Currency substitution in Eastern Europe

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Abstract

Monetary instability during the transition process from a command economy to a market economy has induced a considerable increase in currency substitution in Eastern Europe. Currency substitution itself affects monetary stability since it reduces the stability of velocity. This paper investigates currency substitution in Eastern Europe. The consequences for the conduct of monetary policies are stressed as currency substitution of a significant degree has a large impact on monetary equilibrium and public finance. Currency substitution affects the shape of the seignorage Laffer-curve, since it makes its tax base, real money demand, sensitive to exchange rate expectations. With the use of the available data the sensitivity of money demand to currency substitution in the Eastern European countries is assessed.

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Introduction

The '90-'91 reform wave in Eastern Europe has been accompanied by a high degree of monetary instability. Inflation in Eastern Europe was repressed before the reforms by shortages, administered prices and inconvertible exchange rates. These curbs on inflation were released with the reforms and a strong increase in inflation rates and inflation variability was the inevitable consequence. Apart from monetary instability, substantial drops in output and increases in unemployment, have accompanied the reform process in Eastern Europe thus far. Interesting analyses on the design, implementation and results of the stabilization and reform programs that were launched in Eastern Europe, are found in Bruno (1992) and Solimano (1993). Lane (1992a) provides a detailed description on the design and effects of Poland's reform program of 1990, the Balcerowicz Plan.

Figure 1 in the back of the paper displays the annual inflation rates in several Eastern European countries. The graphs reveal that the reform programs of '90/'91 induced a huge shock in the price level and that inflation remained at a high level in Eastern Europe. A number of factors are often cited to have contributed to the inflationary pressures in Eastern Europe: an initial monetary overhang, an instantaneous liberalization of prices and a general lack of budget discipline combined with monetary financing of fiscal deficits. One interesting phenomenon accompanying the monetary instability is an increase in currency substitution in Eastern Europe: Eastern Europeans hold a considerable part of their monetary and financial wealth in US $ and to a lesser extent in DM rather than in their own currency. Liberalization of foreign currency holdings was an integral element in the reform programs in almost all Eastern European countries[3]. In this paper we provide empirical evidence on currency substitution in Eastern Europe and consider the effects of currency substitution on public finance.

Figure 2 graphs the dollarization process in Bulgaria, Hungary, Poland, the Czech Republic and Romania. As an indicator of dollarization the ratio of foreign currency deposits to narrow money M1 is used. Dollarization is seen to fluctuate substantially over time and among countries. The reform programs that were launched in the beginning of 1990 in these countries were accompanied by a sharp increase in inflation and a sharp increase in dollarization of the Eastern

[3] See Calvo and Kumar (1993) for more details on the financial sector reforms in Eastern Europe.

European economies, as is clear when combining figures 1 and 2. A permanently higher degree of dollarization of the economy is seen in most Eastern European countries: even when inflation rates come down again, the degree of dollarization remains high. Experiences with dollarization in Latin America suggests that dollarization in many cases became a structural phenomenon that did not decrease immediately when inflation rates decrease to a normal level[4].

The remainder of this study is as follows. In section 2 a theoretical framework on currency substitution. In section 3 the theoretical framework is empirically tested for the Eastern European countries to come to an empirical evaluation of the strength of currency substitution pressure in the respective countries. Section 4 summarizes our main findings.

2. Currency Substitution Theory

Currency substitution implies a partial replacement of domestic money by foreign money. Foreign money can replace partially the role of domestic money as a means of transactions and as a store of value. In high-inflation countries in particular this latter function of money becomes increasingly dominant: foreign currency provides a higher degree of purchasing power stability and is therefore more desirable than domestic money.

An important consequence of currency substitution forms the lower degree of controllability of monetary equilibrium by monetary policymakers. Higher sensitivity of velocity to inflation differences between the domestic and foreign economy will tend to reinforce inflationary pressures and exchange rate volatility in the domestic economy and can hamper stabilization efforts by monetary authorities when its stabilization efforts encounter little credibility. Boyer and Kingston (1987) consider the effects of permanent and temporary monetary shocks in the presence of currency substitution with a fully specified theoretical model. The possible effects of currency substitution on the real economy were investigated by Calvo (1985). Innovating empirical contributions to the currency substitution literature were made by Miles (1978), Bordo and Choudri (1982) and Ramirez-Rojas (1985).

Currency controls are measures by monetary authorities that aim at preventing or at

[4] Empirical evidence for such a form of hysteresis in currency substitution in Latin America is found in Guidotti and Rodriguez (1992) and Clements and Schwartz (1993).

least reducing currency substitution in the domestic economy[5]. Eastern Europe maintained an extensive system of currency controls and complete inconvertibility of their currencies with the rest of the world, except for countries that were part of the CMEA. Such a system of inconvertible currencies will have a major impact on trade with the rest of the world, because of the development of large disparities in relative prices. A lively system of black markets for foreign exchange has been operative in most countries, where foreign tourists, smugglers, foreign exchange traders and domestic agents were able to exchange foreign and domestic currencies at the black market exchange rates.

Macro-economic demand for domestic and foreign money in a country can either be derived from an underlying micro-economic structure or be postulated. The standard way to allow for the influence of currency substitution on money demand is to add depreciation expectations to real money demand. Assume that macro-economic money demand is accurately described by the well-known Cagan (1956) money demand function, which we augment with the expected rate of exchange rate depreciation to measure the effect of currency substitution on money demand:

$$\frac{M_t}{P_t} = C e^{-(\beta \pi^e + \gamma \dot{e}^e)} \qquad (1)$$

in which M_t denotes nominal money demand at time t, P_t the price level, π^e the expected rate of inflation and $\dot{e}^e$ the expected rate of depreciation. Money demand in (1) is assumed to be homogeneous of order one in prices. Taking logarithms on both sides of (1) yields:

$$\ln m_t = c - \beta \pi^e - \gamma \dot{e}^e \qquad (2)$$

in which m_t is demand for domestic real money by domestic agents and c is equal to ln C. β and γ are respectively the semi-interest and semi-currency substitution elasticity of real money demand. The last elasticity measures by how much demand for real domestic money decrease from a 1% increase in the expected rate of depreciation of the domestic currency. In principle, we cannot rule out that γ is negative: in that case, foreign money is a complement to domestic

[5] In van Aarle (1994) a small country model is introduced to determine the possible social welfare consequences of the removal or imposition of currency controls. An empirical application was made in the case of Poland that lifted its system of currency controls on the 1th of January 1990.

money instead of a substitute. It is important to note that two important simplifications underlie the Cagan money demand function, namely that real output and the real rate of interest are constant -both assumptions find their way into the constant *C*-. Given that the Cagan money demand function was initially constructed to explain money demand during hyperinflations, these simplifications seem reasonable, since one would expect that real money demand in such turbulent periods is mainly driven by inflation expectations.

The demand for foreign money, F_t, by domestic agents is assumed to depend on a similar way on the expected rate of foreign inflation, π^{*e}, and the expected rate of depreciation:

$$\ln\left(\frac{e_t F_t}{P_t}\right) = \ln f_t = d - \eta\,\pi^{*e} + \theta \dot{e}^{e} \qquad (3)$$

in which f_t is the amount of real foreign money -in terms of domestic currency- demanded by domestic agents at time t. This demand for foreign money is a negative function of the expected rate of inflation on foreign money and a positive function of the expected rate of depreciation. In times of high inflation the latter variable will dominate the first variable which is likely to be more or less constant in the short run. The ratio f_t/m_t is often referred to as the dollarization ratio of the economy.

Regarding expectations formation, we will assume that agents possess perfect foresight regarding inflation and exchange rate depreciation, i.e. that $\pi^e=\pi$, $\pi^{*e}=\pi^*$ and $\dot{e}^e=\dot{e}$.

The 'currency substitution augmented' seignorage Laffer-curve

Currency substitution, via its influence on money demand, affects seignorage revenues accruing to the monetary authorities. Seignorage revenues are the revenues that accrue to the monetary authorities from their monopoly in creating national base money. Real seignorage revenues, s_t, are equal to the nominal rate of money growth, μ, times the amount of domestic real money balances in circulation:

$$s_t = \mu\, m_t = \mu\, C e^{-(\beta \pi^{e} + \gamma \dot{e}^{e})} \qquad (4)$$

In the absence of government debt, real seignorage revenues are the alternative to ordinary taxes, τ_t, in financing of real government expenditures, g_t:

$$g_t - \tau_t = d_t = s_t \tag{5}$$

in which d_t denotes the real fiscal deficit. The government budget constraint in (5) illustrates the inflationary impact of primary deficits in the absence of government debt: a deficit in such a situation is simply monetized. In steady state the rate of inflation, π, is equal to the rate of nominal money growth[6], $\pi=\mu$. Assume, furthermore, that relative purchasing power parity holds, i.e. $\dot{e}^e=\pi-\pi^*$. Steady state real seignorage revenues in the presence of currency substitution then can be written as:

$$s_t = \pi C e^{-(\beta\pi+\gamma(\pi-\pi^*))} = \pi C e^{-(\beta+\gamma)\pi+\gamma\pi^*} \tag{6}$$

In the rest of the paper the steady state seignorage Laffer-curve of (6) will be referred to as the 'currency substitution augmented' seignorage Laffer-curve. Figure 3 graphs the seignorage Laffer curve as a function of domestic inflation, for given values of $\{\beta,\gamma,C,\pi^*\}$[7].

