6355	0.6486
2000 : 4Q	0.0004 (0.0005)	0.8036 *** (0.0812)	-0.0208 (0.1257)	0.0551 (0.1071)	2.1507	0.6376
2001 : 1Q	0.0006 (0.0005)	0.9382 *** (0.0836)	0.2297 * (0.1175)	-0.0008 (0.0792)	2.0913	0.6786
2001 : 2Q	0.0003 (0.0006)	0.7442 *** (0.1133)	0.1347 (0.1534)	-0.0122 (0.0940)	1.7885	0.4013
2001 : 3Q	0.0007 (0.0006)	1.0178 *** (0.1181)	0.2467 ** (0.1409)	-0.0701 (0.0932)	1.3225	0.5317
2001 : 4Q	-0.0004 (0.0006)	0.4615 *** (0.1578)	0.3582 ** (0.1514)	-0.0185 (0.1551)	1.6738	0.2031
2002 : 1Q	-0.0004 (0.0004)	1.0320 *** (0.0962)	0.2593 * (0.1339)	-0.0444 (0.0638)	1.9740	0.6646
2002 : 2Q	-0.0004 (0.0005)	0.9156 *** (0.1560)	0.3735 *** (0.1336)	-0.0748 (0.0923)	2.0591	0.3616
2002 : 3Q	-0.0002 (0.0005)	1.2380 *** (0.1493)	0.3972 *** (0.0984)	-	1.5260	0.5394
2002 : 4Q	-0.0002 (0.0004)	0.7745 *** (0.1233)	0.1104 (0.0964)	-0.0933 (0.0733)	1.9468	0.4340
2003 : 1Q	0.0001 (0.0004)	0.7948 *** (0.1150)	0.2178 ** (0.0931)	-0.0404 (0.0916)	1.9395	0.5444
2003 : 2Q	-0.0001 (0.0003)	0.8780 *** (0.0587)	0.0978 * (0.0562)	-0.0433 (0.0543)	1.4978	0.0020
2003 : 3Q	-0.0002 (0.0005)	0.7771 *** (0.1055)	-0.1400 (0.1166)	0.1026 (0.0965)	1.9603	0.4496
2003 : 4Q	0.0000 (0.0004)	0.9611 *** (0.0975)	0.0114 (0.1156)	0.1506 (0.0776)	2.2822	0.6781
2004 : 1Q	0.0002 (0.0004)	1.1042 *** (0.0936)	0.0256 (0.0665)	-0.1167 (0.0706)	2.0476	0.6849
2004 : 2Q	-0.0003 (0.0003)	0.8418 *** (0.0678)	-0.0579 (0.0521)	0.1840 ** (0.0490)	1.9245	0.7791
2004 : 3Q	-0.0002 (0.0002)	0.9607 *** (0.0424)	-0.0529 (0.0422)	0.0886 * (0.0468)	1.8230	0.9963

1. Calculated by authors. All foreign exchange data are from Datastream.

2. If the estimated coefficient is significantly negative, we re-estimate the equation without them.

3. Standard deviations are in parenthesis. \*, \*\* and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 19. STERLING POUND

	Constant	euro	US dollar	Japanese yen	DW	Adj.R2
1999 : 1Q	-0.0001 (0.0004)	0.1929 (0.1953)	0.5567 *** (0.0821)	- -	1.8074	0.5627
1999 : 2Q	0.0000 (0.0004)	-0.0926 (0.2609)	0.5970 *** (0.0734)	- -	1.9741	0.5049
1999 : 3Q	-0.0004 (0.0005)	0.1604 (0.5325)	0.5415 *** (0.0822)	- -	1.6957	0.4951
1999 : 4Q	-0.0002 (0.0003)	0.3420 (0.2641)	0.6006 *** (0.0945)	-0.0641 (0.0512)	2.1768	0.5854
2000 : 1Q	-0.0001 (0.0005)	-0.0374 (0.3336)	0.5403 *** (0.0683)	- -	2.0020	0.4988
2000 : 2Q	0.0010 (0.0006)	-0.0894 (0.2329)	0.6315 *** (0.0919)	- -	1.8449	0.4199
2000 : 3Q	-0.0002 (0.0005)	0.5095 *** (0.1718)	0.5442 *** (0.0704)	- -	1.5558	0.5072
2000 : 4Q	0.0003 (0.0006)	0.0937 (0.2575)	0.4984 *** (0.0892)	- -	1.9714	0.3137
2001 : 1Q	0.0003 (0.0005)	-0.0220 (0.2439)	0.5346 *** (0.0721)	- -	2.2943	0.4604
2001 : 2Q	-0.0001 (0.0005)	0.1063 (0.2749)	0.5050 *** (0.0726)	- -	1.9070	0.4215
2001 : 3Q	-0.0003 (0.0004)	0.5402 *** (0.0984)	0.5732 *** (0.0517)	- -	1.9944	0.7924
2001 : 4Q	-0.0001 (0.0004)	0.8441 *** (0.1715)	0.3612 *** (0.0684)	- -	1.5081	0.6144
2002 : 1Q	0.0002 (0.0003)	0.2681 (0.1690)	0.6740 *** (0.0730)	- -	1.7797	0.5991
2002 : 2Q	-0.0001 (0.0003)	0.2696 (0.1745)	0.4847 *** (0.0468)	- -	1.4822	0.7015
2002 : 3Q	-0.0004 (0.0003)	0.2132 (0.1745)	0.3545 *** (0.0502)	- -	2.0410	0.5430
2002 : 4Q	0.0002 (0.0004)	0.3587 (0.3095)	0.3619 *** (0.0948)	- -	2.0406	0.3076
2003 : 1Q	0.0008 * (0.0004)	1.2062 *** (0.3360)	0.3774 *** (0.0730)	- -	1.8766	0.5022
2003 : 2Q	-0.0003 (0.0006)	0.4728 ** (0.2127)	0.4665 *** (0.0899)	- -	2.1365	0.4234
2003 : 3Q	0.0000 (0.0004)	0.6700 *** (0.1931)	0.4348 *** (0.0725)	- -	1.3378	0.5178
2003 : 4Q	-0.0007 ** (0.0004)	0.1448 (0.2109)	0.6262 *** (0.0698)	- -	2.0261	0.7126
2004 : 1Q	-0.0008 (0.0005)	0.9652 *** (0.2343)	0.1481 ** (0.0608)	- -	1.8852	0.2944
2004 : 2Q	0.0002 (0.0006)	0.4955 * (0.2707)	0.3103 *** (0.0906)	- -	1.7329	0.3602
2004 : 3Q	0.0001 (0.0004)	0.5414 * (0.3098)	0.2527 *** (0.0805)	- -	2.4179	0.3269

1. Calculated by authors. All foreign exchange data are from Datastream.

2. If the estimated coefficient is significantly negative, we re-estimate the equation without them.

3. Standard deviations are in parenthesis. \*, \*\* and \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 20. Classified currency regimes of 10 East european countries (% of currencies under review)

	1999	2000	2001	2002	2003	2004
<b>Regid peg on a single currency (<math>a_i=1, i=1,2,3</math>)</b>						
US dollar	10.0	10.0	10.0	0.0	0.0	0.0
euro	0.0	10.0	15.0	20.0	27.5	30.0
Japanese yen	0.0	0.0	0.0	0.0		
<b>Partial peg on a single currency (<math>a_i&gt;0, i=1,2,3</math>)</b>						
US dollar	5.0	0.0	0.0	2.5	2.5	0.0
euro	22.5	25.0	27.5	22.5	32.5	40.0
Japanese yen	0.0	0.0	0.0	0.0		
<b>Peg on a basket (<math>a_1</math> and/or <math>a_2</math> and/or <math>a_3&gt;0</math>)</b>						
dollar/euro ( $a_2>a_1$ )	12.5	10.0	10.0	10.0	2.5	0.0
euro/dollar ( $a_1>a_2$ )	30.0	27.5	27.5	32.5	25.0	16.7
euro/yen ( $a_1>a_3$ )	5.0	7.5	0.0	0.0	0.0	3.3
euro/dollar/yen	15.0	10.0	10.0	12.5	10.0	10.0
<b>Free floating (otherwise)</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

We assign the coefficients which are estimated significantly under the level of 10%.

