Cyclical relationship between exchange rates and macro-fundamentals in Central and Eastern Europe

Stavarek, Daniel

Silesian University in Opava, School of Business Administration in Karviná

21 March 2013

CYCLICAL RELATIONSHIP BETWEEN EXCHANGE RATES AND MACRO-FUNDAMENTALS IN CENTRAL AND EASTERN EUROPE[1]

Daniel Stavárek
Silesian University
School of Business Administration
Univerzitní nám. 1934/3, 733 40 Karviná, Czech Republic
E-mail: stavarek@opf.slu.cz

Abstract

We present empirical evidence on the business cycle relationship between nominal and real effective exchange rate, real GDP, consumption, investment, export, import and general government debt for a group of ten countries from the Central and Eastern Europe. We apply cross-correlation on cyclically filtered and seasonally adjusted quarterly time series over the period 1998-2010. The results are mixed in intensity, direction and cyclicality but show generally weak correlation between exchange rates and fundamentals. Sufficiently high coefficients are found only for government debt and import. We also apply simple regressions to relate the correlation to openness and welfare of the economy. The correlation between exchange rates and macroeconomic aggregates tends to be more pronounced in less open and relatively poorer countries.

Keywords: *business cycle, cross correlation, exchange rate, macroeconomic fundamentals, openness, wealth*

JEL classification: *E32, E44, F31*

[1] Support of the Czech Science Foundation within the project GAČR 403/11/2073 „Procyclicality of financial markets, asset price bubbles and macroprudential regulation“ is gratefully acknowledged.

1. INTRODUCTION

The relationship between exchange rates and macroeconomic variables is one of the most important and extensively examined questions in financial and monetary economics. Since the collapse of the Bretton Woods system in the 1970s and introduction of floating exchange rate arrangements quite many theories and models trying to explain exchange rate development have been proposed and empirically tested (see e.g. Cheung et al., 2005). Many of them assume that exchange rates are closely linked to macroeconomic aggregates such as output, trade balance, investment or money supply. We can illustrate this on example of monetary class of models. From the Frenkel (1976) flexible-price monetary models to the subsequent Dornbusch (1976) fixed-price and overshooting model to the recent open-economy general equilibrium models based on Lucas (1982) they tend to focus on shocks to money supply and show how such shocks can explain fluctuations in macroeconomic fundamentals and exchange rates over business cycles.

However, existence of this relationship is weakly supported by data and, as documented by e.g. De Grauwe and Grimaldi (2006) the respective models often fail empirically. Obstfeld and Rogoff (2000) provide an overview of the six major puzzles in international economics and label the missing relationship between nominal exchange rates and other macroeconomic aggregates "exchange rate disconnect puzzle". They also point to extreme (excessive) volatility of exchange rates with respect to other macroeconomic fundamentals (see more in e.g. Dedola and Leduc, 2001) Moreover, business cycle properties of macroeconomic aggregates are only slightly affected by the exchange rate regime applied. This finding, in combination with evidence of considerably higher exchange rate volatility under a flexible regime that in a fixed arrangement, imply a weak and fragile connection between exchange rates and other macroeconomic variables. Flood and Rose (1995) summarize and extend the findings and come to the conclusion that exchange rate appears to have a life of its own.

The aim of the paper is to provide direct empirical evidence on relationship between exchange rates and selected macroeconomic variables for a group of ten European Union (EU) new member states from the Central and Eastern Europe (Bulgaria, Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, Slovakia, Slovenia). In order to maximise reliability of results the empirical estimation is done with respect to business cycles and cyclical properties of the used macroeconomic variables. It is also important to clarify what we do not attempt in this paper. Our focus is on identification of the exchange rate-fundamental relationship, and not on relevance and ability of macroeconomic fundamentals to predict exchange rates or estimation and validation of exchange rate determination models.

This kind of research is motivated by several factors. First, no similar study has been published for the EU new member states. Second, we aim to expand the current knowledge on the topic by using effective exchange rates instead of bilateral to reflect better a real economic environment in which countries interact with many other countries. Third, we connect the obtained correlations with a country's openness and relative wealth to reveal whether these factors are significant in explanation of intensity of the exchange rate-fundamentals relationship.

The remainder of the paper is structured as follows. In Section Two, we describe the dataset and empirical methods used in the paper. In Section Three, the results of cross correlation between exchange rates and macroeconomic aggregates are reported and discussed. In Section Four, we calculate indicators of a country's openness and relative wealth and evaluate their effect on correlation. In Section Five, we conclude the paper with summary of main findings and implications.

2. DATA AND METHODOLOGY

The dataset consists of quarterly data on gross domestic product (GDP), private consumption, investment, exports, import, general government debt, nominal and real effective exchange rates (NEER and REER) over the period 1998:1 – 2010:4. Although even earlier data are available for some of the countries we prefer to work with a consistent dataset that excludes observations from the turbulent part of 1990s.

We work with a group of 10 countries from the Central and Eastern Europe. The group consists of Bulgaria (BG), Czech Republic (CZ), Estonia (EE), Hungary (HU), Latvia (LV), Lithuania (LT), Poland (PL), Romania (RO), Slovakia (SK), and Slovenia (SI). All the countries are members of the European Union (EU). Most of them joined the EU in May 2004, Bulgaria and Romania became the EU member states on January 2007.

