

CURRENCY CRISES IN TRANSITION ECONOMIES: AN EMPIRICAL ANALYSIS

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This paper examines the causes of turbulence in foreign exchange markets by looking closely at the experience of four transition economies (Bulgaria, Romania, Russia, Ukraine). It considers the influence of macroeconomic variables in currency crises occurrence through the use of logit models. In an environment of deteriorating fundamentals the examined issue is whether or not some fundamentals are able to maximise the likelihood of currency crisis incidence.

Keywords: currency crisis, monetary policy, transition economies

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1. INTRODUCTION

Preventing the occurrence of currency problems is undoubtedly a major concern of policymakers – and an understanding of the mechanisms that are behind the upsurge of financial crises is a first step in this direction. Given this, an important path of research has now been developed in an attempt to provide the answers to a range of questions related to the causes and degree of predictability of currency crises.

So far, speculative attacks and devaluation crises have been associated with the developing countries. In the present paper there is an analysis of currency crisis mechanisms within a rather unusual environment: in a subgroup of four transition economies. In these examined economies currency developments are a crucial issue that strongly affects monetary policy. Consequently, a better understanding of the interrelationships among monetary variables can provide valuable guidance, of a sort identifying the type of policy that can help a transition economy avoid currency problems. There is also an attempt here to evaluate the influence of macroeconomic variables on the probability of currency crisis occurrence by the use of logit models. Previous research with currency crises in developing and developed countries can be considered as the main building block

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for this work, although different causes may account for currency crashes within transition economies.

The paper is laid out as follows. Section 2 reviews the literature on the causes of a currency crisis. Section 3 provides a brief overview of monetary policies being pursued in the examined economies. A data description is given in Section 4. Section 5 deals with the econometric model and empirical findings. Finally, in Section 6 some policy lessons and remarks are made. Related figures are given at the end of the paper.

2. PREVIOUS THEORETICAL AND EMPIRICAL RESEARCH

There is a growing volume of literature that seeks to identify and/or predict circumstances under which countries might have a currency crisis. The first generation models provide the simplest framework in which such currency crises are described. According to these, a currency crisis comes from an inconsistency between the exchange rate pegging and domestic credit expansion. The basic idea is that speculative attacks are due to monetary and fiscal expansion, declining price competitiveness, current account deficits and losses in international reserves. A country that has a pegged exchange rate achieves the exchange rate target solely through direct intervention in the foreign exchange market. At the subsequent stage, domestic credit creation in excess of money demand growth leads to a gradual loss of reserves, and ultimately to a speculative attack. In a seminal paper, Krugman (1979) showed that under a fixed exchange rate system domestic credit creation in excess of money demand growth leads to a gradual but persistent loss of international reserves and, ultimately, to a speculative attack on the currency. The process ends with an attack because economic agents understand that the fixed exchange rate regime will ultimately collapse, and that in the absence of an attack they would suffer a capital loss on their holdings of domestic assets. This model suggests that the period preceding a currency crisis would be characterised by a gradual but persistent decline in international reserves and a rapid growth of domestic credit relative to the demand for money.

A number of papers have extended Krugman's basic model in various directions.¹ Some of these have shown that speculative attacks would commonly be

¹ For an overview of the theoretical and empirical developments see Agenor, Bhandari and Flood (1991), Eichengreen, Rose and Wyplosz (1995), Blackburn and Sola (1993), Garber and Svensson (1994), Flood and Marion (1999), Salant and Henderson (1986), Edwards (1989), Grilli (1990), Cumby and Wijnbergen (1988) Harris and Raviv (1989) and Kaminsky, Lizondo and Reinhart (1998).

proceeded by a real appreciation of the currency and a deterioration of the trade or current account balances by upward pressure as regards real wages and by higher interest rates. Extensions also include post-collapse exchange systems other than a permanent floating, the possibility of foreign borrowing, capital controls, imperfect asset substitutability and/or speculative attacks in which the domestic currency is under buying – rather than selling – pressures.

The second generation models show that a crisis may develop without a significant change in the fundamentals. In these models, economic policies are not predetermined but respond to changes in the economy, and economic agents take this relationship into account in forming their expectations. This set of assumptions opens up the possibility of multiple equilibrium and self-fulfilling crises. Second generation models also tend to focus on political factors, such as the political costs of high unemployment or foregone output. They are built on the inevitable collapse of a fixed or pegged exchange rate system, in which either the central bank mechanically expands domestic credit or by a self-fulfilling speculative attack. In the self-fulfilling model, a currency crisis emanates from an indeterminacy of equilibrium that might arise when agents expect a speculative attack to cause an abrupt change in government macroeconomic policy. Obstfeld (1986) presented an economy in which self-fulfilling expectations give rise to a continuum of the equilibrium. A belief that the authorities will respond to a crisis by resorting to heightened inflation makes it non-profitable for an individual to hold on to domestic currency. Expectation of a collapse will lead to higher wages and lower unemployment, which will prompt the government to abandon parity out of a concern for output (Obstfeld 1994). In a second model he showed that expectations of a collapse lead to higher interest rates, which may increase the likelihood of a banking crisis and the associated fiscal costs of a bailout (Obstfeld 1996). A government abandons parity because of worries about the increased cost of servicing public debt.

