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Financial Crisis and the Choice of Currency Regime in NEW EU Member Countries

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Abstract

This paper investigates the relationship between currency regimes and long-term government bond spreads in new EU member (NEM) countries for the period between 2001 and 2008. To specify their currency regimes, we use two different methodologies, estimating implicit basket weight on euro and measuring the z-scores. By using them, we conduct the empirical analyses to find out how their choice of currency regime affect on their bond spreads. As a result, we confirm that floating exchange rate regime reduces the bond spreads in NEM countries. Furthermore, more flexible exchange rate regime might reduce the bond spreads when the financial market is volatile. Our findings provide an essential caveat of currency regime choice for emerging countries during crisis time.

Keywords: currency regime, hard-peg, floating regime, bond spread
JEL Classification: F15, F31, G15

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1. Introduction

The global economy was facing a world-wide financial crisis in 2008. This picture was even worse in some emerging markets. Especially hard hit in Eastern Europe were Bulgaria, Romania, Ukraine and Hungary. In New EU member (hereafter, NEM) countries, there are many countries preparing to accessing euro in near future. However, the impact of financial crisis seemed to be different in each NEM country. What causes such differences among them?

It is pointed out that the exchange rate strategies in new EU member countries differ considerably. An appropriate exchange rate regime, floating, managed or pegged, basically depends on individual countries. Their choice, however, might bring some important changes that have taken place in recent years. These changes include the general increase in capital mobility or the abrupt reversals of capital flows to developing and transition economies. After EU enlargement in 2004, there were several researches about the relationship between the exchange rate regimes and the macroeconomic performances of NEM countries. These studies found that the exchange rate regimes or exchange rate stability vis-à-vis the euro basically brought some sort of effects on their macroeconomic performances. In this way, if we focus on credit risk in financial market, it is important to investigate whether their choice of exchange rate regimes affects on their financial market in crisis time.

The purpose of this paper is to investigate the relationship between exchange rate regimes and long-term government bond spreads in NEM countries for the period between January 2001 and December 2008. Bond spreads of long-term government bonds are usually considered to reflect their risk premium. There are a lot of related works to investigate the determinants of bond spreads in emerging countries, however, our

research is characterized by analyzing them from the view point of exchange rate regime. To analyze their exchange rate regimes, we use two different methodologies, estimating implicit basket weights on euro by Frankel and Wei (1994) and measuring the z-scores proposed by Ghoshm, Gulde, and Wolf (2003). By using above original variables, which represent the exchange rate regimes in each NEM country, we conduct the empirical analyses to find out how their choice of exchange rate regime affect on their bond spreads. Because we includes the latest world-wide financial crisis in the sample period, our findings provide an essential caveat of currency regime choice for emerging countries during crisis time.

The paper is organized as follows. The next section presents the previous studies concerning about the choice of exchange rate regimes in NEM countries. Section 3 figures out the exchange rate regimes estimated by two different methods. Section 4 discusses the determinants of bond spreads in NEM countries. Section 5 investigates the relationship between the choice of exchange rate regimes and bond spreads empirically. Section 6 summarizes the main findings and concludes.

2. The choice of exchange rate regime in the NEM countries

There is considerable diversity in the exchange rate regimes of developing and transition countries, from very hard currency pegs to relatively free floats and with many variations between them. This is not surprising in view of the wide differences among these countries in economic and financial circumstances. However, the choice of exchange rate regime in new EU countries is something special. It seems that they are racing toward the final goal, qualifying to enter the euro zone. There are a lot of researches about the exchange rate regimes adopted by the NEM countries after EU enlargement in 2004.

In the process of EU enlargement, the new accession countries are required to participate in the ERM-ll framework. Krawczyk (2004) discussed the dangerous of adopting ERM-ll, which may result in a serious financial instability in the region. Due to his opinion, they should be allowed for varying monetary integration strategies as they have been adopting a variety of exchange rate regimes.

De Grauwe and Schnable (2004) explored the impact of the exchange rate regime on inflation and output in the Central and Eastern European (hereafter, CEE) countries. By using the panel estimation for the period between 1994 and 2002, they tested the impact of the exchange rate regime on economic growth. Their analytical results indicated that the pegged exchange rate did not reduce these countries' growth rates and brought the benefits of more trade and lower interest rates.

Arratibel, Furceri, and Martin (2008) focused on the difference of macroeconomic performance of different exchange rate regimes, "hard peg" and "floating" CEE country groups. They empirically analyzed the relation between CEE countries' exchange rate volatility and several macroeconomic variables. By using panel estimations for the period between 1995 and 2006, they found that lower exchange rate volatilities were associated with higher growth for relatively less financially developed economies, higher stocks of FDI for relatively more open economies, higher current account deficits, and a more volatile credit cycle.

Darvas and Szapary (2008) argued that main risks for CEE countries with hard-peg were no room to let the nominal exchange rate appreciate to accommodate the price level convergence. For the countries adopting floating regimes with inflation targeting, the possibility of letting the nominal exchange rate appreciate provides more flexibility to control inflation and accommodate price level convergence. From above results, we can summarize that both regimes, hard-peg and floating, have own benefit and loss to NEM

countries.

3. The strategies to change exchange rate regime in NEM countries

NEM countries' exchange rate regimes are officially reported in IMF annually report and we can easily find out what kind of exchange rate they adopt now. However, in this paper, we focus their strategies to change exchange rate regime from joining to EU to euro adoption in future. In this section, we evaluate their path to change exchange rate regimes by two empirical methods and try to figure out how and when they have been changing their regimes exactly. We apply two different methods to evaluate their regimes as follows: One is the methodology introduced by Frankel and Wei (1994), to estimate implicit basket weights on euro. Another is the z-scores measure proposed by Ghoshm, Gulde, and Wolf (2003), which calculate de facto exchange rate volatility against the euro. Before reporting our calculation results, we briefly present the current exchange rate regimes and movements of nominal exchange rate in NEM countries.

3-1. The exchange rate regimes in NEM countries

Before introducing the euro in 1999, most NEM currencies pegged to a highly stable currency, such as the Deutsche Mark, the US dollar or SDR. However, their exchange rate regimes have drastically changed ahead of joining EU in 2004. According to Table 1 which summarizes the exchange rate regime of NEM countries, we classify their choices of currency regime into three categories; floating, hard-peg to euro, and euro adoption. Bulgaria, Estonia, Latvia and Lithuania adopts hard-peg regimes with exchange rate target as their monetary policies, while Czech Republic, Hungary, Poland, and Romania

adopts managed floating or free floating with inflation targeting. Slovenia was the first country to introduce euro among NEM countries since January 2007, followed by Cyprus and Malta since January 2008 and Slovakia has just started to introduce euro since January 2009.

[Insert Table 1 here]

Looking at the movement of nominal exchange rates vis-à-vis the euro since 1999, the pictures of each group are different and mixed. Figure 1 to 3 show the movement of nominal exchange rate index, which is based on 100 at benchmark period of January 1999. A rise in the index means nominal appreciation against the euro.

[Insert Figure 1 here]

Figure 1 shows the movement of hard peg currencies, which are Bulgaria, Estonia, Latvia, and Lithuania. Among them, three currencies, Estonia kroon, and Bulgarian lev have not moved since the euro was introduced into the foreign exchange market in January 1999. Lithuanian lita appreciated almost 40 % from Jan 1999 by middle of 2002, then fixed at this level. On the other hand, Latvian lat appreciated 20 % from 1999 to end of 2001, and then declined and stayed at slightly below the level of January 1999. At the moment, Estonia, Lithuania and Latvia are members of ERM ll.[1]

[Insert Figure 2 here]

Figure 2 shows the movement of floating currencies, which are Czech koruna, Hungarian forint, Polish zloty, and New Romanian leu. New Romanian leu depreciated sharply until 2004 and has stayed around at 40 % lower level than January 1999 since then. Romania adopted inflation targeting in 2005. On the other hand, Czech koruna

[1] Estonia, Lithuania and Slovenia joined ERM II on 27 June 2004, Cyprus, Latvia and Malta joined on 29 April 2005 and Slovakia on 25 November 2005. Estonia and Lithuania adopts ERM ll with a fixed rate and Latvia with +/- 1% fluctuation band as a unilateral commitment.

appreciated continuously. It went up above at 40 % higher level than January 1999 in middle of 2008, and has been declining since then. Polish zloty also was on uptrend after 2004 and has been sharply depreciating since middle of 2008. Hungarian forint slightly depreciated until it adopted inflation targeting in May 2001, and has fluctuated within +/- 10 % range. It has also declined since middle of 2008. These floating currencies' depreciation vis-à-vis the euro in 2008 were affected by escalation of global financial crisis in 2008.

[Insert Figure 3 here]

Figure 3 shows the movement of euro introducing currencies, which are Slovenian tolar, Cyprus pound, Maltese lira and Slovak koruna. Slovenian tolar started to depreciate until 2004, then stayed at 20 % lower level than January 1999 and joined the euro in January 2007. Cyprus pound and Maltese lira also stayed in a narrow range or fixed before joining the euro in January 2008. On the other hand, Slovak koruna continued to appreciate just before joining the euro in January 2009. It is because Slovakia adopted ERM ll with the standard fluctuation band of +/- 15 %.

Above observations indicate that there are various choices for NEM countries to approach the euro adoption. It is a controversial issue which is the most appropriate regime to manage the catching up process with euro-area countries.

