UNIVERSITY OF WUPPERTAL
BERGISCHE UNIVERSITÄT WUPPERTAL

EUROPÄISCHE WIRTSCHAFT
UND
INTERNATIONALE MAKROÖKONOMIK

Paul J.J. Welfens
Dora Borbély

Exchange Rate Developments and Stock Market Dynamics in Transition Countries: Theory and Empirical Analysis

Diskussionsbeitrag 126
Discussion Paper 126

Europäische Wirtschaft und Internationale Wirtschaftsbeziehungen
European Economy and International Economic Relations

ISSN 1430-5445

Paul J.J. Welfens
Dora Borbély

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November 2004

Herausgeber/Editor: Prof. Dr. Paul J.J. Welfens, Jean Monnet Chair in European Economic Integration

EUROPÄISCHES INSTITUT FÜR INTERNATIONALE WIRTSCHAFTSBEZIEHUNGEN (EIIW)/
EUROPEAN INSTITUTE FOR INTERNATIONAL ECONOMIC RELATIONS
Bergische Universität Wuppertal, Campus Freudenberg, Rainer-Gruenter-Straße 21,
D-42119 Wuppertal, Germany
Tel.: (0)202 – 439 13 71
Fax: (0)202 – 439 13 77
E-mail: welfens@uni-wuppertal.de
www.euroeiiw.de

JEL classification: E0, C3
Key words: Transition Countries, Exchange Rate Determination, Stock Markets.

Summary: We present new theoretical approaches to exchange rate determination and stock market price dynamics as well as first empirical results for selected transition countries. The exchange rate is considered as reflecting both the interest parity – with a specific formulation for exchange rate expectations – and impulses from purchasing power parity which in turn is related to a modified monetary approach to exchange rate determination; the modification concerns the role of stock market prices in the demand for money. Our main focus is on the nominal exchange rate. The empirical results for the dollar exchange rate presented, based on quarterly data, are two-stage and three-stage least squares estimations. The three stage estimation reflects – which is a superior approach to the two-stage estimates in terms of exploiting the information in the data of the sample – the theoretical basis, namely that exchange rate dynamics and stock market prices are interdependent. The estimations for Hungary, the Czech Republic and Poland show significant coefficients for the lagged exchange rate, the stock market price and US GDP as well as other variables which are significant only in some of the countries considered. The in-sample forecast is excellent for all three countries so that anticipation of future exchange rate changes seems to be possible: this is not only relevant for economic actors but also for the issue of Euro area membership. Moreover, the considerable impact of stock market prices on the nominal exchange rate suggest that problems of stock market bubbles in the US might strongly contribute to unstable exchange rates in Europe.

Zusammenfassung: In vorliegendem Arbeitspapier wird ein neuer theoretischer Ansatz zur Wechselkursbestimmung und Aktienkursentwicklung dargestellt, zudem werden erste empirische Untersuchungen für ausgewählte Transformationsländer gezeigt. Dabei wird unterstellt, dass der Wechselkurs sowohl die Zinsparität – mit einer bestimmten Formulierung der Wechselkurserwartungen – als auch Impulse von der Kaufkraftparität widerspiegelt, die wiederum mit einem modifiziertem Ansatz zur Wechselkursbestimmung in Verbindung steht. Die Modifizierung betrifft die Rolle der Aktienkurse bei der Geldnachfrage. Das Hauptaugenmerk liegt hierbei bei den nominalen Wechselkursen. Die empirische Untersuchung mit Quartalsdaten der Wechselkurse vis-a-vis dem US Dollar basiert auf zwei- und dreistufigen kleinste Quadrate Schätzverfahren. Der dreistufige Ansatz, der dem zweistufigen hinsichtlich der Nutzung der vorhandenen Information in den Daten überlegen ist, reflektiert die theoretische Grundlage, dass die Wechselkurs- und die Aktienkursentwicklung ein interdependentes System darstellen. Die Schätzergebnisse für Ungarn, die Tschechische Republik und Polen zeigen signifikante Koeffizienten für den zeitverzögerten Wechselkurs, die Aktienkurse und das US BIP, und für weitere Variablen, die jedoch nur in manchen der Länder einen Einfluss haben. Die in-sample Prognose ist für alle drei Länder ausgezeichnet, so dass eine Prognose für zukünftige Zeiträume möglich zu sein scheint; dies ist nicht nur relevant für Wirtschaftsakteure, sondern auch hinsichtlich der Teilnahme dieser Länder an der Eurozone. Außerdem impliziert der beträchtliche Einfluss der Aktienkurse auf die nominalen Wechselkurse, dass eine Spekulationsblase auf dem US Aktienmarkt erheblich zu einer Destabilisierung der Wechselkurse in Europa beitragen könnte.

Prof. Dr. Paul J.J. Welfens, Jean Monnet Chair for Euorpean Economic Integration and European Institute for International Economic Integration (EIIW) at the University of Wuppertal, Rainer-Gruenter-Str. 21, D-42119 Wuppertal, Germany (www.euroeiiw.de), welfens@uni-wuppertal.de, www.econ-international.net

Dora Borbély[*], *European Institute for International Economic Integration (EIIW) at the University of Wuppertal, Rainer-Gruenter-Str. 21, D-42119 Wuppertal, Germany*

EIIW Paper No. 126
November 2004

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Contents:

1. Introduction 1
2. Basic Theory of Nominal Exchange Rate Determination 3
3. Empirical Results 6
   3.1. Two-Stage Least Squares Estimates 6
   3.2. Three-Stage Least Squares Estimates 12
4. Conclusions 16
Data Sources 17
References 18

[*] We are grateful to research assistance by Jens Perret and useful comments by Andre Jungmittag, EIIW. This paper is part of the EU 5th framework project: *"Changes in Industrial Competitiveness as a Factor of Integration: Identifying Challenges of the Enlarged Single European Market"* (Contract No. HPSE-CT-2002-00148). The usual disclaimer applies.

List of Figures:

Graph 1: Hungary Development of the Nominal Exchange Rate vis-à-vis US $ and Development of the Hungarian Stock Market Prices (BUX) ... 2
Graph 2: Czech Republic Development of the Nominal Exchange Rate vis-à-vis US $ and Development of the Czech Stock Market Prices (PX 50) ... 2
Graph 3: Poland Development of the Nominal Exchange Rate vis-à-vis US $ and Development of the Polish Stock Market Prices (WIG 20) ... 3
Graph 4: In-Sample Forecast for the Hungarian Exchange Rate, 2SLS Estimation ... 8
Graph 5: In-Sample Forecast for the Polish Exchange Rate, 2SLS Estimation ... 10
Graph 6: In-Sample Forecast for the Czech Exchange Tate, 2SLS Estimation ... 11

List of Tables:

Table 1: Two-Stage Least Squares (2SLS) Estimation for the Hungarian Exchange Rate ... 7
Table 2: Two-Stage Least Squares (2SLS) Estimation for the Polish Exchange Rate ... 9
Table 3: Two-Stage Least Squares (2SLS) Estimation for the Czech Exchange Rate ... 11
Table 4: Three-Stage Least Squares (3SLS) Estimation for the Hungarian Exchange Rate ... 13
Table 5: Three-Stage Least Squares (3SLS) Estimation for the Polish Exchange Rate ... 14
Table 6: Three-Stage Least Squares (3SLS) Estimation for the Czech Exchange Rate ... 15

