European Bank

for Reconstruction and Development

Assessing macroeconomic vulnerability in central Europe

by Libor Krkoska

Abstract

The central European transition-accession countries experienced several periods of macroeconomic vulnerability since the end of output declines in early 1990s. Some notable periods, which resulted in a necessity to implement extensive stabilisation measures, are March 1995 in Hungary, May 1997 in the Czech Republic, and September 1998 in the Slovak Republic. This paper shows that the standard early warning indicators provided useful information on macroeconomic vulnerability prior to the crises in central Europe, although this information had been mainly indicative; that is, early warning indicators would not have allowed one to predict the crises and their timing. In particular, the growing gap between current account deficit and foreign direct investment (FDI) in all the analysed countries provided clear early warning of subsequent economic turbulence.

Address for correspondence: Office of the Chief Economist, European Bank for Reconstruction and Development, One Exchange Square, London EC2A 2JN, United Kingdom. Telephone: +44 20 7338 6710; Fax: +44 20 7338 6110; e-mail: krkoskal@ebrd.com

Working paper No. 52   **Prepared in June 2000**

1. INTRODUCTION

A number of economic crises in recent years, such as the Mexico crisis in 1994, Asian crisis in 1997 and Russian crisis in 1998, have led to an increased interest in research that investigates various economic crises from different angles. Prominent examples of this literature are Eichengreen et al. (1996), Kaminsky et al. (1997), Berg and Pattillo (1998), IMF (1998) and Kaminsky (1999). Most of the literature focuses, understandably, on the identification of early warning indicators. There is an abundance of proposed indicators (see IMF, 1998), some of which may be of particular importance for assessing macroeconomic vulnerability and the likelihood of a necessity to implement deep stabilisation measures. However, it is unlikely that one may identify an ideal set of indicators that are able to predict crises and their timing since such indicators would be used by economic agents in their decision making, including the authorities who would be given the opportunity to avert the crises.

The purpose of this paper is to examine macroeconomic vulnerability in a few selected countries in central Europe during transition. Herrera and Garcia (1999) have done similar work for the Latin American countries and Kaminsky (1999) for a number of both developing and developed countries. However, very little empirical work has been carried out for countries in transition for obvious reasons – time series are short, data are often unreliable, reporting methodology changes frequently, and transition reforms introduce a number of deep and frequent changes of economic policies even in times of relative macroeconomic stability (see Roubini and Wachtel, 1997, on current account sustainability in transition countries). Not only are time series shorter in the case of central European countries but also the number of crisis periods is smaller. There were three such periods in the four selected central European transition countries in eight years for which reasonable data are available, compared with 102 crises in 20 countries over the 25-year period studied by Kaminsky (1999). Therefore, this paper focuses on a detailed examination of crisis periods in assessing the usefulness of early warning indicators as compared with elaborate econometric modelling of the performance of such indicators.

The empirical analysis is based on data for four transition-accession countries in central Europe: the Czech Republic, Hungary, Poland and the Slovak Republic, during 1993-99. There are several reasons for this selection. Unlike in other transition countries, the currency markets of these countries are relatively liquid and capital accounts are sufficiently liberalised to provide an environment enabling a currency attack to happen (see the Annex on the exchange rate regimes and currency convertibility in the analysed countries since 1993, and EBRD 1999 on exchange rate regimes and currency convertibility in the other transition countries). Also, reasonably accurate data with sufficient frequency are available on a timely basis to permit a meaningful empirical analysis relevant for a potential early warning system.

Three issues are pursued: (i) how informative has been a formal quantitative index of speculative pressure for central European transition-accession countries in the past seven years?; (ii) is there any relation between standard early warning indicators of macroeconomic vulnerability and the index of speculative pressure?; and finally (iii) how useful were standard early warning indicators in periods of excessive macroeconomic vulnerability in central Europe in the past?

The paper is structured such that in the next section the formal index of speculative pressure is constructed and used to identify periods of increased market volatility. In the third section, a macroeconomic model is built and tested, focusing on the relations among major variables related to macroeconomic vulnerability and available indicators of sufficiently high frequency

for the central European transition-accession countries. In the fourth section, selected crisis periods are discussed in more detail and the usefulness of available early warning indicators is examined. The fifth section concludes that the standard early warning indicators provided useful information on macroeconomic vulnerability prior to the crisis although this information had been mainly indicative, namely early warning indicators did not allow one to predict crises and their timing. Among the early warning indicators, the growing gap between current account deficit and foreign direct investment (FDI) has been the most useful and provided clear early warning of forthcoming volatility ending in a crisis. A corollary conclusion to this result suggested a period of macroeconomic volatility for the Polish economy with a probability of currency crisis steadily increasing towards the end of 1999 and in the first few months of 2000, with only strong inflow of FDI, mainly generated by privatisation of large state-owned enterprises, and high interest rates preventing a large depreciation of the currency.

2. INDEX OF SPECULATIVE PRESSURE

A currency crisis is conventionally (e.g., Herrera and Garcia, 1999) defined as a period during which the exchange rate falls significantly despite an attempt to prevent the currency depreciation by a sharp increase in interest rates, and/or an official intervention on the currency markets characterised by a large decline in international reserves. In line with this definition, an index of speculative pressure, isp, is constructed as a weighted average of standardised monthly percentage change of exchange rate, e, monthly percentage change of a headline interest rate, r, and monthly percentage change of liquid international reserves which exclude gold and non-convertible currencies, ir:

$$(2.1) \qquad isp_t = w_1 \cdot e + w_2 \cdot r - w_3 \cdot ir.$$

It should be stressed that the index of speculative pressure is a quantitative indicator designed to identify periods of macroeconomic fragility and has in itself a limited forecasting power as will be shown later.