3-2. The estimated exchange rate regime by Frankel and Wei (1994)

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 anchor currencies which include the

euro, the US dollar and the Sterling pound (UK) as follows.

$$\dot{e}_{i/kt} = a_0 + a_1\dot{e}_{Euro/kt} + a_2\dot{e}_{US/kt} + a_3\dot{e}_{UK/kt} + \varepsilon_t \qquad (1)$$

where $\dot{e}_{ik}$ is rates of change in the exchange rate of currency *i* vis-à-vis currency *k*, which is a numeraire currency.

In the above equation, the constant term a_0 is positive (negative) if the exchange rate of the relevant currency regularly depreciates (or is devalued) against the numeraire currency *k*. The coefficients a_1, a_2, a_3 are interpreted as weights of the three anchor currencies in an implicit basket peg system, which include the euro peg system if the following coefficient is estimated;

$a_1 = 1$

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 coefficients is significant, then the exchange rate system is identified as a floating system.
2. If one coefficient a_1 (or a_2) is significant and closes to unity whereas all others are not significant, then it is identified that the currency is pegged to the euro (or 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 composed of these currencies.

While this method to identify the exchange rate regime is very simple to understand, it causes the serious problem how to decide a numeraire currency *k*. Basically, the numeraire currency *k* should be traded actively in the international currency market and should not be linked strongly to each of anchor currencies. In the previous works, the Swiss francs and the SDR were often used as a numeraire currency.[2] In this paper, we

[2] Takagi (1996) and others who analyzes the coefficients of Asian currencies use the Swiss francs,

focus on the relationship between the euro and new EU currencies, so we change the role of the Japanese yen from one of explanatory currencies to one of the numeraire currency candidates. In order to decide the most desirable numeraire currency, we compare the correlation between each of the numeraire currency candidates and the anchor currencies, which are the euro, the US dollar and the Sterling pound, plus, all of the sampled European currencies.3

[Insert Table 2 here]

Table 2-a shows a correlation matrix between each of the numeraire currency candidates and three anchor currencies in equation (1). Among the three numeraire currency candidates, the Japanese yen has the smallest correlation coefficients with three anchor currencies. Table 2-b shows a correlation matrix between each of anchor currencies, the numeraire currency candidates and NEM currencies in equation (1). Most of the sampled NEM currencies have the smallest correlation with the Japanese yen among the three candidates. Accordingly, we choose the Japanese yen as a numeraire currency in the regression equation (1).

Then we estimate the following equation for NEM countries (Poland, Czech, Slovakia, Hungary, Slovenia, Estonia, Latvia, Lithuania, Malta, Cyprus, Rumania, and Bulgaria). Our regression equation (1) can be re-write as follows:

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

All foreign exchange data are downloaded from Datastream. The whole sample period is 1/1/1999 to 12/24/2008.[4] We divide the whole sample period into some sub-sample

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while Frankel and Wei (1995) used the SDR.

[3] We use the Canadian dollar as a numeraire in order to calculate the correlation matrixes among all of the sampled currencies.

[4] All exchange rate data are from Datastream. We use daily NY closing exchange rates.

quarterly periods and estimate the coefficients on the three anchor currencies for each of the sub-sample quarterly periods. The movements in the coefficients show how linkage of the currency to the three anchor currencies has been changing in the whole sample period.[5] It implies how and when the monetary authorities have been changing their exchange rate policy over time. In this paper, we focus on the movement of the euro coefficient on NEM currencies. Basically most euro coefficients are estimated significantly.

[Insert Table 3 here]

Above results indicate that their changing ways of currency regime are different each other even in a same grouping currencies. In the next section, we confirm these differences by measuring another calculation.

3-3. The Z-scores of NEM currencies

In order to measure the observed exchange rate volatility, De Grauwe and Schnable (2004) and Arratibel, Furceri and Martin (2008) calculate the z-scores. The z-scores proposed by Ghosh, Gulde and Wolf (2003) incorporate both exchange rate fluctuations around a constant level and exchange rate fluctuations around a gradual depreciation/appreciation path. The *z*-score is calculated as follows:

$$Z_t = \sqrt{\mu_t^2 + \sigma_t^2} \qquad (3)$$

In above formula (3), μ_t corresponds to the arithmetic average of month-to-month change in the nominal exchange rate vis-à-vis the euro in year t, and σ_t is the standard

[5] If one of the estimated coefficients is significantly negative, we re-estimate the equation without them.

deviation of the month-to-month changes of the nominal exchange rate vis-à-vis the euro in year t. If z is very low, it means that the currency is pegged to the euro (hard peg). If z is becoming lower, it means that the currency moves from floating regime to hard peg regime with the euro.

[Insert Table 4 here]

Yearly index of z-score by using monthly exchange rate data between January 1999 and December 2008 are reported in Table 4. [6] For hard peg countries, their z-score declined to zero except for Latvia, whose z-score was slightly up in 2007 and 2008. For floating countries, on the other hand, their z-score went up in 2008. It means that their currencies became volatile vis-à-vis the euro due to financial turmoil. For euro adoption countries, their z-score stayed completely zero after their joining in euro-zone except for Slovakia, who has just joined in euro since January 2009. These results indicated that the exchange rates of floating countries and Latvia became volatile vis-à-vis the euro affected by global financial crisis in 2008, and others were stable except for Slovakia, who continued to appreciate vis-à-vis the euro by middle of 2008.

4. The determinants of bond spreads and exchange rate regime

4-1. Financial market integration in NEM countries

In the case of NEM countries, which are committed to adopting the euro at some point, it is important to analyze the alignment of their financial market integration with those of the euro area countries. Joining the euro area without a sufficient degree of financial

[6] All exchange rate data are from Datastream. For calculating z-score, we use month-end NY closing rates.

market integration might bring serious problems in terms of transmission of a common monetary policy and common shocks. A lot of empirical researches confirmed that the financial integration of new EU countries have been promoted especially after EU enlargement in 2004. For example, Cappiello et al (2006) used daily return of the Government bonds from 2000 to 2005 and found that the largest new EU member states, the Czech Republic, Hungary and Poland, exhibit strong co-movements both between themselves and with the euro area. Darvas and Szapary (2008) also confirmed that there has been a substantial convergence of the nominal interest rates in NEM countries towards the lower levels prevailing in the euro area by 2007. Since 2007, however, the world-wide credit crisis has changed above trend of convergences. The nominal money market convergences, which seemed to be established in most NEM countries, have been destroyed by recent financial distress caused by the subprime mortgage loan problems.

[Insert Figure 4 here]

Figure 4 and 5 show the monthly movements of money market interest rate (overnight and 3 month, respectively) of NEM countries and euro area. Just after the introducing the euro in January 1999, the interest rate of euro area was the lowest and all NEM countries' interest rates were much higher than it. Since then, substantial convergences of the nominal interest rate between NEM countries and euro were confirmed in both terms. Lower figures, which focus on the period between 2006 and 2008, can indicate their movements more precisely. In 2006, o/n interest rates of Romania and Hungary were 3 to 4 % higher than euro area, while those of Czech, Bulgaria, Slovakia and Latvia were even lower than euro area. For 3 month interest rates, the differences between NEM countries and euro area were within 1.5 percent except for Romania and Hungary, which operate

floating to the euro.[7] The interest rate differentials were particularly low in Estonia, Lithuania and Bulgaria which operate hard peg to the euro and in the new euro area member, Slovenia and Slovakia. In the Czech, their interest rate differences were negative, consistent with the appreciating exchange rate. Since middle of 2007, however, their trend of narrowing interest differential with euro area has reversed. At first, the interest differential in Latvia, unlike in the other countries with fixed exchange rate regime has sharply increased since 2007. Except for Czech and Slovakia, their differentials were becoming bigger and even accelerated in middle in 2008. These phenomenons suggest us that the recent financial distress might give a serious and unusual impact on market integration in each NEM country. In the next section, we focus on the long-term government bond spreads between NEM countries and euro area.

[Insert Figure 5 here]

4-2. The long term bond spreads in NEM countries

The introduction of the single currency meant that the euro-zone countries introduced the same monetary policy by the ECB. Ahead of the introduction of the single currency euro in 1999, noticeable phenomena in the European government bond markets were recognized, especially in the new-euro zone countries. By necessity, the front ends of the each country's government bonds yields curves was forced to converge the same level. In addition, the long term government bond yields also were converged to the euro-zone benchmark yields' level.[8] The degree of convergence was so big that we could explain it by

[7] It was indicated that high interest rate differentials in Hungary was caused by their large fiscal and current account deficit and high inflation.

[8] The benchmark government bond in the euro-zone is 10 year German government bond.

the introduction of the single currency, the disappearance of the exchange rate risk and the EU's strict budget discipline. Although each country's government bonds have been dealt in reference to the spreads against the benchmark German government bond with the same maturities, market participants became gradually unaware of the difference of the each country's economic and budget condition.