Most of the predictions of these models have been borne out empirically; that is, they attempt to predict currency crises either by a set of macroeconomic fundamentals or with a range of structural/financial explanations. Thus, empirical analysis of the cause of a currency crash has tended to coalesce around two perspectives, which might be termed a “macroeconomic fundamentals” crisis and a “bank run” crisis.²

In accordance with these views, the first research approach argues that countries with monetary and fiscal imbalances, current account deficits and so on are more likely to have a currency crisis; and, according to the second, microeconomic

² We borrow this term from Berg and Pattillo (1999).

problems such as weak banking supervision, corruption etc. trigger capital outflows and, finally, a currency attack. The proponents of this view use data from the Asian crisis to support their main ideas (Corsetti, Pesenti and Roubini 1998a, b).

The academic literature on “speculative attacks” is relevant to the analysis made here even though it remains an open question whether the currency crashes of transition economies are adequately explained by resorting to the aforementioned empirical framework. This is because the standard research path is largely limited to transition from a fixed exchange rate to a post-collapse floating exchange rate. Then, at some point (usually well before the gradual depletion of a government’s reserves), there is a sudden speculative attack that eliminates the last of the reserves, forcing an exchange rate reduction and an exchange rate regime to move to being free floating. In an effort to match the previous theoretical and empirical evidence with the examined transition economies one needs to give consideration to the peculiarities of the macroeconomic environment in such countries.

In contrast with other hyperinflation cases, in which domestic currency remained the principle medium of exchange, macroeconomic mismanagement in the examined transition economies led to the development of a dual economy, one in which the local currency ceased to be the medium of exchange or unit of account. This particular structure of the economy altered the conventional links between the existing exchange rate and prices as pointed to by the Purchasing Power Parity paradigm. Thus, the theoretical framework needs to incorporate the critical role often played in these countries by the parallel market dealing in foreign exchange in any diffusing of speculative pressures on the official rate.

Another peculiarity is associated with the foreign exchange reserves. Central banks in most cases would have run out of reserves before any currency crisis – so the supply of money will be the only liability left on the central bank balance sheet. A standard inference from stylised models (Agenor, Bhandari and Flood 1991) is that the “shadow” floating rate reflects market fundamentals – and it is almost simultaneously depreciated with every increase in central bank credit or money supply. In such a case, the “shadow” exchange rate plays the role of attractor of the existing exchange rate. The reason for this is simple: any exchange rate that does not equal or exceed the “shadow” rate will be attacked (profitably) or forced to be devalued. Alternatively, it might be thought that the deterioration of expectations regarding fundamentals (caused by the money growth) would lead to an increase in the risk premium pertaining to the domestic currency. The resulting increase in the risk premium will increase the gap between the official and parallel rates; and this will then raise prices and see an appreciation of the

real exchange rate, thus accelerating the collapse of the official exchange rate. The final outcome will be a devaluation of the nominal exchange rate. In both cases these frameworks are in accordance with the work of Cagan (1956), who argues that, under hyperinflation conditions, the money supply overrides all other influences in a determination of the foreign exchange rate.

According to Milesi-Ferretti and Razin (1998), a crisis takes place once the floating exchange rate that would prevail after the reserves have been exhausted (e^s) equals the pegged rate (e). Within a simple monetary framework, the following is a measurement of a vulnerability to speculative attacks:

$$\frac{e^s}{e} = \frac{1 - \mu \frac{eR}{M2}}{1 - \eta\pi}$$

where μ is the base money multiplier, $M2$ is broad money, R is the level of foreign exchange reserves, η is the interest semi-elasticity of the demand for money and π the rate of credit expansion. The attack takes place once the “shadow” exchange rate (e^s) equals the pegged exchange rate (e). In another work, Flood and Marion (1999) argue that a fixed rate will break down when domestic credit is growing at a constant rate, and the central bank’s assets will fall at the same rate.

3. MONETARY POLICY IN TRANSITION ECONOMIES

Here, attention will be focussed on four transition economies which have a number of characteristics in common. According to the EBRD’s transition indicators (Fries, Raiser and Stern. 1998) Bulgaria, Romania, Russia and Ukraine represent a group of countries in a less advanced stage of transition that have been exhibiting major fiscal constraints. Policy makers in these countries were unable to provide a stable macroeconomic environment in the early stages of transition in which economic reforms could flourish. Inflation in the economies examined sometimes met Cagan’s (1956) definition of hyperinflation: that is, inflation exceeding 50% in at least one month.³

³ It must be noted that although CPI-inflation seems to fluctuate around moderate levels, the underlying inflation was higher for a number of reasons. For instance, retail prices for a number of key products were kept artificially low by the imposition of profit margin controls. Also, CPI weightings have not been appropriately revised, and the interbank exchange rate was at a more appreciated level than was justified.