The seignorage Laffer-curve displays the characteristic that a given amount of seignorage can be collected by imposing either a low or a high rate of inflation. In the next section empirical estimations of the real money demand function, (1), of a number of Eastern European countries are used to draw the 'currency substitution augmented' seignorage Laffer-curve of these countries. The slope of the 'currency substitution augmented' seignorage Laffer-curve is equal to:

$$\frac{\partial s_t}{\partial \pi} = (1-(\beta+\gamma)\pi)m_t \tag{7}$$

The rate of money growth, $\bar{\pi}$, that maximizes steady state seignorage revenues, s^{max}, is found when putting the partial derivative of s_t with respect to π equal to zero, which results in:

$$\bar{\pi} = \frac{1}{\beta+\gamma} \tag{8}$$

This leads to an interesting result: the revenue maximizing rate of inflation is lower in a situation with currency substitution ($\gamma>0$) than in a situation without currency substitution ($\gamma=0$). In the

[6] More generally, if steady state real output grows at a constant rate, g_y, steady state inflation will be equal to the rate of money growth minus the growth rate of real output, i.e. $\pi=\mu-g_y$.

[7] The foreign rate of inflation is not a parameter in the strict sense, but can be considered to be given from the perspective of a small domestic country, since its actions will have no influence on the foreign rate of inflation.

absence of currency substitution the well-known result that real seignorage revenues are maximized when the rate of inflation is equal to the inverse of the absolute value of the interest rate elasticity, i.e. $\bar{\pi}=1/\beta$, remains. Here, it becomes clear that this is actually a special case of a more general setting that allows for the possibility of currency substitution. By comparing the actual inflation rate to the rate of inflation that would maximize steady state seignorage, it becomes clear on which place of the seignorage Laffer-curve a country finds itself and how much scope there remains to increase seignorage revenues by means of higher inflation.

A change in currency substitution possibilities from the removal of currency controls could be interpreted as a permanent increase in γ since that would imply that the demand for real domestic money becomes more sensitive to a change in the expected rate of depreciation -or more in general to foreign influences- of the domestic currency. In the empirical part we test whether the reform programs that were introduced, had such a permanent effect on γ of the Eastern European countries. The effect on seignorage revenues from an increase in γ is found when differentiating (6) w.r.t. γ:

$$\frac{\partial s_t}{\partial \gamma} = -(\pi - \pi^*)\,\pi\, C e^{-(\beta \pi + \gamma(\pi - \pi^*))} \qquad (9)$$

If domestic inflation exceeds the foreign rate of inflation, steady state real seignorage revenues decrease if γ increases. If money demand is elastic w.r.t. depreciation expectations, seignorage revenues are responsive to depreciation expectations as well. Through the seignorage Laffer curve, currency substitution is seen to influence public finance. An increase in γ, and also an increase in β, implies that the rate of domestic credit growth that maximizes steady state real seignorage moves to the left, i.e. becomes lower. In figure 3 the downward shift and leftward rotation of the seignorage Laffer-curve from an increase of γ -or β- is indicated.

Financial Innovations

Money demand in industrial countries during the 1980s has been subject to several financial innovations. These financial innovations had the effect that traditional formulations of the money demand functions displayed -when estimated- a high degree of parameter instability. Financial innovations have an impact on the individual's demand for traditional money in that they facilitate transactions and provide liquid, interest bearing substitutes for traditional money. It this manner

the economic agent is able to economize on his real money balances. Apart from the lower predictability and controllability of traditional monetary aggregates, financial innovation will lower seignorage revenues at a macro-economic level. Such a decrease in seignorage revenues has to be compensated by higher ordinary taxation that is costly from a social welfare point of view when ordinary taxes are distortionary, a point elegantly worked out by de Grégorio (1991). Arrau, De Grégorio, Reinhart and Wickham (1991), analyze extensively the effects and importance of financial innovations in developing countries.

In our simple model financial innovations consist of negative shocks in *C*, the constant in the money demand function. The effects from a change in *C* on seignorage revenues are found when differentiating s_t with respect to C:

$$\frac{\partial s_t}{\partial C} = \pi e^{-(\beta+\gamma)\pi+\gamma\pi^*} \geq 0 \qquad (10)$$

The inflation rate that maximizes steady state real seignorage revenues is not affected if financial innovations are defined as changes in *C*.

An important source of financial innovations in Eastern Europe is found in the liberalization of financial markets that has taken place. As a consequence of the liberalization programs, private banking systems have been established. The countries are likely to differ in the extent to which such reform programs have already reshaped the institutional structure of financial markets. Hungary, Poland and the Czech Republic, countries that launched liberalization- and reform programs at an earlier stage or at a higher intensity have reached a higher stage in the process than the other countries. In our empirical analysis we test also for a negative shift in the constant of the macroeconomic money demand at the time reforms were introduced. Note that such a downward shift in the constant part of money demand must be attributed to both financial innovations and the drop in real output or the increase in real interest rates that took place in Eastern Europe.

3. Currency Substitution in Eastern Europe

Empirical studies on currency substitution are marked by a large diversity of money definitions that are used. Currency substitution can be present at all levels of monetary aggregation. Currency substitution interpreted in the strict sense applies to circulation of foreign currency

in the domestic economy. Currency substitution applied in the most broad sense would apply to such an extensive monetary aggregate as broad money, *M2*. The distinction between currency substitution and capital flight is blurred if one uses such a broad definition, since a considerable part of *M2* usually consists of interest bearing monetary assets. The interest bearing part of *M2* consists of time - and saving deposits and foreign currency deposits and is often referred to as quasi-money, *QM*.

In the empirical part estimations of money demand are restricted to currency in circulation (*C*), base money (*M0*) and narrow money (*M1*), whenever data could be obtained. The demand for foreign money is approximated by the demand for foreign currency deposits (*F*), on which sometimes data are available. Data on the amount of foreign currency in circulation in the domestic economy are not available. The amount of foreign currency deposits should be considered as a conservative indicator of currency substitution in the economy. Table 1 provides the datasources and sample sizes of the variables of our dataset. It was unfortunately not possible to create a reasonable dataset in the case of the (former) Soviet Union.

There are several problems and reservations regarding an empirical investigation of currency substitution in Eastern Europe. There are serious data problems: data on domestic money in circulation, consumer prices and output in Eastern Europe, generally are only available for a short sample period, of dubious quality or simply not available, e.g. in the case of the recent division between the Czech Republic and Slovakia data on them separately, are not available regarding the period before the division. The quality of data and the limited number of observations will necessarily affect the estimation results.

The money demand functions were estimated with the use of the Error Correction Method (ECM), as introduced by Engle and Granger (1987). This method allows to separate long term behavior of money demand from short term behavior. The difference between short term and long term behavior can be important in Eastern European countries, given that their economies are currently in an out of equilibrium, transitional phase. The ECM relies on a two-step procedure: first the 'static' money demand function is estimated. This static money demand function defines long term money demand. If the dependent and independent variables are nonstationary, a regression between them could give rise to spurious regression results. But if a cointegrating relation between the dependent and independent variables can be found, OLS actually produces super-consistent estimates of the variance-covariance matrix of the model parameters. A cointegration relationship

between the dependent and independent variables exists, if the error-term in the static regression equation turns out to be stationary.

Table 2 indicates that almost all dependent and independent variables are nonstationary. The Dickey-Fuller test indicates nonstationarity of a variable if its test statistic is higher than the critical value. The second step consists of estimating a dynamic version of the static money demand function, inserting the lagged error term of the latter as an explanatory variable, the error-correction term. The parameter estimate of this lagged error term money provides more information of the adjustment speed of money demand towards equilibrium[8].

Using ordinary least squares, (2) and (3)[9] were estimated as:

$$\ln\left(\frac{M_i}{P}\right)_t = c_i + \delta_i D_t - \beta_i^{lt}\pi - \gamma_i^{lt}\dot{e} - \eta_i D_t \dot{e} + \varepsilon_{it} \qquad (11)$$

in which *C*, *M0*, *M1* and *F* are the monetary aggregates that were used. β_i^{lt} and γ_i^{lt} denote the long-run nominal interest rate and currency substitution semi-elasticities of the real demand for the respective monetary aggregates. Note that in the case of foreign currency deposits, *F*, domestic inflation is replaced by US inflation, in accordance with (3).