Since 2007, however, the world-wide credit crisis has changed this picture drastically. Except for the German government bonds, not only in the euro-zone countries, but in the neighboring new EU countries that aimed to be the euro member, the yield spread widened enormously reflecting the degree of the influence of the credit risks, the each country's budged condition and liquidity. In this paper, bond spread is defined as follows.

$$Bond\ spread_{i,t} = Government\ bond\ \ yeild_{i,t} - German\ gevernment\ bond\ \ yield_{t}$$

It is the difference between the yield to maturity (= YTM) of a NEM 10 year government bond denominated in terms of their local currencies and the YTM of the respective 10 year German government bond.[9]

[Insert Figure 6 here]

Figure 6 shows the monthly movements of long term government bond spreads of NEM countries. Due to Figure 6 (upper), many differences in both their levels of bond spreads and their degrees of convergence among NEM countries are recognized. Of course, there are certain differences of credit rating, which definitely affect on their bond spreads.[10] For example, bond spreads of Slovenia, Czech, Estonia, Lithuania, and Slovakia, whose credit

[9] Yield data are mainly from ECB, and Datastream. For Malta, Slovenia, we use the yield data of 10 year government bond in terms of the euro due to the data constraint.

[10] As of April 2008, Ratings of CEE countries by Fitch were as follows; Bulgaria (BBB), Czech (A+), Estonia(A), Hungary(BBB+), Latvia(BBB+), Lithuania(A), Poland(A-), Romania(BBB), Slovakia(A), Slovenia(AA). Some of them were downgrading recently.

rating were above Single A were mostly lower than other countries, such as Romania and Hungary, who's rating were below A. However, there were still differences among same rating countries. Especially when the worldwide financial crisis started to spread in 2007, their bond spreads also started to go up sharply. At the end of 2008, five sampled NEM countries' bond spreads were above 500 basis points (hereafter, bp) and the difference between the highest (Latvia, 598 bp) and the lowest among non-euro countries (Czech, 125 bp) was much larger than normal time. What kinds of factors are affecting these differences? Because these government bonds are issued not in the euro, but in their own local currencies, their choice of exchange rate regimes might be one of them.

4-3. The determinants of sovereign bond spreads in NEM countries

The bond spreads that exist among EMU member countries are primarily explained by their differences in liquidity and credit risk. Regarding credit risk, the disciplinary effect of the financial markets on policy makers has been focused. For example, the relationship between the development of national debt-to-GDP ratios and sovereign yield spreads relative to German government bond indicates that the improved creditworthiness of the EMU member countries since 1999 can explain some of the decline in the spreads. However, credit risk is only one of the factors that determine the size of the bond spreads.

The determinants of sovereign bond spreads have been extensively investigated especially for emerging markets and EMU countries. Recently some researches cover the euro denominated bonds in NEM countries, too. For example, Strahilov (2006) examined the long run relationship between the yield spreads of Eastern European national bonds denominated in US dollars over a US Treasury bond and the country's fundamentals as

well as an US interest rate. They applied the cointegrated VAR model by using the monthly data from June 1997 and September 2002 and confirmed the importance of national factors when studying default risk in emerging market. Ebner (2008) studied the determinants of NEM government bond spreads empirically with monthly data in the period of January 1998 and May 2007. As the explanatory variables of bond spreads, they applied the ECB reference rate, the market liquidity, the market volatility and the consumer price index in the euro zone, which can be regarded as exogenous to NEM countries, in addition to macroeconomic fundamentals of each NEM country. As a result, they found that ECB reference rate and market volatility were the main driving factors to increase bond spreads.[11]

Above researches indicate that the bond spreads of NEM countries are affected by both their macroeconomic fundamentals and outside market conditions. Moreover, there are no common patterns regarding macroeconomic fundamentals. In previous sections, we confirm strong heterogeneity with respect to exchange rate regime within NEM countries, which might bring some different impact on their bond spreads. In this paper, we regards that their exchange rate regimes also is one of the important determinants of bond spreads. Then we try to do some empirical analysis in the next section.

5. Empirical analysis

5-1. Model Specification

To identify the effect of exchange rate regimes on the level of bond spreads, we execute

[11] Hartelius, et.al (2008) also confirmed that expectations of future US interest rates and volatility in those expectations are also a key determinant of emerging market spreads.

a cross-country panel model for the period 1st quarter 2001 and 3rd quarter 2009. In this model, we apply our quarterly data set, which include the indicators for exchange rate regime and we investigate the effect of exchange rate regime on bond spreads (BS). The number of sampled NEM countries is twelve. Due to the data constraint of bond spread, the sampled period is not equal for each NEM country. Bond spreads for each country are plotted in Figure 7.[12]

[Insert Figure 7 here]

The basic framework for the analysis is a bond spread determined by country specific macroeconomic fundamentals, which are the growth rate of government gross debt (DEBT), external balance to GDP (EXBAL), and industrial production (IP)[13]. In addition to the macroeconomic factors, we include the trend of exchange rate vis-à-vis the euro (EXTR) as well. As the external control variables, we employ European market condition factors into our model. As mentioned in previous section, Strahilov (2006) and Ebner (2008) confirmed that financial market condition, which represents the market volatilities or investor's awareness of risk are one of the important factors to determine bond spreads of emerging countries. We use VDAX-NEW, which presents an expected 30 days market volatility of the German stock index DAX, as a market volatility index (VDAXNEW) and the difference of 3 month EURIBOR and O/N market rate (ECB) as a market liquidity (LIQUIDITY) in accordance

[12] The data of bond spreads are start from January 2001 to December 2008 except for Bulgaria (from 2003), Romania (from April 2005), and Slovenia (from 2003).

[13] We use the quarterly percentage change of general government gross debt as the growth rate of government gross debt. The external balance to GDP is calculated as the percentage rate of current account balance to GDP. We use the quarterly percentage change of Industrial Production Index, which are calculated from calendar and seasonally adjusted figures. All data are downloaded from Eurostat.

with Ebner (2008).[14][15]

Starting from this baseline model, we add our original variables to represent the exchange rate regime, which are calculated in section 3. We apply the series of euro coefficients (EUROCOEF), Z-score (ZSCORE)[16], and a dummy variable for exchange rate regime (REGIME) by using the value of euro coefficients, which takes 1 if they are very close to unity (a country adopts a fixed regime) and 0 if they are depart from unity (a country adopts a floating regime).

All data except VDAXNEW are downloaded from Eurostat, EC. Before specifying the regression model, both the explained variable, bond spread, and all explanatory variables have to be tested their time series stationarity. Due to the unit-root tests for all variables, BS (bond spread), VDAXNEW and LIQUIDITY are confirmed to be non stationary in level. They turn to be stationary in first difference. The results from unit-root tests suggest that the model is estimated by employing BS, VDAXNEW and LIQUIDITY in first differences, which delivers consistent estimates. Our regression model is as follows;

$$\begin{aligned}\Delta BS_{i,t} = {} & \alpha_0 + \alpha_1 \cdot \Delta VDAXNEW_t + \alpha_2 \cdot \Delta LIQUIDIY_t \\ & + \alpha_3 \cdot DEBT_{i,t} + + \alpha_4 \cdot EXBAL_{i,t} + \alpha_5 \cdot \Delta IP_{i,t} + \alpha_6 \cdot EXTR_{i,t} \\ & + \alpha_7 \cdot Exchange\ rate\ regime\ (EUROCOEF, ZSCORE, REGIME)_{i,t} + \varepsilon_t\end{aligned} \tag{4}$$

In equation (4), explanatory variables in the first line are common among all sampled countries and investigate how European market conditions affect on bond spreads of NEM

[14] VDAX-NEW, which offered by Deutsche Börse, presents an expected 30 days market volatility of the German stock index DAX. We got the daily data from website of Deutsche Börse and Bloomberg. As quarterly data, we adopt the average of monthly closing rates.

[15] Our liquidity index does not express the liquidity condition of bond markets in NEM countries, but the liquidity condition of European financial market itself. .

[16] We calculate Z-score data set in quarterly basis by using the same methodology (monthly average and monthly volatilities are used).

countries. On the other hand, those in the second line are country specific data and investigate how each of local macroeconomic fundamental factors affects on bond spreads. We put our main variables in third line, which can investigate the effect of exchange rate regime on bond spreads in NEM countries. Since they are strongly correlating each other, we adopt these variables separately.

5-2. The predicted impact of explanatory variables

Our model specification is basically decided in accordance with the related previous literatures and market customs, which are usually reported by bond market watchers. Although there are no concrete rules with respect to the variables the model should include, we summarize the predicted impact of explanatory variables according to economic and market conventions in Table 5.

[Insert Table 5 here]

As mentioned in Table 5, the variables are classified into four groups. The first group describes the common market factors. VDAX-NEW is a proxy of European financial market volatility. Liquidity is European money market liquidity measured by the difference between 3month EURIBOR and O/N (ECB reference rate). Usually this difference becomes small when the market is liquid. It becomes larger when the market participants are so nervous or more risk averse that they eager to borrow money.[17]

[Insert Figure 8 here]

Figure 8 shows the both series. We recognize that VDAX-NEW sharply went up in

[17] One of the most active trading terms in money market is usually in 3 month. On the other hand, O/N rate are basically controlled by ECB.

middle of 2008, which represents a sudden escalation of world-wide financial crisis. As for Liquidity, it climbs up in middle of 2007, which means the expanding of subprime loan problems in Europe. If market is volatile and illiquid, the bond spreads of NEM countries are supposed to be higher. Accordingly, the predicted sign of both variables are positive.