All the data are collected from the Eurostat database on economy and finance. The series for all macroeconomic fundamentals are obtained in local currencies at constant prices and seasonally adjusted. The series for investment is gross capital formation. The series for effective exchange rates are constructed for 27 main trading partners. An increase of the exchange rate represents an appreciation of the currency. Effective exchange rate is the exchange rate of the domestic currency vis-à-vis other currencies weighted by their share in the country's international trade. We choose effective rather than bilateral exchange rates because the former measure a country's international competitiveness against all important trading partners and capture the role exchange rates in economy more reliably.

We convert all series into logs and use the Hodrick-Prescott filter (HP filter) to obtain a cyclical component of each time series. Next, we apply cross correlation to all combinations of changes in cyclical component of NEER resp. REER and macroeconomic variable.

The HP filter estimates an unobservable time trend for time series variables. It is used to obtain a smoothed-curve representation of a time series, one that is more sensitive to long-term than to short-term fluctuations. The procedure was first introduced by Hodrick and Prescott in 1980 in the context of estimating business cycles; notably their paper (Hodrick and Prescott, 1997) was published 17 years later after the filter has already been widely used in macroeconomics. Let y_t denote an observable macroeconomic time series. The HP filter decomposes into y_t a nonstationary trend g_t and a stationary residual cyclical component c_t that is:

$$y_t = g_t + c_t \tag{1}$$

Note that g_t and c_t are unobservables. Since c_t is a stationary process we can think of y_t as a noisy signal for the nonstationary trend g_t. Hence, the problem boils down to how extract an estimate for g_t from data on y_t.

The HP filter solves this problem by allocating some weight to a linear trend against the signal y_t. Let λ represent that weight. If there is no noise then the signal is fully informative and λ is set to zero. As λ increases more weight is allocated to the linear trend, and for $\lambda \to \infty$, g_t approaches the ordinary least squares estimate of y_t against a linear time trend. Hodrick and Prescott find that if c_t and the second difference of g_t, $\Delta\Delta g_t$, are identically and independently distributed normal variables with mean zero and variances $\sigma^2_{c_t}$ and $\sigma^2_{\Delta\Delta g_t}$, then the best choice of λ is $\frac{\sigma^2_{c_t}}{\sigma^2_{\Delta\Delta g_t}}$. Generally, data in high frequency is noisier relative to low frequency data series and, therefore, high frequency data require a higher value of λ. Hodrick and Prescott advise that, for quarterly data, a value of $\lambda = 1600$ is reasonable.

Given an adequately chosen, positive value of λ, there is a trend component that will minimize:

$$\min_{\{g_t\}_{t=1}^{T}} \sum_{t=1}^{T}(y_t - g_t)^2 + \lambda \sum_{t=2}^{T-1}\left[(g_{t+1} - g_t) - (g_t - g_{t-1})\right]^2 \qquad (2)$$

The first term of the equation is the sum of the squared deviations which penalizes the variance of cyclical component. The second term is a multiple λ of the sum of the squares of the trend component's second differences. This second term penalizes variations in the growth rate (lack of smoothness) of the trend component. The larger the value of λ, the higher is the penalty. In other words, the HP filter identifies the cyclical component c_t from y_t by the trade-off to the extent to which the trend component keeps track of the original series y_t (good fit) against the prescribed smoothness in the trend component g_t.

Cross correlation is a standard method of estimating the degree to which two series are correlated. It assesses how one reference time series correlates with another time series as a function of time shift (lag). Cross correlation does not yield a single correlation coefficient but rather a whole series of correlation values. This series of correlation coefficients is achieved by shifting one of the series forward and backward in time. Cross correlation is important in studying the relationship between time series for two reasons. First, one series may have a delayed response to the other series, or perhaps a delayed response to a common stimulus that affects both series. Second, the response of one series to the other series or an outside stimulus may be "smeared" in time, such that a stimulus restricted to one observation elicits a response at multiple observations. Like all correlations, cross correlation only shows statistical associations not causation. Hence, we cannot say that changes in one time series cause changes in the other, but the two series behave as if this were happening.

Consider two financial series x_t and y_t, then the cross-correlation at lag (lead) k is defined as follows:

$$\rho(y_{t+k}, x_t) = \frac{\text{cov}(y_{t+k}, x_t)}{\sqrt{V(y_{t+k})}\sqrt{V(x_t)}} = \frac{T\sum_{t=k-1}^{T}(y_{t+k} - m_y)(x_t - m_x)}{(T+k)\sqrt{\sum_{t=k}^{T}(y_{t+k} - m_y)^2}\sqrt{\sum_{t=k}^{T}(x_t - m_x)^2}} \quad (3)$$

where ρ is the correlation coefficient and m_x and m_y are the means of corresponding series. The series can be related in three possible ways: (i) y_t can lead x_t ($\rho(y_{t-k}, x_t) \neq 0$), (ii) y_t can lag x_t ($\rho(y_{t+k}, x_t) \neq 0$), (iii) series can be contemporaneously related ($\rho(y_t, x_t) \neq 0$).