In the theoretical analysis some attention was paid to the possibility that money demand is subject to financial innovations over time that could translate in permanent decreases in the constant *C* of the money demand functions. It was shown how a financial innovation would induce a downward shift in the seignorage Laffer-curve. With respect to Eastern Europe it was remarked that the process of liberalization and deregulation of financial markets, started in 1990 and 1991, could be looked upon as a form of financial innovation. The restoring of currency convertibility resulting from removing currency controls was expected to have made money demand also more sensitive to currency substitution. Apart from financial liberalization, the reform programs of '90/'91 were accompanied by a drop in (officially recorded) output.

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[8] In his study on Poland, Lane (1992b) finds evidence that the adjustment speed towards monetary equilibrium in this socialist economy was quite high, in contrast to the traditional view that money is largely passive in a socialist economy. Our results largely support this view.

[9] Instead of estimating (2) and (3) separately, a large number of empirical currency substitution studies, estimate a regression of π and $\dot{e}^e$ on the dollarization ratio m_t/f_t. Examples include, amongst others, Miles (1978) in the case of $ currency substitution in Canada, Ramirez-Rojas (1985) in the case of Argentina, Uruguay and Mexico, and Clements and Schwartz (1993) for Bolivia.

In order to investigate the possible effects on real money demand from financial liberalization and the drop in real output a dummy on the constant was added to (2) to see whether there has been significant effects from them on money demand. Also a dummy on the slope of the expected rate of depreciation was added to capture possible effects on real money demand from removals of currency controls. The dummy D_t takes a value of 0 before the liberalization program and a value of 1 afterwards. In cases were the dummies turned out to be insignificant, the money demand functions were estimated without the reform dummy. δ_i and η_i measure the effects of the dummy associated with the reform programs. The use of dummies to capture the effects of financial innovations is also found in Clements & Schwartz (1993) and Lane (1992b).

Not entirely without arbitrariness, the dates of the reform programs were fixed at:

Hungary	:	February 1991
Poland	:	January 1990
Czechoslovakia	:	January 1991
Czech Republic	:	-
Bulgaria	:	January 1991
Romania	:	April 1991

A common element in the reform programs were measures to achieve price liberalization and to restore current account convertibility. Capital account convertibility and financial liberalization still lag behind the liberalization of currency restrictions and trade restrictions, mainly because of the fear that speculative capital movements could disrupt foreign exchange markets. The process of liberalization was introduced in a "big bang" fashion as in Poland, Bulgaria and Czechoslovakia or in a more gradual fashion as in Hungary and Romania.

To avoid multicollinearity problems if both the expected rate of inflation and the expected rate of depreciation are included as explanatory variables, we follow Ramirez-Rojas (1985) and other empirical currency substitution studies, in taking the following proxy of the expected rate of (black market) exchange rate depreciation:

$$\dot{e}^{e} = \ln P_t - \ln P_t^{*} - \ln e_t^{b} \qquad (12)$$

in which P_t^{*} is the world price level and e_t^{b} is the US $ spot rate of domestic currency in the black market for foreign exchange. World prices P_t^{*} are approximated by the US Consumer Price Index at time t. According to (12), the expected rate of depreciation will be high when

the purchasing power of foreign money, the RHS of (12), is high as compared by the purchasing power of domestic money, as measured by the opposite of the RHS -(ln P_t-ln P_t^*-ln e_t^b).

The estimation results from (11) are summarized in table 3. In the *DF* column the Dickey-Fuller statistic regarding stationarity of the error term is recorded. A unit root in the error term can be rejected -at a 95% level of significance- if the *DF* test statistic is smaller than the 95% significance level, given in brackets below the *DF* statistic. If nonstationarity of the error term is rejected, a cointegrating relationship in the static money demand function is present and the ECM applicable.

The second step of the Error Correction Method consists of the estimation of the 'dynamic' money demand function that describes short-term behavior of money demand. The 'dynamic' money demand function is derived by estimating (11) in first differences after inserting the s.c. error-correction term, which consists of the lagged error term of the estimated static money function:

$$\Delta \ln(\frac{M_i}{P})_t = -\beta_i^{st} \Delta \pi - \gamma_i^{st} \Delta \dot{e} - \rho_i \epsilon_{it-1} + \nu_{it} \qquad (13)$$

β_i^{st} and γ_i^{st} are the short-term interest rate and exchange rate depreciation semi-elasticities of the money demand functions. The error-correction term $-\rho_i\varepsilon_{it-1}$ measures the adjustment of real money demand in each period towards its long term equilibrium level of (11). ρ_i measures the adjustment speed: a value of ρ_i of -0.5 e.g. implies that 50% of the adjustment towards long-term equilibrium occurs within one observation period. In the case of the Czech Republic, the error term of the estimated static money demand function is found to be non-stationary. Therefore, it was decided to refrain from estimating the dynamic money demand function in this case. The estimation results of (13) are summarized in table 4.

Discussion of the empirical results

From the empirical estimations in table 3 and 4, the following picture arises for the countries involved:

Bulgaria

Currency substitution has had a significant influence on real money demand in Bulgaria.

The estimation results regarding the demand for foreign currency deposits reinforce the currency substitution hypothesis. The estimates of δ_i and η_i suggest a strong impact of the 1991 reform package on monetary equilibrium in this country. The adjustment speed from the dynamic money demand, though imprecisely estimated, is relatively small in currency demand and demand for narrow money and relatively high in the case of demand for currency deposits. A value of 0.24 implies that the final adjustment towards steady state is achieved in about 4 quarters.

Hungary

Also in the case of Hungary currency substitution has had probably a strong effect on real currency demand. There is less evidence for strong influence on the demand for base money and narrow money. The implementation of reform programs has a longer history already in Hungary, which could explain why the estimated effect from the reform dummy, as indicated by δ_0, is fairly small.

Poland

Currency substitution has also influenced demand for money in Poland. A significant "reform" effect on the constants of the money demand functions is certainly present in Poland, that implemented its 1990 reforms at an unprecedented pace. Not all parameters are, however, estimated with a high degree of precision indicating at neglected variables systematically affecting money demand as well. Note that the error term in the static money demand function of F is non-stationary, indicating at the absence of a cointegrating relation and the need to be rather reserved in interpreting the estimation that is found. Chawluk and Cross (1994) in an insightful analysis of money demand in Poland, consider the possibility that shortages systematically influenced money demand before the 1990 reform and provide empirical evidence for such effects.

Romania

The results in the case of Romania are more or less consistent with those of Bulgaria and Poland, the other countries with high inflation rates during most of the sample period. The influence of currency substitution on monetary equilibrium in Romania is probably fairly important. The 1991 reform has caused a significant downward shift in the constant of the demand for

currency and base money, according to the estimates of δ_0. No signicifant effect on demand for narrow money and foreign currency deposits is found. Apart from the problem of the very short sample size, we have to note that reforms in Romania have proceeded in a very moderate pace up till now.

Czechoslovakia

No evidence of currency substitution is found in the case of the former Republic of Czechoslovakia. This might be explained by the fact that Czechoslovakia displayed a relatively high degree of monetary and economic stability, as compared to the other Eastern European countries. The reform program of 1991 has induced a downward shift in the constant of the money demand function.

The Czech Republic

Currency substitution has possibly also not been very influential in the new Czech Republic. The reform dummy was not included in the case of the Czech Republic, since it was established after the 1990/1991 reform wave in Eastern Europe. it is interesting to note that monetary stability in this new small country is high compared to the other Eastern European countries. A good indication thereof give figure 1 and 2: inflation has deceased to a low level and the degree of dollarization is actually declining the last year.

The estimation results suggest that the adjustment speed, though not always estimated with high precision, towards monetary equilibrium is in most cases in the range of -0.25 and -0.5, suggesting a reasonable adjustment towards steady state. This finding is in line with the finding of Lane (1992b) who found an error-correction coefficient of -0.57 in the case of Poland.

The parameter estimates of the static money demand functions for currency allow us the draw the 'currency substitution augmented' seignorage Laffer- curve for the Eastern European countries under consideration and to look at the impact of the reform programs on the 'currency substitution augmented' seignorage Laffer-curve, as measured by the estimated dummy coefficients. In figure 4 the change in the seignorage Laffer-curve are drawn in the case of Bulgaria and Poland, where these shifts appear to have been most prominent. As the source of seignorage revenues in both cases currency in circulation was taken.

The graphs reveal the strong impact from the reform programs on the seignorage Laffer-curve. In the case of Bulgaria not only a downward shift is present but also a leftward rotation from the increase in γ. The graphs also reveal the rate of inflation at which seignorage revenues are maximized. In the case of Bulgaria the seignorage maximizing rate of inflation decreased from around 81% to 67%. In Poland the seignorage maximizing rate of inflation is higher, namely around 137%.