1. Introduction

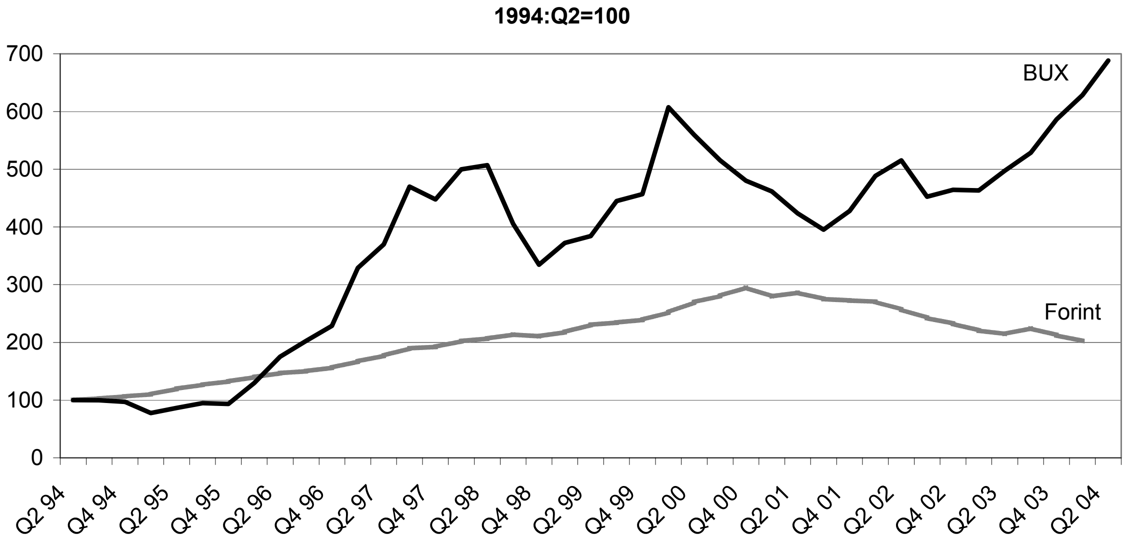
Exchange rates in transition countries have changed considerably in the 1990s as economic opening, new monetary policy strategies and economic growth – after an early period of transformational recession – coincided. After an initial transition stage with high inflation rates and flexible exchange rates most transition countries switched for several years to explicit or implicit pegging or a crawling peg regime where the aim was to reduce inflation rates and achieve greater nominal and real exchange rate stability. The latter was often considered to provide an anchor for monetary policy and bringing down inflationary expectations. As regards economic development it is mainly the real exchange rate which matters; in the short term it is also the nominal exchange rate which is crucial, namely for those dealing in the foreign exchange markets and for speculators in the context of interest parity. As regards the real exchange rate it can, of course, change even if the nominal exchange rate is fixed. The real exchange rate can be expected to change faster in periods of flexible exchange rates than in periods of a fixed nominal rate or a crawling peg regime.

The nominal exchange rate is closely linked to financial market dynamics on the one hand and on the current account development and real economic dynamics on the other hand. With respect to the nominal exchange rate the logic of the real economy can be covered through purchasing power parity in the form $eP^* = P$ where P^* and P can be replaced from the equilibrium condition for foreign money market $M^*/P^* = m^*(...)$ and the domestic money market, namely $M/P = m(Y, i, P')$ where m is real money demand and Y is real output, i the nominal interest rate and P' the stock market price index. We basically assume that part of the demand for money is explained by transactions in stock markets so that a higher stock market price – going along with higher transactions in stock markets – should raise the demand for money: WELFENS (2001, chapter B) has developed theoretical arguments for this approach and presented empirical estimates on the Euro/$ exchange rate change which was explained by the lagged exchange rate change, the change in the ratio of the Eurostoxx index to the US Standard & Poors Index on the one hand and on the other hand by the change in the long term interest differential; R^2 was close to 0.5, all coefficients were significant, the Durbin Watson coefficient acceptable and a good out-of-sample forecast obtained. Explaining exchange rate dynamics in accession countries is certainly more complicated than the case of Germany; this holds all the more since we want to explain the level of the exchange rate. Note that we are not concerned with the real exchange rate and the question to which extent there is misalignment or deviation from the real equilibrium exchange rate (on this problem see for EU15 countries HANSEN/RÖGER, 2001).

As regards financial market dynamics interest parity is a compact form of expressing the link between the exchange rate and domestic and foreign interest rates. If domestic and foreign bonds are perfect substitutes the interest rate parity should hold without a risk premium term R; moreover, if there is full capital mobility interest parity should hold at any moment of time. While it is true that EU accession countries have opened up for capital flows only gradually in the 1990s we will nevertheless assume that interest parity is holding – but one might include a risk premium which could e.g. depend on the debt-GDP ratio or other variables.

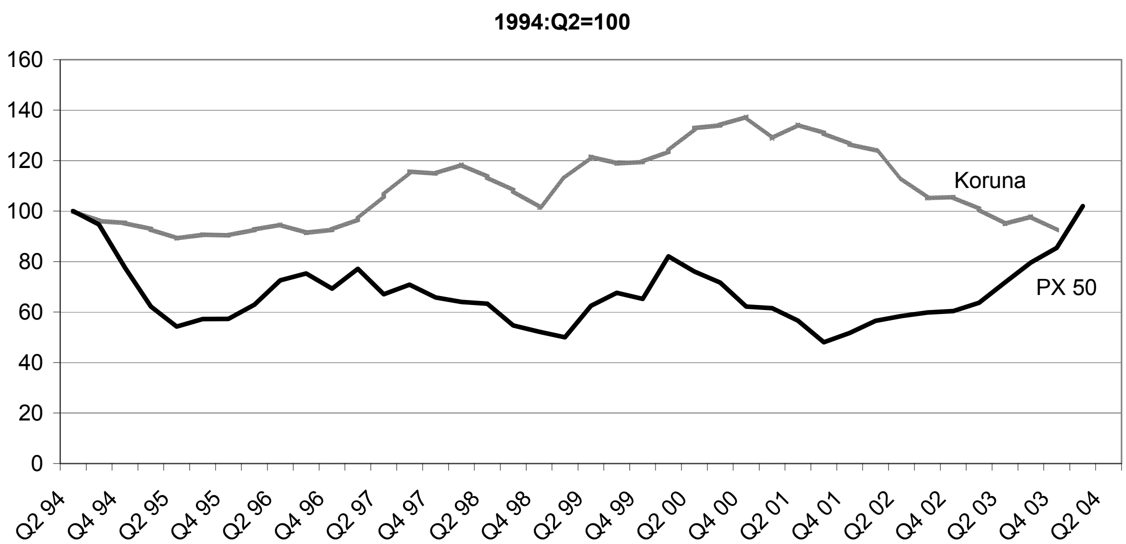
As regards economic opening up for trade eastern European accession countries had largely achieved free trade with the EU in the 1990s. The liberalization process was more difficult in the sphere of capital flows; it was not before EU membership that EU accession countries had fully liberalized both foreign direct investment inflows and portfolio capital flows (actually, a transition period for foreign ownership of land in Poland still represents effective restrictions to capital flows). Explaining the nominal exchange rate in the 1990s is rather difficult since periods of a crawling peg in Poland was followed by a more flexible exchange rate in the second half of the 1990s.