As regards monetary policy of each of these countries, it varies considerably, with certain characteristics being held in common but at the same time having a few unique, country-specific characteristics, too. The key players are the central banks, which are, typically, not independent of the fiscal authorities. Monetary policy, in most cases, has been driven by the need to finance large budget deficits. Credit policies were highly accommodating and repeatedly subject to direct intervention by the government and parliament. In Bulgaria, for example, money supply *M2* increased by more than 6200% between 1993 and 1999.

The development of local capital markets has been slow, decreasing the possibility of importing portfolio capital. Most importantly, the incomplete and highly regulated markets had, given all this, a volatility of prices and of real exchange rates – which were used to giving the wrong signals. These countries faced large relative and absolute price movements, which led to higher and uneven inflation compared to what existed in more advanced countries. It should be pointed out here that all transition economies have suffered to one degree or another from a lack of developed financial and fiscal institutions, low confidence in economic policy, and the accumulation of bad debts. Initial conditions in the early stages of the transition of these examined economies were unfavourable. The fact that these countries now lag behind most central European and Baltic countries as regards stabilisation and structural reform reflects, to some degree, these relatively adverse starting conditions. At the same time, the lag in structural reform has added serious complications to an already fragile economic environment. Disruptions of trade and payment arrangements in the former COMECON bloc sharply reduced the volume of external trade – and the result was a deterioration in terms of trade. Within this macroeconomic environment, the rapid exchange rate devaluation fed inflationary pressures.

Bulgaria is an example of a country that had a sequence of episodes – in 1994 and 1996–97. The uniqueness of the Bulgarian case lies in the interplay of several serious problems that accelerated the crisis and amplified its magnitude.⁴ The Bulgarian predicament can be viewed as a “triple drain” crisis: it affected at one fell swoop public finances, the banking system and the exchange rate. Each of these three problems was so acute that it might have given birth to a major crisis *on its own*. The Bulgarian situation is also interesting as regards the negative effect of policy measures and policy responses in the period preceding the crisis in this extremely fragile, transitional environment. Some of the policy loopholes included slack financial discipline (which became endemic) and a general lack of commitment by the authorities to pursuing hard budget constraints.

⁴ For an extensive overview of the transition crisis in Bulgaria see Dobrinsky (2000).

It also included a lack of co-ordination between monetary and fiscal policy, which led to the emergence of vicious circles and macroeconomic instability. These policy mistakes developed fears in people that the Bulgarian National Bank (BNB) would continue to be a source of money expansion and that it would also block foreign exchange deposits. The failure of monetary policy to prevent accelerating inflation up until 1997 led to the adoption of a currency board in mid-1997, which legally constrained monetary policy and thus helped restore confidence.⁵ In this arrangement, the Bulgarian lev was pegged to the German mark for an indefinite period of time, and the BNB discontinued direct lending to the budget, the refinancing of commercial banks and open market operations.

In 1995, the Russian stabilisation seemed to have been successfully completed with inflation being under control. In mid-1995, the authorities announced a fluctuation corridor for the rouble, tied to the USD. However, this corridor had to be revised several times. In the spring of 1997 the central bank was able to build up foreign currency reserves, and there was upward pressure on the rouble. The financial instability coming from Asia put pressure on the rouble in October–November 1997, when the Asian crisis intensified, and again in January 1998. In late 1997, the corridor was replaced by a pivot mechanism. The last change took place at the beginning of 1998, when the authorities moved from the pivot system to a wide corridor, where the rouble was allowed to fluctuate within a 15% band on both sides. In spite of the aforementioned negative developments, the balance of payments did not present any noteworthy imbalances at all before the crisis.⁶ Only afterwards did capital flight put major pressures on the country's external account balances.⁷

The authorities tried to counteract the pressures by intervening in the foreign exchange and money markets. Another significant policy response was to raise the reserve requirements on foreign currency deposits. Nevertheless, the crisis re-emerged and culminated on the 17th August, 1998. The rouble was effectively allowed to float. The stabilisation period that had begun in 1995 was over. This float turned, in essence, into a free fall as the rouble rate went down to being as little as Rbl 20.8 per USD. In all of these years the fiscal situation of the Russian economy was very weak. The government's ability to borrow on the domestic Russian market to thereby finance the deficit was severely limited by the lack of

⁵ Before the introduction of the Currency Board and, since 1991, in view of the limited forex reserves and an isolation from international financial markets due to its defaulting, Bulgaria opted for a floating exchange rate regime and money-based stabilisation.

⁶ This makes the Russian crisis look different when compared to other crises, e.g. Latin American crises.