4 Conclusions

In the inflationary environment that characterized Eastern Europe after the implementation of liberalization and reform programs, currency substitution has found a fertile soil. Currency substitution will complicate inflation stabilization efforts by the monetary authorities, since it reduces controllability and predictability of domestic money in circulation. Especially in situations were inflation stabilization programs do not encounter much credibility, a substantial rise in currency substitution will result, given the expected superiority of the foreign currency in securing purchasing power.

Furthermore, currency substitution affects public finance of the Eastern European economies as it implies that the tax base for the inflation tax, the amount of real base money in the economy becomes sensible to exchange rate depreciation expectations. The 'currency substitution augmented seignorage Laffer-curve' describes the effect of currency substitution on real seignorage revenues. The liberalization of current account transactions that was part of all reform programs, clearly has facilitate currency substitution.

The error-correction method was used to estimate both long-term and short-term money demand. The estimation results often supported the hypothesis that currency substitution has influenced money demand and by that monetary equilibrium in these countries. Empirical support was also found in many cases for a significant permanent shift in demand for real money balances from the reform programs. The design of monetary policies in Eastern Europe and their ultimate results are likely to benefit from more attention towards the presence of currency substitution in these economies. The effects on the seignorage Laffer curve from the drop in the constant term of the demand for real base money and the increased sensistiveness to depreciation expectations that has accompanied the reform and liberalization in Eastern Europe, were found

to be present in particularly in the case of Bulgaria and Poland

References

Aarle, B. van (1994), Currency Substitution and Currency Controls: the Polish Experience of 1990, Tilburg University Working Paper 637.

Agénor, J.P. (1992), Parallel Currency Markets in Developing Countries: Theory, Evidence and Policy Implications, Essays in International Finance 188. Princeton University.

Arrau, P. , De Grégorio, J., Reinhart, C. and Wickham, P. (1991), The Demand for Money in Developing Countries: Assessing the Role of Financial Innovation, IMF Working Paper, 91/45.

Bordo, M. and Choudri, E. (1982), Currency Substitution and the Demand for Money. Some Evidence for Canada, Journal of Money, Credit and Banking, **14**, 48-57.

Boyer, R. and Kingston, G. (1987), Currency Substitution under Finance Constraints, Journal of International Money and Finance, **6**, 235-250.

Bruno, M. (1992), Stabilization and Reform in Eastern Europe. A Preliminary Evaluation, IMF Staff Papers, **4**, 741-777.

Cagan, P. (1956), The Monetary Dynamics of Hyperinflation. In M. Friedman (ed.), Studies in the Quantity Theory of Money. University of Chicago Press.

Calvo, G. (1985), Currency Substitution and the Real Exchange Rate: the Utility Maximization Approach, Journal of International Money and Finance, **4**, 175-188.

Calvo, G. and Kumar, M. (1993), Financial Sector Reforms and Exchange Arrangements in Eastern Europe, IMF Occasional Paper 102.

Chawluk, A. and Cross, R. (1994), Zloty and Dollar Balances in Poland. 1965-1993, The Manchester School Supplement 1994, 41-66.

Clements, B. and Schwartz, G. (1993), Currency Substitution: the Recent Experience of Bolivia, World Development, **21**, 1993, 675-704.

Engle, R. and Granger, C. (1987), Co-integration and Error Correction: Representation, Estimation, and Testing, Econometrica, **55**, 251-276.

Grégorio, J. de (1991), Welfare Costs of Inflation, Seignorage, and Financial Innovation, IMF Staff Papers, **38**, 675-704.

Guidotti, P. and Rodriguez, C. (1992), Dollarization in Latin America. Gresham's Law in Reverse,

IMF Staff Papers, **39**, 518-544.

Lane, T. (1992a), Inflation Stabilization and Economic Transformation in Poland: the first year, Carnegie-Rochester Conference Series on Public Policy, **36**, 105-156.

Lane, T. (1992b), Household Demand for Money in Poland. Theory and Evidence, IMF Staff Papers, **39**, 825-854.

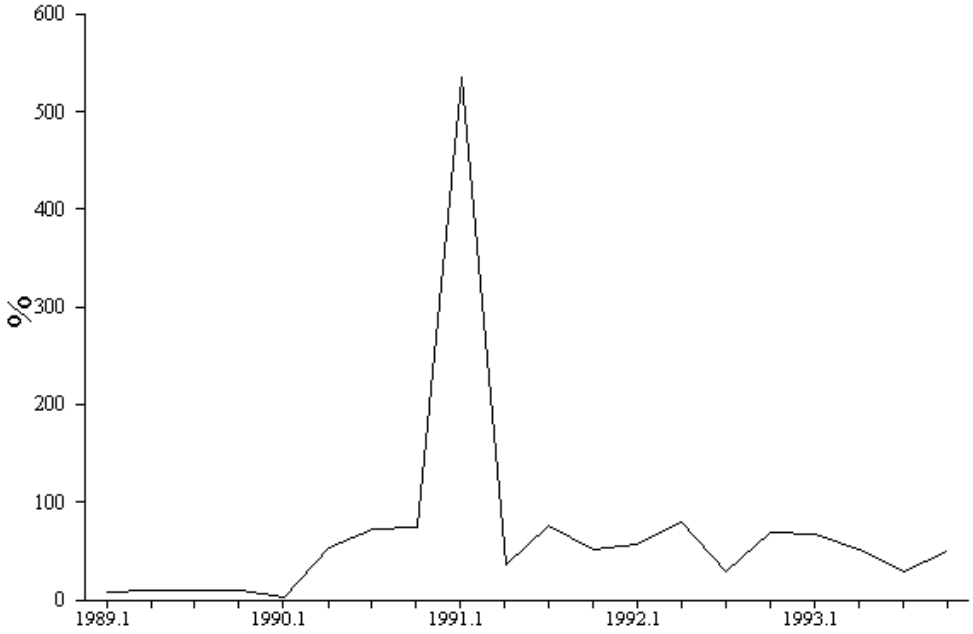
Miles, M. (1978), Currency Substitution, Flexible Exchange rates, and Monetary Independence, American Economic Review, **68**, 428-436.

Ramirez-Rojas, C. (1985), Currency Substitution in Argentina, Mexico and Uruguay, IMF Staff Papers, **32**, 629-667.

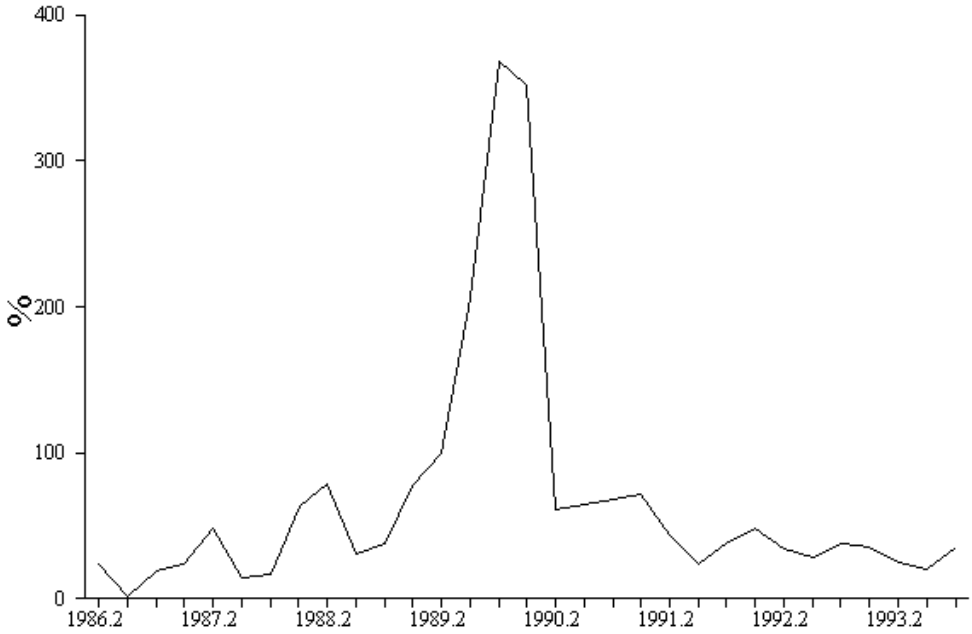
Solimano, A. (1993), The Postsocialist Transitions in Comparative Perspective: Policy Issues and Recent Experience, World Development, **21**, 1823-1835.

World Currency Yearbook 1988-1989 (1990). International Currency Analysis Inc. New York.