Since Eichengreen et al. (1996) showed that different weights do not have a significant impact on the empirical results and to avoid a necessity to estimate weights which, ideally, would change over time, the weights were standardised, $w_1 = w_2 = w_3 = 1$. A period of excessive market volatility is defined as the period during which the index rises above a pre-specified threshold based on the previous n observations:
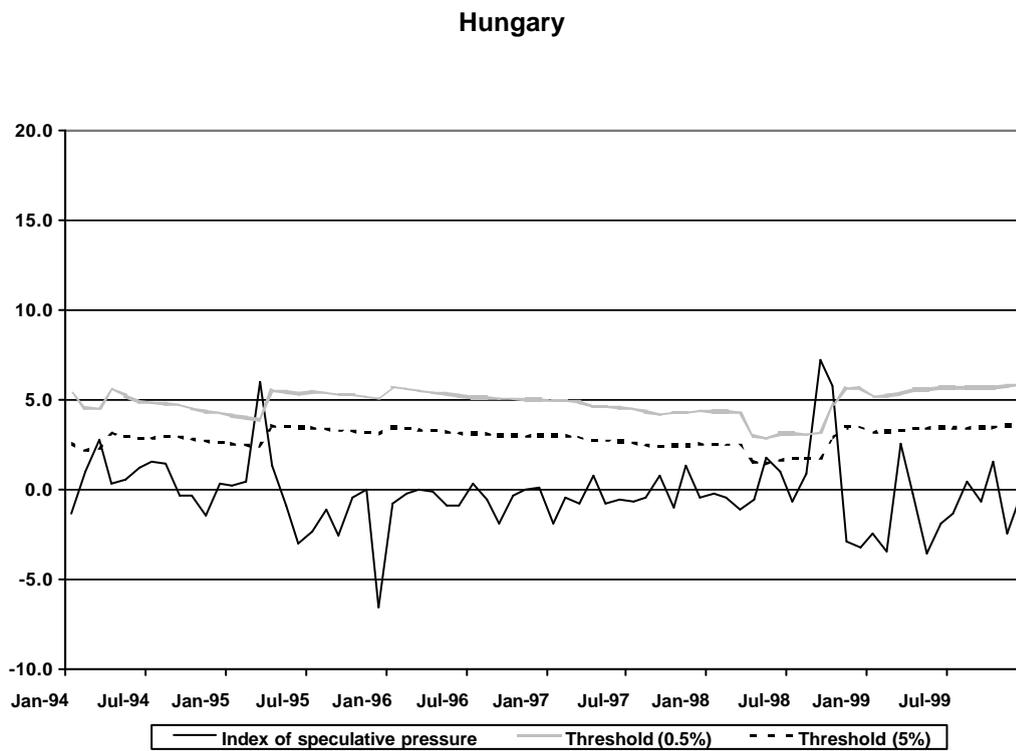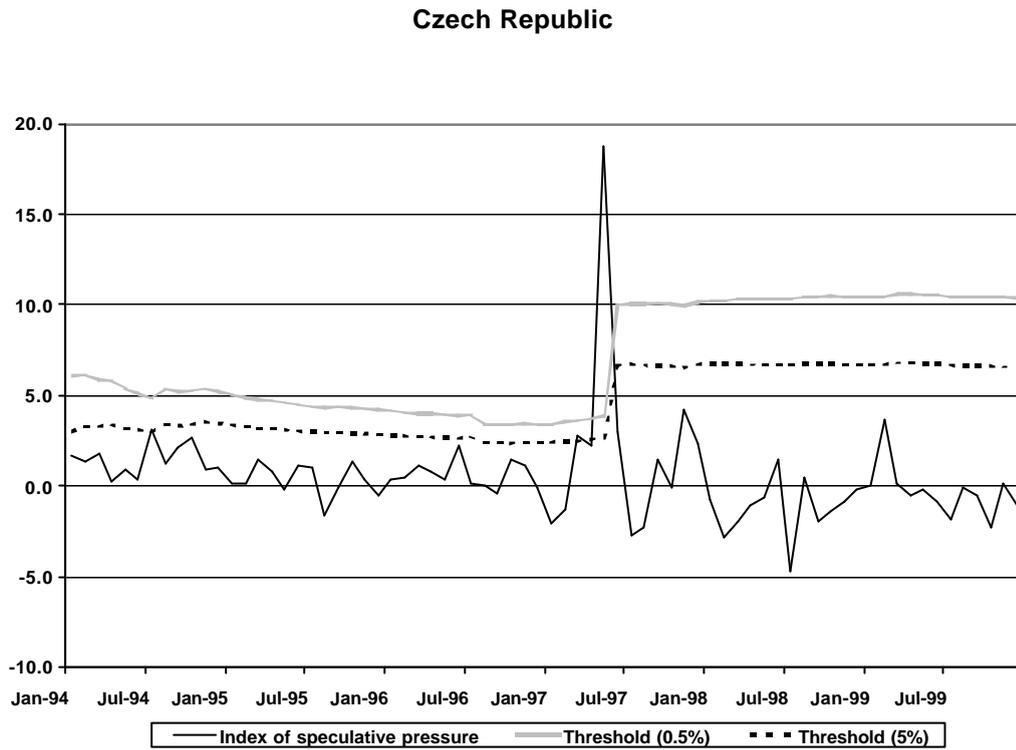
$$(2.2) \qquad isp_t \geq m_n + t(n,q) \times s_n,$$

where m_n is the sample mean and s_n is the sample standard deviation of the index of speculative pressure based on the previous n observations, $n = 36$ in this case to adjust the sample mean and standard deviation to the rapidly changing transition environment, and $t(n,q)$ is a t-statistic for quantile q based on n observations.

In order to have a sufficient number of observations to standardise the variables used, the index of speculative pressure is calculated for January 1994 – December 1999, i.e., there is a total of 72 observations. Chart 1 presents the index of speculative pressure for the four selected central European countries from January 1994 to December 1999.

The analysis of the index of speculative pressure identified eight periods of excessive market volatility based on quantile q equal to 0.5 per cent, i.e., the index of speculative pressure was higher than what would be expected with 99.5 per cent probability based on the historical data, and 17 such periods based on quantile q equal to 5 per cent. However, one may divide those periods into two broad categories which partially overlap. The first category covers periods of macroeconomic instability due to structural problems which are likely to result in a genuine speculative attack on the currency, such as happened in the Czech Republic in May 1997. The other category includes periods of overheating and increased inflationary pressures which are relatively easy to tackle by a proper mix of monetary and fiscal policies – such as was the case of Poland in July 1997 – but which do not necessarily lead to a need for extensive stabilisation measures and deep structural reforms. The list of the periods of excessive market volatility for both quantiles, 5 per cent and 0.5 per cent, and a brief description of the economic background is provided in Table 1. A detailed description of selected periods of macroeconomic vulnerability leading to radical shifts in the economic policy is provided in Section 4.

Chart 1: Index of speculative pressure

Czech Republic

| | Index of speculative pressure | Threshold (0.5%) | Threshold (5%) |

Hungary

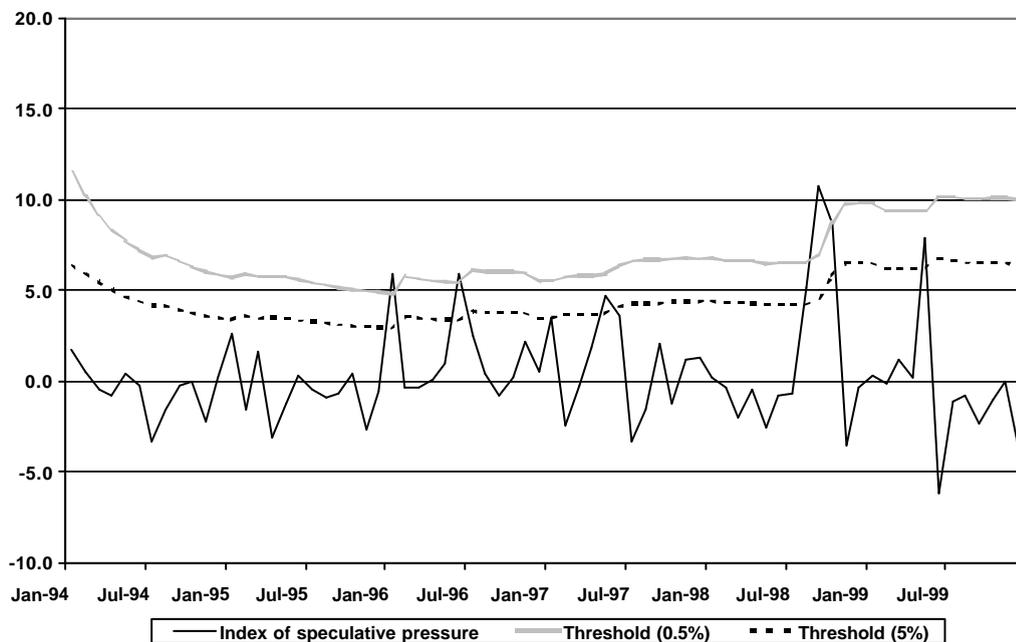| | Index of speculative pressure | Threshold (0.5%) | Threshold (5%) |

Source: Czech National Bank, National Bank of Hungary and author's calculations.