Source: Authors calculations



Table 21. Trade share within the EU area and others in 2003 (export+import)

--- euro countries, EU countries, new EU countries and potential EU countries ---

	Trading partner area / country					
	euro12	EU15	EU25	EU25+4	US	Japan
<euro 12 countries>						
Austria	59.3%	64.5%	77.2%	80.4%	3.6%	1.1%
Belgium	62.3%	73.0%	75.2%	76.3%	6.3%	2.0%
Finland	34.9%	57.3%	63.7%	64.5%	6.2%	2.4%
France	54.0%	64.3%	67.2%	68.7%	6.1%	1.7%
Germany	42.3%	53.3%	62.8%	65.1%	8.4%	2.6%
Greece	45.1%	52.0%	55.5%	61.7%	5.5%	3.5%
Ireland	34.2%	60.7%	61.7%	62.2%	18.8%	3.0%
Italy	47.6%	55.3%	60.1%	64.2%	6.2%	1.9%
Luxembourg	72.7%	79.8%	81.7%	81.9%	2.1%	0.7%
Netherlands	53.5%	65.4%	68.0%	69.1%	6.1%	2.2%
Portugal	69.4%	78.4%	79.9%	80.7%	3.4%	1.1%
Spain	59.2%	69.0%	71.4%	72.8%	3.5%	1.5%
<EU 15 countries>						
Denmark	46.8%	67.4%	71.5%	72.4%	4.8%	2.0%
Sweden	44.2%	59.6%	64.8%	65.8%	8.1%	2.1%
United Kingdom	49.5%	52.6%	55.1%	56.6%	12.7%	2.8%
<10 new EU member countries>						
Cyprus	41.1%	55.7%	56.9%	58.0%	3.8%	4.7%
Czech Republic	58.8%	64.5%	78.8%	80.5%	2.8%	1.3%
Estonia	39.7%	54.6%	66.5%	67.1%	2.7%	2.6%
Hungary	57.4%	63.8%	71.6%	75.0%	3.2%	2.5%
Latvia	35.7%	54.8%	76.8%	77.4%	2.2%	0.5%
Lithuania	31.5%	43.5%	58.5%	60.0%	2.9%	1.5%
Malta	39.6%	49.1%	50.7%	55.2%	6.7%	4.1%
Poland	55.3%	64.5%	74.3%	76.3%	2.5%	1.1%
Slovak Republic	55.0%	58.1%	83.1%	84.9%	2.5%	0.3%
Slovenia	59.2%	63.1%	71.5%	79.7%	3.0%	0.8%
<4 potential EU member countries>						
Bulgaria	45.5%	52.8%	57.7%	68.2%	3.3%	0.8%
Croatia	51.0%	55.8%	70.5%	72.3%	2.4%	1.6%
Romania	56.3%	62.1%	70.2%	76.2%	2.8%	0.8%
Turkey	40.2%	48.1%	50.9%	53.7%	6.2%	1.8%

Author's calculations.

Data: Direction of Trade Statistics, IMF.

Figure 1. The movement of sampled East European currencies v.s. euro

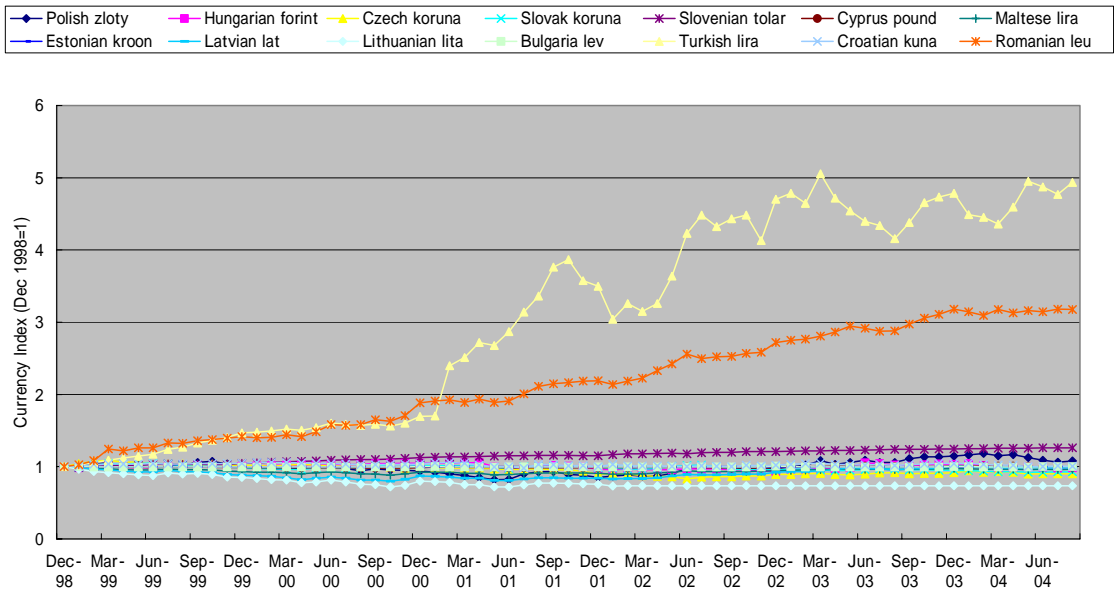


Figure 2. The movement of 10 new EU currencies v.s. euro

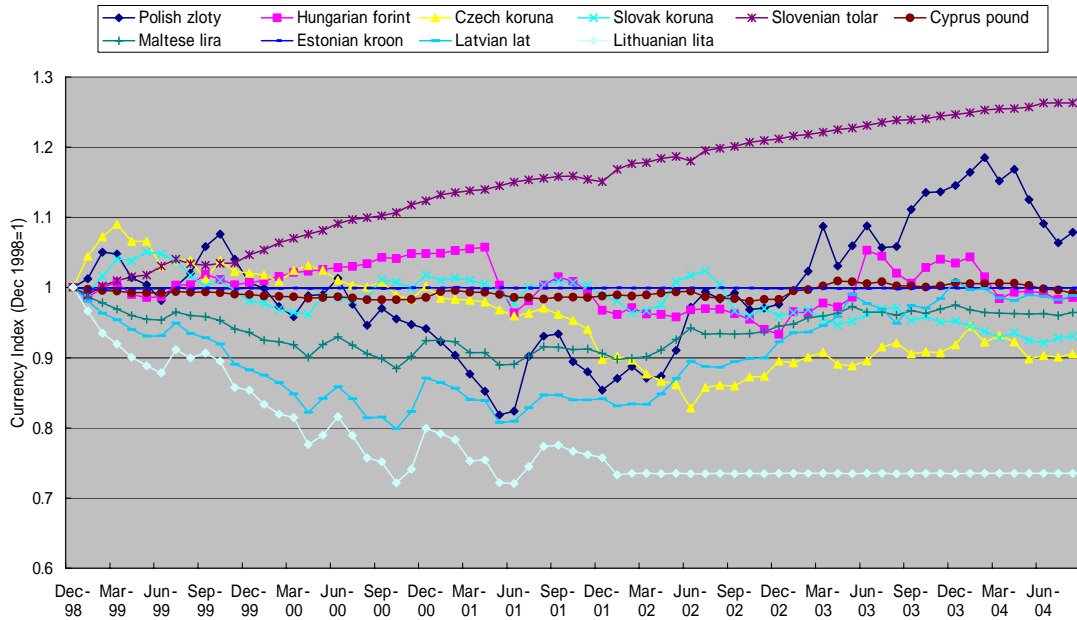


Figure 3.

The euro coefficient of Polish zloty

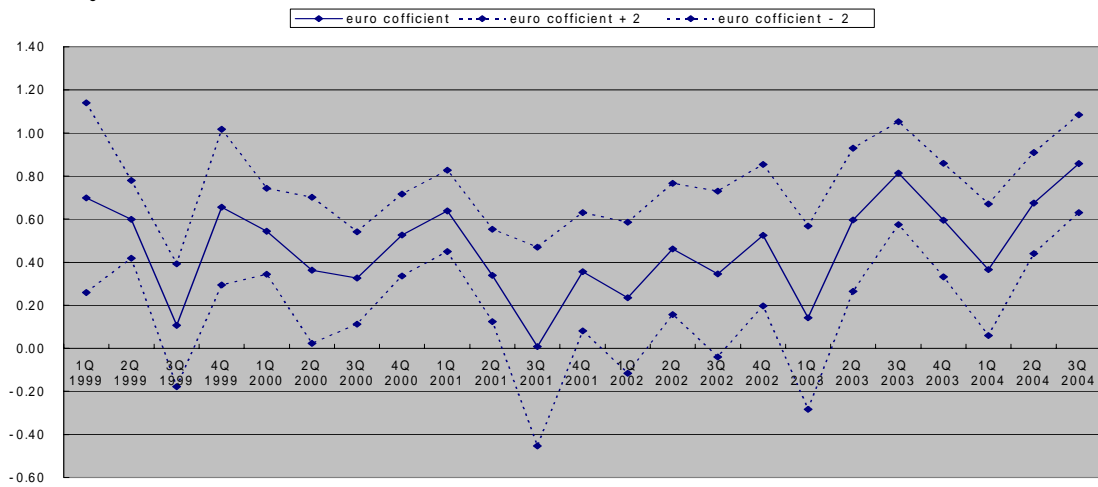


Figure 4.