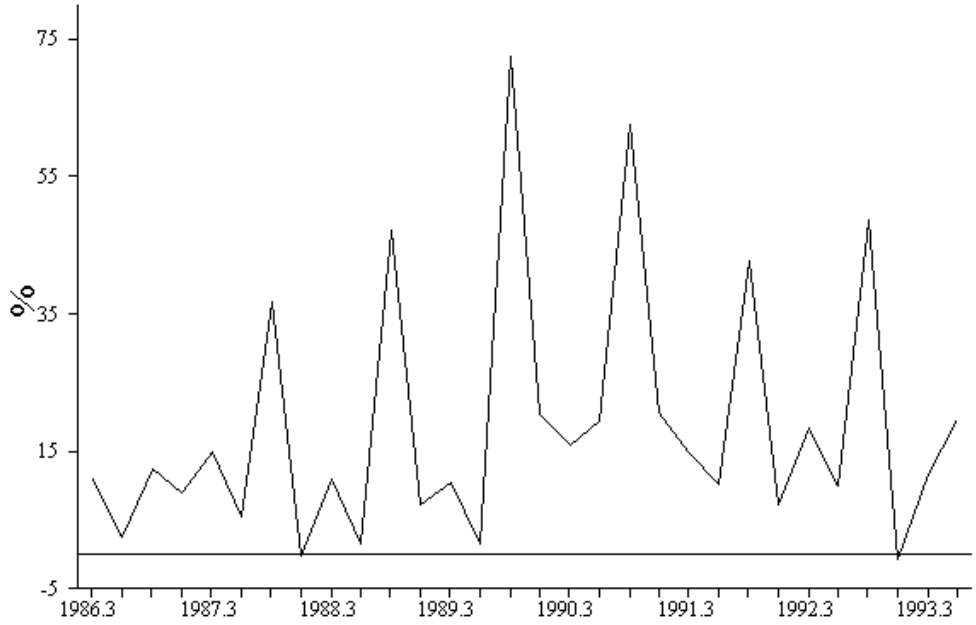
BULGARIA
annualized rate of inflation



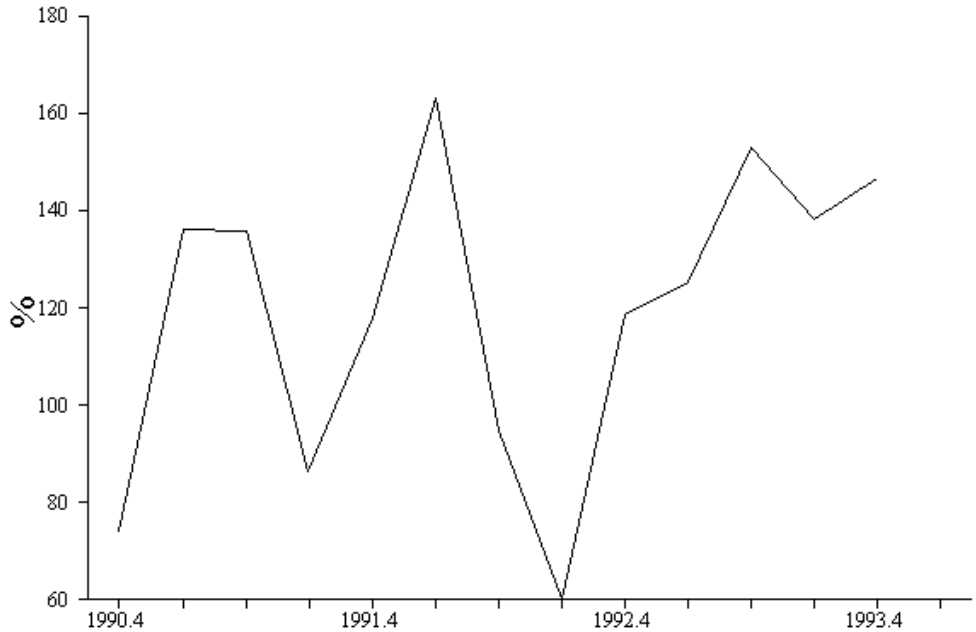
POLAND
annualized rate of inflation



HUNGARY
annualized rate of inflation



ROMANIA
annualized rate of inflation



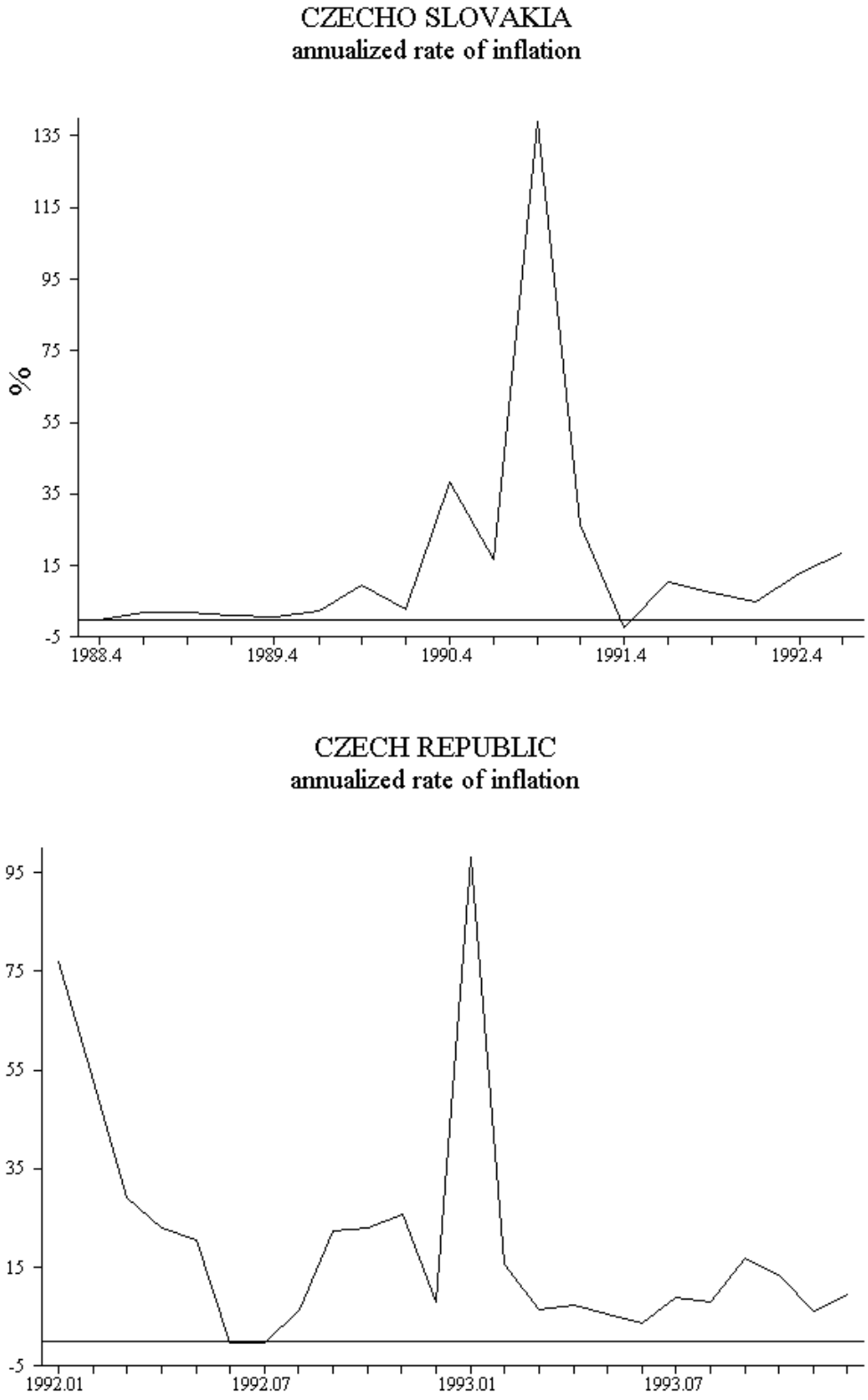
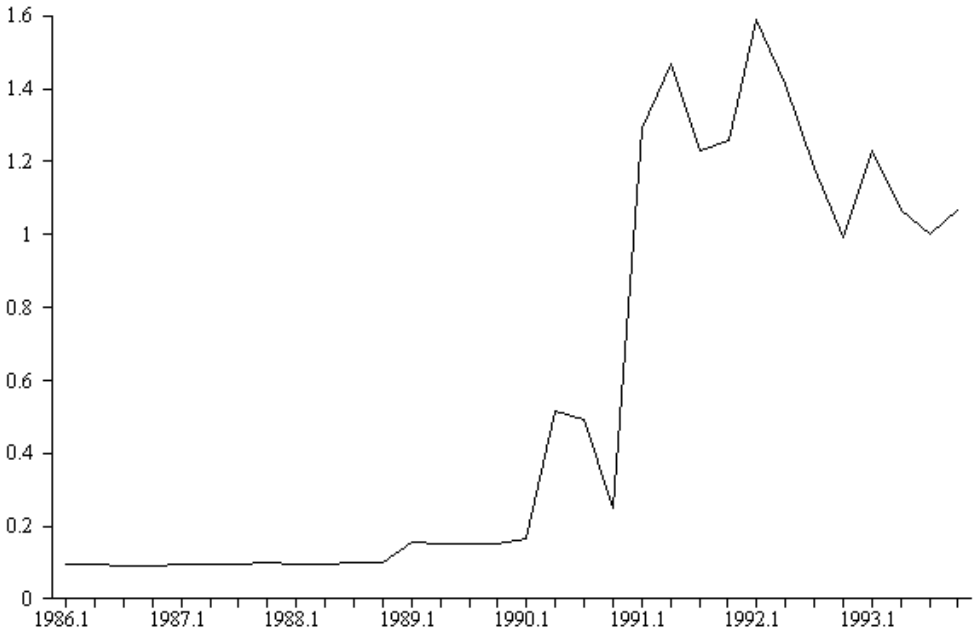
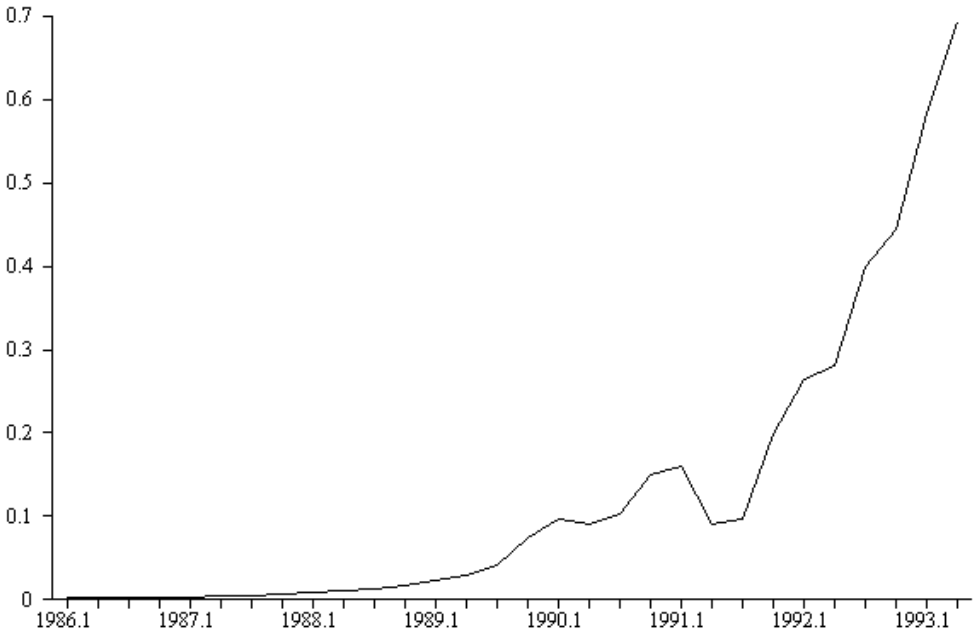


