Anticipations, External Crises and Growth Cycles in Emerging Market Countries*

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Abstract

This paper attempts to carry out a study of relative importance of *anticipated* and *unanticipated* external crises for the dynamics of economic growth. The estimations are carried out within a two equation system capturing the possibility of a common shock to external crises and growth. The effect of current-account reversals on growth appears to be similar across considered regions, however, one cannot draw any general conclusion about the importance of the unanticipated component of the reversals for growth. The effect of currency crises appears to vary across the regions of Central and Eastern Europe, Latin America and Asia. The unanticipated component of the currency crises is significant only in CEE. The unanticipated component in the effect of the joint crisis on growth appears to be important in Latin America, and with lower precision also in CEE and Asia.

Keywords*:* Anticipations, External Crises, Growth Cycle, Panel Data.

JEL Classification: E32, F31, F32, O52, O53, O54

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1 Introduction

Many emerging market economies and developing economies have encountered serious problems with their external positions during the last few decades or so. These problems have been mostly related to external financing or dramatic developments of variables crucial for foreign trade and overall uncertainty in an economy. Such problems have usually resulted in lower economic performance of the affected country and prolonged periods of recovery from ensuing economic and political depressions. Given the prevailing consequences such events or periods are classified as crises.

The associated literature has developed in this respect and nowadays people tend to categorize the external crises into two major groups, of *currency crises* and *sudden stops in capital (in)flows*. Several methodologies of how to identify such events have been developed and are based upon a set of necessary and sufficient conditions[1]. One extensive strand of the literature attempts to produce so called *early warning models* (EWM) of the external crises so that such events can be to some extent forecasted[2]. Another, more recent, strand of the literature strives to quantify consequences of the crises for economic performance. The theoretical literature on the possible effects of external crises on economic performance is wide-ranging. However, unlike in the case of sudden stops in capital flows that are deemed to have a negative

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[1] see e.g. Eichengreen et al. (1995), Frankel and Rose (1996), Park and Lee (2001), Barro (2001), Milesi-Ferretti and Razin (1998) and (1999), Edwards (2001), and Hutchison and Neuberger (2002b).

[2] Frankel and Rose (1996), Kaminski, Lizondo and Reinhart (1998), Kaminski and Reinhart (1999), Milesi-Ferretti and Razin (1998), Milesi-Ferretti and Razin (1999), Berg and Pattillo (1999), and Edison (2000).

influence on economic performance (see Calvo, 1998 and 2000, and Calvo and Reinhart, 1999), the effect of currency crises is ambiguous (Moreno (1999), Gupta et. al. (2000), Shankar (2001).

The approaches adopted for the estimation of an impact of external crises on growth can be roughly summarized into three groups. The so called *event studies* look at stylized facts derived from the difference in the development of the most important macroeconomic variables before and after the crises occurrence and draw some conclusions based on this (see e.g. Gupta et al. (2001), Aziz et al. (2000) and Millesi-Ferretti and Razin (1999, 1998). Another approach is to look at significance of crises identification dummies in *long-run growth regressions* (5-year averages) as applied e.g. by Barro (2001). Finally, recently the most popular approach seems to be the one looking at the *short-run growth regressions* (using yearly data) as e.g. Edwards (2001), Hutchison and Neuberger (2001, 2002a, 2002b) and Moreno (1999).

Since the external crises are likely to affect a disparate set of macroeconomic fundamentals apart from growth, some of the studies look into what is called the *indirect effect* of the crises on growth as well. These are for example Barro (2001), Edwards (2001) and Melecky (2003) where the latter attempts to compound the *direct* and *indirect* effects into an overall effect of the crises.

This paper attempts to carry out a study of relative importance of *anticipated* and *unanticipated* external crises for the dynamics of economic growth. The anticipation of external crises is assumed to be rational, i.e. based on an information set available to the markets (agents) for forecasting of such events. The estimation of the total effect of external crises on growth and the effect coming from their anticipated components are carried out within a two equation system capturing the

possibility of a common shock to external crises and growth. The estimates of the effects are then formally compared using a t test for matched-pairs data and the relative impact of the anticipated and unanticipated components of external crises is discussed.