Poland
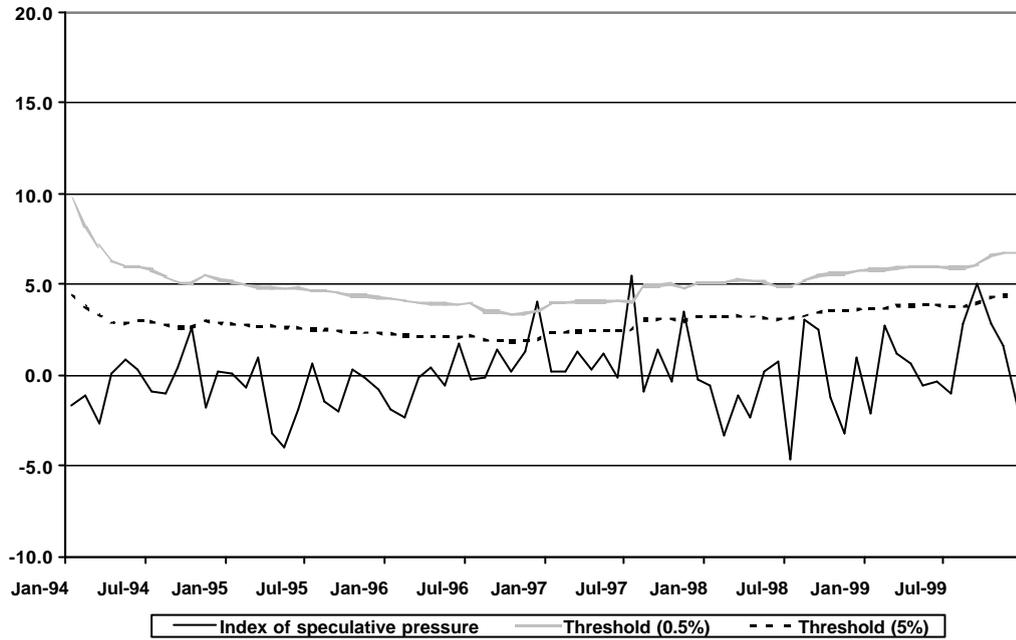
Slovak Republic

Sources: National Bank of Poland, Slovak National Bank and author's calculations.

Table 1: Periods of increased market volatility

Country	5% quantile	0.5% quantile	Background
Czech Republic	July 1994	-	Monetary tightening on inflationary pressures and first signs of banking sector weaknesses
	March 1997	-	An extent of external imbalances is revealed while fiscal pressures emerge
	May 1997	***May 1997***	***Successful currency attack***
Hungary	March 1994	-	A large official external debt repayment
	March 1995	***March 1995***	***Stabilisation measures introduced and the currency devalued as a result of excessive external debt and twin deficits***
	May 1998	-	Impact of moving standardisation which ceases to include March 1995 crisis
	September - October 1998	September - October 1998	Contagion from the Russian crisis
Poland	December 1996	December 1996	Overheating
	July 1997	July 1997	Overheating and extensive flooding in south-west Poland
	September 1999	-	Signs of overheating re-emerged after the slowdown due to the Russian crisis while external imbalances worsen
	November 1999	-	Continuation of unfavourable trends - twin deficits increasing while inflation is growing towards double digits
Slovak Republic	January 1996	January 1996	Overheating
	June 1996	June 1996	Overheating
	January 1997		Overheating and sizeable external imbalances emerge
	May 1997		Contagion from the Czech crisis and the impact of excessive external debt and twin deficits
	August - October 1998	***September 1998***	***Devaluation as a result of political instability around parliamentary elections as well as long term excessive twin deficits, rapidly growing external debt and structural deficiencies on micro-level***
	May 1999		Political instability - presidential elections

Sources: Kaminsky et al. (1997), Berg and Pattillo (1998), IMF (1998), Herrera and Garcia (1999), and Kaminsky (1999).

3. A MODEL OF MACROECONOMIC VULNERABILITY AND EMPIRICAL RESULTS

3.1 MODEL

There is an extensive list of possible early warning indicators of macroeconomic vulnerability (see, e.g., IMF, 1998, and Kaminsky, 1999). However, some of them are not easily available on higher frequencies (e.g., foreign debt, total debt service and budget balance), others are not particularly relevant because of a transition economy environment (e.g., asset prices, because of underdeveloped asset markets and doubtful asset valuations). The list of potential early warning indicators not included in the following analysis is in Table 2. The common approach in currency crisis literature is to focus on the performance of thresholds for a set of early warning indicators, although the small number of crisis periods in central Europe, a transition economy environment and short time series, lead us to focus on the economic reasoning behind the use of the chosen indicators.

The variables used in the following analysis are: current account for the last four quarters as a percentage of GDP, *ca;* net FDI for the last four quarters as a percentage of GDP, *fdi;* the ratio of broad money over liquid international reserves, *m2ir;* real exchange rate, *rer;* real credit growth, *rcg;* inflation, *inf;* industrial production, *ind;* exchange rate between the DM and the US dollar, *dmusd;* industrial production in the European Union, *euind;* and the index of speculative pressure as defined in the previous section as *isp*. In addition, the portion of current account deficit uncovered by the FDI, defined as the sum of FDI and current account balance, *fdica*, is included as well. The latter indicator is based on the assumption that FDI is relatively stable, compared with portfolio capital and short-term capital flows, and thus most relevant in the assessment of the current account deficit and its coverage by capital inflows.

The empirical model is a standard VAR model based on the macroeconomic indicators listed above. There are five dependent variables in the full model, $Y_t = (isp_t, rer_t, ind_t, fdi_t, ca_t)$, lags of which enter the model as explanatory variables, and six additional explanatory variables $X_{t-1} = (fdica_{t-1}, rcg_{t-1}, inf_{t-1}, dmusd_{t-1}, m2ir_{t-1}, euind_{t-1})$:

$$(3.1) \qquad Y_t = A \times Y_{t-1} + B \times X_{t-1} + e_t \ ,$$

where e_t is a random vector with 0 mean and variance-covariance matrix Λ. Although the basic model is a VAR model with no prior assumptions, the number of observations is too small to allow estimation of the coefficients, *A* and *B*, for the full model. Hence, some restrictions, by setting a number of coefficients in *A* and *B* to zero by testing down individual equations, were imposed. The restrictions were constrained by the following assumptions:

The first equation relates the index of speculative pressure to its past performance through lagged real exchange rate, to external economic conditions through growth of industrial production in the European Union, and to the sustainability of the possible current account deficit through the gap between the current account deficit and FDI.