Figure 1. Inflation rates in Eastern Europe.

BULGARIA
foreign currency deposits/M1 ratio

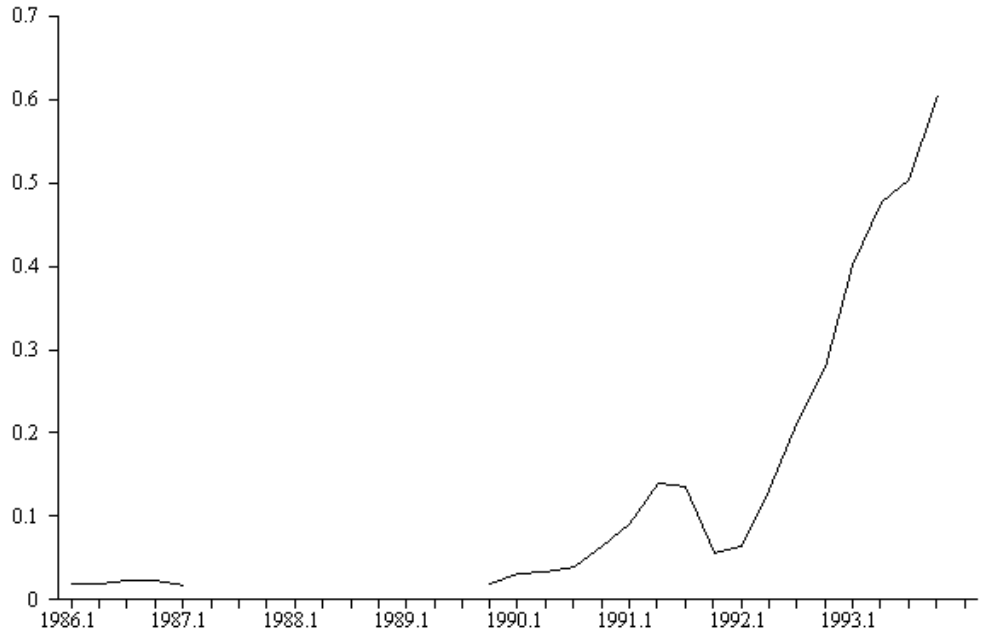


POLAND
foreign currency deposits/M1 ratio



HUNGARY
foreign currency deposits/M1 ratio

ROMANIA
foreign currency deposits/M1 ratio



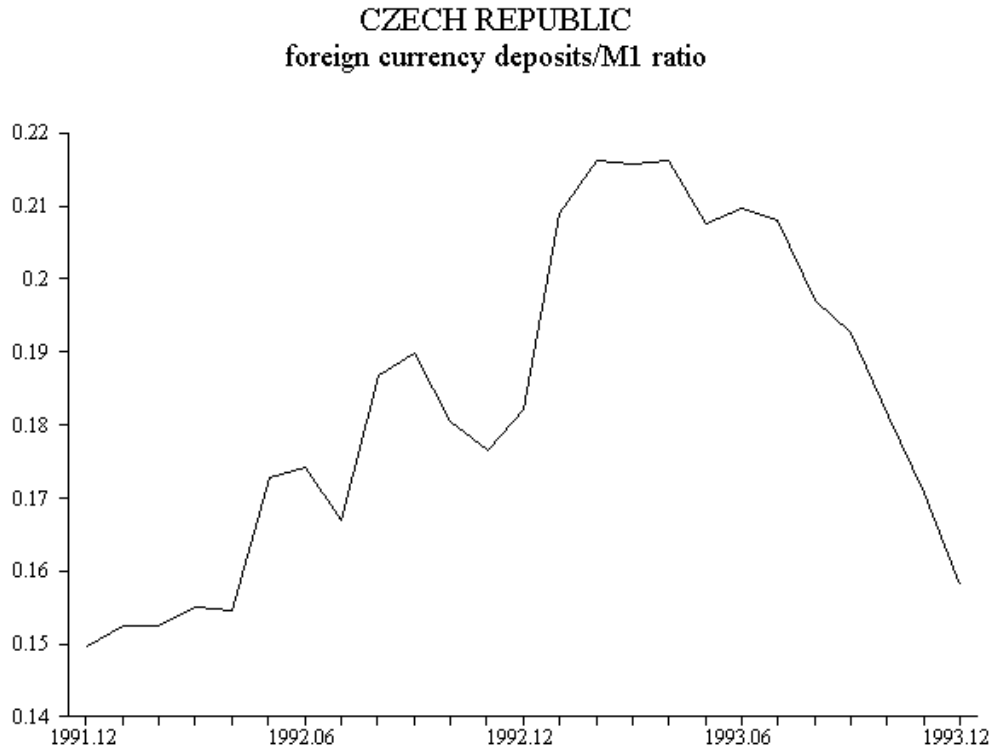


Figure 2. Dollarization in Eastern Europe.