Graph 1: Hungary Development of the Nominal Exchange Rate vis-à-vis US $ and Development of the Hungarian Stock Market Prices (BUX)

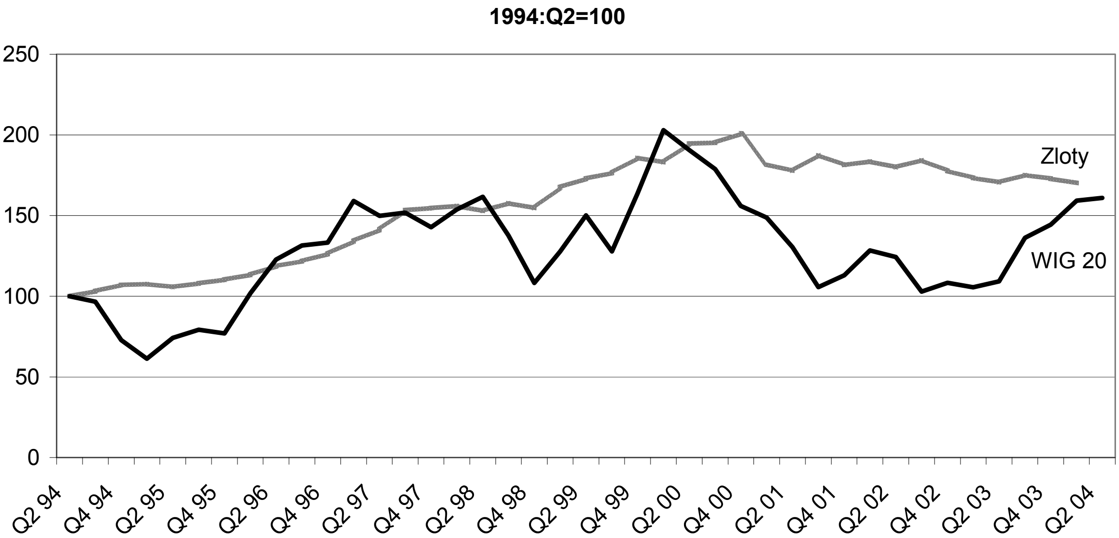


The graphs 1-3 show the development of the nominal dollar exchange rates for Hungary, the Czech Republic and Poland; in addition the development of stock market price indices is shown.

Graph 2: Czech Republic Development of the Nominal Exchange Rate vis-à-vis US $ and Development of the Czech Stock Market Prices (PX 50)



Graph 3: Poland Development of the Nominal Exchange Rate vis-à-vis US $ and Development of the Polish Stock Market Prices (WIG 20)



The nominal exchange rate in many accession countries has shown a strong nominal depreciation in the 1990s; but in 2001-03 there was a nominal appreciation in all three countries considered, Hungary, Poland and the Czech Republic. We emphasize that the explanation of the nominal exchange rate in transition countries is rather complicated. However, at the bottom line we present empirical evidence that the foreign exchange market and the stock market are interdependent. The results presented indicate that exchange rate dynamics and stock market developments can be explained satisfactorily; the findings are not only important for firms and banks but also for national policymakers and the ECB – that is the question of future Euro membership.

2. Basic Theory of Nominal Exchange Rate Determination

As regards short-term nominal exchange rate modelling one may state the hypothesis that price level dynamics at home and abroad are not influenced by short term exchange rate fluctuations as the price level is a sticky variable. Rather the short term exchange rate will be influenced by price level developments. According to open interest parity we should have (with e as the nominal exchange rate, i as the nominal interest rate, * to denote foreign variables and R' as the risk premium)

(1) $\left[Ee_{t+1} - e_t\right] / e_t = i - i^* - R'$

(2) $\left[Ee_{t+1} / e_t\right] = 1 + (i - i^*) - R'$

Assuming that $(i - i^*) + R'$ is relatively small we can use the approximation $\ln(1 + x) = x$ and write:

(3) $\ln Ee_{t+1} - \ln e_t = (i - i^*) - R'$

(4) $\ln e_t = \ln Ee_{t+1} + (i^* - i) + R'$

We will assume that the risk premium R depends on the sustainability of fiscal policy as proxied by the debt-GDP ratio d'.

(5) $\ln e_t = \ln Ee_{t+1} + (i^* - i) + R'(d')$

The expected exchange rate is supposed to be determined according to (WELFENS, 2004):

(6) $\ln Ee_{t+1} = \ln e_{t-1} + \beta(\ln Y - \ln Y^*) + \beta'(\ln e\Diamond_t - \ln e_t) + \beta''(\ln e_t - \ln e_{t-1}) =$
$\beta(\ln Y^* - \ln Y) + (1-\beta'')\ln e_{t-1} + \beta'\ln e\Diamond - (\beta' - \beta'')\ln e_t$

This equation – where we assume $0 < \beta'' < 1, (\beta' - \beta'') \le 1$ – states that the expected exchange rate is based on the past spot exchange rate plus three factors, namely the current account impact related net exports of goods and services and hence the differential $\ln Y / Y^*$, the difference between the hypothetical long term (read purchasing power: PPP) equilibrium exchange rate $e\Diamond$ and the actual exchange rate; and the difference between the present exchange rate and the exchange rate of the previous period. This learning pattern may reflect pragmatic learning in the sense that economic agents consider the present exchange rate with a certain probability as an equilibrium exchange rate (perfectly rational if the equilibrium exchange rate were characterized by a random walk), but also consider the relevance of the rational component $e\Diamond$; and $e\Diamond$ is based on purchasing power parity. Inserting (6) into (5) gives

(5') $\ln e_t[1 - (\beta' - \beta'')] = \beta(\ln Y^* - \ln Y) + [1 - (\beta' - \beta'')]\ln e_{t-1} + \beta'\ln e\Diamond + (i^* - i) + R'(d')$

As regards the hypothetical equilibrium exchange rate – according to PPP – we follow the monetary approach to exchange rate determination in a modified form. The modification concerns the role of the stock market price index P' which is assumed to positively affect real money demand as transactions on stock markets will rise along with P'. The expected exchange rate is assumed to depend on relative money supply. Hence we assume the law of one price (in its weak form, that is $V' \neq 1$), that is purchasing power parity, and hence

(7) $P_t = V' e\Diamond_t P_t^*$

(7') $\ln P_t = \ln V' + \ln e\Diamond_t + \ln P_t^*$

We assume money market equilibrium at home and abroad; and we denote real money demand $m = m(Y, i, P')$ and $m^* = m^*(Y^*, i, P')$ abroad. P' is the stock market price index (real income is denoted as *Y*, the income elasticity of money demand denoted as α and the semi-interest elasticity denoted as α' and the elasticity with respect to the stock market price index as α''). The real money supply is *M/P* in the home country and *M/P** in the foreign country so that the equilibrium conditions read as follows (with e' denoting the Euler number):