The euro coefficient of Czech koruna

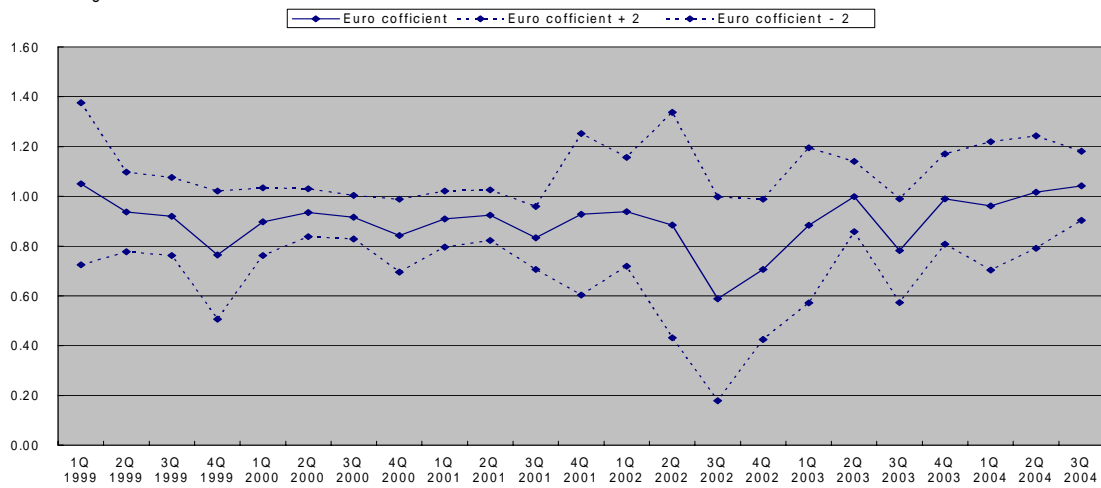


Figure 5.

The euro coefficient of Slovak koruna

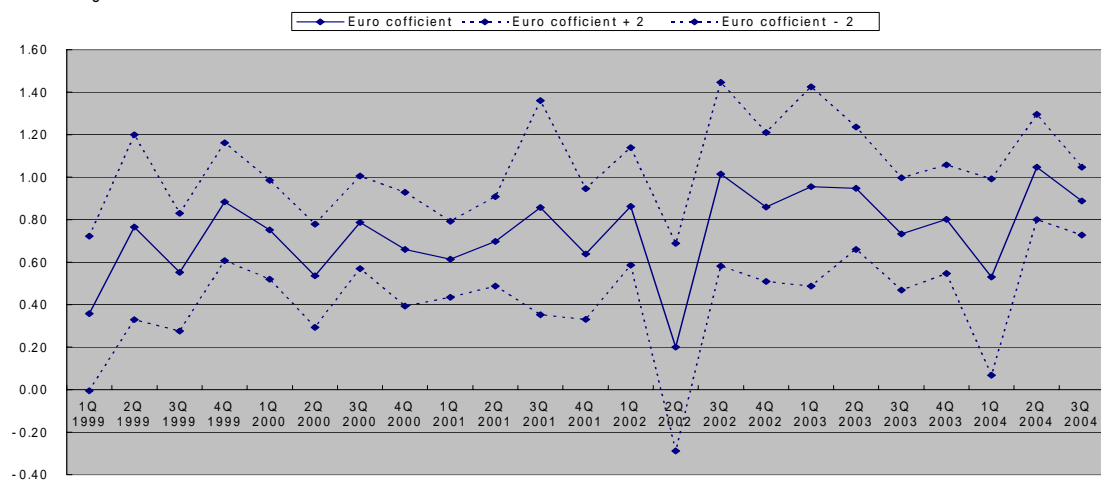


Figure 6.

The euro coefficient of Hungarian forint

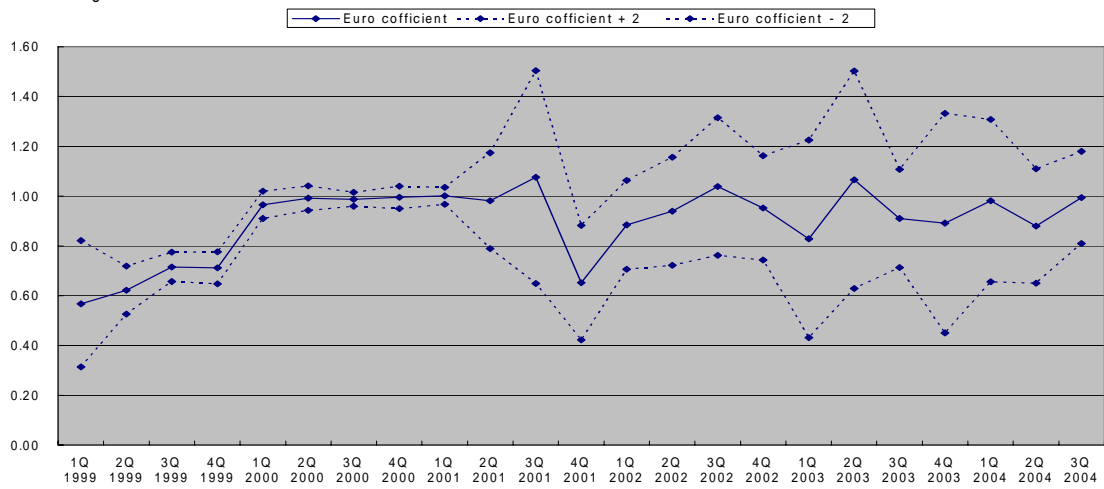


Figure 7.

The euro coefficient of Slovenian tolar

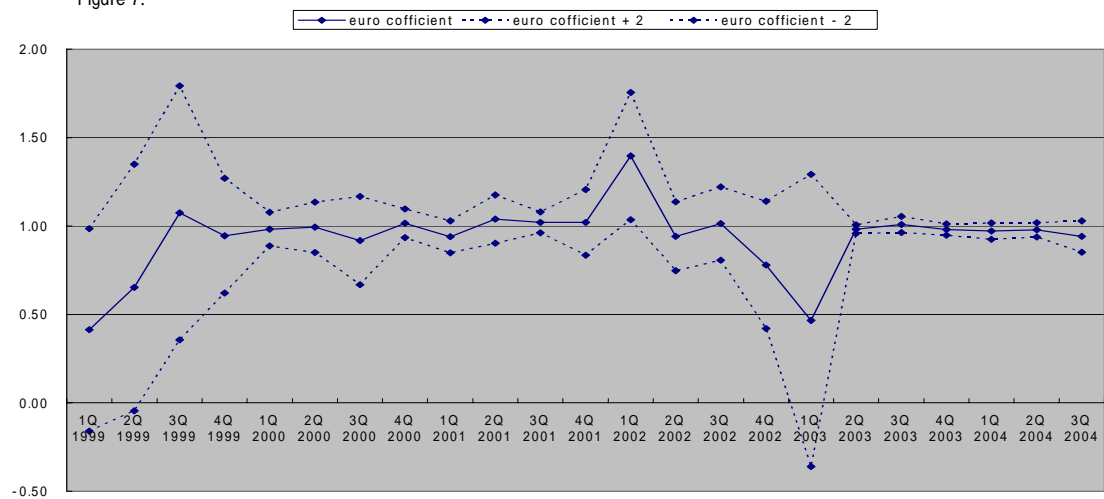


Figure 8.