The next section outlines the two equation system used for estimation and comments on the estimation techniques to be used. In section three the two types of external crises are identified and all the data used for estimations described. Section four discusses briefly the peculiarities associated with the weak instrument problem and performs checks on whether such a problem is likely to occur here. The estimations are carried out and commented on in section five. Section six looks into some regional specifics of the currency crises' effects on growth. The presence of the unanticipated component in the effect of external crises on growth is tested in section seven. Section eight concludes.

2 Outline of the Model

The effects of external crises on economic performance have been largely investigated in a context of a single, growth regression equation. Using this approach, one first identifies the events that most likely bear the characteristics of external crises and then attempts to estimate the effect of external crises on growth by including the identification dummies as explanatory variables into the growth regression together with some control variables. More formally, the regression equation run by many researchers is of the form:

$$growth_{t,i} = \boldsymbol{\alpha}_0 \boldsymbol{x}_{t,i} + \boldsymbol{\alpha}_1 \boldsymbol{d}_{t,i} + \varepsilon_{t,i} \qquad (1)$$

where *growth* is some measure of economic performance, $\boldsymbol{x}_{t,i}$ is a vector of control variables and $\boldsymbol{d}_{t,i}$ is a vector of the external-crises identification dummies. $\boldsymbol{\alpha}_0$ and $\boldsymbol{\alpha}_1$ are vectors of estimated coefficients, with $\boldsymbol{\alpha}_1$ being the direct effects of external crises. The subscripts t and i denote time and individuals (countries), respectively. An estimate of the expected part of the external crises is then obtained from the following regression:

$$\boldsymbol{d}_{t,i} = E\left(\boldsymbol{d}_{t,i} \mid \boldsymbol{I}_{t-1,i}\right) + \xi_{t,i} \tag{2}$$

where $E\left(\xi_{t,i} \mid \boldsymbol{I}_{t-1,i}\right) = 0$ and $E\left(\varepsilon_{t,i}\xi_{t,i}\right) = \sigma_{\varepsilon\xi}$. $\boldsymbol{I}_{t-1,i}$ is the information set available to the markets at time $t-1$. Since $E\left(\varepsilon_{t,i}\xi_{t,i}\right) \neq 0$ one can observe that the correlation of the shocks entering the system via (1) and (2) make the $\boldsymbol{d}_{t,i}$ variable endogenous since $E\left(\varepsilon_{t,i} \mid \boldsymbol{d}_{t,i}\right) = 0$ no longer holds. The simultaneous equation system consisting of (1) and (2) enables us to investigate the effect of the anticipated part of external crises on growth.

Now, let us rewrite equation (1) as:

$$growth_{t,i} = \boldsymbol{\beta}_0\boldsymbol{x}_{t,i} + \boldsymbol{\beta}_1 E_{t-1}\left(\boldsymbol{d}_{t,i}\right) + \eta_{t,i} \tag{3}$$

where $E_{t-1}\left(\boldsymbol{d}_{t,i}\right)$ stands for the expectation of the external crises based on information that are available to the markets (agents) at time $t-1$.

The difference between the magnitudes of $\boldsymbol{\alpha}_1$, estimated under the assumption $E\left(\varepsilon_{t,i} \mid \boldsymbol{d}_{t,i}\right) = 0$, and $\boldsymbol{\beta}_1$ can be introduced as a measure of the impact the unanticipated component of the crises has on growth. One can then investigate

significance of the unanticipated part by testing the hypothesis of $\boldsymbol{\alpha}_1 - \boldsymbol{\beta}_1 = 0$[3]. If the hypothesis is not rejected then a country with sound economic environment should not suffer any major harm when experiencing a disturbance equivalent to an external crisis.

The equation (3) can be readily estimated using the generalized method of moments (GMM) where $\boldsymbol{\beta}_0$ and $\boldsymbol{\beta}_1$ are the vectors of parameters of interest and $E\left(\boldsymbol{d}_{t,i} \mid \boldsymbol{I}_{t-1,i}\right)$ is deemed to be some projection of the vector of the crises-identification dummies into the plane spanned by the information set I_{t-1} which is orthogonal to the error term from equation (3), i.e. $E\left[\eta_{t,i} \mid E\left(\boldsymbol{d}_{t,i} \mid \boldsymbol{I}_{t-1,i}\right)\right] = 0$. The latter assumption requires the instrument coming from the information set I_{t-1} to be valid. This assumption is tested using the Sargan Test reported as a part of the estimation results.