⁷ For an overview of the macroeconomic situation before, during and after the crisis see Sipila (2002), Butorina (2000) and Gobbin and Merlevede (2000).

cash balances in the economy. Its budgetary revenues were low, both absolutely and relative to revenues in those transition economies that had begun reform processes at an earlier date. The authorities seemed unable to legislate for the drastic cuts in expenditure that were necessary for monetary stabilisation. Between 1995 and the first half of 1998, the government struggled against easy budgetary restraints at the enterprise level, huge budgetary imbalances at the macroeconomic level, and to deal with weak monetary policy. It succeeded in tightening monetary policy, yet it continued to struggle with its microeconomic and macroeconomic budgetary problems. Banks were also affected during the currency crisis. The most important manifestation of the banking crisis is seen in the fiscal role being played by banks: the larger banks had a large share of their assets in the form of government bonds, which became illiquid in the crisis and so lost their value.

In Ukraine, the exchange rate was relatively strong from 1992 until 1993, for capital inflows were relatively high and strengthened the balance of payments position. Up until September 1993 the National Bank of Ukraine (NBU) supported the domestic currency (the hryvnia) by intervening in the foreign exchange market when there were substantial downward pressures. The economic transition process in Ukraine can also be related to inflation. Following the near-hyperinflationary conditions prevailing until the end of 1995, inflation remained high and extremely volatile over much of 1996. During early 1997 and the first half of 1998, the Ukrainian economy made significant progress in reducing inflation. Two key factors underlie this development: a reduction in the fiscal deficit and tight monetary and credit policy. Since the fourth quarter of 1998 there has been an acceleration in inflation mainly due to the depreciation of the hryvnia. The National Bank of Ukraine stopped selling foreign exchange on the market, introduced a number of administrative measures to control the foreign exchange market and removed the exchange rate band – though, despite these efforts, the Ukrainian economy experienced hyperinflation conditions in 1999.⁸

Although monetary policy has been used (sometimes effectively) by Romanian authorities since late 1993 in an attempt to reduce inflation, the increase in central bank direct credit jeopardised their efforts.⁹ Over the past nine years the

⁸ For a discussion regarding the sources of inflation in Ukraine see Chionis, Giannias and Liargovas (2003).

⁹ In Romania, the effective monetary policy used during 1994 succeeded in reducing inflation to two digits during the first three quarters of 1995: from over 49% in the second quarter of 1993 it was reduced to 24.7% in 1995. Then the deterioration of the macroeconomic fundamentals led to an increase in the inflation rate from mid-1995, with a sharp acceleration occurring in 1997. Consistent with patterns from previous years, in 1998 and 1999 the CPI increased by 34.7 and 44.6% respectively (see Chionis, Giannias and Liargovas (2003) for more details).

Romanian authorities have implemented a number of regulatory and institutional reforms which have brought about a significant liberalisation of the country's foreign exchange system. In order to contain inflationary pressures and emerging private sector imbalances, all of these examined countries have adopted either a fixed exchange rate regime or a crawling peg with an intervention band. Romania is an exception, though, as it kept hold of an independently floating exchange rate regime in the last quarter of 1997.

The above suggests the existence of great similarities in processes leading to an exchange rate crisis among countries in transition. Such similarities partly explain the currency weakness of these countries. In the period leading to a crisis, domestic inflation is high, and often rising, while the money supply tends to go up at an increasing rate, reflecting the over-expansionary credit policy. Domestic interest rates have a tendency to rise to very high levels in the period immediately preceding crisis episodes (*Figures 1–4*); while economic fundamentals steadily deteriorate in the period leading up to a crisis. The issue, then, is whether some rudiments maximise the likelihood of such an occurrence.

4. THE DATA SET USED

Any researcher dealing with empirical work in transition economies is faced with the problems of the availability and quality of data. In particular, inflation data is likely to be biased in a downward direction since, in most cases, single digit inflation rates are accompanied by a great increase in money supply and by domestic currency depreciation.

The set of data used in this paper was taken from the IMF's 2000 International Financial Statistics CD-ROM. It consists of monthly observations of interest rates (the lending rate), money supply (the sum of currency outside deposit money banks and demand deposits other than those of central banks), CPI-inflation, the official exchange rate set against the USD (end of the period) and foreign exchange reserves in USD. Owing to problems related to data availability, a time series has been employed to cover the different time periods. In particular, for Bulgaria the series covers the period from September 1993 to December 1999, for Romania it is between January 1994 and December 1999, for Ukraine from December 1992 to December 1999, and for Russia it covers between December 1994 and December 1999.