The euro coefficient of Estonian kroon

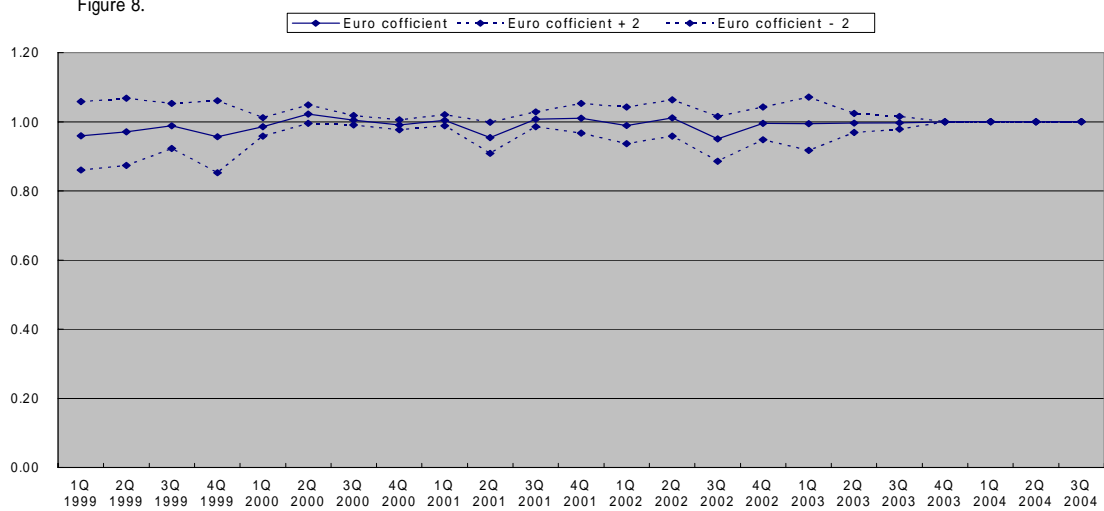


Figure 9.

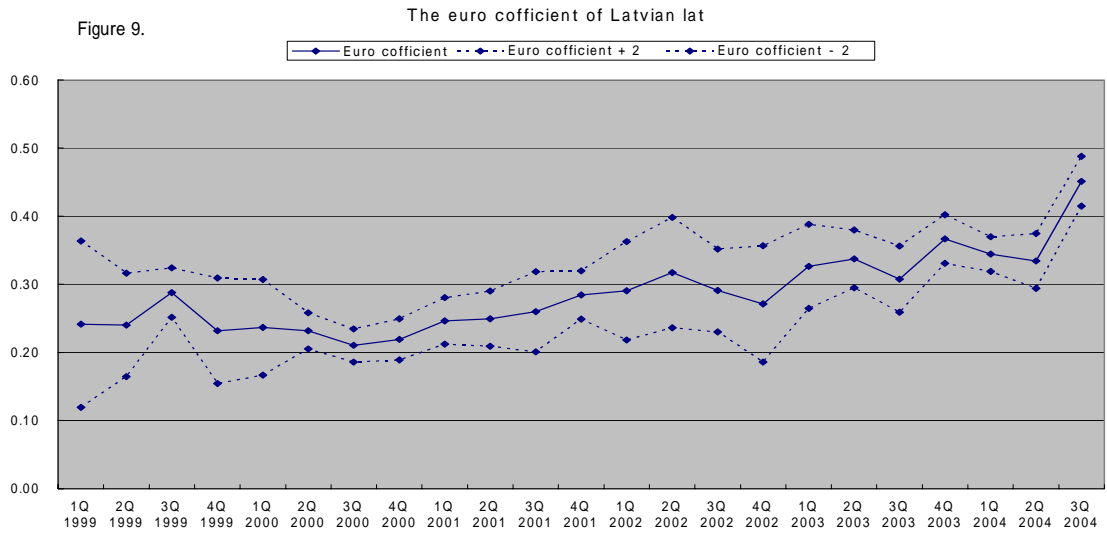


Figure 10.

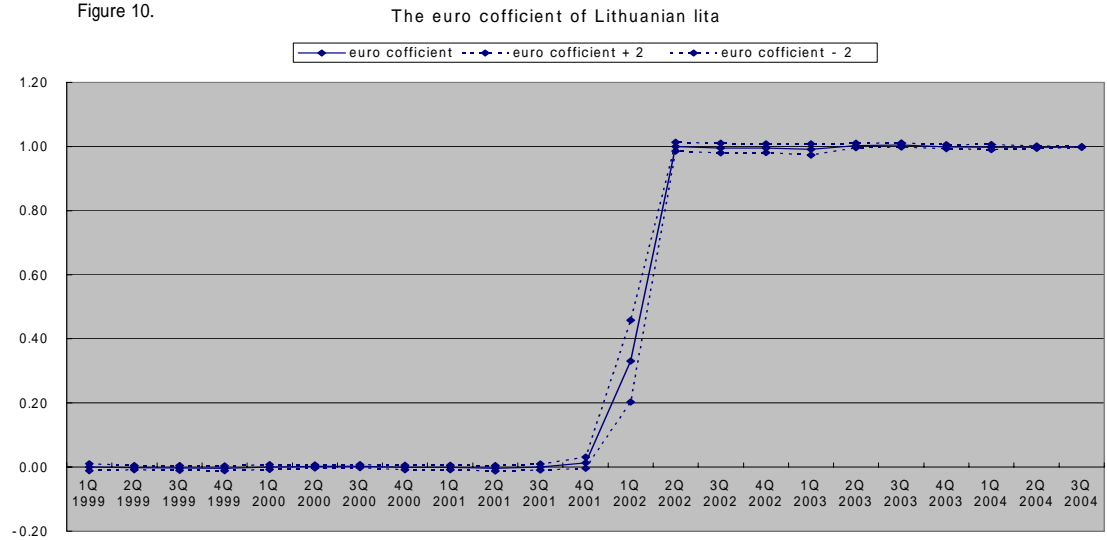


Figure 11.