A higher government debt to GDP increases bond spread, on the other hand, growing external balance and industrial production reduce bond spread. As for exchange rate trend vis-à-vis the euro (EXTR), the appreciation of local currency leads more appetite for their government bond by international investors, which reduce bond spread.[18]

In this paper, attention is particularly focused on the coefficient of exchange rate regime. Regarding the exchange rate regime, both signs are possible. A high euro coefficient means that a local currency is nearly pegged to the euro. On the other hand, rising z-score means more floating exchange rate regime. Accordingly, if fixed exchange rate regime is considered to be good for bonds of NEM countries, the sign of EUROCOEF (Z-score) is positive (negative), and if more flexible regime is considered to be good for them, the sign EUROCOEF (Z-score) is negative (positive). REGIME dummy's sign is positive (negative) if fixed exchange rate regime is considered to be good (not good) for them.

5-3. Empirical Results

In this section, the main findings of our cross-country panel analyses are presented. It is an unbalanced panel due to two reasons: one is the data constraint of bond spread data and the other is the existence of euro-adoption countries. Accordingly, we execute full

[18] Exchange rate trend is calculated as a monthly (quarterly) return vis-à-vis the euro. Positive value means local currency's appreciating vis-à-vis the euro.

sample analysis and selected 8 countries analysis, which exclude three euro-adoption countries (Malta, Cyprus and Slovenia) and Romania. In both analyses, we add three kinds of variables to represent the exchange rate regime, separately. Both results are summarized in Table 6 and Table 7, respectively. It is remarkable that all coefficients of DEBT and IP are significant and consistent with the expected sign, which confirm that each country's government debt and industrial production affect its bond spread. All coefficients of EXTR are significant and consistent with the expected sign, which confirm that the appreciation of local currencies reduce their bond spreads.[19] Furthermore, the coefficients of market volatility index, VDAXNEW are significant and consistent with the expected sign in 9 cases out of 16 cases. It suggests that bond spreads of NEW countries tend to be affected by the financial market condition in Europe. Regarding to the variables of currency regime, the coefficients of EUROCOEF and REGIME are significant and positive in the analysis of selected 8 countries. It suggests that the hard-peg to euro increase their bond spreads.

Since the volatility index turns to be one of the important factors to decide bond spreads of NEM countries, we conduct the additional model to confirm the impact of exchange rate regime on volatility index as follows;

$$\begin{aligned}\Delta BS_{i,t} = {} & \beta_0 + \beta_1 \cdot \Delta VDAXNEW_t + \beta_2 \cdot (\Delta VDAXNEW_t \otimes Exchange\ rate\ regime_{i,t}) \\ & + \beta_3 \cdot \Delta LIQUIDIY_t + \beta_4 \cdot DEBT_{i,t} + \beta_5 \cdot EXBAL_{i,t} + \beta_6 \cdot IP_{i,t} \\ & + \beta_7 \cdot EXTR_{i,t} + \beta_8 \cdot Exchange\ rate\ regime_{i,t} + \varepsilon_t\end{aligned} \tag{5}$$

To apply the variables of exchange rate regime as an intercept of the volatility index, we try to analyze how the exchange rate regimes influence the effect of volatility on bond spread. The lower row in Table 6 and Table 7 show the results. In the analysis of 8

[19] It might be considered that the strong demand of NEM government bonds by international investors leads the appreciation of NEM currencies.

countries, the coefficient of interaction between VDAXNEW and Regime are positive and significant, and the coefficient of interaction between VDAXNEW and ZSCORE is negative and significant. These results indicate that hard-peg regime could increase their bond spreads and floating regime could reduce their bond spreads when the European financial market is volatile. [20]

[Insert Table 6 and Table7 here]

6. Conclusion

In this paper, we investigate the relationship between exchange rate regimes and long-term government bond spreads in NEM countries. To analyze their exchange rate regimes, we use two different methodologies, estimating implicit basket weights on euro and measuring the z-scores. By using above original variables, which represent the exchange rate regimes in each NEM country, we conduct the empirical analyses to find out whether their choice of exchange rate regime affect on their bond spreads.

Our main findings are follows. First, by evaluating the exchange rate regimes in NEM countries, we confirm that there are several unique features among their strategies to change exchange rate regime in their accession process toward the euro. Second, European financial market factors, especially the volatility of financial market, have an impact on bond spreads in NEM countries, while each country's government debt and industrial production also have a significant impact on them. Third, hard peg regime might increase their bond spread. In another word, more flexible exchange rate regime can reduces the bond spreads in NEM countries. Forth, floating regime could reduce the bond spread when the market is volatile. The last finding is interpreted as follows. For

[20] In panel analysis, we use the fixed effect model with cross section weights. This result is robust even when we use random effect model.

emerging countries, pegging their currency to a main neighboring currency seems to be a good strategy to stabilize their economy. In normal time, it is not so hard to make their interest rates converge to those in pegged country. The disappearance of the foreign exchange risk makes market participants unaware of the difference of the each country's economic condition. The foreign capital tends to flow more into hard-peg NEM countries, which makes their bond spreads indifferent. As the global financial crisis happen, however, bond spreads becomes strongly affected by market volatility especially for hard pegging countries. It is because a lack of the flexibility of exchange rate, which could make country's economic management more difficult in near future, might be regarded as a bad news for market participants.

Our findings provide an essential caveat of currency regime choice not only for New EU member countries but also other emerging countries especially during crisis time. There are other important determinants, such as liquidity condition of each local bond market, movement of capital flow, or credit rating which should be included in explanatory variables. News concerning about governmental credit supply and bail-out plan, or the decision of IMF assistance also have strong impact on bond spreads. We leave them for future researches.

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Figure 1. Hard peg currencies vis-à-vis the euro (100=Jan 1999)

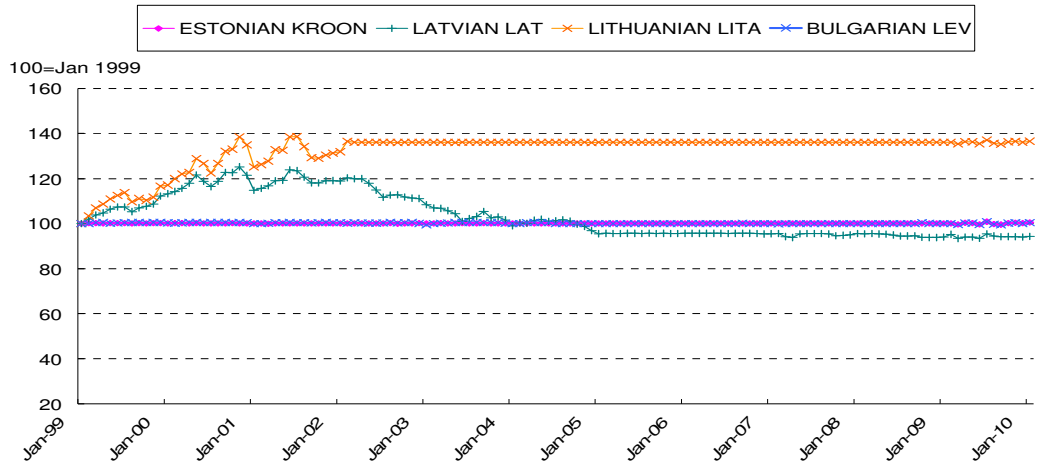


Figure 2. Floating currencies vis-à-vis the euro (100=Jan 1999)

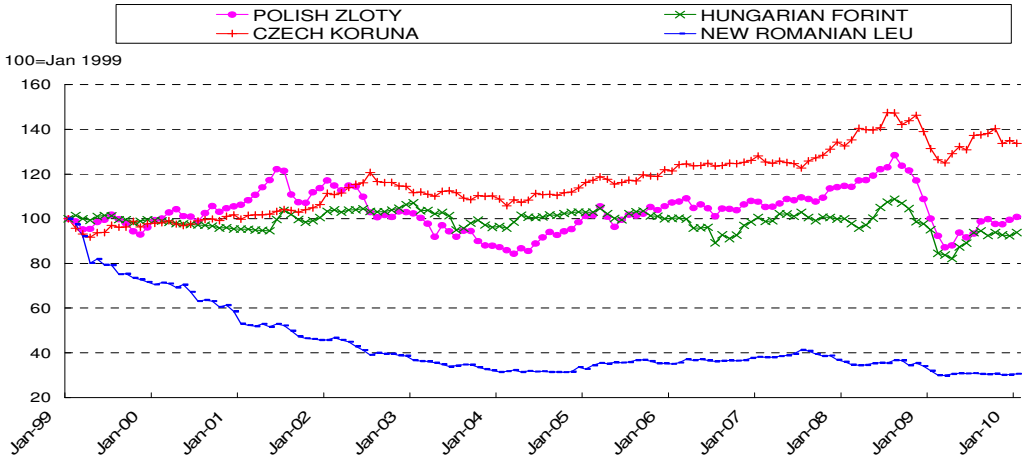
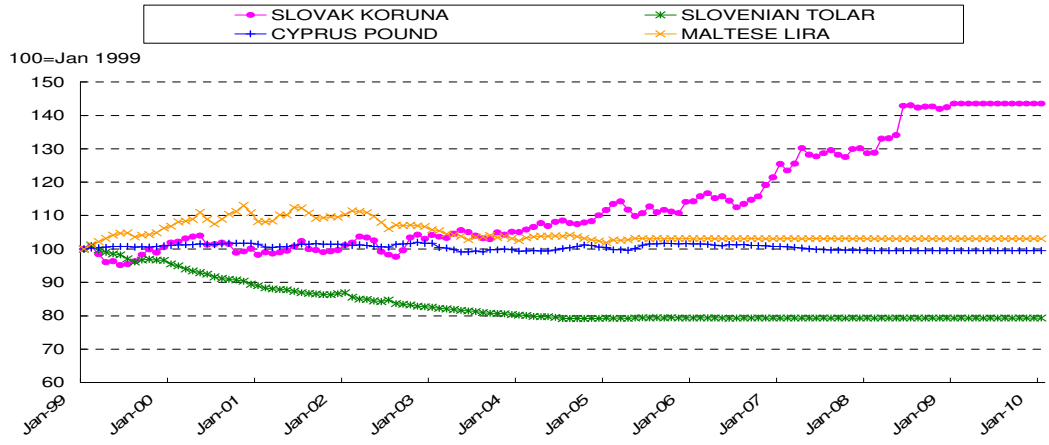