The empirical literature provides little guidance as regards a generally accepted definition of "currency crisis". Most studies examine large and infrequent de-

valuation;¹⁰ others look at small though repeated devaluations;¹¹ while some adopt a broader definition of a crisis,¹² e.g., speculative attacks, loss of international reserves, attacks that are averted without a devaluation (though at the cost of major increase in domestic interest rates etc.). Eichengreen, Rose and Wyplosz (1995) saw an exchange rate crisis as a depreciation that is at least two standard deviations above the mean. Kaminsky, Lizorno and Reinhart (1998) argue that a currency crisis occurs when a weighted average of monthly percentage depreciation in the exchange rate and monthly declines in reserves exceeds its mean by more than three standard deviations. Frankel and Rose (1996), requires an exchange rate depreciation against the USD of 25%, one which is at least 10% higher than the depreciation of the previous year. Milesi-Ferretti and Razin (1998) along with the Frankel and Rose filter require a doubling in the rate of depreciation over the previous year and also that the previous year's depreciation rate is below 40%. Additionally, the latter also experimented with two alternative filters focusing on episodes in which exchange rates were relatively stable in the preceding year.

For the present work, we are making use of a distinctive filter to define a currency crisis. A “currency crash” is to be defined as a nominal depreciation of the end-period domestic currency against the USD of at least by 10%, no matter if this comes as a result of a speculative attack or not.¹³ For tractability reasons we think that currency crashes should be limited to episodes that end in a great fall in value of the currency, and no event that occurs within one month of another crisis will be considered as such – thus, a “window” will be constructed around each crisis event (which will, in turn, reduce the total amount of crises¹⁴).

Our definition of a currency crash gives us 31 different crashes (*Table 1*). These crashes are spread among the examined countries but have the tendency to cluster themselves around the early stages of the transition. Given our filter, we can

¹⁰ See, for example, Edwards (1989), Edwards and Montiel (1989), Edwards and Santella (1993), Frankel and Rose (1996) and Milesi-Ferretti and Razin (1998).

¹¹ See, for example, Collins (1995), Flood and Marion (1999), Kamin (1998) and Klein and Marion (1994).

¹² For instance, Eichengreen, Rose and Wyplosz (1995), Kaminsky and Reinhart (1996), Sachs, Tornell and Velasco (1996).

¹³ It is acknowledged that the 10% cut-off level is arbitrary. This is definitely the case, though – and of course – any choice would be arbitrary.

¹⁴ According to the window procedure, a 10% devaluation (depreciation), then a less than 10% change, and, subsequently, a 10% devaluation is made up of two episodes – while a consecutive 10% weakening is one episode. Slight differences might be observed when using different versions of IFS data.

Table 1
Logit Results

	Russia	Ukraine	Bulgaria	Romania
Constant	-3.305* (0.806)	-2.78* (0.542)	-3.241* (0.670)	-2.920 (2.290)
%M2/forex reserves	0.029* (0.0144)	0.014* (0.004)	0.017* (0.53)	0.157* (0.072)
Interest Rate	0.001 (0.004)	0.0005 (0.003)	0.013* (0.005)	-0.070 (0.046)
Inflation Rate	0.0521 (0.063)	0.035* (0.0147)	-0.0004 (0.053)	0.448* (0.211)
Number of crisis	5	15	7	4
Number of observations	61	85	74	72
R ²	0.85	0.94	0.88	0.92
Log-Likelihood	-27	-34.07	-21.77	-26.72
Likelihood Ratio Test	21*	13.59*	16.46*	32.03*

Note: * denotes statistical significance at 5% level.

see Ukraine as providing the greatest number of crashes, namely fifteen episodes – while Romania has had just four.¹⁵

It is recognised that our definition of a currency crisis raises a number of issues. One is whether there is the right exchange rate against the USD. If a currency is pegged to some other foreign currency (e.g. the DM), then a relatively large movement in the USD–DM rate could cause a “10% crisis episode” against the USD, though not against the DM. To eliminate this concern we re-classified a crisis using the implied rate against the DM instead of the USD – and we came up with a similar number of crises.

A second issue relates to usage of an end-period instead of a period average exchange rate. There might be episodes which happened *within* one month but which do not show up in end-of-month arrangements. To eliminate this concern we re-classified a crisis using the period average exchange rate instead of the end-period rate – and we again attained approximately the same number of crises.

¹⁵ Bulgaria did not experience any crisis after the establishment of a currency board (mid-1997). This is because currency boards enhance transparency and are predicated on the maintenance of conservative financial policies.

5. THE ECONOMETRIC MODEL AND THE EMPIRICAL FINDINGS

A great number of researchers employing a variety of econometric methods and various time spans have considered the influence of macroeconomic variables in a case of currency crisis. In this section we come up with a risk premium model deriving from the macro fundamentals approach. With reference to Flood and Marion (1999), the driving variables of currency crises episodes can be looked at.