(8) $M_t / P_t = Y_t^{\alpha} P_t^{'\alpha''} e^{'-\alpha' i}$

(9) $M_t^* / P_t^* = Y_t^{*\alpha^*} P_t^{'*\alpha''*} e^{'-\alpha'^* i^*}$

(8') $\ln M_t - \ln P_t = \alpha \ln Y_t - \alpha' i_t + \alpha'' \ln p_t'$

(9') $\ln M_t^* - \ln P_t^* = \alpha^* \ln Y_t^* - \alpha'^* i_t^* + \alpha''^* \ln P_t'^*$

Inserting from (8') and (9') P and P* into the equation for purchasing power parity (7') we have:

(10) $\ln e\Diamond_t = -\ln V' + \ln M_t - \ln M_t^* + \alpha^* \ln Y_t^* + \alpha^{*\prime} i_t^* + \alpha^{*\prime\prime} \ln P_t'^* - \alpha \ln Y_t - \alpha' i_t - \alpha'' \ln P_t'$

Inserting (10) in (5) we get:

$$(11)\ [1-(\beta'-\beta'')]\ln e_t = \beta \ln Y/Y^* + [1-(\beta'-\beta'')]\ln e_{t-1} - \beta' \ln V' + \beta' \ln M_t - \beta' \ln M_t^* + \alpha^* \beta' \ln Y_t^* - \alpha\beta' \ln Y_t + \beta'(1+\alpha^{*\prime}) i_t^* - \beta'(1+\alpha') i_t + \beta' \alpha^{*\prime\prime} \ln P_t'^* - \beta' \alpha'' \ln P_t' + R_t'$$

Defining $[1-(\beta'-\beta'')]$ as b we obtain:

$$(12)\ \ln e_t = \ln e_{t-1} - \beta'/b \ln V' + \beta'/b \ln M_t - \beta'/b \ln M_t^* + [(\alpha^* \beta' - \beta)/b]\ln Y_t^* + [(\beta - \alpha\beta')/b]\ln Y_t + \{[\beta'/b][1+\alpha^{*\prime}] i_t^* - [\beta'/b][1+\alpha'] i_t\} + [\beta'/b]\alpha^{*\prime\prime} \ln P_t'^* - (\beta'/b)\alpha'' \ln P_t' + (1/b) R_t'$$

Note that if $\beta > \alpha^* \beta'$ – that is the current account effect dominates money demand side effect – a rise of foreign output will bring about an appreciation of the currency. If β exceeds $\alpha\beta'$ a rise of national output will lead to a depreciation of the currency. If we assume that the semi-interestelasticity for the demand for money is the same at home and abroad we can replace the expression {…} by the interest differential $i^* - i$. Equation (12) is a testable hypothesis, which takes into account both short term dynamics from the capital account and more long term dynamics related to the current account and purchasing power parity, respectively. We expect that an expansion of monetary policy will raise the nominal exchange rate – that is bring about a nominal depreciation – and that a rise of real output will bring about an appreciation. A rise of the domestic stock market price index will cause an appreciation. A rise of the interest rate will bring an appreciation and a rise of the risk premium (that is of the deficit-GDP ratio) a depreciation. In particular we can test whether the coefficient for the nominal money stock – could be M1, M2 or M3 – is unity and whether the coefficient for the nominal interest rate is larger than unity.

If the stock market price is important for the determination of the exchange rate one must be interested in the explanation of the stock market. Without presenting the basic reasoning behind the equation we state here the relevant equation which is a modified capital asset market model (WELFENS, 2004) in which the exchange rate plays a role; the equation explains the ratio of the stock market price to the output price level σ is the variance of stock market prices, λ' is the degree of risk aversion, K the capital stock, τ the corporate tax rate and q^* the real exchange rate defined as $q^* = eP^*/P$.

$$(I)\ P'/P = -a_o i + a_1 E\sigma^{*2} + a_2(M/P) + a_3\lambda' - a_4 K - a_5\tau + a_6 q^*$$

We will use a simplified equation which reads (with positive parameters a_0, a, a''; the impact of the price level and hence a' is ambiguous a priori):

$$(II)\ P' = -a_0 i + aM + a'P + a''e$$

An interesting alternative approach to the determination of the equilibrium exchange rate has been presented by ÉGERT/LAHRECHE-REVIL (2003) who have suggested to analyze equilibrium exchange rates for accession countries which combines the fundamental equilibrium exchange rate FEER (fundamental equilibrium exchange rate) with the behavioural equilibrium exchange rate "BEER" methodology. The authors focus on a VAR-based 3-equation cointegration system and estimate structural equations for internal and external balances and link those to the real exchange rate; the authors use estimated misalignment to determine equilibrium nominal exchange rates. One may, however, raise some doubts that a decade of post-socialist economic development is a period long enough to apply cointegration analysis which rests on the assumption of a stable long term relationship between the endogenous variable and a set of exogenous variables.

3. Empirical Results

With respect to the empirical analysis of exchange rate dynamics in transition countries one should bear in mind that the speed of economic opening up and institutional modernization has differed across countries. E.g. while the Czech Republic has been rather slow in the privatization of banks Hungary has adopted early on fast privatization with a strong emphasis on including foreign investors. Poland has adopted a big bang liberalization in 1991/92, however, privatization of banks and firms took many years. Hence behaviour of economic agents is likely to differ somewhat compared to Western Europe. Moreover, one should note that establishment of stock markets also did not occur at the same time in transition countries and that the strategy of privatization in some countries nurtured stock market dynamics – e.g. in Poland and the Czech Republic which both had some voucher privatization associated with investment funds quoted on the stock market. Using quarterly data we will focus on the period from 1993 until the end of 2003. Starting the sample period only in 1993 allows avoiding the particular problem of the strong inflation coupled with relative price adjustments in the early transition process. At the outset we can state that the debt-GDP ratio was not found to be a significant proxy for the country risk premium. As regards the nominal interest rates we will use the short term interest rate (3-months rate).

3.1. Two-Stage Least Squares Estimates

As the stock market and the foreign exchange market are interdependent markets, it is adequate to proceed on the basis of two-stage and three-stage regressions. At first the empirical analysis is based on a Two-Stage Least Squares (2SLS) estimation, followed by a Three-Stage Least Squares (3SLS) regression analysis. Subsequently the results of the 2SLS estimation of the nominal exchange rates vis-à-vis the US $ of the Hungarian Forint, the Polish Zloty and the Czech Koruna are presented including the graphs for the in-sample forecasts.

The 2SLS is a single equation estimator, which does not take into account the covariances between residuals.[1] The use of it is appropriate, but not efficient. The two-stage estimation approach for the nominal exchange rate – based on quarterly data with the exchange rate being average quarterly rates, defined on the basis of domestic currency units per foreign currency units – uses the estimations for the stock market price index in the estimation of the nominal exchange rate.

[1] See Johnston, J. and J. DiNardo (1997).