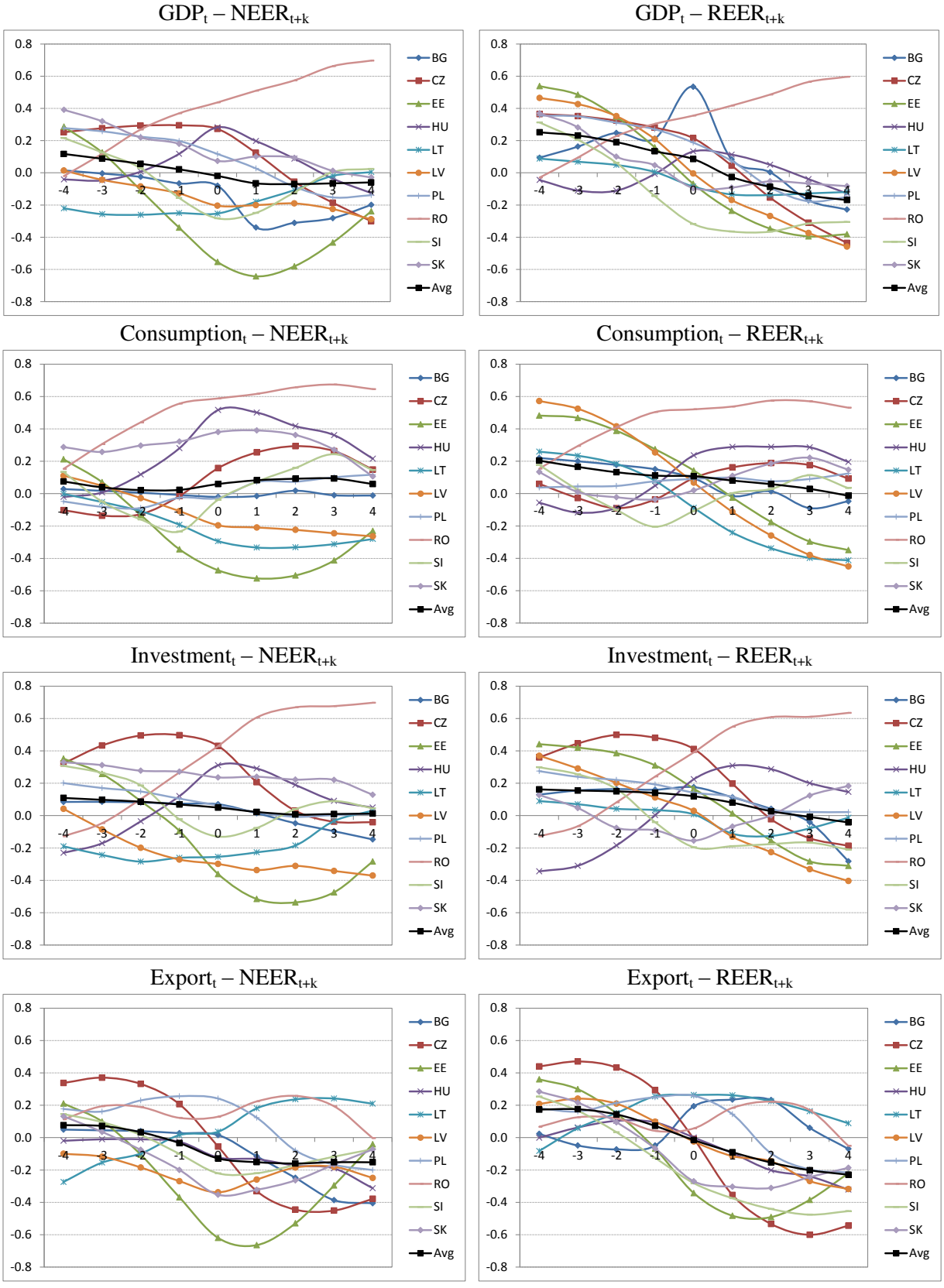
3. CROSS CORRELATION ANALYSIS

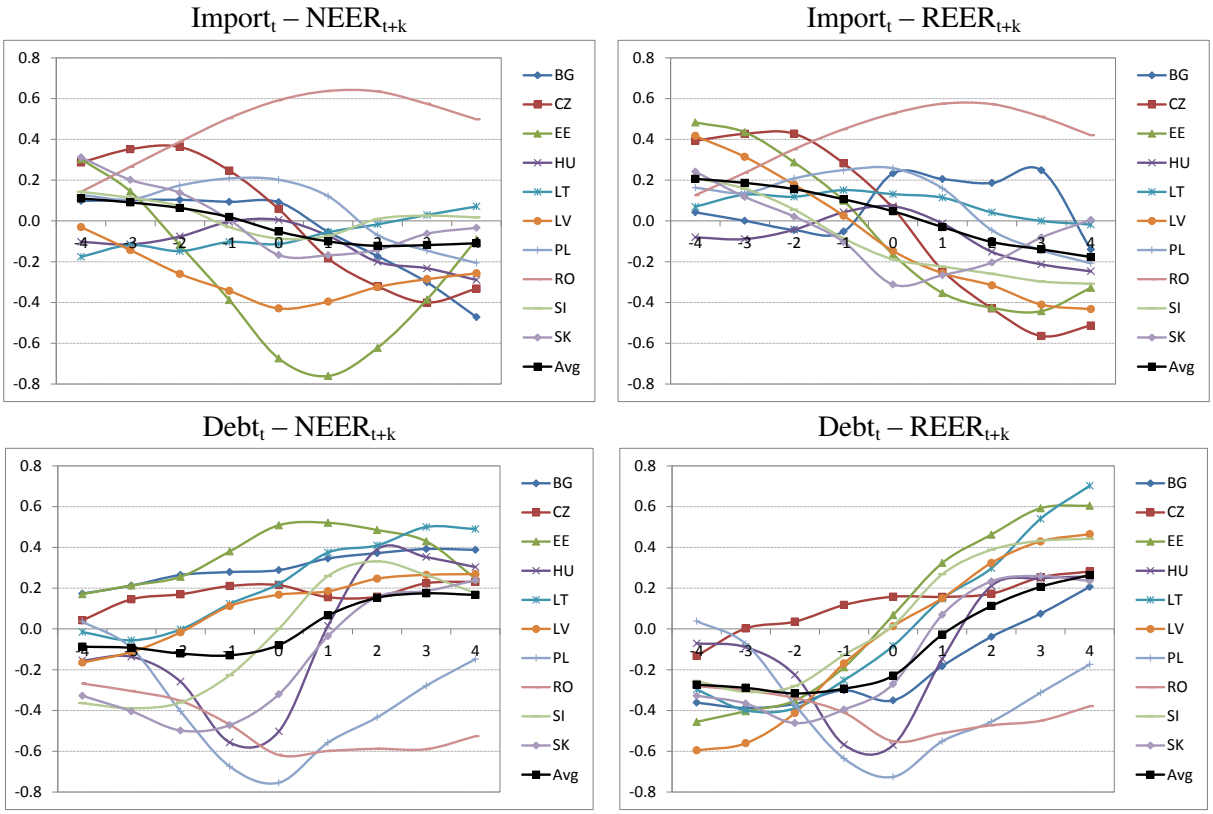
We follow Duarte et al. (2007) and run cross correlations for all 12 possible combinations of exchange rates and macroeconomic fundamentals for each country. We apply a time shift up to four lags (leads) on the time series of exchange rate cycle relative to the cycle in macroeconomic fundamental variable. Hence, we say that the exchange rate leads the fundamental (fundamental lags the exchange rate) by *k* quarters if $|\rho(y_{t+k}, x_t)|$ is a maximum for a negative *k*, the exchange rate is synchronous with the fundamental if $|\rho(y_{t+k}, x_t)|$ is a maximum for *k* = 0, and the exchange rate lags the fundamental (fundamental leads the exchange rate) if $|\rho(y_{t+k}, x_t)|$ is a maximum for a positive *k*. The correlation coefficients obtained from analysis are presented in Figure 1. We report cross correlations for all countries as well as the average value.

Before we discuss the relations between exchange rates and macro fundamentals it is worth to stress some general findings. Romania seems to be an outlier frequently showing considerably different shape of cross correlation curve than other countries. One should take this into account mainly when interpreting the average correlation coefficients. The group of ten Central and Eastern European countries is very diverse in terms of exchange rate arrangement applied in economic policy. There are countries with currency board or very similar arrangement (Bulgaria, Estonia, Latvia, Lithuania) as well as countries with floating regime (Czech Republic, Hungary) including completely independent floating (Poland) or countries with different de jure and de facto regime (Slovenia). Some of the analyzed countries adopted the euro during the estimation period (Slovakia, Slovenia). The effect of exchange rate regime is evident in some of the correlations as well as in differences between correlations with NEER and REER.

In analyzing the cross correlations, we follow Rand and Tarp (2002) and define the exchange rate as procyclical, acyclical, or countercyclical depending on whether the respective correlation coefficient is positive, zero, or negative. Furthermore, we deem the exchange rate to be strongly correlated if $0.26 \leq |\rho(y_{t+k}, x_t)| \leq 1$, weakly correlated if $0.13 \leq |\rho(y_{t+k}, x_t)| < 0.26$, and uncorrelated if $0 \leq |\rho(y_{t+k}, x_t)| < 0.13$.