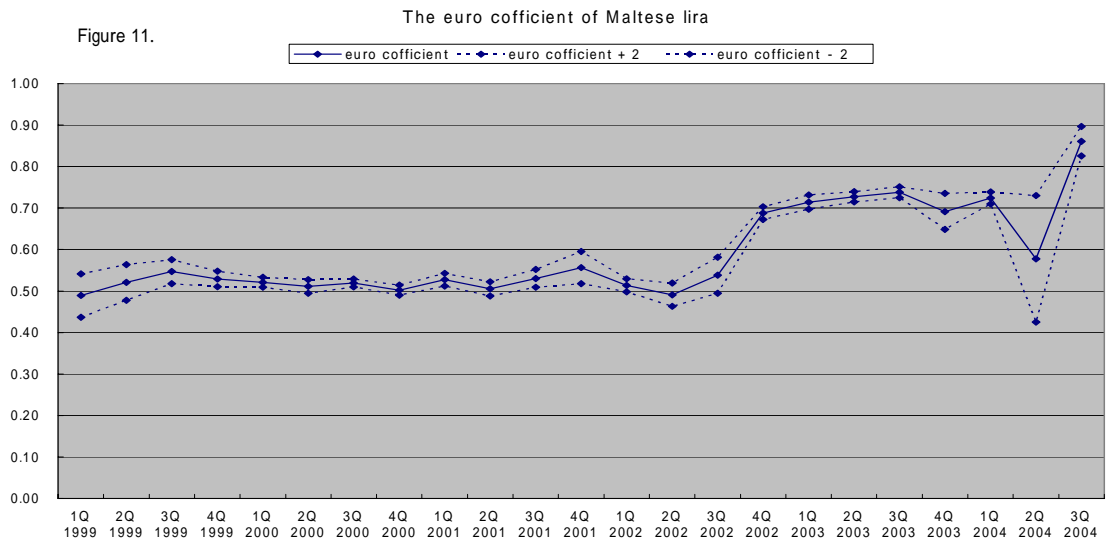


Figure 12. The euro coefficient of Cyprus pound

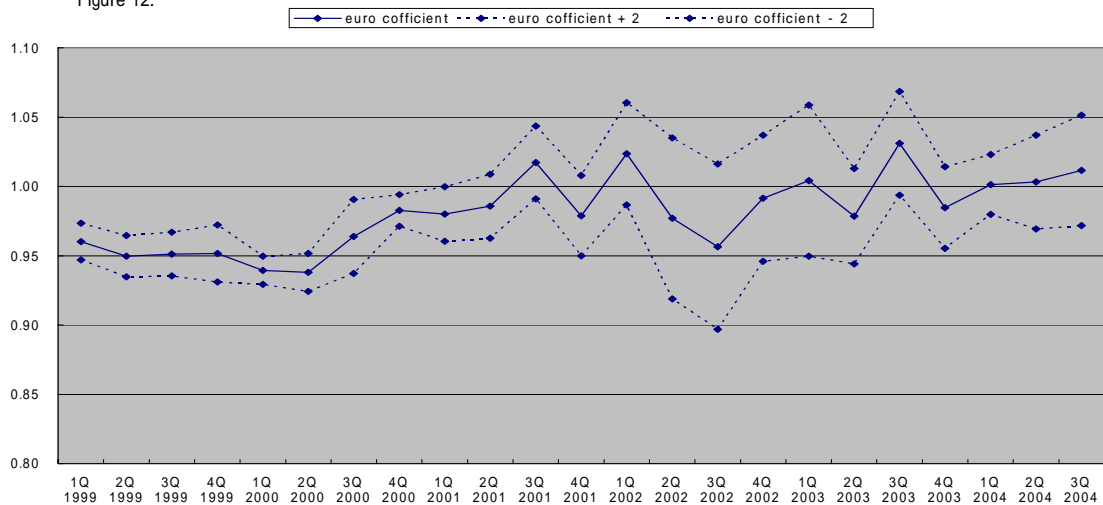


Figure 13. The euro coefficient of Rumanian leu

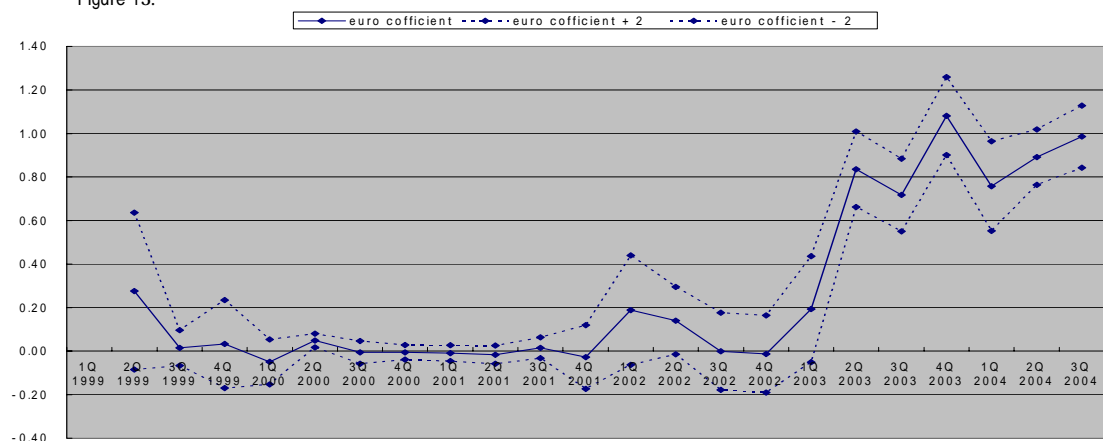


Figure 14. The euro coefficient of Bulgarian lev

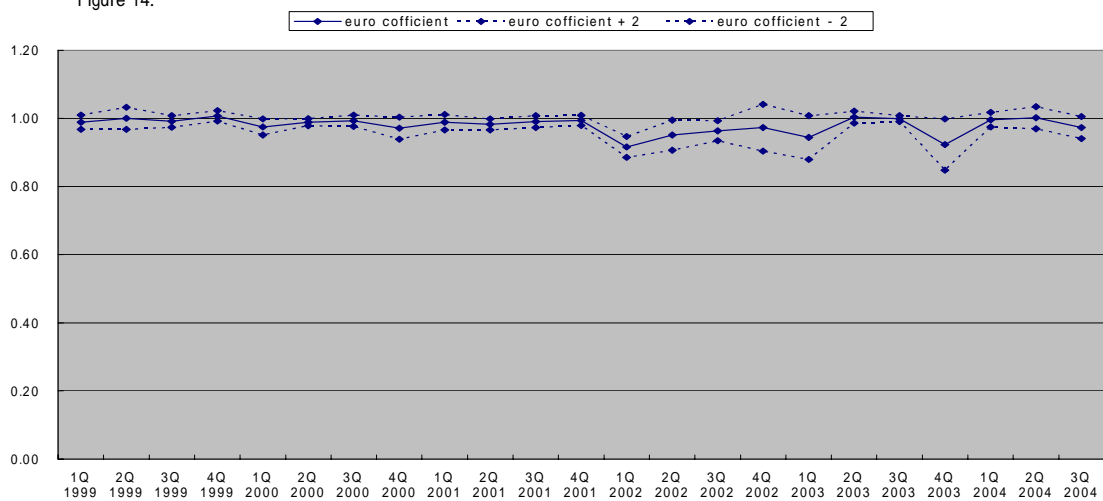


Figure 15.

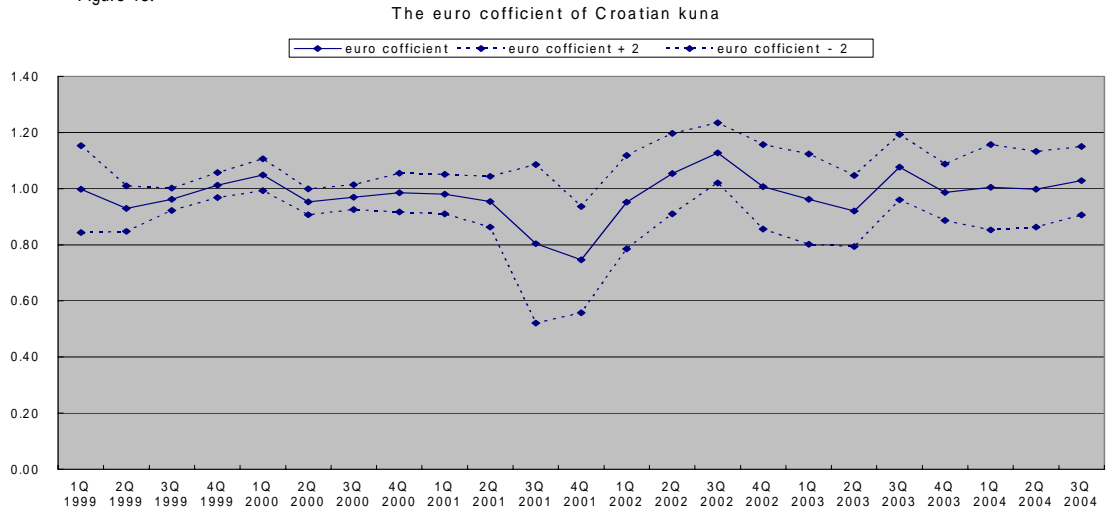


Figure 16.

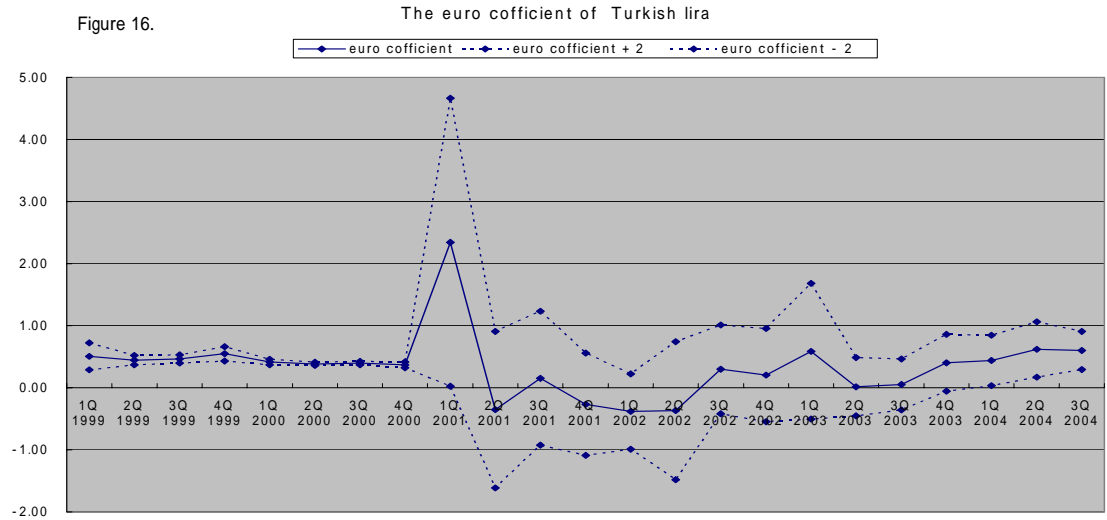


Figure 17.