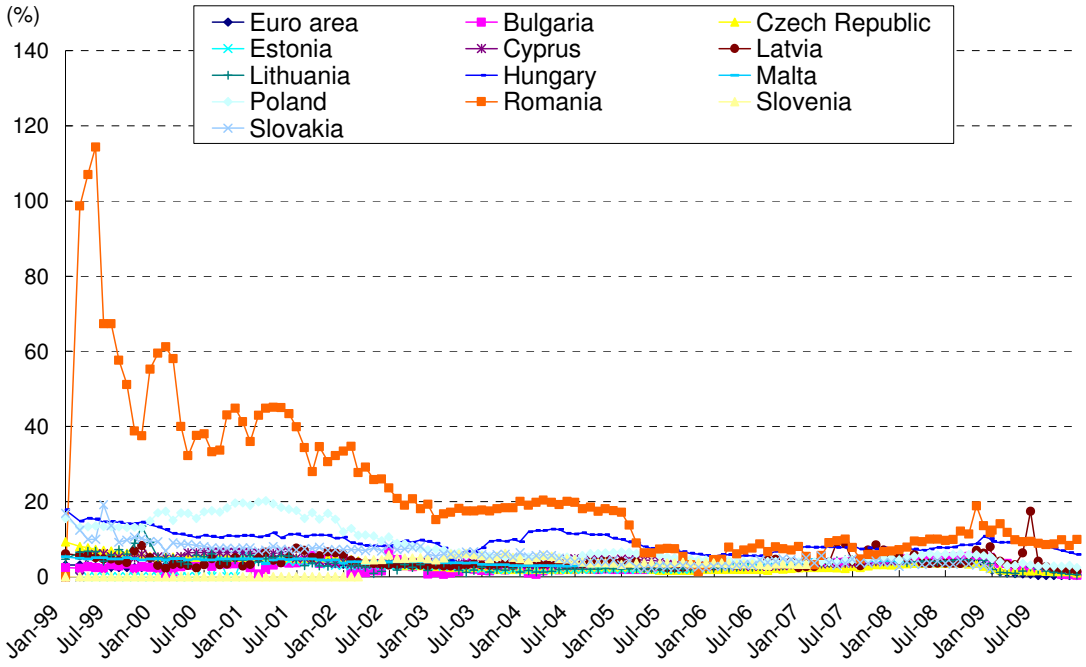
Figure 3. Euro adoption currencies vis-à-vis the euro (100=Jan 1999)



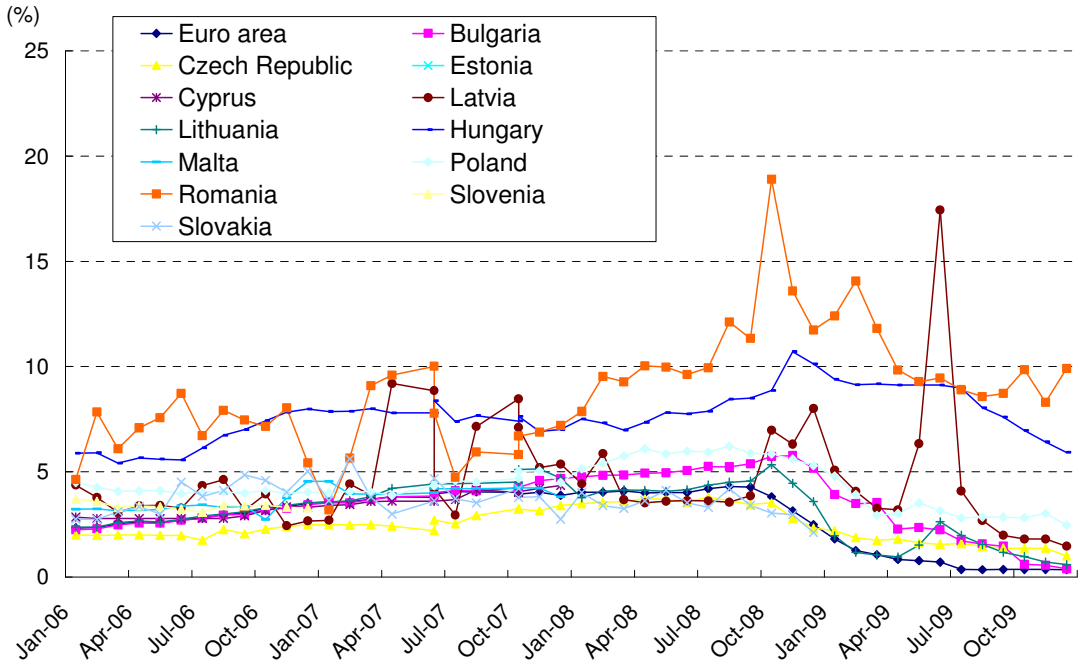
(Source: Datastream)

Figure 4. The movement of Money Market Rates (short-term, O/N)

(Jan 1999- Dec 2009)



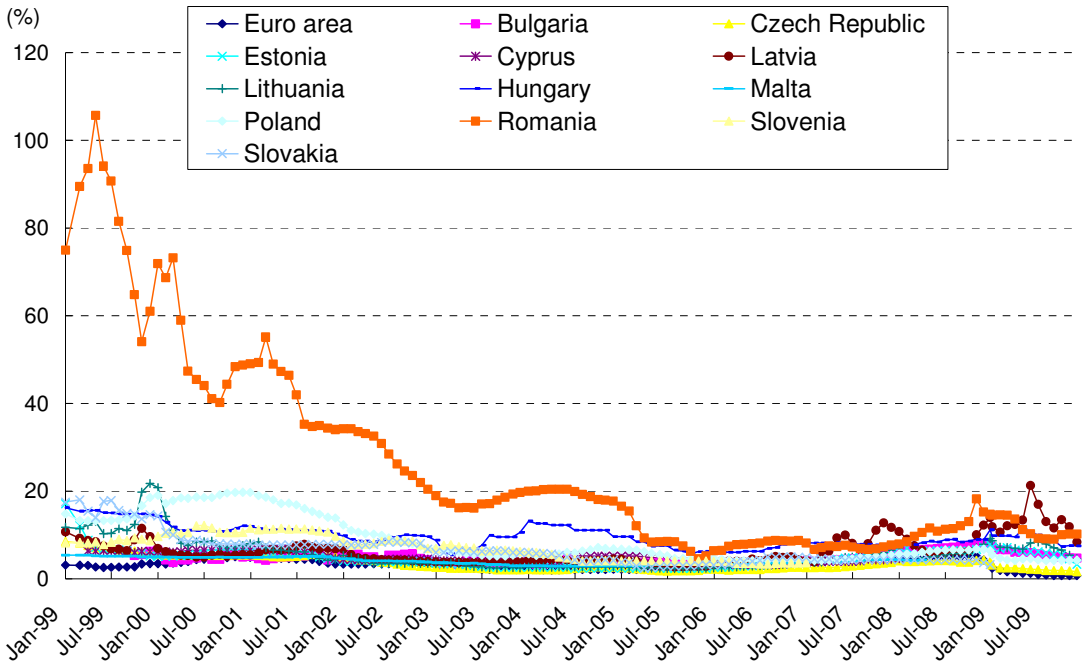
(Jan 2006- Dec 2009)