Figure 1: Cross correlation between macroeconomic fundamentals and exchange rates





Source: Author's calculation

Note: Lags and leads refer to time shift of time series of exchange rate

If we plot the cross correlation coefficients obtained from using the current value of a macroeconomic aggregate and lagged as well as lead values of the exchange rate, we can often see that the depicted pattern resembles the letter S or reverse letter S. The S-curve is a way that the cross correlation is positive only between the current value of macroeconomic aggregate and future values of the exchange rate and the cross correlation is negative between the current value of the aggregate and past values of the exchange rate. In other words, exchange rates are procyclical if they lag the aggregate but countercyclical if they lead the aggregate. The reverse-S-curve demonstrates the opposite relations pointing to procyclicality of leading exchange rates and countercyclicality of lagging exchange rates.

The relationship between exchange rates and GDP is more evident if REER is used in correlation analysis. The effective exchange rate leads the GDP mostly by four quarters. Correlation coefficients are generally positive and range from 0.08 for Lithuania to 0.54 for Estonia indicating a procyclicality of exchange rates as a leading variable. Similar but negative coefficients are shown if REER lags GDP and indicate and point to countercyclical behaviour.

There is mixed evidence on relationship between detrended consumption and exchange rates. While some countries like Baltic States exhibit rather countercyclical patterns of cross correlation in other countries such as Czech Republic, Slovakia or Hungary a procyclical relationship prevails. Nevertheless, the correlations usually peak with a lead of 1-3 quarters which means that exchange rate lags the consumption.

Results of cross correlations between investment and exchange rates are also hard to interpret. However, the picture is much clearer if examine REER. The highest correlation coefficients are obtained at the lag of four quarters, which suggests procyclicality and leading position of exchange rates in relation to investments. It is worth to mention that whereas some countries report similar correlation coefficients for all aggregates (GDP, consumption, investment) the correlation pattern of consumption seems to be opposite to the other aggregates in the Czech Republic, Hungary and Poland.