The second equation relates the real exchange rate to the perception of macroeconomic vulnerability in the past, measured by the index of speculative pressure, and to the ratio of broad reserves to liquid international reserves, incorporating exposure to sudden changes in capital flows as well as inflationary pressures into the analysis.

Table 2: Alternative early warning indicators not used in the macroeconomic model

Indicator	Reasons for exclusion from the macroeconomic model
Export growth	Provides similar information as the current account deficit but has higher variance and greater impact of seasonality
Budget deficit	In some cases only annual data are meaningful
External debt	Only annual data are generally available
Short term capital flows, including portfolio investment	Available with a considerable time lag; fairly unstable indicator so reliable expectations of future developments are unavailable for an early warning system
Real interest rate	Credit growth is used instead
Real wage growth	Inflation provides sufficient information since nominal wage growth tends to be relatively rigid in the analysed countries
Terms of trade	DM/USD exchange rate used as a substitute given the import - export mix of the analysed countries
Real GDP growth	Industrial production which is available on higher frequency is used instead
Foreign interest rates	Interest rate differential was significantly positive by a wide margin throughout the analysed period
Commercial bank debt	Credit growth used instead; no reliable high frequency data on the quality of bank debt are available for transition countries
Various debt indicators	Only annual data are generally available
Equity prices	Capital markets were established during the analysed period and large corporates which usually form the basis of the stock market capitalisation were introduced on the capital markets only gradually
Asset prices	Asset valuation is often unreliable and asset markets are underdeveloped

In the third equation, industrial growth is seen to be dependent on both domestic and external environment, approximated by past growth performance. The fourth equation focuses on the dynamics of FDI, which is dependent mainly on a general perception of the economy by investors, which is in turn assumed to be correlated with the growth of domestic industrial production.

Finally, the last equation focuses on the indicators affecting the current account, i.e., an impact of domestic and international prices measured by domestic inflation, real exchange rates, and DM/USD exchange rate, and the impact of debt-induced domestic demand measured by domestic credit growth.

Although the assumptions listed above are rather ad hoc, they are in line with the typical empirical findings in the literature on currency crises (e.g. Kaminski, 1999). Another approach would be to use one of a number of currency crisis models developed in recent years (e.g., Aghion et al, 2000) and derive a set of theoretically based assumptions. Although there

is a wide range of available theoretical models, their relevance in the case of economies in transition is still to be proven both theoretically and empirically, and this is a task that goes beyond the scope of this paper.[1]

3.2 EMPIRICAL RESULTS

Since some of the time series are available only on a quarterly basis, the model was estimated by a maximum likelihood method using the panel of quarterly data for the Czech Republic, Hungary, Poland and Slovak Republic from 1994-99. There were 92 observations after an adjustment for the lag structure. The empirical results are presented in Table 3.

The empirical results confirm the relevance of selected early warning indicators for transition economies. Although the first equation on index of speculative pressure is not very informative with rather small R^2, showing that the index of speculative pressure has a limited forecasting power, all the other equations have R^2 around 0.60 and greater, and the signs of all the coefficients are in line with what is expected.

In the case of the index of speculative pressure, the greater is the gap between the current account and FDI, the greater is speculative pressure. Market volatility also increases with a stronger, possibly overvalued, real exchange rate in the past, although this coefficient is significant only at a 6 per cent level, and with worse external conditions, as shown by a negative sign of the coefficient for the EU growth.

The real exchange rate is negatively influenced by both a greater macroeconomic vulnerability in the past and by a greater inflationary pressures and/or greater exposure to sudden shifts in the direction of capital flows, the latter is expressed in terms of broad money divided by liquid international reserves. The growth in the EU has a positive impact on industrial growth, so the coefficient on the EU growth in the third equation is positive. The FDIs are influenced by long-term perspectives of the country, as the positive coefficient on industrial growth shows, although this coefficient is significant only at an 8 per cent level.

The current account is dependent on a number of factors. There is a negative impact on real exchange rate appreciation and greater real credit growth but a positive impact on inflation and DM/USD exchange rate. Although the positive impact on inflation may be somewhat surprising, as it is necessary to keep in mind a disinflationary environment and rigid nominal wage growth. The DM/USD influence is due to the composition of imports and exports. While imports are denominated mainly in US dollars, exports mostly use the euro as a base currency. Therefore, a stronger US dollar has a negative impact on the current account balance.

---

[1] See EBRD 1999 on macroeconomic developments in the transition countries during the last 10 years and on the extent of structural changes during this period.

Table 3: Empirical results for the VAR model

	lsp	Rer	Ind	fdi	ca
constant	1.92** (6.89)	0.11 (1.36)	0.15 (1.93)	-0.15* (2.07)	-0.02 (0.59)
isp (-1)		-0.05* (2.29)			
rer (-1)	0.57** (1.95)	0.69** (9.67)			-0.07* (2.19)
ca (-1)					0.89** (24.63)
Fdi (-1)				0.81** (10.75)	
fdica (-1)	1.03* (3.63)				
ind (-1)			0.75** (10.98)	0.11 (1.67)	
rcg (-1)					-0.12** (3.33)
inf (-1)					0.17** (4.54)
dmusd (-1)					0.11** (3.15)
m2ir (-1)		-0.17** (2.68)			
euind (-1)	-0.56* (2.09)		0.14* (2.00)		
R^2	0.16	0.59	0.60	0.63	0.92

Note: t-statistics are in parentheses; a star denotes statistical significance at 5% level; two stars denote statistical significance at 1% level; empty cell represents a priori restriction on a particular coefficient which was verified by testing down of the individual equation; the restricted VAR model was estimated by a maximum likelihood method

The empirical analysis above conforms to the expected quantitative relations among standard early warning indicators and the index of speculative pressure for the central European transition countries. However, this does not imply that such a model may be useful in predicting periods of greater market volatility. It merely suggests that the analysed early warning indicators are important for the overall assessment of macroeconomic vulnerability in post-communist countries. In the next section, selected periods of excessive macroeconomic vulnerability will be discussed in detail and the performance of early warning indicators assessed.

4. PERFORMANCE OF EARLY WARNING INDICATORS DURING CRISIS PERIODS

4.1 PERIODS OF ECONOMIC FRAGILITY IN CENTRAL EUROPE

There were three distinct periods of macroeconomic vulnerability which resulted in the necessity to implement an extensive package of macroeconomic measures and to change the exchange rate regime: March 1995 in Hungary, May 1997 in the Czech Republic and September 1998 in the Slovak Republic. These periods were also identified by the quantitative analysis of the index of speculative pressure in Section 2. In the next few paragraphs, these periods will be described in more detail.