3 Crises Identification and Data Description

The data pool used for estimation comprises 46 countries and covers the period of 10 years starting from 1992 up to 2001. All the data has been obtained from the International Financial Statistic (IFS) published by the IMF.

3.1 Currency Crises

To identify currency crises the methodology proposed by Park and Lee (2001) is followed here. It is based on the identification of currency crises introduced by

[3] If only one crisis dummy was used one could simply compare the resulting variances of the residuals from equation (1) and (3). Once a vector of dummies is in use one has to apply a sequence of tests as it is done here.

Frankel and Rose (1996). They identified these kinds of crises with large nominal deprecations of a country's currency over a short period. The more rigorous identification of Park and Lee, recently applied by Barro (2001), defines a currency crisis as a situation in which the nominal depreciation of the currency was at least 25 percent during any quarter of the year and exceeded by at least 10 percentage points the depreciation of the currency in the previous quarter[4].

Such identification is applied to the sample of emerging market countries where a month-to-month change is used as a measure of the necessary condition of the 25 percent depreciation. Using such a method 35 currency crises from 590 observations for the total of 59 EM countries have been identified; 17 of them in Central and Eastern Europe, 5 in East Asia and 13 in Latin America. The exact number of crises and the number of available observations for each particular country are presented in the Appendix in Table A1[5]. The time profile of currency crises, current account reversals and their joint occurrence (the crises) is portrayed in Figure 1 for the entire sample of EM countries.

****** Figure 1 Here ******

3.2 Current Account Reversals

So-called "sudden stops" in capital flows are viewed as more harmful for economic growth (at least in the short run) relative to currency crises (see e.g. Hutchison and

[4] Note that such identification may result in the $\boldsymbol{d}_{t,i}$ being serially correlated.

[5] Although only the provided identification is used throughout this paper, I have also include currency crises' dummies based on the sufficient condition only, i.e. 10% quarter-to-quarter devaluation, into the regression equation. Surprisingly, such optional dummy appeared to be more significant, bearing a larger negative coefficient relative to the primary one.

Neuberger, 2002b). It is common practice to identify such "sudden stops" with current account reversals beyond certain threshold (see. e.g. Hutchison and Neuberger, 2002b; Edwards, 2001 or Milesi-Ferretti and Razin, 1998 and 1999). Initially, two thresholds are considered following in this respect Milesi-Ferretti and Razin. A current account reversal is thus defined as a positive change of the current account balance-to-GDP ratio of at least 3 % (alternately 5 %) in the particular year[6,7].

Applying this criterion 76 current account reversals have been identified using 453 observation on the changes in current account-to-GDP ratios in the total of 59 EM countries during 1993-2001; 29 of them in Central and Eastern Europe, 23 in East Asia and 24 in Latin America. The exact number of the reversals for each country and the available observations are provided in the Appendix in Table A1.

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[6] For instance, Edwards uses another alternative measure that is less restrictive and identifies currency crises with a positive change in the current account-to-GDP ratio of at least 3 % in three consecutive years. On the other hand, Hutchison and Neuberger impose, alternatively, an additional condition that the post-reversal current account deficit is higher than –1 % of GDP. This is motivated by the hypothesis that capital inflow reversals will be especially painful if they constitute an almost complete stop in capital inflows (or even capital outflows). In my robustness checks I also control for the size of the reversal (as a fraction of GDP). The approach applied here is therefore a mixture of the two since I use two thresholds of 3 % and 5 % but we are concerned with changes in the current account relative to GDP.

[7] The results provided later in this paper are associated with the 3% threshold only. The inclusion of dummy indicating the 5% reversal appeared to be of the similar significance and a somewhat higher magnitude proportional to the difference between the two thresholds.