Typically, in writing such models we assume that the domestic market equilibrium is given by:

$$m - p = -a(i) \quad (1)$$

where m = money supply, p = price level, i = interest rate and a = coefficient > 0

We also assume that the log-linearised supply of high power money consists of foreign reserves (d) and the central bank's assets (r)

$$m = d + r \quad (2)$$

The price level is governed by PPP

$$p = p^* + s \quad (3)$$

where s = exchange rate and * denotes foreign and covered interest parity holdings

$$i = i^* + \Delta s^e + \text{covering cost} \quad (4)$$

substituting equation (2)–(4) by equation (1), with $\Delta s^e = 0$, it follows that:

$$d + r - p^* - s = -a(i^* + \Delta s^e + \text{covering cost})$$

or

$$s = -a(i^* + \Delta s^e + \text{covering cost}) + d + r - p^*$$

Based on this model we actually return to the classical specification of a currency episode: one prompted by excessive money creation and exhausted international reserves. Consider the case where the exchange rate, foreign price, foreign interest rate and covering cost are fixed. If d grows at the rate of μ and r simultaneously falls, the fixed rate will break down. We could then estimate multivariate logit models linking our binary crash measurement to the explanatory variables. The choice of explanatory variables is based on the previous model.¹⁶ In each period the country concerned is either experiencing a crisis, or it is not.

¹⁶ The availability of an appropriate time series is also a constraint that has to be dealt with.

Accordingly, our dependent variable, the crisis dummy, has a zero value if there is no crisis, and a value of one if there is a crisis. It is hypothesised that the probability that a crisis will occur at a specific time for a particular country is a function of a vector of n explanatory variables X_t . Consider a case where P_t denotes the dummy variable taking the value of one when a currency crisis occurs in time t , and a value of zero otherwise. β is a vector of n unknown coefficients and $F(\beta'X(t))$ is the cumulative probability distribution function evaluated at $\beta'X(t)$. From this, the log-likelihood of the model is given by:

$$\ln L = \sum_{t=1, \dots, T} P(t) \ln \{F[\beta'X(t)]\} + [1 - P(t)] \ln [1 - F[\beta'X(t)]]$$

So, when interpreting regression results using the logistic functional form, it is important to remember that the estimated coefficients reflect the effect of a unit change in an explanatory variable on $\ln[P_t/(1-P_t)]$. The increase in probability therefore depends upon the original probability and, thus, upon the initial values of all of the independent variables and their coefficients. It should be additionally noted that while the sign of the coefficient does indicate the *direction* of the change, the *magnitude* depends on the slope of the cumulative distribution function at $\beta'X(t)$. In other words, a change in the explanatory variable will have different effects on a crisis likelihood depending on the country's initial crisis probabilities. Under the logistic specification, if a country has an extremely high, initial crisis probability, then a marginal change in the independent variables will have little effect on its prospect – while the same marginal change will have a greater effect if the country's probability of crisis is in the intermediate range.

Inflation is introduced as an explanatory variable because it may be proxy to a form of macroeconomic mismanagement that is having an adverse effect on a country's economy.

In addition, since certain characteristics of capital flows can be associated with interest rate changes, also introduced here is a short-run interest rate.¹⁷ With forward looking participants in a foreign exchange market, there is always a chance that confidence in the macroeconomic policy stance will collapse with an increase in money supply, something indicating monetary and fiscal expansion. Such a decrease or collapse in confidence can take the form of a large risk premium increase and a subsequent accelerated devaluation of the official rate. The ratio of $M2$ to foreign exchange reserves can be interpreted as an indicator of reserves adequacy because, in the event of an exchange rate crisis or panic, liquid money

¹⁷ It should be noted that interest rates might indeed act as a proxy for capital outflow, though they can be directly influenced by a central bank. Whether or not a central bank uses this tool, and for what reasons, could be crucial as regards the role interest rates play. See Section 3 for a relevant discussion of interest rate policies in the countries concerned.

assets can be converted into foreign exchange. This is in accordance with the work of Calvo (1996), which proposes that the ratio of $M2$ to foreign exchange reserves is a good predictor of a country's vulnerability to external crises (see *Figures 1–4*).

We estimate a logit model¹⁸ for each country separately using maximum likelihood. The obtained results appear in *Table 1*. When measuring the model's worth, we should take into consideration the fact that the dependent variable has only two values, so the standard R^2 cannot be used. Maddala (1983) proposed an alternative measurement of suitability, as follows:

$$R^2 = 1 - \{L(0) / L(\hat{\beta})\}^{2/n}$$

where $L(0)$ denotes the likelihood of the model's nullity (i.e. having no regressors).