In March 1995, the Hungarian authorities announced a package of economic measures, including a number of legislative changes aimed at improving the investment climate. In addition the introduction of a supplementary budget devalued the currency by 9 per cent and changed the fixed exchange rate regime to a crawling peg against a currency basket (leading to a 30 per cent devaluation by the end of the year). An important part of these economic measures was the focus on privatisation, mainly through direct sales of state enterprises to foreign investors. The main reason for such measures was the deterioration of the external and internal imbalances; without a supplementary budget the fiscal deficit would have exceeded 10 per cent of GDP and a default on external debt was a real possibility.

The Czech authorities adopted two stabilisation packages in the spring of 1997. In April, government expenditures were reduced, measures to suppress imports and support exports were proposed, and the need to improve corporate governance and complete privatisation of strategic enterprises, including the large banks, was finally recognised. In May, additional spending cuts were agreed, an acceleration of structural reforms was announced, and the fixed exchange rate regime was abandoned in favour of a managed float against DM. The stabilisation measures were necessary as rapidly growing external imbalances were complemented by emerging fiscal pressures and increasing contingent liabilities in the form of state guarantees for commercial loans and excessive non-performing loans in state-owned banks.

The Slovak crisis in September 1998, including proposed stabilisation measures and a change in the exchange rate regime, was a mirror image of the Czech May 1997 crisis, although the size of both external and internal imbalances was larger as a percentage of GDP. Political instability contributed greatly to macroeconomic vulnerability in the Slovak case, and an additional set of stabilisation measures was adopted in May 1999.

4.2 EARLY WARNING INDICATORS AND MACROECONOMIC VULNERABILITY: THE EMPIRICAL EVIDENCE

Recent years have highlighted the impact of the spillover effect from crises elsewhere on economies where macroeconomic fundamentals seemed to change only marginally (see Fries et al., 1999, on contagion in transition countries). Not only did the period of excessive macroeconomic vulnerability in Hungary follow the Mexico crisis, but also the Czech currency crisis in May 1997 coincided with the Asian crisis. The Slovak devaluation in October 1998 immediately followed the August 1998 Russian crisis (which was also a factor in the pressure on the Hungarian currency in September and October 1998). Clearly, recent crises have had an impact on investors' awareness of economic weaknesses elsewhere. However, one may talk about greater *regional* instability only in the case of the Slovak Republic since its fragile economic situation had been recognised for some time (see EBRD, 1998).

Some elementary signs of greater macroeconomic vulnerability were revealed by the annual data in all three cases (annual time series on external and public debt, general government deficit, and GDP growth are presented in Tables 4-7). Although the external debt was growing until the time of macroeconomic vulnerability, by which time it had exceeded 40 per cent of GDP in all three cases, it appears that only in Hungary did the size of the external debt contribute significantly to the macroeconomic vulnerability. It is worth noting that the size of contingent liabilities adds considerably to the explicit level of public debt in the Czech and Slovak Republics, and the share of non-performing banking sector loans in total exceeded 25 per cent in all three cases. Hence, the fiscal pressures are revealed by the headline indicators only tentatively.

Table 4: Total external debt (% of GDP)

	1993	1994	1995	1996	1997	1998	1999
Czech Republic	24.7	26.0	31.8	36.0	40.3	42.6	43.4
Hungary	63.7	68.7	70.4	61.1	51.9	56.9	60.5
Poland	54.9	47.1	38.0	35.2	36.0	36.2	37.6
Slovak Republic	28.2	33.9	32.7	40.8	50.9	58.5	57.6

Table 5: Total public debt (% of GDP)

	1993	1994	1995	1996	1997	1998	1999
Czech Republic	30.8	27.9	25.1	22.3	25.5	27.7	29.6
Hungary	90.4	88.2	86.4	72.8	63.9	62.3	59.0
Poland	88.7	72.4	57.9	51.2	49.8	43.2	43.3
Slovak Republic	33.4	29.6	26.0	25.8	24.8	27.2	28.7

Table 6: General government deficit (% of GDP)

	1993	1994	1995	1996	1997	1998	1999
Czech Republic	0.5	-1.1	-2.5	-2.3	-2.3	-1.6	-3.8
Hungary	-6.6	-8.4	-6.4	-3.0	-4.8	-6.6	-3.7
Poland	-3.1	-3.1	-2.8	-3.3	-3.1	-3.0	-3.5
Slovak Republic	-7.0	-1.3	0.2	-1.9	-4.4	-5.8	-3.2

Table 7: Gross Domestic Product growth (in %)

	1993	1994	1995	1996	1997	1998	1999
Czech Republic	0.6	3.2	6.4	3.8	0.3	-2.3	0.0
Hungary	-0.6	2.9	1.5	1.3	4.6	4.9	4.1
Poland	3.8	5.2	7.0	6.1	6.9	4.8	4.1
Slovak Republic	-3.7	4.9	6.9	6.6	6.1	4.4	1.5

Source: EBRD and national authorities.

The most important indicators available on a quarterly basis are from the balance of payment statistics: FDI and current account. Chart 2 suggests that in all three periods, a large part of the current account deficit was not covered by FDI. In the case of the Czech Republic and Hungary, the stabilisation package was necessary immediately after the gap between current account deficit and FDI exceeded 5 per cent of GDP. Although this indicator may be a good candidate as an early warning indicator based on a clearly defined threshold, the Slovak experience shows that it is possible to surpass 5 per cent threshold gap between current account deficit and FDI for up to two years before the crisis occurs, especially if currency markets are still not very liquid and initial indebtedness is low. In none of the cases discussed was emergency IMF financing necessary since the economies concerned had easy access to international capital markets. Thus, the analysis of the official flows is irrelevant although if the paper were to be extended to analysing less advanced transition countries, official flows would have to be included.

Chart 3 presents growth rates for early warning indicators available on the highest (monthly) frequency (inflation, domestic credit, ratio of broad money to liquid international reserves, and real exchange rate) 18 months prior to the adoption of stabilisation measures. One may define and calculate a composite index of market vulnerability (a sum of deviations from long-run trend for the four basic indicators: inflation, real exchange rate, broad money over international reserves, and real domestic credit) as proposed by Herrera and Garcia (1999). However, the environment of transition-accession reforms, which are expected to lead from a centrally planned economic system to a full membership in the Eurozone in less than 20 years, and which include regular price liberalisations and rapid growth of the underdeveloped financial sector, ensures that long-run trends picked up by standard econometric tools, such as the Hodrick-Prescott filter, would be largely superficial. Hence, a disaggregated analysis of individual indicators is preferred.

Inflation has been moderately declining in the last six to 12 months prior to the adoption of stabilisation measures in the Czech and Slovak Republics, but growing rapidly in Hungary. While the inflation rate was below 10 per cent in both the Czech and Slovak cases, it mostly exceeded 20 per cent in Hungary. All three countries are still in the transitionary period of disinflation disrupted by irregular price liberalisations, so the signals given by the inflation rate are neither particularly strong nor unambiguous.

There was strong domestic credit growth in nominal terms in all the three countries. The growth rates were between 10- 25 per cent in the Czech Republic and Hungary and between 30-60 per cent in the Slovak Republic. However, credit growth was subdued in the last nine months before the adoption of stabilisation measures in the latter case. The real credit growth was below 10 per cent in the Czech Republic and negative in Hungary and the Slovak Republic.