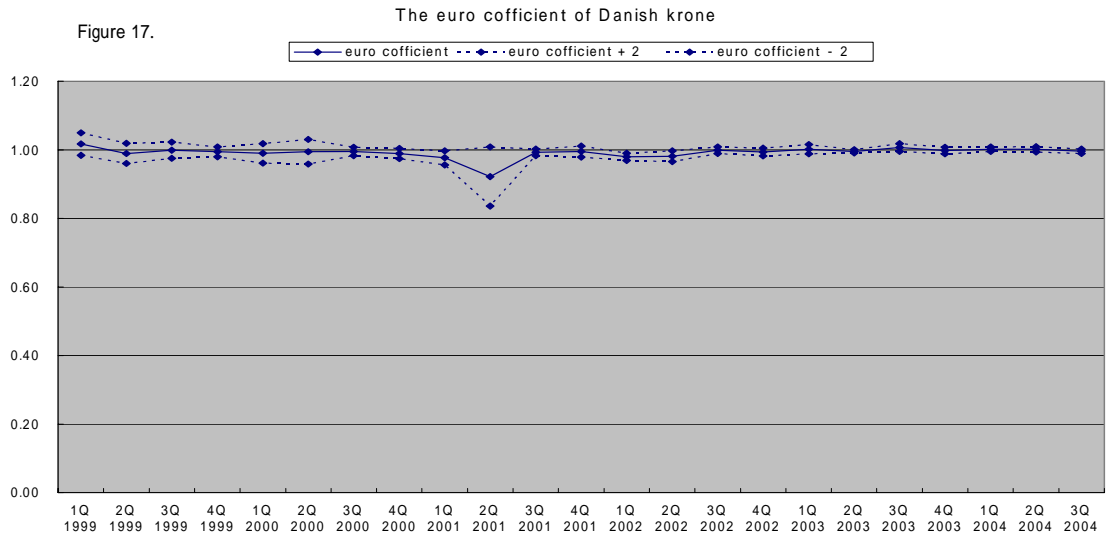


Figure 18.

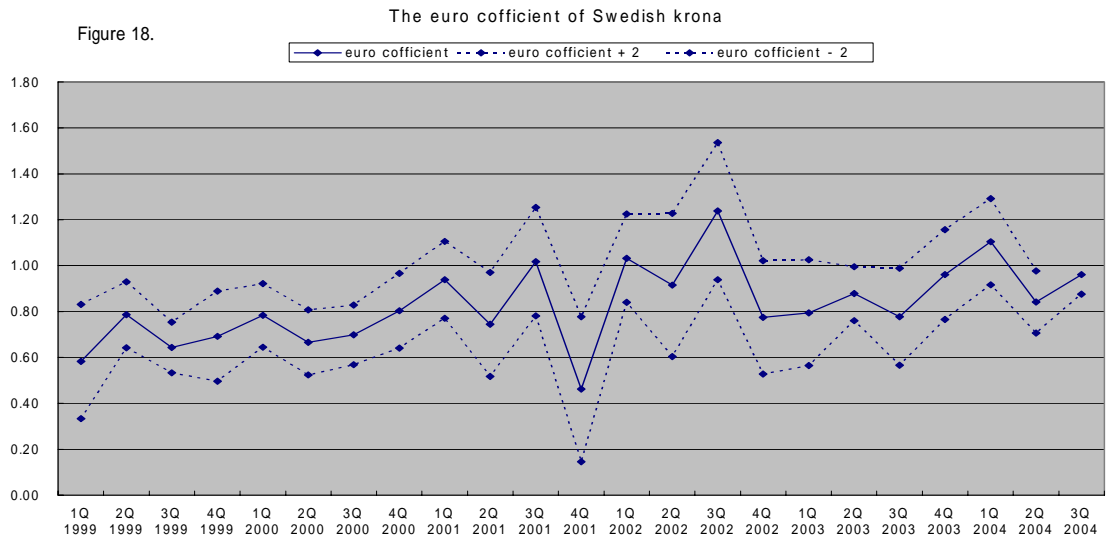


Figure 19.

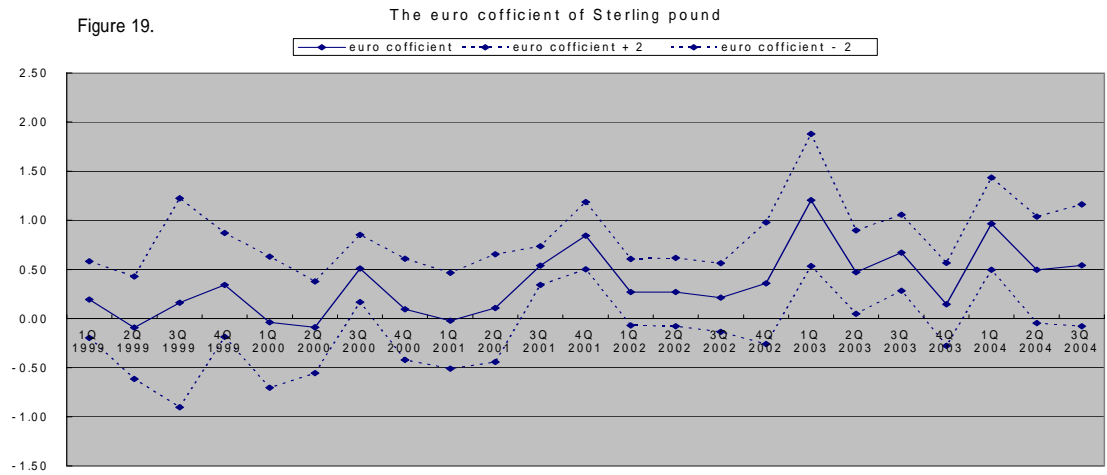
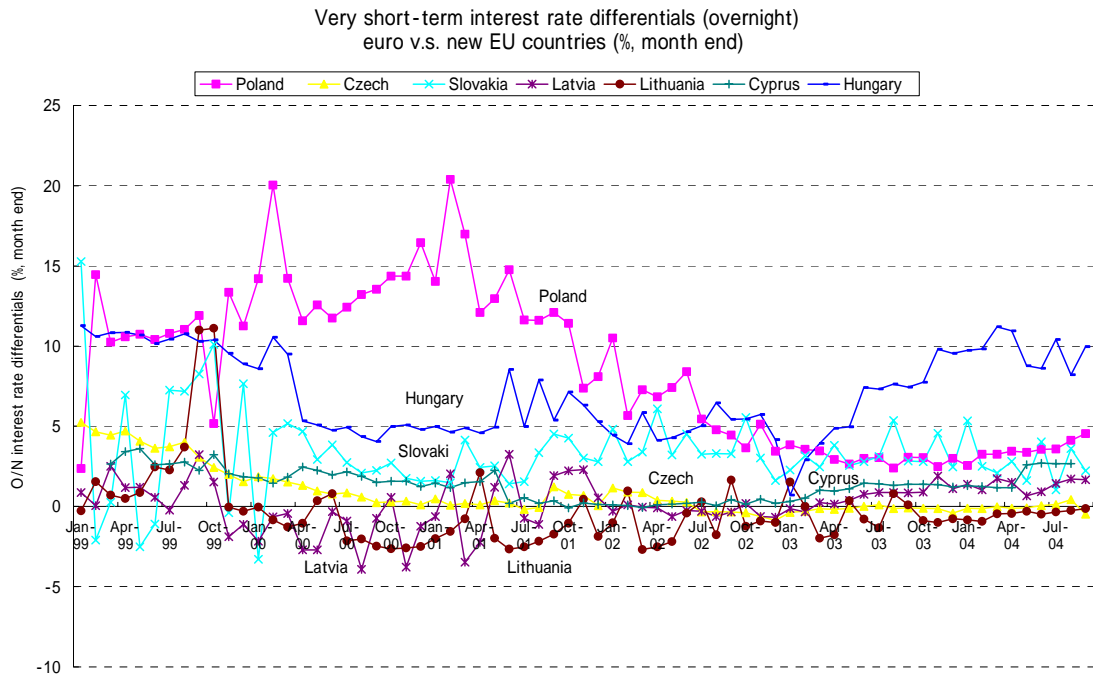