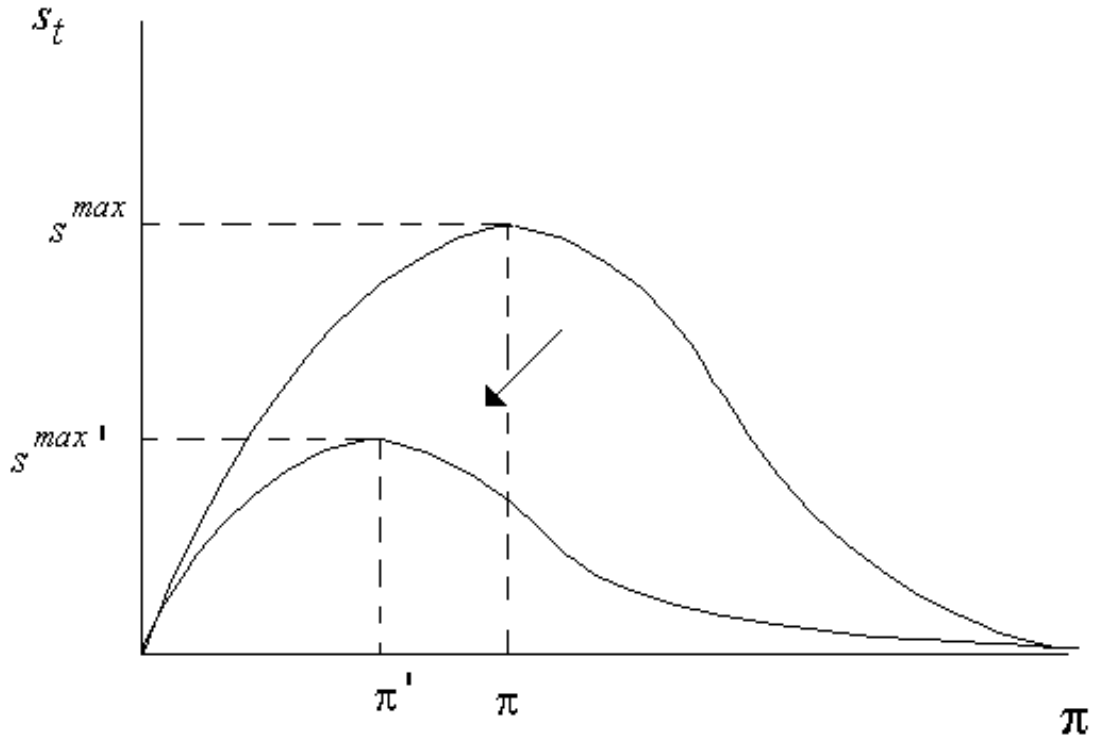


Figure 3. The ’currency substitution augmented’ seignorage Laffer curve.

	Bulgaria	*Hungaria*	*Poland*	*Romania*	*Czecho-slovakia*	*Czech Republic*
C	*X (BNB)*	*X (IMF)*	*X (IMF)*	*X (IMF)*	*X (IMF)*	*X (CNB)*
M0	*n.a.*	*X (IMF)*	*X (IMF)*	*X (IMF)*	*X (IMF)*	*X (CNB)*
M1	*X (BNB)*	*X (IMF)*	*X (IMF)*	*X (IMF)*	*X (IMF)*	*X (CNB)*
F	*X (BNB)*	*X (NBH)*	*X (PNB)*	*X (IMF)*	*n.a.*	*X (CNB)*
P	*X (BNB)*	*X (IMF)*	*X (IMF)*	*X (IMF)*	*X (IMF)*	*X (CNB)*
e^b	*X (WCY)*	*X (WCY)*	*X (WCY)*	*X (WCY)*	*X (WCY)*	*X (WCY)*
no.obs.	*20*	*32*	*30*	*14*	*15*	*24*
period	*89I- 93IV*	*86I-93Iv*	*86I-93II*	*90III-93IV*	*88I-91IV*	*92:01-93:12*

Table 1. Characteristics of the dataset. X means available, n.a. not available.

Datasources are indicated by IMF: International Financial Statistics, BNB: Bulgarian National Bank Annual Report, HNB: Hungarian National Bank Monthly Report, NBP: National Bank of Poland Monthly Bulletin,WAY: World Currency Yearbook, CAB: Czech National Bank: Annual Report.

	CU/P	*M0/P*	*M1/P*	*F/P*	π	$\dot{e}^{e}$
Bulgaria	*-0.81* *[-3.02]*	-	*-1.58* *[-3.02]*	*-1.58* *[-3.02]*	*-2.59* *[-3.02]*	*-0.75* *[-3.02]*
Hungary	*-0.83* *[-2.99]*	*1.13* *[-2.99]*	*-2.10* *[-2.99]*	*-2.50* *[-3.07]*	*-5.84* *[-2.99]*	*0.48* *[-2.99]*
Poland	*-1.06* *[-2.97]*	*-0.77* *[-2.97]*	*-0.54* *[-2.97]*	*-0.49* *[-2.97]*	*-2.17* *[-2.97]*	*-1.05* *[-2.97]*
Romania	*-1.69* *[-3.12*	*-1.23* *[-3.12]*	*-0.83* *[-3.12]*	*-1.37* *[-3.12]*	*-3.07* *[-3.12]*	*6.80* *[-3.18]*
Czecho-Slovakia	*-0.77* *[-3.10]*	*-0.54* *[-3.10]*	*-1.14* *[-3.10]*	-	*-3.47* *[-3.10]*	*-1.02* *[-3.10]*
Czech Republic	*-1.65* *[-2.99]*	-	*-1.82* *[-2.99]*	*-1.45* *[-2.99*	*-4.30* *[-2.99*	*-1.37* *[-2.99*

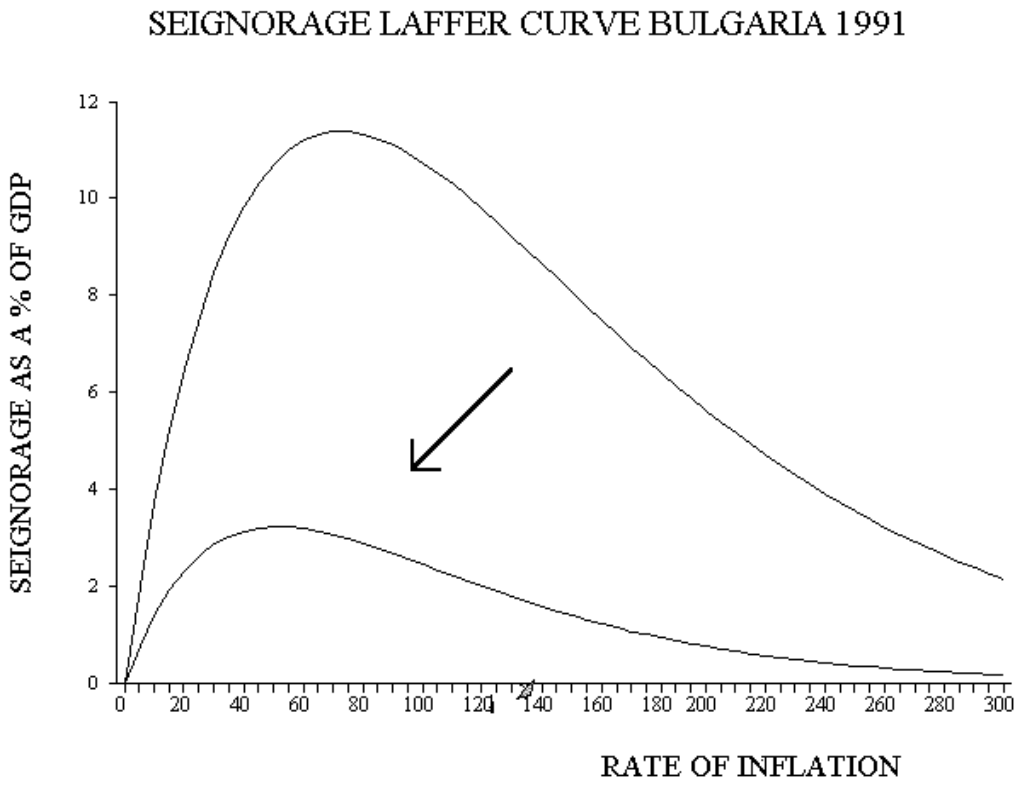
Table 2. Dickey-Fuller test on stationarity of the variables. 95% critical values in brackets.