The cross correlation curves obtained for export and import are almost identical for virtually all countries. However, one can again find considerable differences among countries in terms of pro(counter)cyclicality and intensity of correlation. In average, REER turns out to be more correlated with both sides of international trade as it better reflects international competitiveness of a country. In most of countries, the correlation achieved the highest absolute values at the lead of 1-3 quarters indicating that the exchange rates lag the export and import and have a countercyclical development. Slightly weaker but procyclical relationships were identified at the lag of 3-4 quarters.

Cyclicality of government debt in relation to cyclicality of exchange rates differs remarkably according to the type of exchange rate examined. While the debt and NEER seem to be contemporaneously correlated one can observe a classical S-curve with countercyclicality if REER leads the debt or procyclicality if REER lags the debt.

A simple arithmetical average of correlation coefficients is showed in graphs in Figure 1. However, it is impossible to use the simple average to draw any conclusion on the lead/lag at which the correlation is the most intensive. Hence, Table 1 reports the highest average of absolute values of national correlation coefficients and respective lead/lag at which this mean value peaks. The relation between government debt and exchange rate is the strongest while the averages for all remaining macro variables are very similar. It is also apparent from Table 1 that exchange rates generally lag the fundamentals. The only exception is investment whose current values are mostly correlated with current or past values of exchange rates.

Table 1: Highest average of absolute values of correlation coefficients with respective time shift

	NEER		REER	
	Average	Lag/lead	Average	Lag/lead
GDP	0.2571	1	0.2886	4
Consumption	0.3041	2	0.2622	3
Investment	0.2584	0	0.2563	-4
Export	0.2588	2	0.2902	2
Import	0.2522	1	0.2912	3
Debt	0.3569	0	0.3747	4

Source: Author's calculation

One of the few aspects that can be observed frequently in results graphically presented in Figure 1 is a substantial difference between the correlation coefficient based on NEER and the coefficient computed with REER. Table 2 reports the correlations between NEER and REER. One can notice very high coefficients (above 0.9) for several countries such as Czech

Republic, Hungary and Poland. Some more countries exhibit correlations between 0.8 and 0.9 (Latvia, Romania, and Slovakia). The degree of co-movement of NEER and REER in remaining countries was lower. The correlation between (the log of) NEER and REER is related to the ratio of the standard deviation of NEER and REER $\sigma(n)/\sigma(r)$, and the correlation between NEER and the price ratio, $\rho(n, pr)$, and is given by

$$\rho(n,r) = \frac{\sigma(n)}{\rho(r)} + \rho(n, pr)\frac{\sigma(pr)}{\sigma(r)} \tag{4}$$

When the ratio of the standard deviations $\sigma(n)/\sigma(r)$ is larger than the correlation of NEER and REER, changes in REER do not track changes in NEER as well because NEER is negatively correlated with the price ratio across the countries. In particular, in countries with flexible exchange rate regime the nominal depreciations of a country's currency are associated with increases in the price level of that country relative to the price level in other countries. Under a fixed exchange rate regime, the nominal rate is maintained at certain level by a monetary authority (central bank or currency board) and, hence, changes in relative prices are the only channel of changes of real exchange rate.

Table 2: Correlations between NEER and REER and ratio of standard deviations

	BG	CZ	EE	LV	LT	HU	PL	RO	SI	SK
C.C.	-0.581	0.9377	0.5144	0.7949	0.7763	0.9411	0.9801	0.8461	0.6094	0.8498
R.S.D.	5.006	0.8770	0.5532	0.7525	0.8421	0.9773	0.9683	0.9003	1.0482	0.8802

Source: Author's calculation

Note: C.C. is correlation coefficient and R.S.D. is ratio of standard deviations

4. EFFECT OF COUNTRY'S OPENNESS AND WEALTH

The final step of our empirical analysis is to put the obtained correlations into relation with openness and relative wealth of the analyzed countries. The degree of openness of an economy is measured by the following indicator:

$$open = \frac{|ex| + |im|}{y} \tag{5}$$

where *ex* denotes exports, *im* denotes imports and *y* denotes GDP. We used not seasonally adjusted, unfiltered time series at current prices for calculation of the indicator. In this formula, the higher the openness indicator *open* the more open the economy is. For the purpose of further analysis we computed the average value of the *open* indicator over the sample period. This measure varies from 0.67 in Poland to 1.50 in Estonia. The measure of relative wealth is a ratio of the country's GDP per capita to that of Germany. All the GDP per capita series are constructed on the purchasing-power-parity basis. Similarly with the openness indicator we calculate the average value of the wealth indicator for each country

over the entire period of analysis. One can observe substantial differences in relative wealth of the new EU member states. The level of relative wealth varies from 0.28 in Bulgaria and Romania to 0.71 in Slovenia. Average values of both indicators are reported in Table 2.