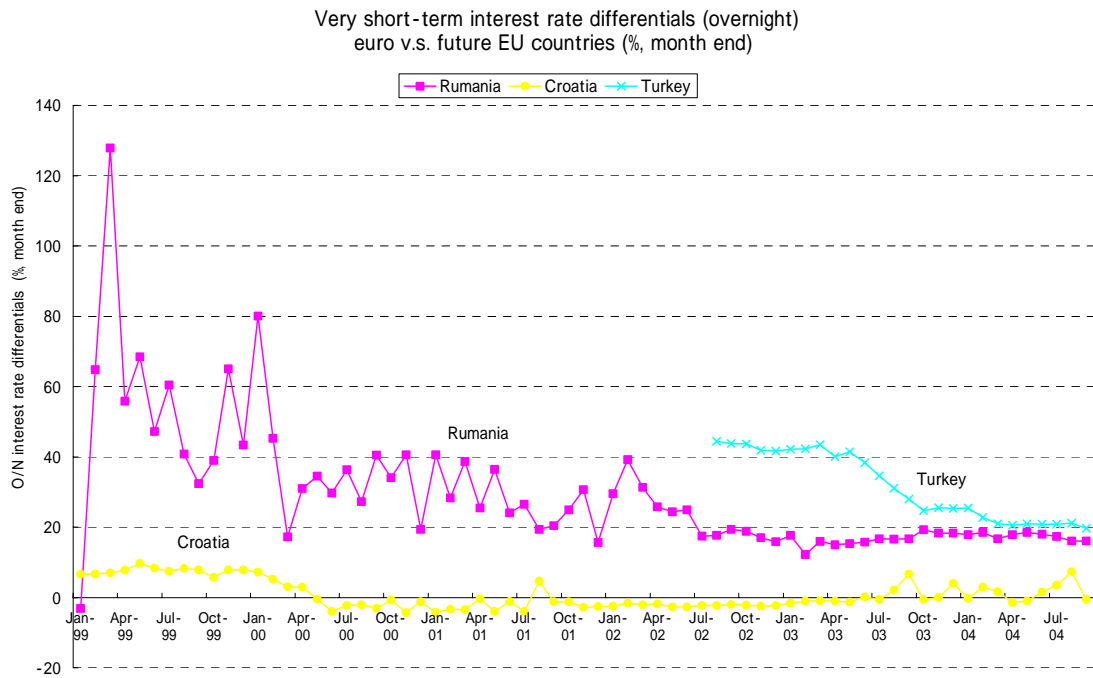


Figure 20



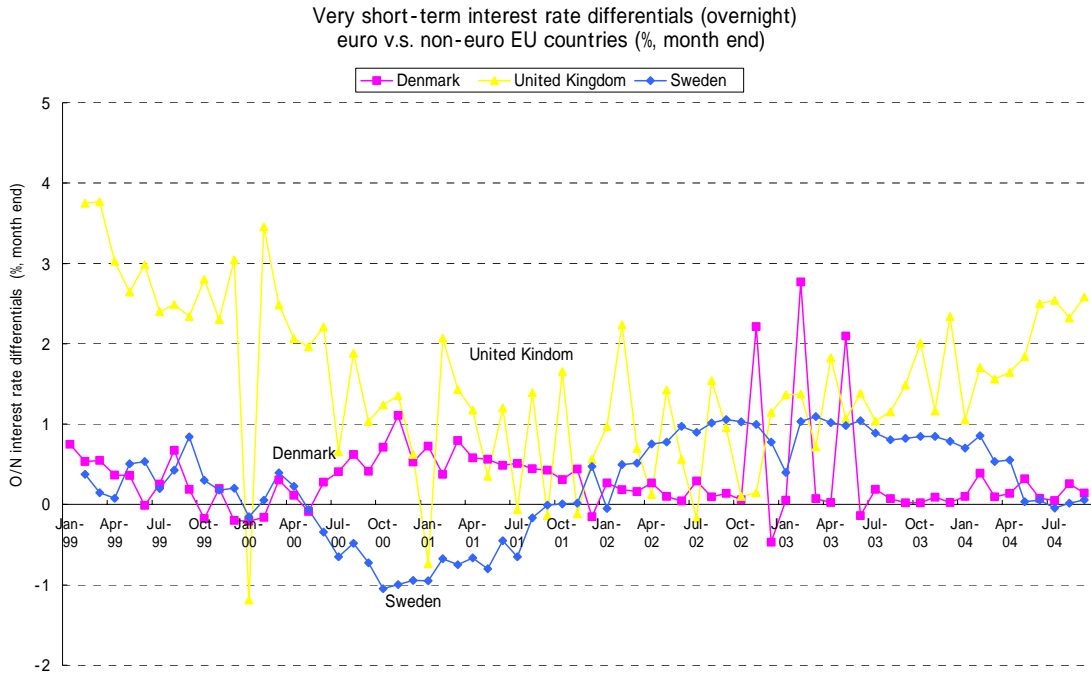
Source: Datastream and each county's central bank HP  
Short-term interest rate differential = each country's overnight interest rate – euro overnight interest

Figure 21



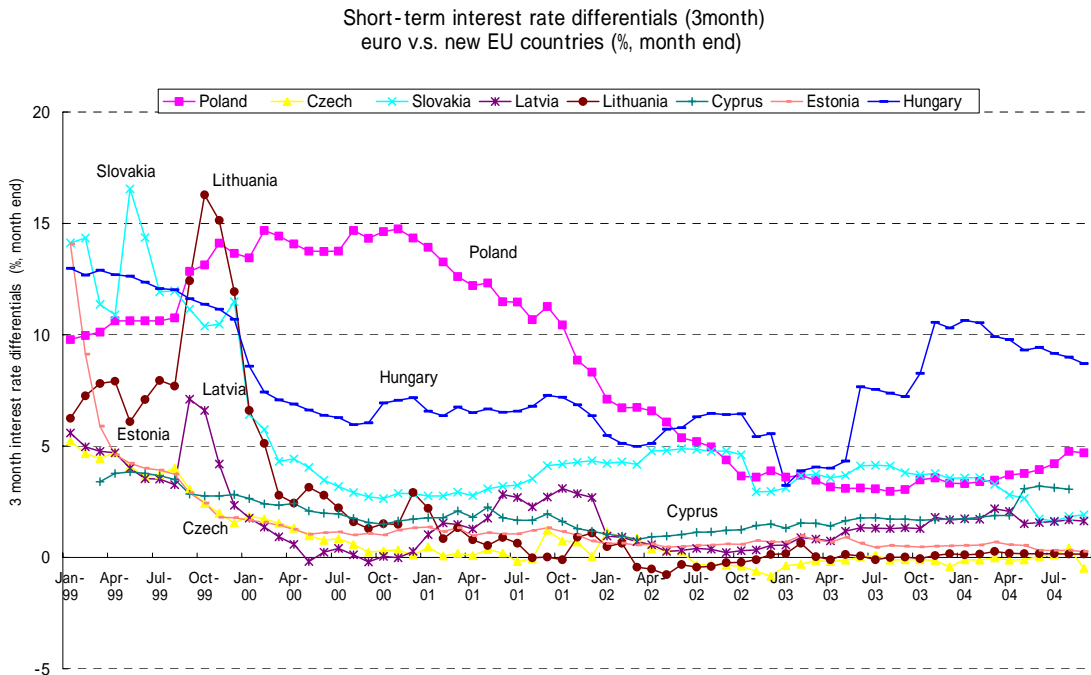
Source: Datastream and each county's central bank HP  
Short-term interest rate differential = each country's overnight interest rate – euro overnight interest

Figure 22



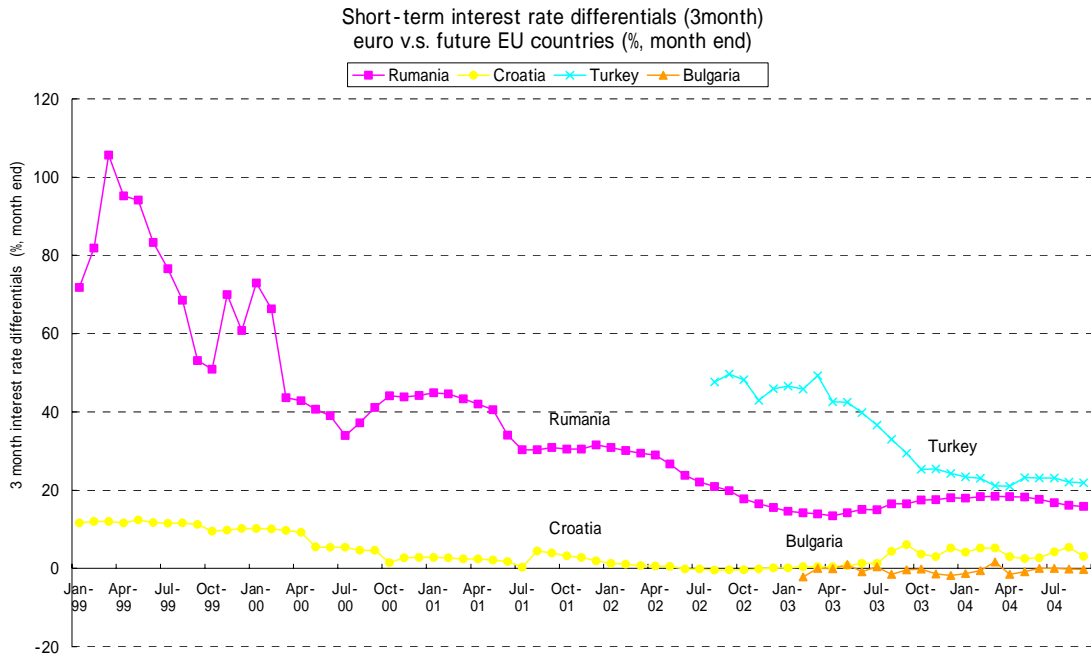
Source: Datastream and each country's central bank HP  
 Short-term interest rate differential = each country's overnight interest rate – euro overnight interest