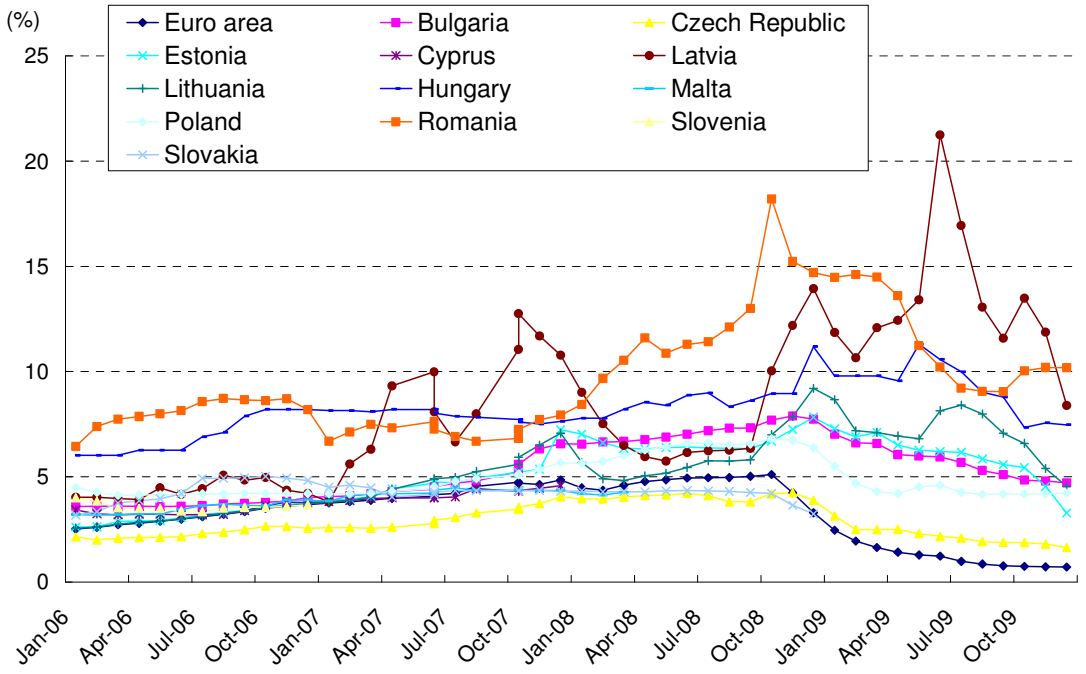
(Source:Eurostat)

Figure 5. The movement of Money Market Rates (3 Month)

(Jan 1999- Dec 2009)



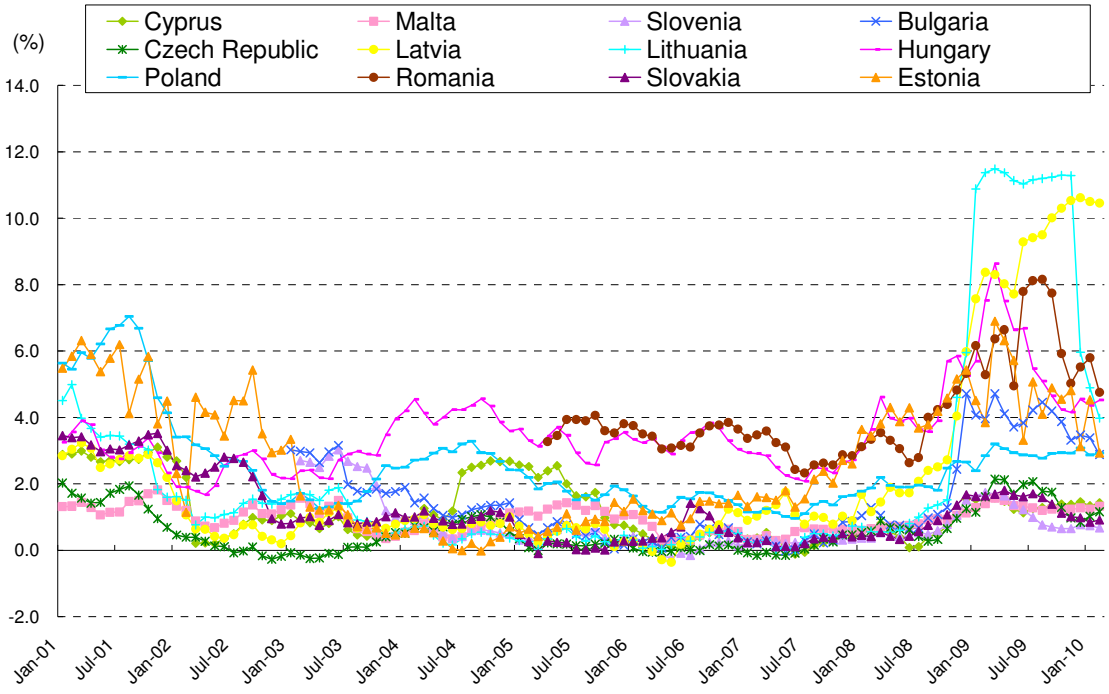
(Jan 2006- Dec 2009)



(Source: Eurostat)

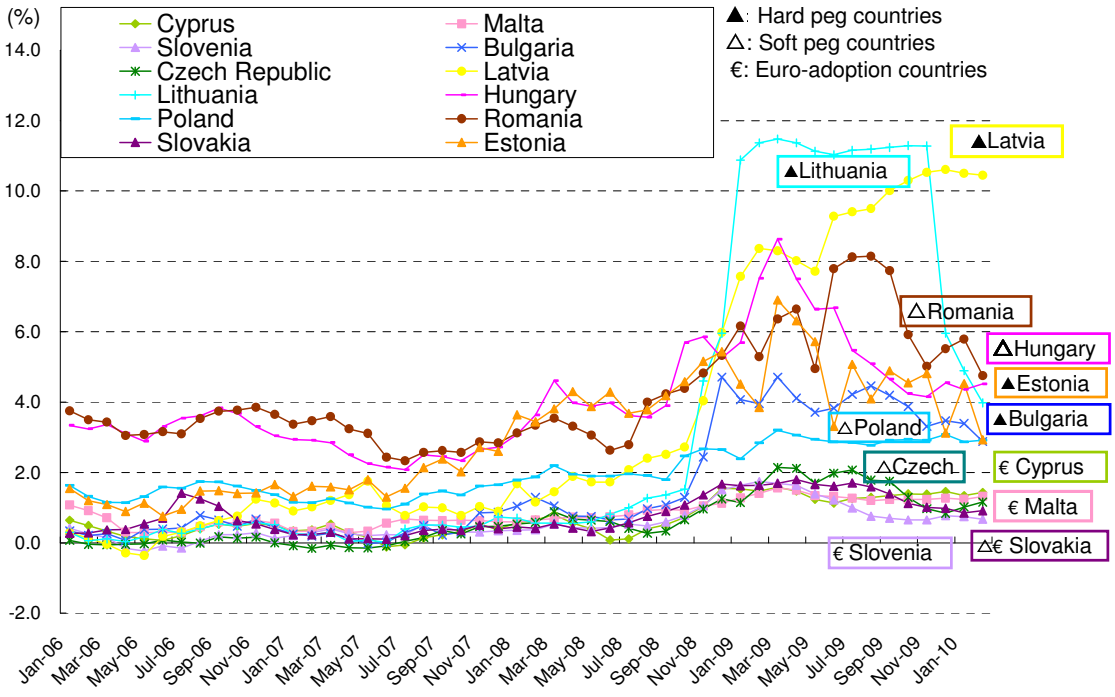
Figure 6. The movement of Long-term Government Bond Yield Spread

(Jan 2001- Dec 2009)



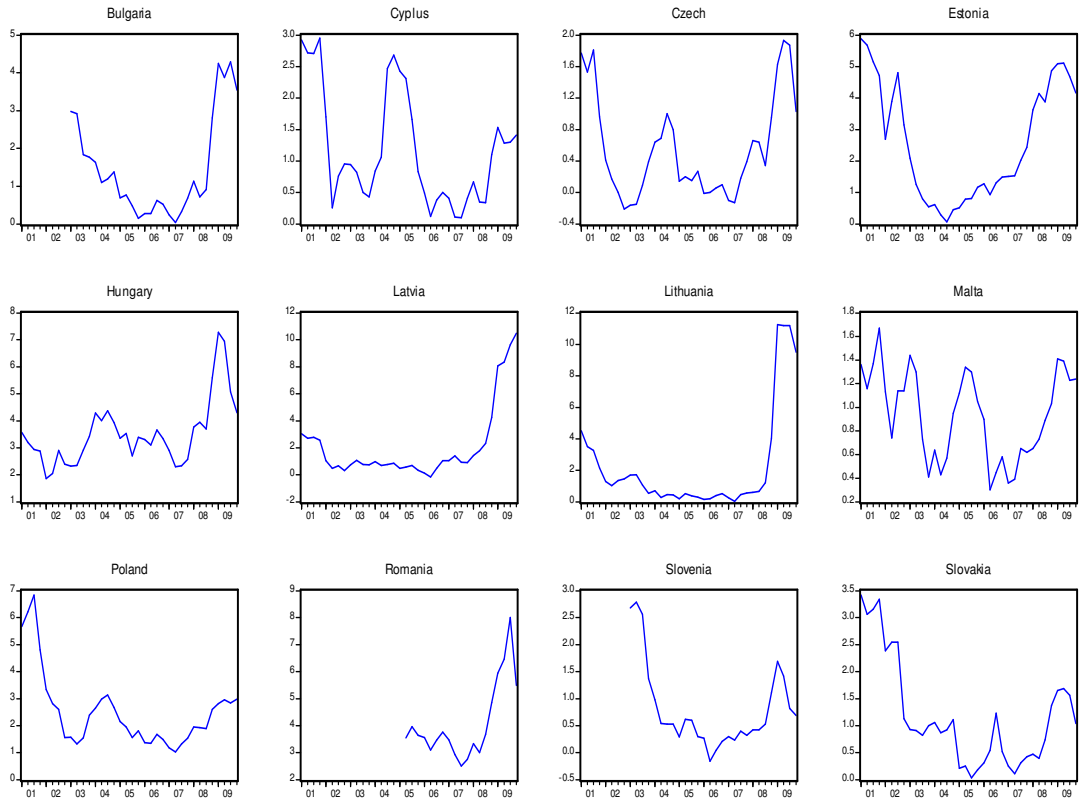
(Source: Eurostat)

(Jan 2006- Dec 2009)