Table 3: Average values of the openness and wealth indicators

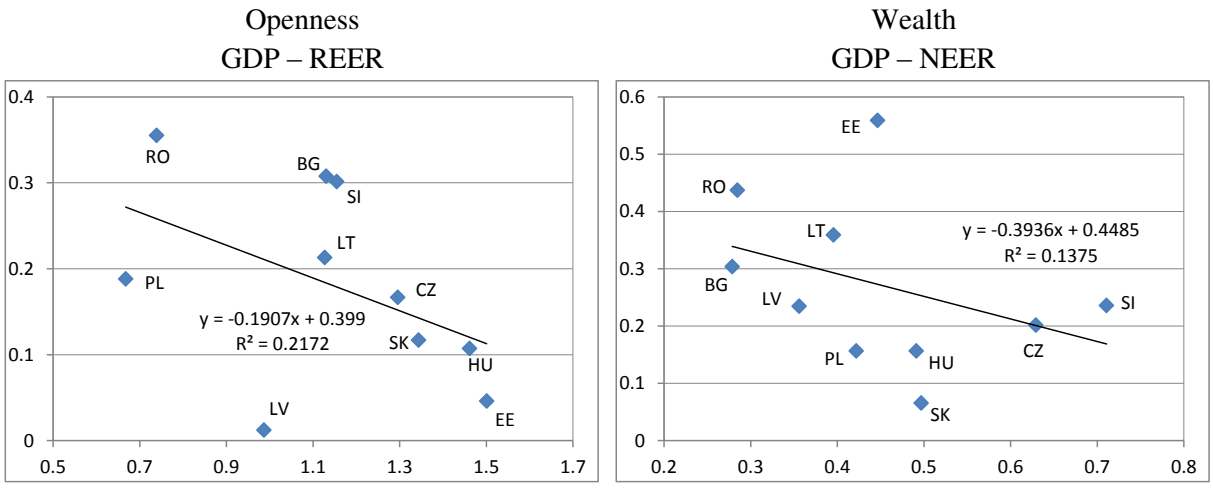
	BG	CZ	EE	LV	LT	HU	PL	RO	SI	SK
Openness	1.1303	1.2959	1.5011	0.9867	1.1270	1.3440	0.6675	0.7391	1.1547	1.4615
Wealth	0.2786	0.6292	0.4466	0.3561	0.3957	0.4913	0.4220	0.2847	0.7108	0.4969

Source: Author's calculation

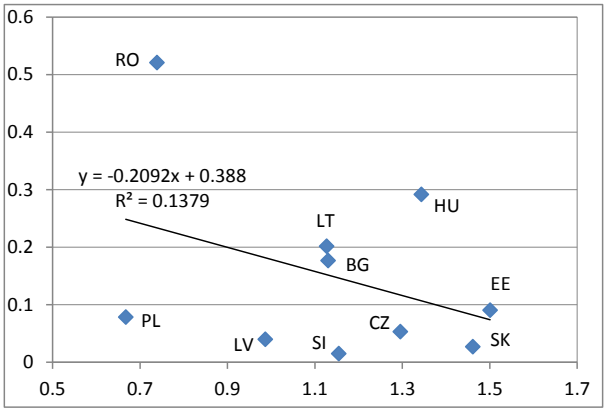
We have expectation that the correlation between exchange rates and macroeconomic fundamentals should be stronger in countries with higher degree of openness. In a country where international trade represents larger part of GDP the exchange rates have more room to influence or be influenced by underlying macroeconomic variables. On the other hand, we expect exchange rates and fundamentals to be more correlated in less developed countries with lower relative wealth. This is because less developed countries are usually more fragile in facing economic shocks leading to higher volatility in macroeconomic variables and exchange rates.

Figure 2 portrays scatter plots with simple regressions between the absolute value of correlation coefficient and level of openness or wealth respectively. We use the maximum cross correlation coefficient obtained in the interval of (-4, 4) lags. To conserve the space we present only one graph for each macroeconomic fundamental. It presents only the stronger regression relationship, i.e. with NEER or REER.

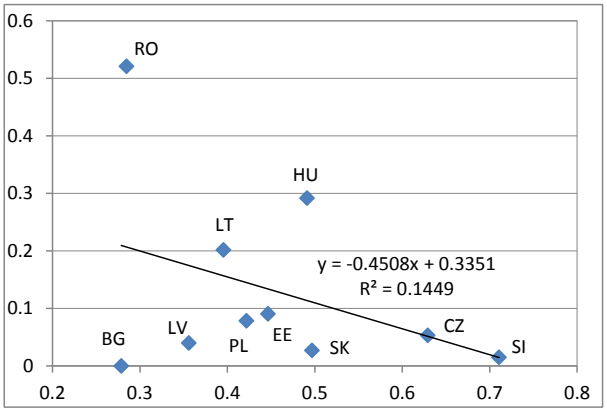
Figure 2: Regressions between correlation and openness or wealth