Table 1: Two-Stage Least Squares (2SLS) Estimation for the Hungarian Exchange Rate

Dependent Variable: LOG(HUNEXCH)
Sample(adjusted): 1993:2 2003:4
Instrument list: LOG(HUNEXCH(-1)) HUNINTDIFF(-1) LOG(USASTOCK) LOG(USAGDP(-1)) LOG(HUNSTOCK(-1)) LOG(HUNCPIREL(-1))

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.568216	1.372565	3.328233	0.0020
LOG(HUNEXCH(-1))	0.810282	0.049095	16.50439	0.0000
HUNINTDIFF(-1)	0.007318	0.002486	2.944141	0.0056
LOG(USASTOCK)	0.145607	0.029776	4.890071	0.0000
LOG(USAGDP(-1))	-0.531378	0.158718	-3.347940	0.0019
LOG(HUNSTOCK)	0.044388	0.024776	1.791544	0.0814
Adjusted R-squared	0.996604	Durbin-Watson stat		2.478026
Durbin-h	1.595651	No. of observations		43

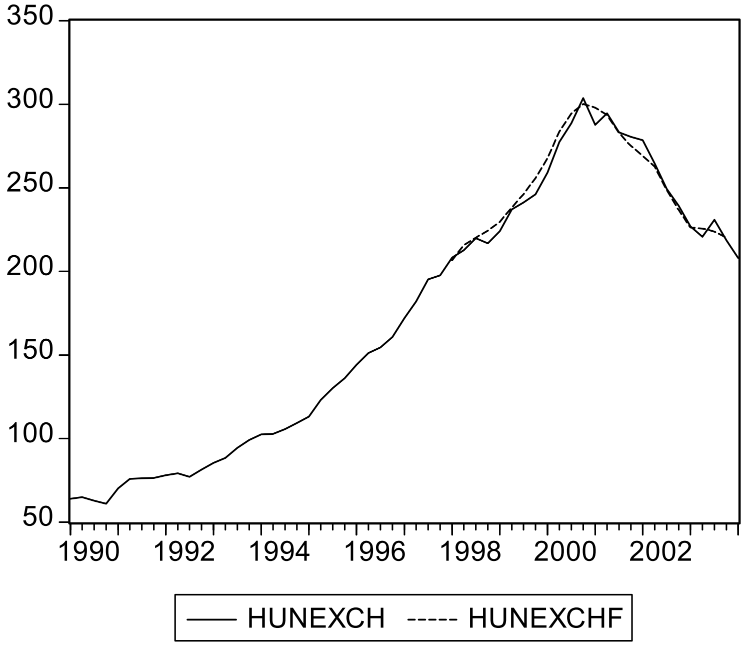
The equation for the exchange rate in Hungary (Table 1) shows a significant impact of:

- the lagged exchange rate (positive impact);
- the lagged international interest rate differential which shows a positive coefficient for $i - i^*$;
- the US stock market price index (positive impact) which is the S&P 500 index;
- the lagged US real GDP, which shows a negative sign that suggests that the current account impact on the exchange rate is strong, and
- the Hungarian stock market price index, which shows a significant positive impact. However, this is not the expected sign. One might explain this result by pointing out that the US stock market development is dominating stock markets in Europe so that our finding is not so surprising.

The adjusted R^2 is close to unity and all coefficients - but one - are significant at the 99% level. Only the Hungarian stock market price index is significant to merely 90%. The Durbin Watson statistics is biased in the presence of a lagged endogenous variable; therefore we additionally calculated the Durbin-h test statistics, which indicates that there is no problem with autocorrelation.

As we can see from graph 4, the in-sample forecast for the Hungarian exchange rate vis-à-vis the US $ is excellent. The forecast – starting in 1998 - is based on an observation period of five years (1993-1997).

Graph 4: In-Sample Forecast for the Hungarian Exchange Rate, 2SLS Estimation



The list of instruments used can also be viewed in Table 1. The choice of instruments for the 2SLS estimation was made by estimating the exchange rates and the stock market prices separately with OLS, initially including all possible exogenous variables. The final list of instruments is received through elimination of variables, which were not significant in either equation.

Next we take a look at the stock market in Hungary, which certainly has strongly been influenced by foreign direct investment inflows. As regards Hungarian stock market price dynamics - based on the underlying equation of the 2SLS estimation - we find that the lagged stock market price has a highly significant positive influence. Lagged money supply has a positive but insignificant effect and is therefore dropped as an instrument of the exchange rate. By contrast, the relative consumer price index ($CPI_{REL}=CPI_{HUN}/CPI_{USA}$) – lagged by one time period – has a positive impact which is highly significant. Including the lagged 3-months interest rate yields a positive coefficient, which is not totally surprising, namely to the extent that a rise of lagged interest rate is a signal that future interest rate will fall; and this should raise the stock price index.

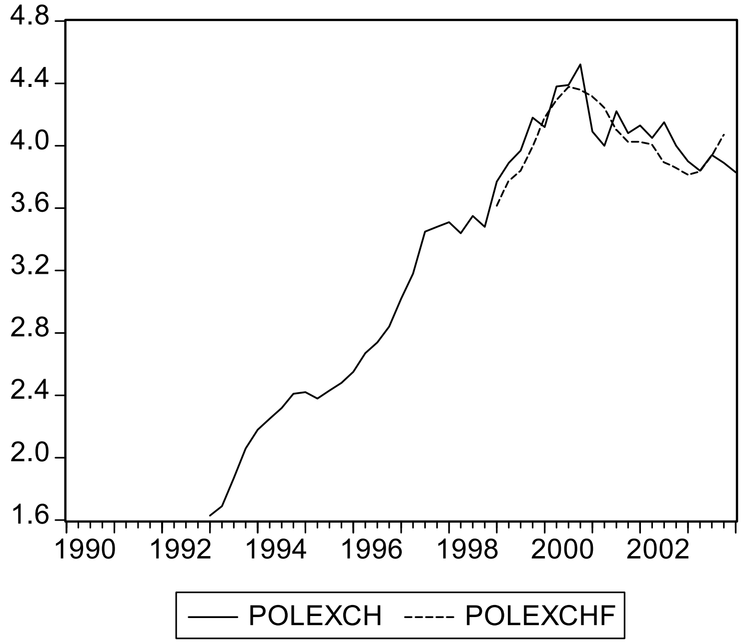
Table 2: Two-Stage Least Squares (2SLS) Estimation for the Polish Exchange Rate

Dependent Variable: LOG(POLEXCH)
Sample(adjusted): 1994:3 2003:4
Instrument list: LOG(POLEXCH(-1)) LOG(USASTOCK)
LOG(POLSTOCK(-1)) LOG(USAGDP(-1))
LOG(POLCPIREL(-1)) LOG(POLM1(-1))

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.886158	1.996342	-1.946639	0.0601
LOG(POLEXCH(-1))	0.631433	0.129750	4.866522	0.0000
LOG(USASTOCK)	0.082923	0.057408	1.444458	0.1580
LOG(USAGDP(-1))	0.360278	0.215610	1.670967	0.1042
LOG(POLSTOCK)	0.069512	0.042011	1.654609	0.1075
Adjusted R-squared	0.978382	Durbin-Watson stat		2.303454
Durbin-h	1.525002	No. of Observations		38

In the case of Poland (Table 2), the exchange rate is explained by the lagged exchange rate, which is – unsurprisingly – highly significant and yields a positive coefficient, and the US stock market price, which would only be significant if we allowed for an error probability of 15 %. Furthermore the lagged US GDP shows a positive sign, suggesting that money demand effect dominates the current account effect. Last but not least, the Polish stock market price shows the wrong sign (just like in the case of Hungary), which again might be explained by the international dominance of the US stock market. The adjusted R^2, as well as the in-sample forecast shown in Graph 5 are satisfactory. Furthermore the Durbin-h test statistics indicates no problem with autocorrelation.