When evaluating the derived R^2 , the models appear to perform relatively well, as the statistic varies from 0.80 to 0.97. We also test the significance of the proposed specification by using a likelihood ratio test (see Davidson and MacKinnon 1993). This test examines the joint importance of regressors by comparing the model's likelihood with that of a model with only the intercept. As shown in *Table 1*, a hypothesis that the coefficients of the explanatory variables will be jointly equal to zero has to be rejected at a 5% level of significance.¹⁹

Interestingly, for the whole sample of transition economies at the early stages (Russia, Ukraine, Bulgaria, Romania), an increase in the rate of the money supply becoming foreign exchange reserves is to be associated with the existence of a higher currency crisis probability. High domestic money expansion coincides with an increased probability of a crash. CPI-inflation seemed to contribute to the likelihood of a crisis in two countries, i.e. Ukraine and Romania. Surprisingly, though, prices in Russia are not statistically significant – while in Bulgaria they do not have the expected sign. This might be due to currency substitution or to problems related to the quality of the series employed. In combination with

¹⁸ The probit model gives similar results. A useful extension of the model is when further controls are introduced to the right hand side (for example, external debt), if country fixed effects are incorporated, when robust standard errors are used, or to explicitly test for the cross-country equality of certain parameters within a panel framework.

¹⁹ The incorporation of both nominal interest rates and inflation does not cause multicollinearity since the correlation between inflation and nominal interest rates was quite low for all the examined countries. In addition, variants of the model with a lagging interest rate, inflation and $M2/Reserves$ lead to only marginal differences in the magnitude of coefficients. Finally, the logit regressions were repeated with some other variants of crisis classification (e.g. a 12% or 9% devaluation instead of 10%) and the results were alike.

money supply to foreign exchange reserves ratio, interest rates also appear to have contributed to exchange rate crises in Bulgaria.

Undoubtedly, the above countries have inherited an economic structure that was highly vulnerable to currency crises. Even though high monetary growth does not nullify the influence of other variables (except for in the case of Russia), the significance of this variable tended to produce a range of “stylised” facts for our examined economies.²⁰ The higher the ratio of *M2* to foreign exchange reserves, the highest the chance of a currency “episode” – which accords with previous findings stressing the importance of domestic money growth (see *inter alia* Frankel and Rose (1996), Calvo (1996)) lending support to the “fundamentals” perspective. Similarly, in Latin American cases the ratio of *M2* to foreign exchange reserves appears to convey useful information on a country’s financial vulnerabilities.

6. CONCLUSIONS

This paper addressed the question of whether some macroeconomic variables have a systematised role to play in currency crisis incidence in transition economies. With the use of logit models and the experiences of Bulgaria, Romania, Russia and Ukraine, it is found that economic fundamentals – especially *M2* as set against reserves – *do* have a significant predictive power with regard to crisis occurrence. This result is not surprising, for it resembles the case of Latin America in the ’70s and ’80s. The macroeconomic situation of those countries (e.g. the Argentine crisis of 1981, the Mexican crisis of 1982) was akin to the macroeconomic situation in countries in their early stages of transition: giving us high inflation, little confidence in or consistency of economic policy, *de facto* dual exchange rate arrangements, a large amount of indebtedness, and under-development of financial markets and institutions. Often, they had macro fundamental type exchange rate crises, usually starting with realignments within a fixed exchange rate regime, where the peg was abandoned only later (and not from necessity).

The currency crises studied here resemble neither the recent Asian crises nor the Mexican (“Tequila”) crisis nor the ERM crisis of the ’90s. These crises could

²⁰ As opposed to the Latin American crises of the ’70s and ’80s, in Russia the balance of payments did not present any noteworthy imbalances at all before its crises. This peculiarity might offer some explanation regarding our logit results in the case of Russia. Anyhow, our results for Russia accord with the results coming from other studies – such as Begg, Halpern and Wyplosz (1999) and Kharas, Pinto and Ulatov (2001) – although they do not do so with the results of Sipila (2002), where the Russian crisis was rather a second than a first generation crisis.

be attributed to external factors (like world money and commodity markets, and/or contagion from other crises). This way of explaining can best be understood in the context of second-generation currency crisis literature. The approach here stresses the self-fulfilling nature of currency crises, which provides us with a multiple equilibrium. In these models, liquidity concerns within the banking sector can be given a central role.

Understanding financial and currency crises in transition economies is an issue of great concern. This paper has made an effort to open a discussion dealing with currency crises in a relatively new environment, that of transition countries. However, further research is needed – and it should focus on alternative methodologies as well as the specific characteristics of economies in a state of transition (for example, the parallel exchange market, political concerns, capital flight, and other factors not directly associated with the official exchange rate).

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FIGURES

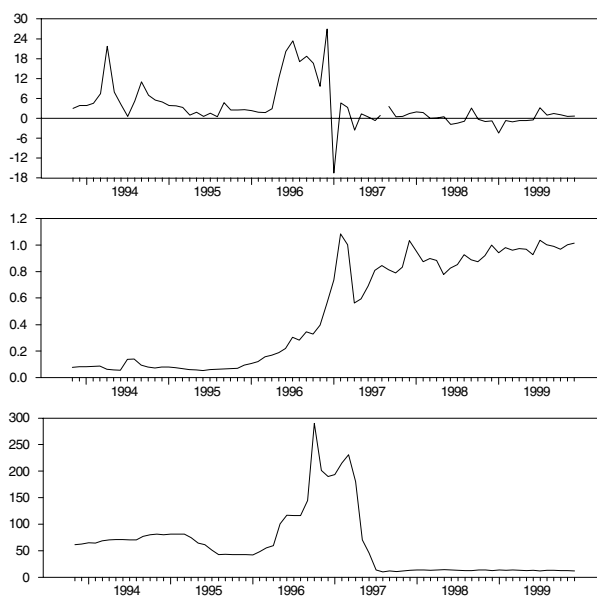


Figure 1. Bulgaria

(1) inflation; (2) money growth/forex reserves; (3) interest rate (%)