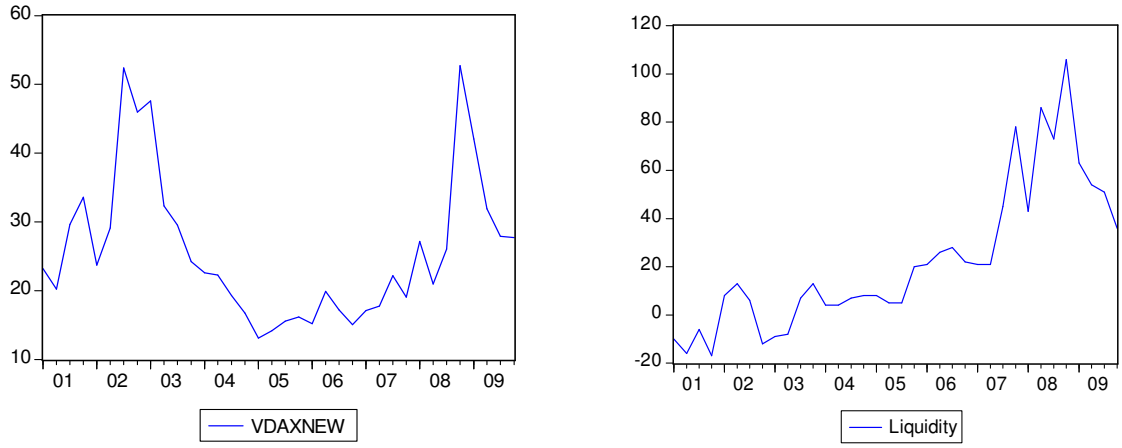
(Source: Eurostat)

Figure 7. The Movement of Bond Spread in NEM Countries



(Source: Eurostat)

Figure 8. The Movement of VDAX-NEW and Liquidity



(Source: Eurostat, Deutsche Börse)

Note : Liquidity is calculated as the difference of euro 3month money market rate and O/N ECB reference rate.

Table 1. Official Monetary Policy Strategies of NEM countries

	Exchange rate regime	Monetary policy strategy	Features
Bulgaria	peg to euro	Exchange rate target	(with Currency Board)
Czech	Managed floating	Inflation target (1998)	
Cyprus	Fixed (euro since 2008)		
Estonia	ERM ll with +/-15%*	Exchange rate target	(with Currency Board)
Malta	Fixed (euro since 2008)		
Latvia	ERM ll with +/-15%**	Exchange rate target	
Lithuania	ERM ll with +/-15%*	Exchange rate target	(with Currency Board)
Hungary	Floating	Inflation target (2001)	(crawling peg)
Poland	Floating	Inflation target (1998)	(crawling peg)
Romania	Managed floating	Inflation target (2005)	
Slovakia	Fixed (euro since 2009)	(Inflation target)***	
Slovenia	Fixed (euro since 2007)		

Source: ECB, Arratibel, Furceri and Martin (2008), Darvas and Szapary (2008)
*: In Estonia and Lithuania, their nominal band of ERM ll is +/- 15%, however their actual band is 0%.
**: In Latvia, their nominal band of ERM ll is +/- 15%, however their actual band is +/- 1%.
***: In Slovakia, the inflation target was set below 2% at end-2007 and at end-2008.

Table 2. Correlation Matrix between sampled currencies and the candidates of numeraire

a. Correlation Matrix with explanatory variables

	US dollar	euro	Sterling pound
US dollar	1.000	0.411	0.524
Euro	0.411	1.000	0.740
Sterling pound	0.524	0.740	1.000
Japanese yen	0.450	0.403	0.428
Swiss francs	0.339	0.864	0.670
SDR	0.802	0.826	0.812

b. Correlation Matrix with explained variable (NEM currencies)

	Polish zloty	Hungarian forint	Czech koruna	Slovak koruna	Slovenian tolar	Cyprus pound	Maltese lira	Estonian kroon	Latvian lat	Lithuania n lita	Bulgarian lev	Rumanian leu
US dollar	0.384	0.339	0.364	0.383	0.411	0.416	0.544	0.409	0.693	0.554	0.418	0.416
Euro	0.574	0.820	0.867	0.688	0.964	0.996	0.955	0.994	0.823	0.762	0.997	0.434
Sterling pound	0.516	0.622	0.662	0.548	0.726	0.741	0.844	0.738	0.799	0.712	0.741	0.453
Japanese yen	0.284	0.323	0.353	0.362	0.377	0.409	0.458	0.403	0.590	0.477	0.407	0.297
Swiss francs	0.477	0.694	0.747	0.660	0.826	0.864	0.837	0.856	0.734	0.701	0.861	0.382
SDR	0.573	0.683	0.729	0.632	0.804	0.829	0.900	0.822	0.939	0.823	0.829	0.529

Author's calculati Data: All foreign exchange data are from Datastream. Sample period is 1/1/1999 to 12/24/2008.
To calculate each correlation, we use the Canadian dollar as a numeraire.

Table 3. Estimated euro coefficients of NEM currencies

	Bulgaria	Estonia	Latvia	Lithuania	Czech	Hungary	Poland	Romania*	Slovenia	Cyprus	Malta	Slovakia
1Q 1999	0.989	0.959	0.241	0.000	1.052	0.393	0.420	-	0.587	0.960	0.489	0.354
2Q 1999	1.001	0.972	0.241	0.000	0.938	0.623	0.536	-	0.597	0.952	0.521	0.768
3Q 1999	0.991	0.987	0.288	0.000	0.919	0.716	0.106	-	0.941	0.951	0.546	0.555
4Q 1999	1.008	0.957	0.232	0.000	0.759	0.712	0.647	-	0.850	0.952	0.530	0.881
1Q 2000	0.975	0.986	0.237	0.000	0.898	0.965	0.546	-	0.995	0.940	0.521	0.748
2Q 2000	0.989	1.022	0.232	0.002	0.935	0.995	0.361	0.036	0.992	0.938	0.512	0.536
3Q 2000	0.994	1.004	0.210	0.003	0.916	0.987	0.325	-	0.975	0.964	0.519	0.788
4Q 2000	0.972	0.991	0.219	0.000	0.843	0.970	0.442	-	0.998	0.983	0.502	0.661
1Q 2001	0.989	1.004	0.247	0.000	0.908	1.001	0.638	-	0.994	0.980	0.527	0.615
2Q 2001	0.983	0.954	0.250	0.000	0.925	0.982	0.342	-	0.994	0.986	0.506	0.700
3Q 2001	0.991	0.994	0.260	0.000	0.835	0.892	-	-	1.000	1.017	0.531	0.853
4Q 2001	0.995	1.009	0.284	0.013	0.925	0.653	0.354	-	0.988	0.979	0.556	0.637
1Q 2002	0.917	0.990	0.290	0.330	0.939	0.885	0.237	-	0.946	1.024	0.513	0.749
2Q 2002	0.951	1.012	0.315	0.999	0.883	0.937	0.588	0.206	1.040	1.004	0.491	0.195
3Q 2002	0.964	0.949	0.292	0.995	0.581	1.036	0.341	-	1.014	0.957	0.538	0.753
4Q 2002	0.974	0.995	0.273	0.995	0.708	0.953	0.526	-	0.861	1.018	0.689	0.968
1Q 2003	0.945	0.994	0.326	0.991	0.892	0.831	0.141	-	0.929	1.004	0.714	0.961
2Q 2003	0.990	0.996	0.337	1.008	0.999	1.066	0.808	0.835	1.001	0.979	0.727	1.145
3Q 2003	1.000	0.997	0.308	1.000	0.781	0.911	0.812	0.717	1.021	1.003	0.738	0.732
4Q 2003	0.924	1.000	0.366	0.999	0.989	0.890	0.372	1.080	0.990	0.985	0.692	0.802
1Q 2004	0.997	1.000	0.344	1.000	0.962	0.981	0.366	0.757	0.991	1.001	0.724	0.528
2Q 2004	1.002	1.000	0.334	0.999	1.018	0.879	0.674	0.891	1.000	1.003	0.578	1.047
3Q 2004	0.975	1.000	0.354	1.001	0.939	1.003	0.820	0.903	0.982	1.017	0.725	0.948
4Q 2004	0.994	1.000	0.356	1.001	0.832	0.848	0.678	0.300	0.992	0.987	0.718	0.540
1Q 2005	1.004	1.000	0.953	1.002	1.055	1.074	1.022	0.500	0.969	1.020	0.703	0.901
2Q 2005	0.995	1.000	0.999	1.001	0.928	0.947	0.672	1.031	0.911	0.996	0.904	0.895
3Q 2005	0.989	1.000	0.999	0.998	0.861	1.001	-	1.060	0.969	0.982	0.966	0.979
4Q 2005	1.000	1.000	0.969	1.002	0.958	0.945	1.000	0.698	1.004	0.993	1.002	0.535
1Q 2006	1.002	1.000	1.001	0.999	0.949	0.927	0.759	1.023	1.008	0.988	0.999	0.779
2Q 2006	0.997	1.000	1.000	0.999	0.956	0.888	0.864	0.872	0.917	1.012	0.997	0.618
3Q 2006	1.044	1.000	0.992	0.999	0.983	0.797	0.874	0.870	1.005	1.011	0.994	0.559
4Q 2006	1.009	1.000	0.966	1.000	0.852	1.282	1.032	1.335	1.003	1.016	1.000	0.574
1Q 2007	0.986	1.000	0.820	0.999	0.966	1.150	1.102	1.029		1.020	1.000	1.240
2Q 2007	0.952	1.000	1.089	1.000	0.997	1.369	1.001	1.161		0.972	0.991	1.097
3Q 2007	0.996	1.000	0.898	0.999	0.711	1.071	1.125	0.684		0.998	1.000	1.009
4Q 2007	0.999	1.000	1.009	1.000	1.044	1.008	1.073	0.535		1.003	0.999	0.914
1Q 2008	0.995	1.000	0.956	1.001	1.313	1.315	1.256	1.227				1.076
2Q 2008	0.995	1.000	1.006	0.999	0.925	0.977	0.980	0.979		**euro zone**		1.151
3Q 2008	0.970	1.000	1.000	1.001	1.204	1.203	1.049	1.317				0.729
4Q 2008	0.982	1.000	0.996	1.000	1.051	0.950	0.919	1.210				0.864
1Q 2009	1.000	1.000	0.988	1.002	1.230	1.480	1.390	1.100				
2Q 2009	-	-	-	-	-	-	-	-				
3Q 2009	-0.250	-0.250	-0.260	-0.250	0.000	-0.530	-0.500	-				
4Q 2009	-	-	-	-	-	-	-	-				