Graph 5: In-Sample Forecast for the Polish Exchange Rate, 2SLS Estimation



In Poland the underlying stock price is explained in terms of the highly significant lagged stock price, and the first lag of M1, which is significant to 95 %. The interest rate has been dropped due to insignificance, and the relative consumer price index has the wrong sign, although it is significant with an error probability of 10 %.

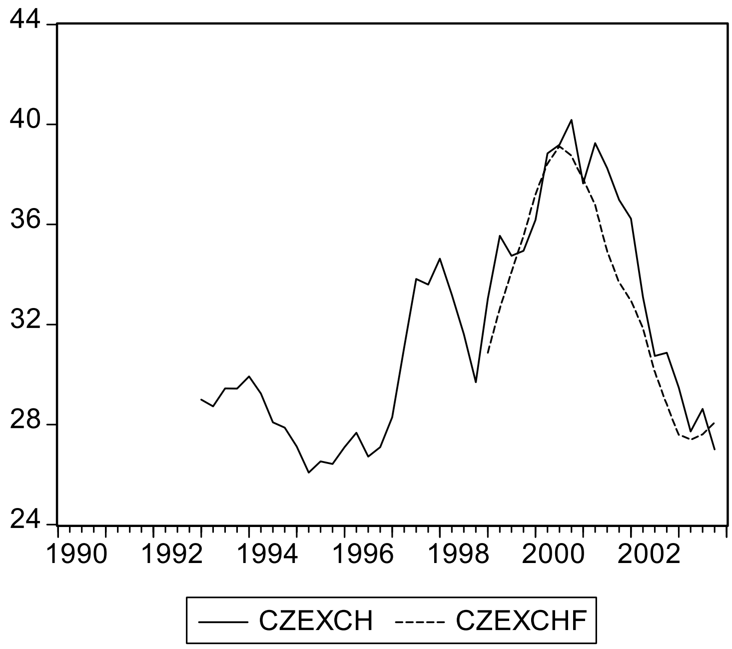
The Czech exchange rate (Table 3) shows a highly significant impact of the lagged exchange rate, a positive and significant impact of the US stock market price and a negative impact of the US GDP. Latter suggests that - similarly to Hungary and in contrast to Poland - the current account effect dominates the relative money demand effect. Furthermore there is a positive impact of the domestic stock market price. Again, the explanation could be the international dominance of the US stock market. Adjusted R^2 (0.91) is somewhat lower than in the case of Hungary and Poland. The Durbin-h test statistics (0.56) and the in-sample forecast (Graph 6) are satisfactory.

Table 3: Two-Stage Least Squares (2SLS) Estimation for the Czech Exchange Rate

Dependent Variable: LOG(CZEXCH)
Sample: 1994:1 2003:4
Instrument list: LOG(CZEXCH(-1)) LOG(USASTOCK) LOG(USAGDP(-1)) LOG(CZSTOCK(-1)) CZINT(-1) LOG(CZCPIREL(-1)) LOG(CZM1(-1))

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.533288	0.955303	2.651817	0.0119
LOG(CZEXCH(-1))	0.807371	0.072376	11.15522	0.0000
LOG(USASTOCK)	0.174546	0.036585	4.771008	0.0000
LOG(USAGDP(-1))	-0.390003	0.114535	-3.405089	0.0017
LOG(CZSTOCK)	0.079805	0.043716	1.825536	0.0765
Adjusted R-squared	0.911509	Durbin-Watson stat		1.843656
Durbin-h	0.568305	No. of Observations		40

Graph 6: In-Sample Forecast for the Czech Exchange Tate, 2SLS Estimation



In the underlying analysis of the Czech stock market price dynamics the lagged stock price and the lagged relative consumer price – latter with a negative coefficient – are significant variables. The lagged interest rate enters with a correct negative sign, but is only significant with an error probability of 15 %. The latter might be explained by the fact that we use the short term interest rate, not the long term bond rate.

3.2. Three-Stage Least Squares Estimates

In case of contemporaneous correlation in the residuals, the 2SLS is appropriate, but not an efficient estimator. Therefore we will now apply Three-stage least squares (3SLS) estimates, which are both consistent and efficient, because they take into account the covariances between the residuals. So one should prefer them to the two-stage analysis, however, the three stage approach is less transparent.

The first two stages of the 3SLS estimation are the same as the 2SLS estimation. In the third stage the system is estimated with a feasible Generalized Least Square method in a way that is analogous to the Seemingly Unrelated Regression (SUR) estimation. Thus the 3SLS estimation is the 2SLS-version of the SUR method. Applying the 3SLS estimation to our system, the same set of instruments is used for both equations.

Tables 4-6 present the results for the 3SLS Estimations. Taking a look at the estimation results for Hungary (Table 4) reveals the following insights. Unsurprisingly, the analysis shows similar results as the 2SLS estimation: The lagged exchange rate is significant and has a positive effect on the nominal exchange rate. Also the interest rate differential to the US 3-months interest rate, and the US stock market price have a significant positive influence. According to the 2SLS, the lagged US GDP is negatively correlated with the nominal exchange rate of the Forint vis-à-vis the US \$. The coefficient named C(6) represents the positive influence of the contemporaneous Hungarian stock market price on the nominal exchange rate. The correlation is positive and significant with an error probability of 5 %. This finding underlines the interdependence between nominal exchange rates and stock market prices, and reinforces the findings of the 2SLS estimation, where we found a significant correlation with an error probability of 10 %. The positive sign reinforces the assumption that stock markets in Europe, such as in Hungary, are dominated by the US stock market development. Otherwise we would expect to get a negative correlation. The adjusted R^2 of the estimation is rather high (0.99) and the Durbin-h test statistics accounts for 1.63. Latter is slightly below the critical value, so we can still accept the zero hypothesis of no autocorrelation with an error probability of 10 percent.