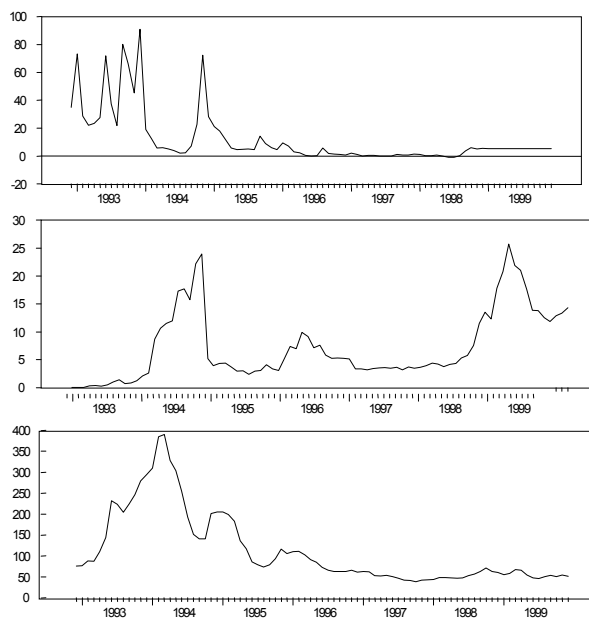


Figure 2. Ukraine

(1) inflation; (2) money growth/forex reserves; (3) interest rate (%)

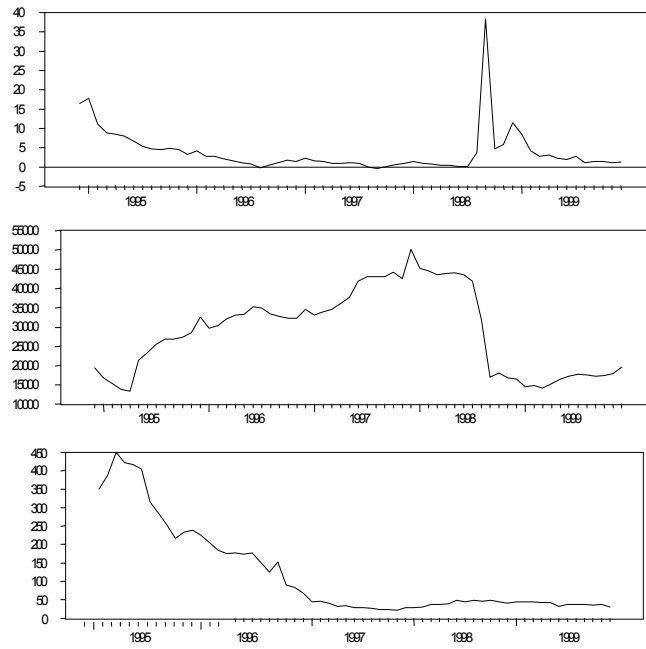


Figure 3. Russia

(1) inflation; (2) money growth/forex reserves; (3) interest rate (%)

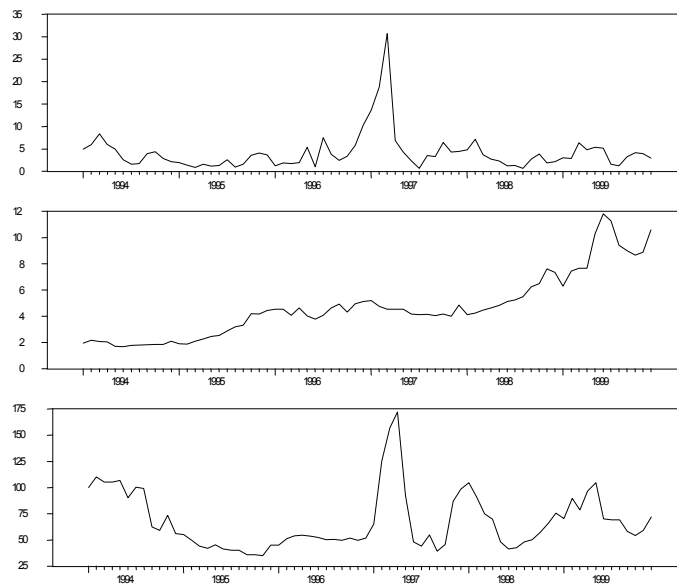


Figure 4. Romania

(1) inflation; (2) money growth/forex reserves; (3) interest rate (%)