Figure 23



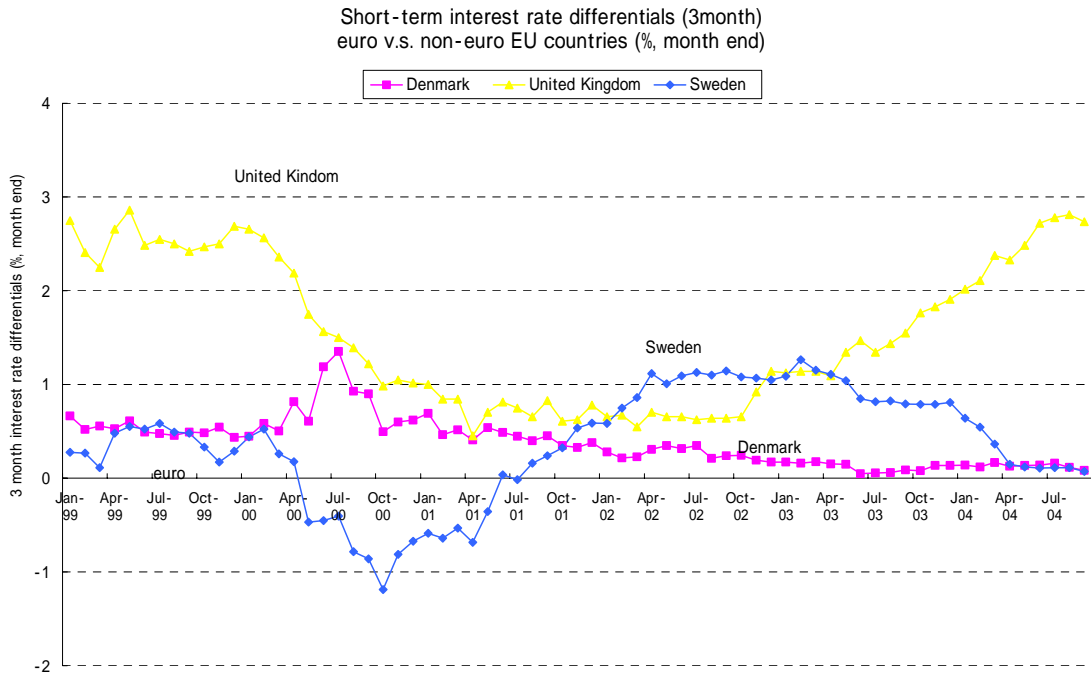
Source: Datastream and each county's central bank HP  
 Medium-term interest rate differential = each country's 3month money market interest rate – euro 3month money market interest rate

Figure 24



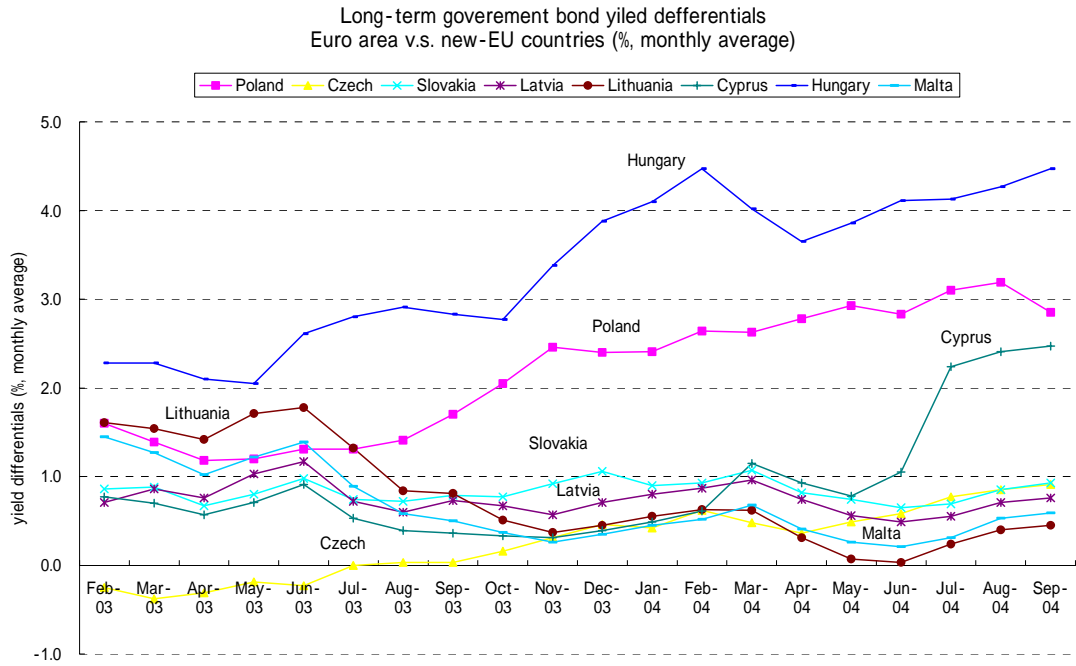
Source: Datastream and each county's central bank HP  
 Medium-term interest rate differential = each country's 3month money market interest rate  
 – euro 3month money market interest rate

Figure 25



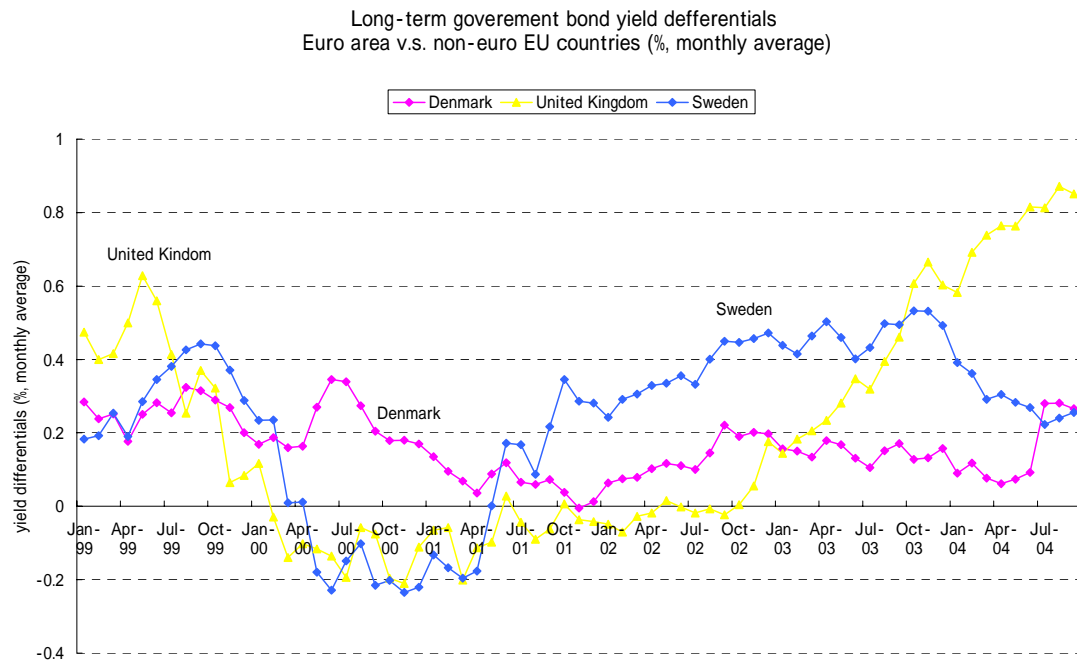
Source: Datastream and each county's central bank HP  
 Medium-term interest rate differential = each country's 3month money market interest rate  
 – euro 3month money market interest rate

Figure 26



Source: ECB Monthly Bulletin  
 Long-term Government bond yield differential = each country's 10-year government bond yield – euro area 10-year government bond yield

Figure 27



Source: Datastream and each country's central bank HP  
 Long-term Government bond yield differential = each country's 10-year government bond yield – euro area 10-year government bond yield