Author's calculation. All coefficients are statistically significant within 10 % significance level. (-) means the coefficient is not significant.

*: In Rumania, their euro coefficients by 2003 were not statistically significant due to their adopting US$ peg regime.

Table 4. Z-score of monthly exchange rate changes vis-à-vis the euro (%)

	Hard peg countries				Floating countries				Euro adoption countries			
	Bulgaria	Estonia	Latvia	Lithuania	Czech	Hungary	Poland	Romania	Slovenia	Cyprus	Malta	Slovakia
1999	0.17	0.11	1.60	2.45	2.38	1.14	2.66	5.31	0.84	0.16	0.86	1.55
2000	0.16	0.05	2.81	3.78	1.17	0.45	2.28	4.48	0.64	0.17	1.57	1.35
2001	0.13	0.06	1.65	2.40	1.62	2.35	3.94	2.63	0.37	0.33	1.02	1.12
2002	0.29	0.06	1.57	1.00	1.98	0.83	2.80	3.25	0.69	0.33	0.94	1.86
2003	0.23	0.06	1.86	0.02	1.18	2.63	3.42	2.02	0.26	0.52	0.61	0.94
2004	0.19	0.00	1.11	0.02	1.69	1.36	2.48	2.32	0.19	0.30	0.40	0.93
2005	0.03	0.00	0.07	0.00	1.36	1.56	2.86	2.15	0.11	0.42	0.27	1.57
2006	0.05	0.00	0.08	0.00	1.00	3.39	2.27	1.80	0.03	0.17	0.01	1.72
2007	0.05	0.00	0.77	0.00	1.60	1.56	1.64	2.63	0.00	0.14	0.01	1.59
2008	0.14	0.00	0.32	0.00	3.28	3.02	4.24	3.50	0.00	0.00	0.00	2.10
2009	0.62	0.62	1.00	0.62	2.77	4.63	4.20	2.35	0.00	0.00	0.00	0.00

Author's calculation.
Source: Datastream

Table 5. Predicted sign of explanatory variables

Explanatory variable	Predicted sign
• Common market factors	
VDAXNEW (Market Volatility Indicator)	+
LIQUIDITY (3mEURIBOR-O/N)	+
• Individual macroeconomic factors	
IP (Growth rate of Quarterly Industrial Production)	-
DEBT (Growth rate of Quarterly Government Debt to GDP)	+
External Balance (CA to GDP)	-
EXTR (Exchange trend, Quarterly Change of Exchange Rate, Euro/CEE)	-
• Individual exchange rate regime factors	
EUROCOEF (Euro Coefficient)	
ZSCORE (Z-score)	?
REGIME (Exchange Regime Dummy)	

Table 6. Estimation Results of Cross-country Panel Estimation (All sampled countries)

Euro Coefficient (EC)

Variable	Coefficient	
C	-0.089	
ΔVDAXNEW	0.011	**
ΔLIQUIDITY	-0.003	
DEBT_NEM	0.019	***
IP_NEM	-0.034	***
EXBAL_NEM	0.007	
EXTR_NEM	-0.030	**
EC_NEM	0.155	
Unweighted R-squared	0.222	

Variable	Coefficient	
C	-0.131	***
ΔVDAXNEW	-0.004	
ΔVDAXNEW×EC_NEM	0.017	
ΔLIQUIDITY	-0.003	
DEBT_NEM	0.019	***
IP_NEM	-0.034	***
EXBAL_NEM	0.006	
EXTR_NEM	-0.032	***
EC_NEM	0.197	**
Unweighted R-squared	0.225	

Z-score (Z)

Variable	Coefficient	
C	0.037	
ΔVDAXNEW	0.012	**
ΔLIQUIDITY	-0.003	
DEBT_NEM	0.019	***
IP_NEM	-0.035	***
EXBAL_NEM	0.005	
EXTR_NEM	-0.030	**
Z_NEM	0.002	
Unweighted R-squared	0.209	

Variable	Coefficient	
C	0.032	
ΔVDAXNEW	0.014	***
ΔVDAXNEW×Z_NEM	-0.002	
ΔLIQUIDITY	-0.003	
DEBT_NEM	0.019	***
IP_NEM	-0.035	***
EXBAL_NEM	0.005	
EXTR_NEM	-0.033	**
EC_NEM	0.006	
Unweighted R-squared	0.214	

Exchange rate regime dummy (ER)

Variable	Coefficient	
C	-0.050	
ΔVDAXNEW	0.012	**
ΔLIQUIDITY	-0.003	
DEBT_NEM	0.017	***
IP_NEM	-0.036	***
EXBAL_NEM	0.005	
EXTR_NEM	-0.029	**
EC_NEM	0.179	
Unweighted R-squared	0.222	

Variable	Coefficient	
C	-0.051	
ΔVDAXNEW	0.008	
ΔVDAXNEW×ER_NEM	0.008	
ΔLIQUIDITY	-0.004	
DEBT_NEM	0.017	***
IP_NEM	-0.037	***
EXBAL_NEM	0.005	
EXTR_NEM	-0.031	**
EC_NEM	0.185	
Unweighted R-squared	0.224	

Author's calculation. Cross-sections included 12 NEM countries. Total pooled (unbalanced) observations are 359.
Estimation method is a Fixed Effect Model with cross section weights. *** significant at 1% level ** sigunificant at 5% level * significant at 10%

Table 7. Estimation Results of Cross-country Panel Estimation (Selected 8 countries)

Euro Coefficient (EC)

Variable	Coefficient	
C	-0.150	
ΔVDAXNEW	0.014	***
ΔLIQUIDITY	-0.003	
DEBT_NEM	0.022	***
IP_NEM	-0.040	***
EXBAL_NEM	0.002	
EXTR_NEM	-0.030	***
EC_NEM	0.220	**
Unweighted R-squared	0.238	

Variable	Coefficient	
C	-0.194	*
ΔVDAXNEW	-0.001	
ΔVDAXNEW×EC_NEM	0.018	
ΔLIQUIDITY	-0.003	
DEBT_NEM	0.022	***
IP_NEM	-0.040	***
EXBAL_NEM	0.001	
EXTR_NEM	-0.032	***
EC_NEM	0.261	**
Unweighted R-squared	0.239	

Z-score (Z)

Variable	Coefficient	
C	0.014	
ΔVDAXNEW	0.014	***
ΔLIQUIDITY	-0.003	
DEBT_NEM	0.020	***
IP_NEM	-0.043	***
EXBAL_NEM	-0.002	
EXTR_NEM	-0.029	**
EC_NEM	0.000	
Unweighted R-squared	0.215	

Variable	Coefficient	
C	0.011	
ΔVDAXNEW	0.023	***
ΔVDAXNEW×Z_NEM	-0.005	**
ΔLIQUIDITY	-0.002	
DEBT_NEM	0.019	***
IP_NEM	-0.043	***
EXBAL_NEM	-0.001	
EXTR_NEM	-0.035	***
EC_NEM	0.007	
Unweighted R-squared	0.216	

Exchange rate regime dummy (ER)

Variable	Coefficient	
C	-0.068	
ΔVDAXNEW	0.014	***
ΔLIQUIDITY	-0.003	
DEBT_NEM	0.019	***
IP_NEM	-0.043	***
EXBAL_NEM	0.003	
EXTR_NEM	-0.029	**
EC_NEM	0.277	*
Unweighted R-squared	0.235	

Variable	Coefficient	
C	-0.070	
ΔVDAXNEW	0.009	*
ΔVDAXNEW×ER_NEM	0.017	*
ΔLIQUIDITY	-0.003	
DEBT_NEM	0.017	***
IP_NEM	-0.043	***
EXBAL_NEM	0.004	
EXTR_NEM	-0.031	***
EC_NEM	0.312	**
Unweighted R-squared	0.232	

Author's calculation. Cross-sections included 8 NEM countries. Total pooled (unbalanced) observations are 264.
Estimation method is a Fixed Effect Model with cross section weights. *** significant at 1% level ** sigunificant at 5% level * significant at 10%