	c_i	δ_0	β_i^{lt}	γ_i^{lt}	η_i	$\bar{R}^2$	S.E.	DF
Bulgaria C	*3.01* (12.49)*	*-0.92* (-5.79)*	*-1.23* (-13.09)*	*-0.01 (-0.01)*	*-0.26* (-1.72)*	*0.99*	*0.09*	*-3.52 [-3.03]*
M1	*5.34* (12.16)*	*-2.77* (-6.08)*	*-1.44* (-11.22)*	*0.08 (0.45)*	*-0.55* (-2.51)*	*0.99*	*0.13*	*-3.32 [3.03]*
F	*1.97* (2.70)*	*0.33 (0.91)*	*2.12 (0.21)*	*0.62* (2.29)*	*0.43 (1.44)*	*0.32*	*0.33*	*-3.43 [-3.03]*
Hungary C	*3.48* (3.29)*	*-0.12* (-2.02)*	*-0.19* (-2.37)*	*-0.42* (-3.30)*	*-*	*0.82*	*0.07*	*-4.54 [-2.99]*
M0	*0.98* (2.21)*	*0.09* (1.72)*	*-0.13* (-3.06)*	*0.03 (0.30)*	*-*	*0.28*	*0.08*	*-4.57 [-2.99]*
M1	*0.28 (0.47)*	*-0.14* (-2.03)*	*-0.23* (-5.09)*	*-0.13 (-0.89)*	*-*	*0.63*	*0.08*	*-4.30 [-2.99]*
F	*3.50* (4.88)*	*0.37* (1.73)*	*1.81 (0.37)*	*1.06* (2.93)*	*-*	*0.83*	*0.15*	*3.44 [-3.08]*
Poland C	*2.18* (3.73)*	*-0.52* (-11.88)*	*-0.21* (-3.09)*	*-0.54 (-0.11)*	*-*	*0.93*	*0.08*	*-3.96 [-2.97]*
M0	*1.83* (1.79)*	*-0.63* (-8.02)*	*-0.03 (-0.50)*	*-0.23 (-1.14)*	*-*	*0.87*	*0.14*	*-3.41 [-2.97]*
M1	*0.17 (0.14)*	*-0.51* (-5.69)*	*-0.25* (-4.07)*	*-0.57* (-2.51)*	*-*	*0.84*	*0.16*	*-3.28 [-2.97]*
F	*3.09 (1.14)*	*0.54* (4.59)*	*0.93 (1.05)*	*1.35 (0.81)*	*-*	*0.80*	*0.39*	*-2.82 [-2.97]*
Romania C	*4.40 (19.82)*	*-0.45* (-3.75)*	*-0.33* (-1.94)*	*-0.16* (-2.65)*	*-*	*0.81*	*0.16*	*-3.24 [-3.18]*
M0	*5.36* (15.26)*	*-0.80* (-4.17)*	*-0.21 (0.80)*	*-0.14 (-1.57)*	*-*	*0.73*	*0.26*	*-3.31 [-3.18]*
M1	*5.01* (14.04)*	*-0.17 (-0.88)*	*-0.12 (-0,45.)*	*-0.33* (-3.52)*	*-*	*0.66*	*0.26*	*-3.20 [-3.18]*
F	*2.55* (5.18)*	*0.47 (0.18)*	*0.34 (0.12)*	*1.31* (2.74)*	*-*	*0.38*	*0.34*	*-3.15 [-3.18]*
Czecho-Slovakia C	*-0.46 (1.76)*	*-0.39* (-9.35)*	*-0.50* (-2.07)*	*0.02 (0.25)*	*-*	*0.94*	*0.04*	*-3.40 [-3.10]*
M0	*0.16 (0.15)*	*-0.64* (-3.93)*	*0.42* (4.06)*	*0.05 (0.16)*	*-*	*0.57*	*0.20*	*-3.30 [-3.10]*
M1	*0.79* (1.97)*	*-0.34* (-4.78)*	*-0.14* (-3.95)*	*-0.05 (-0.49)*	*-*	*0.86*	*0.08*	*-3.18 [-3.10]*
Czech Republic C	*2.57* (11.17)*	*-*	*-0.24 (-1.40)*	*-0.03* (-5.27)*	*-*	*0.53*	*0.19*	*-1.66 [-2.99]*
M1	*5.23 (60.04)*	*-*	*-0.01 (0.06)*	*-0.01* (-2.74)*	*-*	*0.20*	*0.07*	*-0.69 [-2.99]*
F	*3.90* (45.61)*	*-*	*-0.05 (-0.81)*	*0.01 (1.31)*	*-*	*0.13*	*0.07*	*-1.27 [-2.99]*

Table 3. Estimation of the static money demand function. t-statistics in parentheses.
* means significant at a 90% level of confidence.

	β_i^{st}	γ_i^{st}	ρ_i	$\bar{R}^2$	S.E.
Bulgaria C	*-0.34** *(-2.15)*	*-0.50** *(-2.34)*	*-0.24* *(0.37)*	*0.49*	*0.22*
M1	*-0.34** *(-1.81)*	*-0.61** *(-2.43)*	*-0.40* *(0.57)*	*0.43*	*0.27*
F	*-0.29* *(1.03)*	*0.31* *(0.14)*	*-0.45** *(-2.02)*	*0.22*	*0.27*
Hungary C	*-0.12** *(-2.28)*	*-0.22* *(-1.38)*	*-0.28* *(-1.21)*	*0.38*	*0.06*
M0	*-0.05** *(-2.03)*	*-0.11* *(-1.26)*	*-0.46** *(-3.12)*	*0.19*	*0.07*
M1	*-0.14** *(-2.78)*	*-0.25* *(-1.71)*	*-0.58** *(-3.03)*	*0.44*	*0.08*
F	*-0.23* *(-0.11)*	*0.63** *(1.84)*	*-0.21* *(-0.83)*	*0.14*	*0.12*
Poland C	*-0.09** *(-2.92)*	*2.24* *(1.18)*	*-0.24* *(-0.58)*	*0.37*	*0.08*
M0	*-0.03* *(-1.42)*	*3.91* *(0.97)*	*0.18* *(0.51)*	*-0.02*	*0.15*
M1	*-0.13** *(-5.47)*	*2.31* *(1.44)*	*-0.19* *(-0.86)*	*0.51*	*0.09*
Romania C	*-0.17* *(-1.50)*	*-0.02* *(-1.47)*	*-0.71** *(-2.21)*	*0.24*	*0.15*
M0	*0.12* *(0.52)*	*-0.15* *(-0.67)*	*-0.50** *(-1.20)*	*0.05*	*0.29*
M1	*0.05* *(0.24)*	*-0.32* *(-1.68)*	*-0.85** *(-2.38)*	*0.15*	*0.24*
F	*2.11* *(0.26)*	*0.19* *(0.85)*	*-0.36* *(-1.17)*	*0.09*	*0.28*
Czecho-Slovakia C	*-0.09* *(-1.52)*	*-0.20* *(-1.48)*	*0.24* *(0.40)*	*0.42*	*0.08*
M0	*0.13* *(0.89)*	*-0.56* *(-1.29)*	*-0.72** *(-2.22)*	*0.47*	*0.18*
M1	*-0.10* *(-1.47)*	*-0.30** *(-2.09)*	*-0.42* *(-1.31)*	*0.41*	*0.09*

Table 4. Estimation of the dynamic money demand function. t-statistics in parentheses. *means significant at a 90% level of confidence.



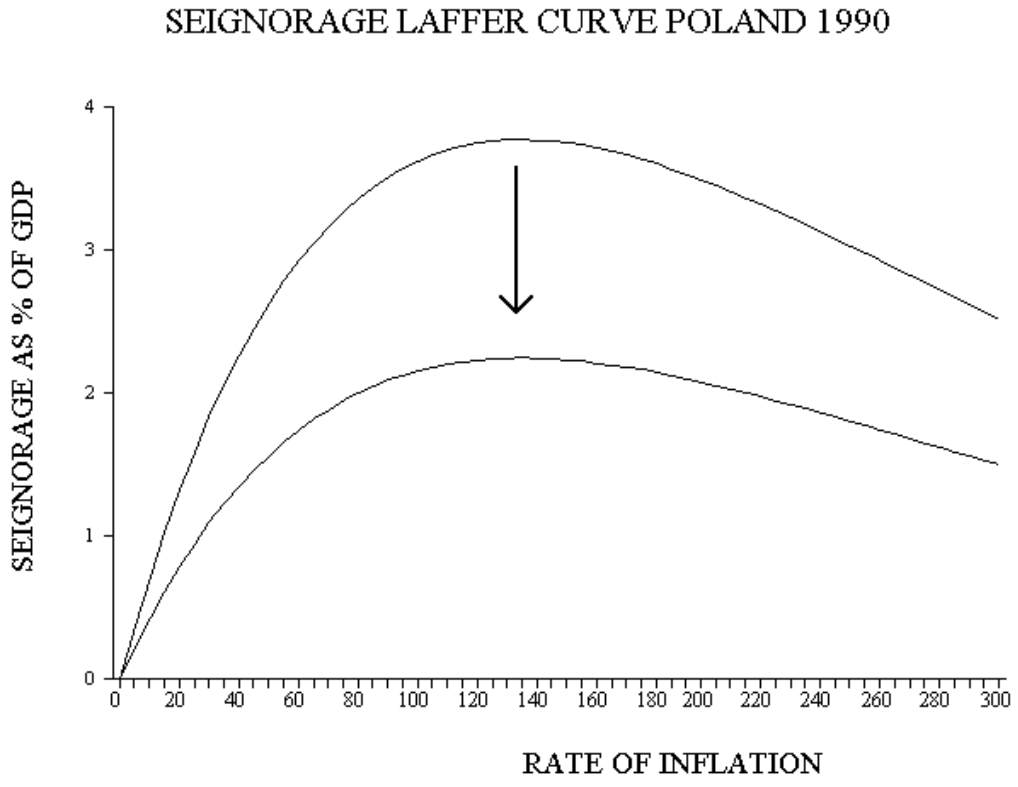


Figure 4. Reform shifts in the currency substitution augmented seignorage Laffer-curve in Bulgaria and Poland.