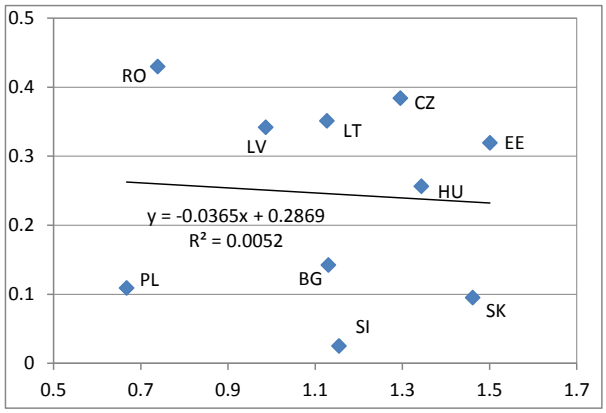
Consumption – REER



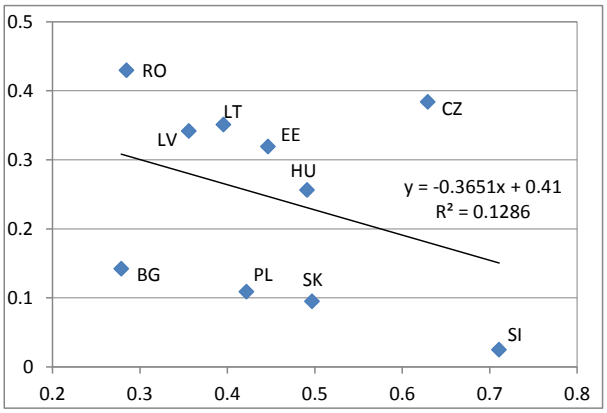
Consumption – REER



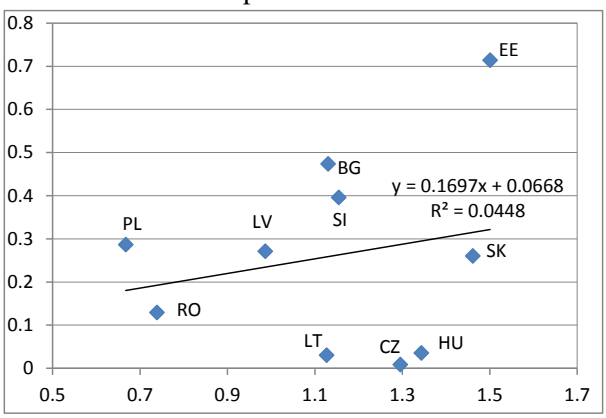
Investment – NEER



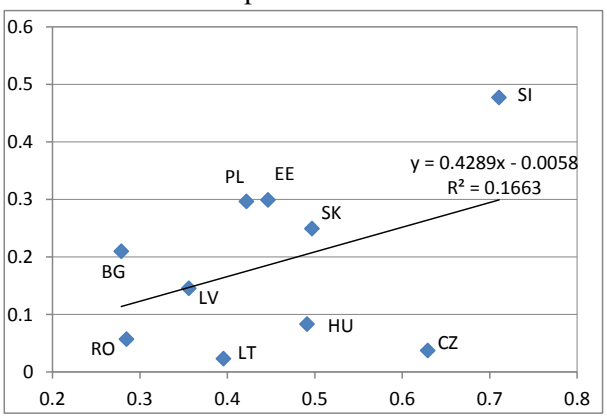
Investment – NEER



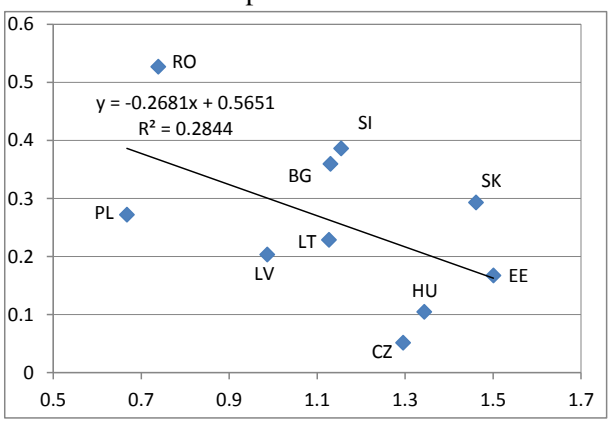
Export – NEER



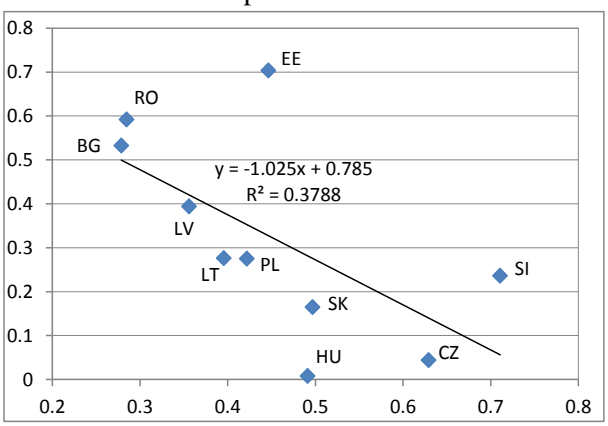
Export – REER



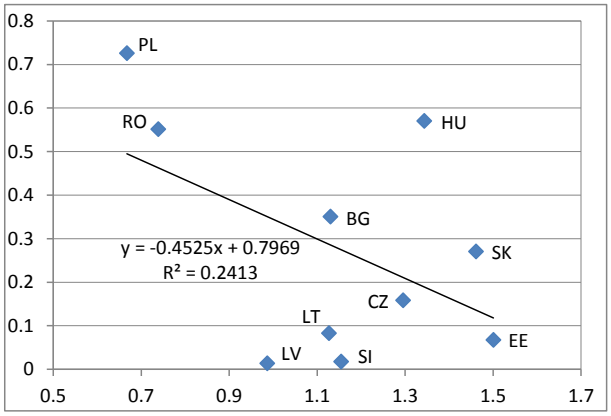
Import – REER



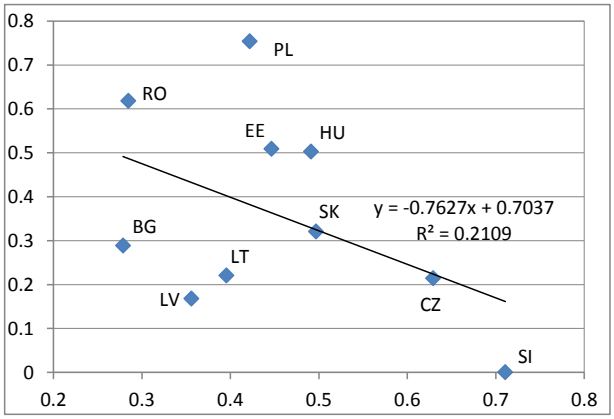
Import – NEER



Debt – REER



Debt – NEER



Source: Author's calculation

Note: We present the stronger relation (NEER or REER) between correlation coefficient and country's openness and wealth. The absolute value of correlation coefficient is on horizontal axis and the openness or wealth indicator on vertical axis.

While the openness of an economy seems to be more related to correlation of macro aggregates with REER, the level of wealth is more intensively related to correlations that include NEER. However, the regressions shown in Figure 2 confirm rather weak relationship between the country's openness and wealth and correlations. The coefficients of determination are rarely above 0.2. The strongest relationship exists between country's wealth and import–NEER correlation. There is a solid evidence of decreasing correlation with rising level of wealth. Similar kind of negative and relatively strong relationship can be also revealed between degree of openness and import–REER correlation. Next, significantly lower correlations in more open and wealthier countries are found if we examine the government debt. In other cases, the cross correlation does not vary systematically with wealth and openness in our dataset. Interestingly, there is just one example of positive relationship between country's wealth and openness measures and cross correlations. It is the case of export for which wealthier and to a lesser degree also more open countries tend to exhibit stronger cross correlations.

5. CONCLUSION

The aim of the paper was to provide direct empirical evidence on relationship between exchange rates and selected macroeconomic variables for ten new EU member states from Central and Eastern Europe. We used cyclical components of the time series and run cross correlations with leads and lags of up to four quarters. Substantial differences in the exchange rates–fundamentals relationships were revealed across the countries. The differences exist in intensity as well as direction and make interpretation of the results complicated. However, few findings are applicable to most of the incorporated countries.

The analysed relationship is usually stronger and more evident if REER is used in the correlation. This suggests that in small open economies the real exchange rate as indicator of a country's international competitiveness is more related to macroeconomic aggregates than nominal exchange rate. Cross correlation pattern for GDP, investment, export and import