Table 4: Three-Stage Least Squares (3SLS) Estimation for the Hungarian Exchange Rate

System: SYS_HUN_E, Sample: 1993:2 2003:4				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	5.094806	1.258421	4.048571	0.0001
C(2)	0.811163	0.044905	18.06407	0.0000
C(3)	0.008373	0.002264	3.698398	0.0004
C(4)	0.136214	0.027170	5.013389	0.0000
C(5)	-0.588735	0.145696	-4.040841	0.0001
C(6)	0.052195	0.022738	2.295518	0.0245
C(7)	4.325916	2.141760	2.019795	0.0470
C(8)	0.833944	0.090512	9.213638	0.0000
C(9)	0.686884	0.366947	1.871888	0.0651
C(10)	-0.231570	0.153447	-1.509122	0.1355
C(11)	-0.185325	0.250573	-0.739606	0.4618
Determinant residual covariance		7.41E-06		
Equation: LOG(HUNEXCH)=C(1)+C(2)*LOG(HUNEXCH(-1))+C(3) *HUNINTDIFF(-1)+C(4)*LOG(USASTOCK)+C(5)*LOG(USAGDP(-1))+C(6)*LOG(HUNSTOCK)				
Instruments: LOG(HUNEXCH(-1)) HUNINTDIFF(-1) LOG(USASTOCK) LOG(USAGDP(-1)) LOG(HUNSTOCK(-1)) LOG(HUNCPIREL(-1)) LOG(HUNM1(-1)) C				
Adjusted R-squared	0.996625	Durbin-Watson stat		2.489044
Durbin-h	1.630891	No. of Observations		43
Equation: LOG(HUNSTOCK)=C(7)+C(8)*LOG(HUNSTOCK(-1))+C(9) *LOG(HUNCPIREL(-1))+C(10)*LOG(HUNM1(-1))+C(11) *LOG(HUNEXCH)				
Adjusted R-squared	0.964020	Durbin-Watson stat		1.542810
Durbin-h	1.868263	No. of Observations		43

The coefficients explaining the Hungarian stock market prices are also similar to the results of the 2SLS estimation. The lagged endogenous variable is highly significant, so is the lagged relative consumer price index. Money supply as measured by M1 did not have a significant influence in the 2SLS estimation, accordingly, it is only significant in the Three-stage least squares estimation if we allowed for an error probability of 15 %. The exchange rate does not appear with a significant coefficient in the stock market equation. The adjusted R^2 of the stock market estimation (0.96) is satisfactory. However, the Durbin-test indicates that there might be a slight problem with autocorrelation.

Table 5: Three-Stage Least Squares (3SLS) Estimation for the Polish Exchange Rate

System: SYS_POL_E				
System: SYS_POL_E, Sample: 1994:3 2003:4				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-4.271690	1.866927	-2.288085	0.0253
C(2)	0.582603	0.120292	4.843246	0.0000
C(3)	0.106482	0.052854	2.014629	0.0480
C(4)	0.387753	0.201924	1.920295	0.0591
C(5)	0.074207	0.039352	1.885755	0.0637
C(6)	0.902021	0.126239	7.145347	0.0000
C(7)	0.119751	0.063559	1.884103	0.0639
C(8)	-0.006038	0.006649	-0.908038	0.3671
C(9)	-0.412951	0.290970	-1.419221	0.1605
Determinant residual covariance		1.38E-05		
Equation: LOG(POLEXCH)=C(1)+C(2)*LOG(POLEXCH(-1))+C(3) *LOG(USASTOCK)+C(4)*LOG(USAGDP(-1))+C(5) *LOG(POLSTOCK)				
Instruments: LOG(POLEXCH(-1)) LOG(USASTOCK) LOG(POLSTOCK(-1)) LOG(USAGDP(-1)) LOG(POLM1(-1)) POLINT(-1) C				
Adjusted R-squared	0.977756	Durbin-Watson stat		2.203927
Durbin-h	0.916090	No. of Observations		38
Equation: LOG(POLSTOCK)=C(6)*LOG(POLSTOCK(-1))+C(7) *LOG(POLM1(-1))+C(8)*POLINT(-1)+C(9)*LOG(POLEXCH)				
Adjusted R-squared	0.741151	Durbin-Watson stat		1.756879
Durbin-h	1.226353	No. of Observations		38

Table 5 presents the 3SLS estimation for Poland. Again, the coefficients are close to the ones estimated by 2SLS. The lagged exchange rate is highly significant with a positive sign, so is the US stock market price, which was, however, significant in the 2SLS estimation only with an error probability of 15 %. Also the positive influence of the lagged US GDP is reinforced in the 3SLS estimation; that variable's coefficient was significant to merely 90 % in the 2SLS. This undermines the fact that money demand effect dominates the current account effect in Poland. Similarly to Hungary, also in Poland the positive influence of the stock market prices on nominal exchanges is confirmed by the consistent and efficient 3SLS estimation - shown in the coefficient (C(5)). A rather high adjusted R^2 (0.97), and an acceptable Durbin-h statistics (0.91) affirm the results.

Estimating the Polish stock market prices is somewhat more challenging. The underlying estimation yields an adjusted R^2 of only 0.74; but the Durbin-h test confirms the absence of autocorrelation. The results of the 2SLS are mostly asserted. The lagged stock market price is confirmed to have a strong positive influence on the current stock market price. Also the effect of money supply as measured by M1 is significant with a positive sign in both estimations. The lagged short-term interest rate (3-months rate) does not appear with a significant coefficient in the estimation. The Polish exchange rate only influences the Polish stock market prices if we allowed for an error probability for slightly more than 15 %.

Table 6: Three-Stage Least Squares (3SLS) Estimation for the Czech Exchange Rate

System: SYS_CZ_E, Sample: 1994:2 2003:4				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	2.723006	0.879364	3.096562	0.0028
C(2)	0.801760	0.069549	11.52802	0.0000
C(3)	0.173528	0.033815	5.131734	0.0000
C(4)	-0.394414	0.107228	-3.678282	0.0005
C(5)	0.059963	0.044431	1.349585	0.1816
C(6)	2.840787	0.686909	4.135606	0.0001
C(7)	0.681254	0.091596	7.437618	0.0000
C(8)	-0.003764	0.003861	-0.974905	0.3331
C(9)	0.210230	0.220661	0.952730	0.3441
C(10)	-0.239735	0.156139	-1.535397	0.1293
Determinant residual covariance		1.21E-05		
Equation: LOG(CZEXCH)=C(1)+C(2)*LOG(CZEXCH(-1))+C(3) *LOG(USASTOCK)+C(4)*LOG(USAGDP(-1))+C(5) *LOG(CZSTOCK)				
Instruments: LOG(CZEXCH(-1)) LOG(USASTOCK) LOG(USAGDP(-1)) LOG(CZSTOCK(-1)) CZINT(-1) LOG(CZCPIREL(-1)) C				
Adjusted R-squared	0.913501	Durbin-Watson stat		1.858402
Durbin-h	0.519033	No. of Estimations		39
Equation: LOG(CZSTOCK)=C(6)+C(7)*LOG(CZSTOCK(-1))+C(8) *CZINT(-1)+C(9)*LOG(CZCPIREL(-1))+C(10)*LOG(CZEXCH)				
Adjusted R-squared	0.649717	Durbin-Watson stat		1.627140
Durbin-h	1.442043	No. of Estimations		39

The 3SLS analysis of the Czech exchange rate dynamics (Table 6) confirms a highly significant positive influence of the lagged exchange rate and the US stock market price. US GDP appears with a negative sign, similarly to Hungary and in contrast to Poland. There is one main difference between the 2SLS and 3SLS estimates concerning the influence of Czech stock market prices on the nominal exchange rate. While the 2SLS estimation yields a significant positive correlation, the 3SLS yields this positive correlation only with a high error probability of 18 %, thus the influence cannot be regarded as significant (C(5)). The Czech Republic is the only one of the three countries analysed, where the 3SLS does not confirm the significant influence of the stock market prices on the exchange rate with a 90 % probability. The Durbin-h test statistics (0.51) and the adjusted R^2 of the estimation (0.91) are acceptable.