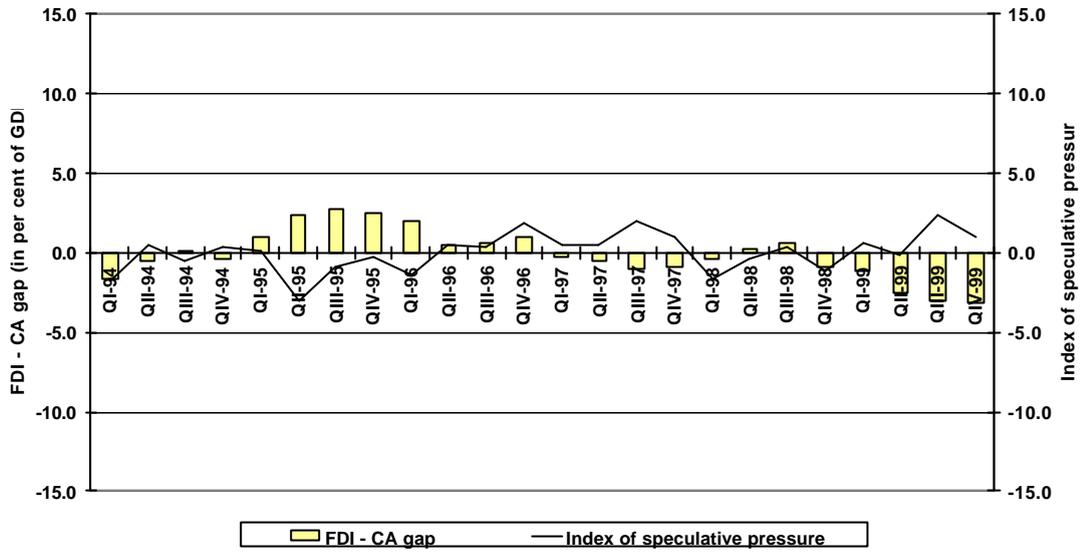**Chart 2: Market volatility and gap between current account and FDI**
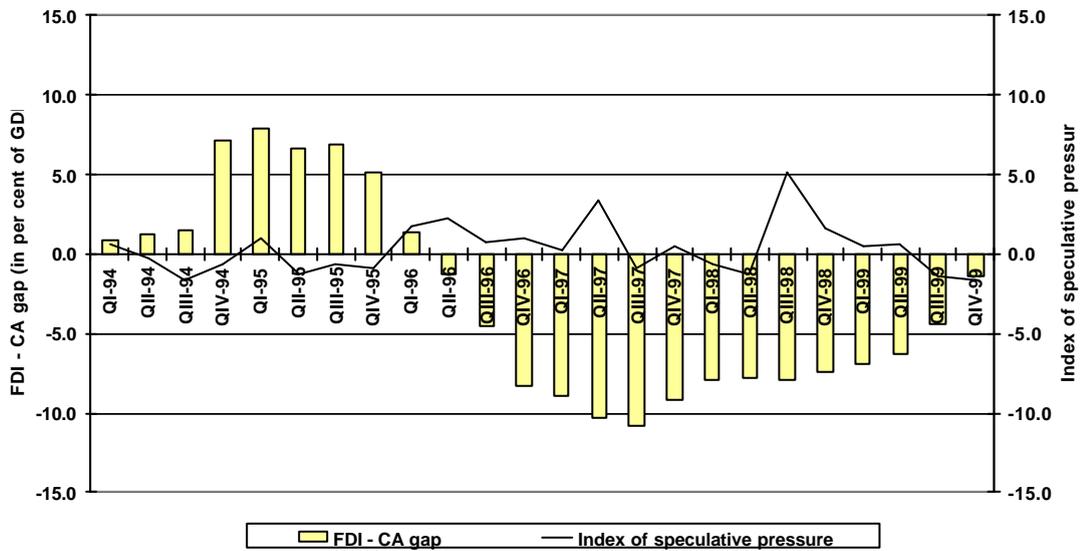
Czech Republic
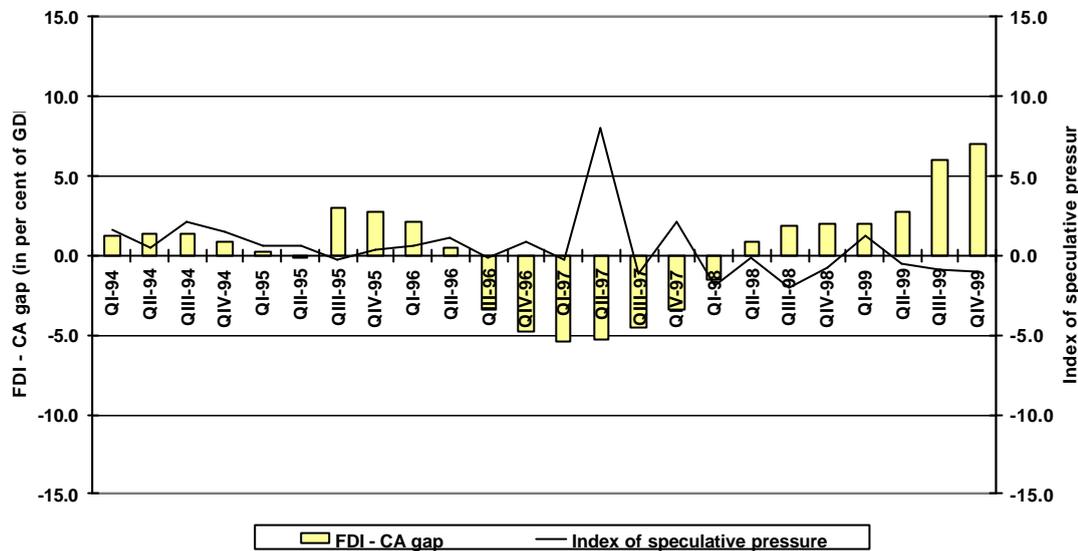
Hungary
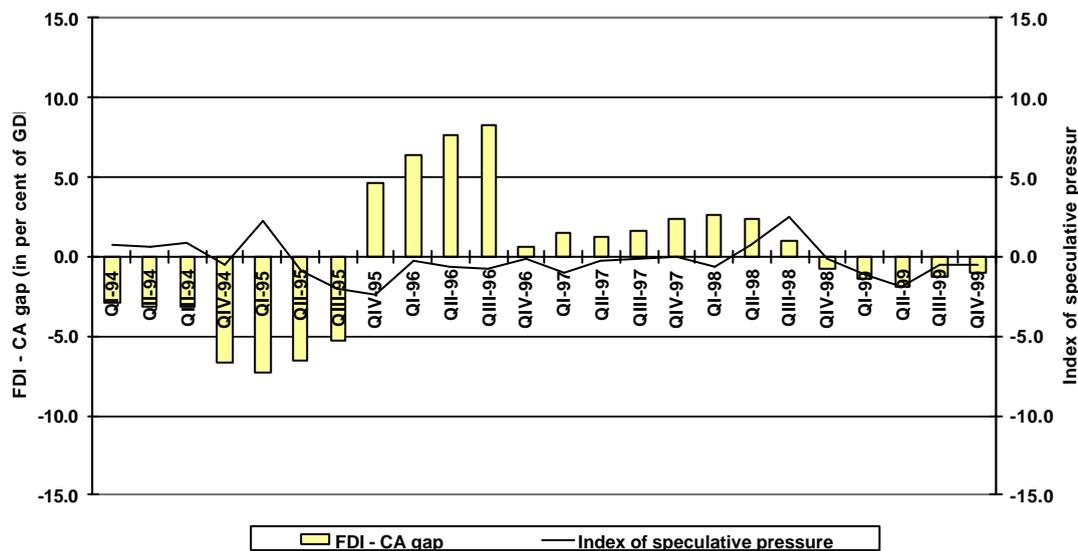
Source: Czech National Bank, National Bank of Hungary, and author's calculations.
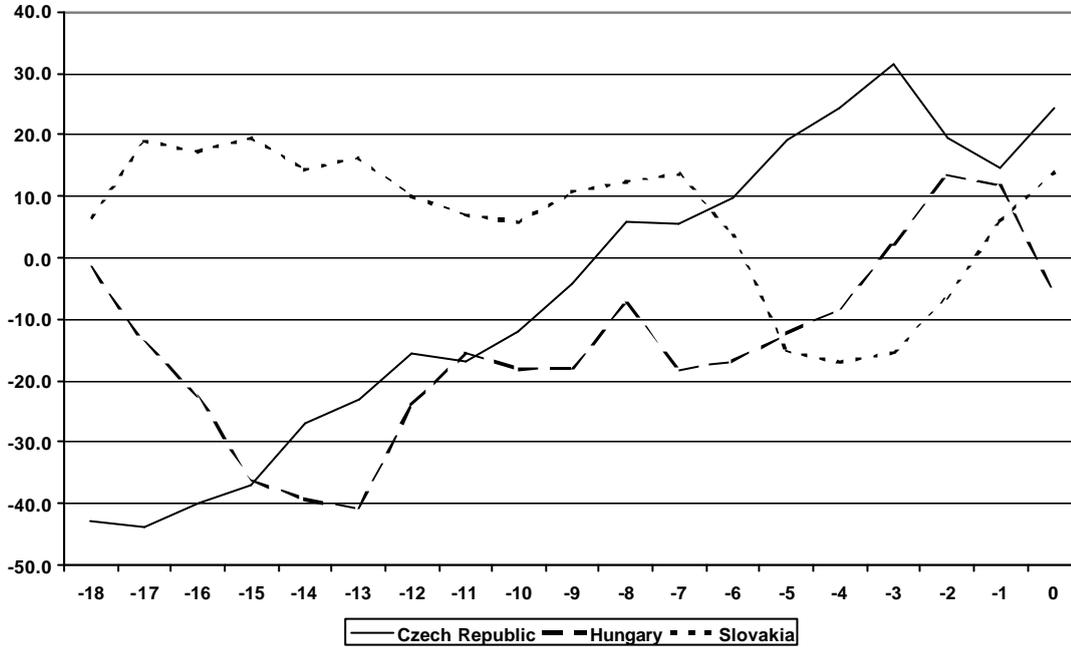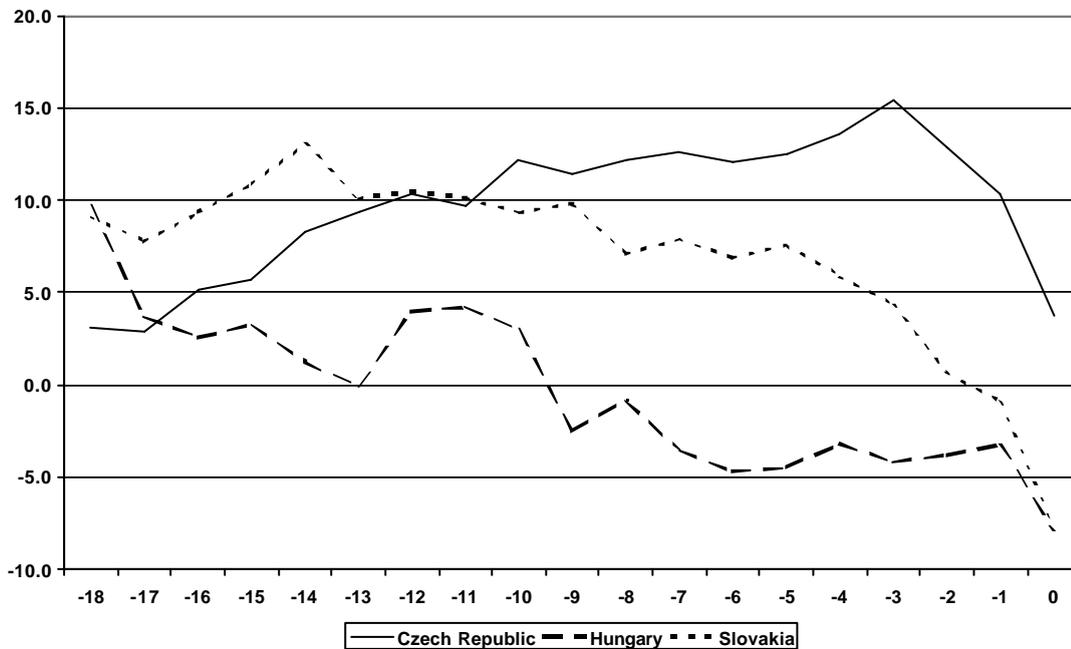
14