resembles the reversed letter S. Such a shape illustrates procyclicality of exchange rates at lags and countercyclicality of exchange rates at leads. By contrast, cross correlation function of government debt and consumption (half of countries) seems to be similar in shape to the letter S. This demonstrates procyclicality of leading and countercyclicality of lagging exchange rates. Based on considerable level of cross–country generalization we can conclude that the most significant relationship with exchange rates was discovered for government debt and, to a lesser extent, for import. However, policy analyses related to business cycles should not overemphasize the effects of exchange rates on the economy and crucial fundamentals.

Cross correlations were further related to indicators of country's openness and wealth. We did not find solid evidence that these characteristics have impact on magnitude of cross correlation. In other words, factors other than openness, measured by the weight of international trade in the economy, and relative wealth are associated with the degree of co-movement of exchange rates with macro variables. The only exceptions are again government debt and import for which correlation with exchange rates evidently increases in less open and poorer countries.

REFERENCES

Cheung, Y.W., Chinn, M.D., Pascual, A.G., (2005), "Empirical exchange rate models of nineties: Are any fit to survive?", *Journal of International Money and Finance*, 24(7): 1150-1175.

Dedola, L., Leduc, S., (2001), "Why Is the Business Cycle Behaviour of Fundamentals Alike across Exchange Rate Regimes?", *International Journal of Finance & Economics*, 6(4): 401-419.

De Grauwe, P., Grimaldi, M., (2006), "Exchange Rate Puzzles: A Tale of Switching Attractors", *European Economic Review*, 50(1): 1-33.

Dornbusch, R., (1976), "Expectations and exchange rate dynamics", *Journal of Political Economy*, 84(6): 1161-1176.

Duarte, M., Restuccia, D., Waddle, A.L., (2007), "Exchange Rates and Business Cycles across Countries", *Federal Reserve Bank of Richmond Economic Quarterly*, 93(1): 57-76.

Flood, R.P., Rose, A.K., (1995), "Fixing Exchange Rates a Virtual Quest for Fundamentals", *Journal of Monetary Economics*, 36(1): 3-37.

Frenkel, J., (1976), "A monetary approach to the exchange rate: doctrinal aspects and empirical evidence", *Scandinavian Journal of Economics*, 78(2): 200-224.

Hodrick, R.J., Prescott, E.C., (1997), "Postwar US Business Cycles: An Empirical Investigation", *Journal of Money, Credit & Banking*, 29(1): 1-16.

Lucas, R.E., (1982), "Interest rates and currency prices in a two-country world", *Journal of Monetary Economics*, 10(3): 335-359.

Obstfeld, M., Rogoff, K.S., (2000), "The six major puzzles in international economics: Is there a common cause?", in Bernanke, B., Rogoff, K.S. (eds) *NBER Macroeconomics Annual 2000,* (Cambridge: MIT Press).

Rand, J., Tarp, F., (2002), "Business Cycles in Developing Countries: Are They Different?", *World Development*, 30(12): 2071-2088.