Again the underlying estimation of the stock market price is a little catchier. This is reflected by the adjusted R^2 of merely 0.64, but again the Durbin-h test statistics is acceptable (1.44). The influence of the lagged endogenous variable is, however, steadily significant with the expected sign. Although showing the expected negative influence, the coefficient of the lagged interest rate is not significant; this was the case in the 2SLS estimation, too. Neither is the impact of the relative consumer price index significant. The assumption that the nominal exchange rate influences stock market prices could only be stated with an error probability of 12 %, which is too high to call it a significant influence. It is unclear whether parts of these findings are due to the foreign exchange market crisis in the mid 1990s and the slow progress in privatization of the banking sector.

4. Conclusions

We have shown that exchange rate dynamics in EU accession countries can be explained by modern theoretical and empirical analysis which takes into account not only standard arguments but also the role of stock markets. The role of stock markets in emerging market economies is naturally rather limited in the early stages of growth, but it should increase (parallel to accumulation relative to GDP) over time. From this perspective it is quite interesting that theoretical and empirical analysis is able to explain financial market dynamics to some extent.

Assuming that our exchange rate model would work well also for the exchange rate vis-à-vis the Euro it is clear that EU accession countries eager to join the euro area should carefully analyze to which extent distorting foreign stock market dynamics affect the level of the exchange rate. At the same time one may emphasize that future research should take into account not only the short term but also more the long term link between the stock market and the exchange rate.

The considerable impact of stock market prices on the nominal exchange rate suggests that problems of stock market bubbles in the US might strongly contribute to unstable exchange rates in Europe. To the extent that inadequate prudential supervision – allowing fraudulent US investment bankers to influence investors - in the US has reinforced the stock market bubble in the US in the 1990s has distorted stock market dynamics and exchange rate developments in Europe; if increases in exchange rate volatility and stock market volatility reduce economic growth, US markets and economic policymakers, respectively, create negative international external effects.

Data Sources

VARIABLE	COUNTRY	SOURCE	TIME PERIOD
Nominal Exchange Rate	Hungary	IMF, International Financial Statistics	1993:01 - 2003:04
	Poland	IMF, International Financial Statistics	1993:01 - 2003:04
	Czech Republic	IMF, International Financial Statistics	1993:01 - 2003:04
Stock Market Prices	Hungary	Budapest Stock Exchange	1991:01 - 2004:01
	Poland	www.money.pl	1994:02 - 2004:01
	Czech Republic	Prague Stock Exchange	1993:04 - 2004:01
	USA	http://de.finance.yahoo.com /	1993:01 - 2004:01
Interest Rates	Hungary	IMF, International Financial Statistics	1993:01 - 2003:04
	Poland	IMF, International Financial Statistics	1993:01 - 2003:04
	Czech Republic	IMF, International Financial Statistics	1993:01 - 2003:04
	USA	IMF, International Financial Statistics	1993:01 - 2003:04
Consumer Price Index	Hungary	IMF, International Financial Statistics	1993:01 - 2003:04
	Poland	IMF, International Financial Statistics	1993:01 - 2003:04
	Czech Republic	IMF, International Financial Statistics	1993:01 - 2003:04
	USA	IMF, International Financial Statistics	1993:01 - 2003:04
Money Supply M1	Hungary	National Statistics	1993:01 - 2003:04
	Poland	National Statistics	1993:01 - 2003:04
	Czech Republic	National Statistics	1993:01 - 2003:04
	USA	IMF, International Financial Statistics	1993:01 - 2003:04
GDP	USA	IMF, International Financial Statistics	1993:01 - 2003:04

References

ÉGERT, B., and LAHRECHE-REVIL A. (2003), Estimating the Equilibrium Exchange Rate of the Central and Eastern European Acceding Countries: The Challenge of Euro Adoption, Review of World Economics, Vol. 139 (4), pp: 683-708.

HANSEN, J., and RÖGER, W. (2001), Estimation of Real Equilibrium Exchange Rates, European Commission Economic Papers No. 144, Brussels.

JOHNSTON; J., and DINARDO, J. (1997), Econometric Methods, McGraw-Hill, Singapore.

WELFENS, P.J.J. (2001), European Monetary Union and Exchange Rate Dynamics, Heidelberg and New York: Springer.

WELFENS, P.J.J. (2004), Productivity Shocks, Innovations, Stock Market Dynamics and Growth in Open Economies, Paper presented at the conference "Efficiency, Competition, and Regulation in Banking: Theory and Evidence" at Sulzbach-Rosenberg, June 4-5; forthcoming as chapter 5 in Welfens, P.J.J. (2004), Innovations in Macroeconomics, Heidelberg and New York 2004.

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PALKINAS, P.; EICHHORN, B., WELFENS, P.J.J. (eds., 1998), Europäische Währungsunion: Argumente und Fakten zur Euro-Debatte, Frankfurt/Main.

GLOEDE, K., STROHE, H.B. WAGNER, D., WELFENS, P.J.J. (eds., 1998), Systemtransformation in Deutschland und Rußland: Erfahrungen, ökonomische Perspektiven und politische Optionen, Heidelberg und New York: Springer.

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WELFENS, P.J.J., WOLF, H. (ed., 1997), Banking, International Capital Flows and Growth in Europe, Heidelberg and New York: Springer.

BÖRSCH-SUPAN, A., VON HAGEN, J., WELFENS, P.J.J. (eds., 1996,1997), Springers Handbuch der Volkswirtschaftslehre, Band 1 und 2, Heidelberg und New York: Springer.

WELFENS, P.J.J., YARROW, G. (eds., 1996), Telecommunications and Energy in Systemic Transformation, Heidelberg and New York: Springer.

GRAACK, C., WELFENS, P.J.J. (1996), Telekommunikationswirtschaft: Deregulierung, Privatisierung und Internationalisierung, Heidelberg und New York: Springer: (award-winning book).

WELFENS, P.J.J. (ed., 1996), European Monetary Integration, 3rd edition, Heidelberg and New York: Springer.

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TILLY, R., WELFENS, P.J.J. (eds., 1995), European Economic Integration as a Challenge to Industry and Government, Heidelberg and New York: Springer.

WELFENS, P.J.J. (1995), Grundlagen der Wirtschaftspolitik, Heidelberg und New York: Springer.

JASINSKI, P., WELFENS, P.J.J. (1994), Privatization and Foreign Direct Investment in Transforming Economies, Aldershot: Dartmouth/Gower.

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KLEIN, M., WELFENS, P.J.J. (eds., 1992), Multinationals in the New Europe and Global Trade, Heidelberg and New York: Springer.

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BALCEROWICZ, L., WELFENS, P.J.J. (1988), Innovationsdynamik im Systemvergleich. Theorie und Praxis unternehmerischer, gesamtwirtschaftlicher und politischer Neuerung, Heidelberg: Physica.