Poland

Slovak Republic

Source: National Bank of Poland, Slovak National Bank, and author's calculations .

Chart 3: Early warning indicators prior to adoption of stabilisation measures

Broad Money / Liquid International Reserves (% change year-on-year)

Real Exchange Rate (% change year-on-year)

Sources: Czech National Bank, National Bank of Hungary, National Bank of Poland, Slovak National Bank and author's calculations .

16

It is most likely that the contribution of credit growth to macroeconomic vulnerability lies mainly in the credit quality, which is not accounted for in the headline early warning indicators and on which is difficult to gather reliable information. It should be noted that the assessment of credit quality greatly changed prior to the period of excessive macroeconomic vulnerability. In the Czech Republic this was due to tighter banking regulations in Hungary it was because of strict bankruptcy law, and in the Slovak Republic an overall deterioration of the investment climate was the catalyst.

There is a clear and positive trend in the growth rate of broad money to liquid international reserves in the Czech Republic and Hungary, having increased from a negative growth of about 40 per cent to a positive growth exceeding 10 per cent. A similar trend can be found in the Slovak Republic although it appeared already 18-30 months before September 1998.[2]

The chart on real exchange rates for the last 18 months before the stabilisation measures were adopted shows the lack of a clear trend. While the currency appreciated strongly in the Czech case, real depreciation of the Hungarian currency was apparent for the last 9 months and there was a slowdown in the real appreciation of the Slovak koruna. However, this may be caused by different trends in DM/US dollar exchange rate. While the US dollar was strengthening for the last 12 months before the Czech currency crisis, the DM was gaining strength 3-9 months prior to the adaptation of stabilisation measures by both Hungary and the Slovak Republic. It is worth noting that there was a significant change in the DM/US dollar exchange rate movement in all three cases: Minimum and maximum year-on-year change during the 18 months prior to adoption of stabilisation measures was -8 per cent and 15 per cent in the Czech case, -14 per cent and +12 per cent in the Hungarian case, and -5 per cent and 24 per cent in the Slovak case.

---

[2] Not reported in the chart, but available on request.

5. CONCLUSION AND IMPLICATIONS FOR EARLY WARNING SYSTEMS FOR ADVANCED TRANSITION COUNTRIES

This paper analysed macroeconomic vulnerability in the four selected transition-accession central European countries during 1993-99. An index of speculative pressure was constructed and used for identification of periods of increased economic fragility, some of which had led to the adoption of wide-ranging stabilisation measures. A set of early warning indicators, available on high frequency and with minimum delay (usually one or two months) was analysed by the VAR model of macroeconomic vulnerability. Further, some of those indicators were later shown to be useful as an early warning system for advanced transition countries.

The analysis of three significant periods of high macroeconomic vulnerability, which ended in the change of an exchange rate regime and the introduction of deep structural reforms, reveals the limitations of technical analysis of potential early warning indicators. The most useful early warning indicator seems to be the gap between the current account deficit and FDI. Whenever this gap exceeded 5 per cent of GDP, pressure on the currency necessitated decisive policy action. The other early warning indicators did not provide such thresholds, mainly because of a transition economy environment, although there were some common trends and features in most of the analysed indicators. Among annual data, rising external debt and worsening fiscal performance were the most significant. As for the monthly data available, relatively high growth rate of domestic credit (potentially contributing to an increase in non-performing loans), rapid change in the growth rate of broad money to international reserves, from about -40 per cent year-on-year to more than +10 per cent, and volatile world exchange rates (namely DM/USD exchange rates) preceded the periods of unsustainable macroeconomic vulnerability.

There are several important lessons to be learned from the analysis of early warning indicators of a currency crisis in advanced transition countries: (i) the standard early warning indicators provide useful information on macroeconomic vulnerability prior to the crisis; (ii) this information is mainly indicative of growth rate trends; (iii) the 5 per cent gap between the current account deficit and FDI provides a clear and early warning of forthcoming volatility, ending in an economic crisis in all the analysed countries; and lastly (iv) an early warning system needs to include information which is hard to quantify and the data which is often not readily available (such as quality of loan portfolio, competitiveness of domestic production, etc.).

An important test case for any existing early warning system for transition-accession countries of central Europe is the Polish economy. Based on information available at the time of writing (May 2000), the gap between current account deficit and FDI may exceed 5 per cent of GDP within a year or two, depending on the development of external imbalances and the progress of privatisation, which is scheduled to be largely completed in 2001. Further, domestic credit has been growing strongly for more than a year, the growth rate of broad money to liquid international reserves has changed from -10 per cent to +10 per cent in the course of the last 18 months, and there was a significant volatility in the international currency and capital markets, with the euro falling at an alarming rate and stock markets experiencing a correction of overvalued technology stocks. Also, there are strong fiscal pressures owing to a number of reforms implemented in 1999 and there is doubt about competitiveness of Polish exports. Thus, early warning indicators analysed in this paper indicate a period of unsustainable macroeconomic vulnerability which may result in an economic crisis within a year or two unless the authorities adopt a stabilisation policy aimed at increasing the competitiveness of Polish economy.

ANNEX - EXCHANGE RATE REGIMES AND CURRENCY CONVERTIBILITY IN SELECTED CENTRAL EUROPEAN COUNTRIES DURING THE 1990S

The Czech Republic adopted a fixed exchange rate regime against a currency basket in January 1991 as a part of an extensive reform package. The fluctuation band was substantially increased from ±0.5 per cent to ±7.5 per cent in February 1996. In May 1997, the authorities were forced to abandon the fixed exchange rate regime following a successful currency attack and adopted managed float against the DM.

Hungary followed a fixed exchange rate regime against a currency basket with periodic devaluations and a small intervention band until March 1995 when a crawling peg regime was introduced with a devaluation rate reflecting the expected inflation rate. The devaluation rate was subsequently lowered as disinflation proceeded. At the end of 1999, the Hungarian forint followed the pre-announced crawling peg to a currency basket with devaluation rate of 0.4 per cent and fluctuation band of ±2.25per cent.

Poland adopted a crawling peg exchange rate regime already in May 1991 with declining monthly devaluation rate and a widening fluctuation band. In December 1999, the devaluation rate was 0.3 per cent and the fluctuation band ±15 per cent. The width of the fluctuation band accommodated substantial depreciation throughout 1999, from about 9 per cent above the parity at the beginning of the year to about 4 per cent below the parity at the time of tax reform and budget discussions in November 1999.

The Slovak Republic, which split from Czechoslovakia in January 1993, had a fixed exchange rate regime against a currency basket with a gradually increasing fluctuation band until the end of September 1998. On 1 October the fixed exchange rate was abandoned and the managed float adopted.

Full current account convertibility was introduced in the Czech Republic in October 1995, in Hungary in January 1996, in Poland in June 1995, and in the Slovak Republic in October 1995. There are still a number of restrictions on the capital account in all the countries, especially on short-term capital flows in Hungary and Poland, but foreign exchange markets have been fairly developed and liquid throughout the analysed period. It is worth noting that the level of forex market liquidity helps to explain why the currency attack in May 1997 was successful in the Czech Republic but failed in the Slovak Republic at the same time.

REFERENCES

P. Aghion, P. Bacchetta and A. Banerjee (2000), "Currency Crises and Monetary Policy in an Economy with Credit Constraints", manuscript.

A. Berg and C. Pattillo (1998), "Are Currency Crises Predictable?", Working Paper 98/154, International Monetary Fund, Washington D.C.

European Bank for Reconstruction and Development (1998), *Transition Report 1998*, London.

European Bank for Reconstruction and Development (1999), *Transition Report 1999*, London.

B. Eichengreen, A. K. Rose and C. Wyplosz (1996), "Contagious Currency Crises", Working Paper 5681, National Bureau of Economic Research.

S. Fries, M. Raiser and N. Stern (1999), " Stress Test for Reforms. Transition and East Asian Contagion", *The Economics of Transition*, 7 (2), pp. 535-567.

S. Herrera and C. Garcia (1999), "User's Guide to an Early Warning System for Macroeconomic Vulnerability in Latin American Countries", Policy Research Working Paper 2233, World Bank, Washington D.C.

International Monetary Fund (1998), *World Economic Outlook*, Washington D.C.

G. L. Kaminsky (1999), "Currency and Banking Crises The Early Warning of Distress", Working Paper 99/178, International Monetary Fund.

G. L. Kaminsky, R. Saul and M. Carmen (1997), "Early Warning Indicators of Currency Crises", Working Paper 97/79, International Monetary Fund.

N. Roubini and P. Wachtel (1997), "Current Account Sustainability in Transition Economies", mimeo, New York Stern School of Business, New York University.