3.3 Joint Occurrence of Currency Crises and Current Account Reversals[8]

The joint occurrence of a currency crisis and a current account reversal is expected to have an additional effect on economic performance of EM countries since both sets of transmission channels of negative effects associated with the two slightly different events are in force and combined together. 12 joint occurrences of currency crises and current account reversals has been identified using 453 available observations for the total of 59 EM countries during 1993-2001; 4 of them were identified in Central and Eastern Europe, 3 in East Asia, and 5 in Latin America. The number of such events for each country is provided in Table A1 in the Appendix.

3.4 Data Description

All the data described in this subsection are assumed to belong to the information set $\boldsymbol{I}_{t,i}$ and will be used to obtain the conditional expectation of the vector of the identification dummies as described in equation (2). The choice of the variables included in the information set is based upon work by Frankel and Rose (1996), Kaminski, Lizondo and Reinhart (1998), Kaminski and Reinhart (1999), Milesi-Ferretti and Razin (1998 and 1999), Berg and Pattillo (1999), and Edison (2000).

Current Account Indicators

The large deficits of the current account as a percentage of GDP (CA) create good grounds for a severe adjustment of this balance, i.e. current account reversals. An

[8] Only such joint occurrence of a currency crisis and a current account reversal is deemed to be the so-called "sudden stop" according to Hutchison and Neuberger.

excessive appreciation of the nominal exchange rate (*NER*) defined as 'DCC'/USD (DCC – domestic country's currency) induces small adjustments that can result in large depreciations, i.e. currency crises. The real exchange rate (*RER*) overvaluations are positively linked to the external crises. *RER* is defined as the nominal exchange rate ('DCC'/USD) adjusted for relative consumer prices. A depreciation of the exchange rate (*NER* and *RER*) is an increase in the magnitude of the exchange rate. Here *RER* is not filtered by a time trend due to a short time period of available data. The volume of *Exports* and *Imports* indicate how strong the external sector is. Namely, a decrease in exports and an increase in imports are associated with external crises. In general, investment (*Invest*), here gross fixed capital formation, as a percentage of GDP is expected to worsen the external position of a country which exposes it to a possible severe adjustment of its current account position and so an external crisis. However, the latter is a rather short-run perspective and in the long run investment should generate higher output growth working against this exposure.

Capital Account Indicators

A loss of foreign exchange reserves (*FERes*) makes a country more vulnerable to external, particularly currency, crises. The M2-to-foreign exchange reserves ratio (*M2/FERes*) appears to be a good indicator of external crises as expansionary monetary policy and/or sharp decline in the foreign reserves are likely causes of such crises. An increase in the foreign direct investment (*FDI*) inflow as a percentage of GDP raises foreign exchange reserves and the stock of less reversible capital in the domestic country making it less vulnerable to external crises. On the other hand, inflows of portfolio investment (*PI*) help a country to finance its current account

deficit but since these inflows are highly reversible they increase its exposure to external crises.

Domestic Financial Indicators

M2 multiplier (*M2multi*), defined as a ratio of M2 aggregate to base money, and the ratio of domestic credit (*DomCredit*) to GDP, are indicators of credit growth. Credit expands prior to the crises and contracts afterwards. High domestic real interest rates could signal a liquidity crunch, or have been increased to fend off a speculative attack and/or attract short term foreign capital. Here the real interest rates are calculated using ex post CPI inflation (*infCPI*). Both deposit and lending rates (*Dep IR* and *Lend IR*) are used together with CPI inflation entering the information set unrestricted. Further, the lending to deposit ratio is implicitly included in the information set since lending rates tend to rise relatively to deposit rates prior to the crises reflecting decline in loan quality. The ratio again enters unrestricted. Since a loss of commercial deposits emerges as the crises unfold overall bank deposits (*Deposits*) and demand deposits (*DmdDep*) are used as indicators of the crises, both deflated by CPI.

Domestic Real Sector Indicators

Percentage *growth* of GDP and an index of a GDP level (*GDP*) are used here as the indicators of recessions that often precede external crises.

Fiscal Sector Indicators

Increasing government budget deficit-to-GDP ratio (*GovBudget*) as well as government consumption-to-GDP (*Govcons*) ratio are deemed to make the domestic country more vulnerable to external crises.

Structural and Institutional Factors

A country more open to foreign trade as measured by the sum of exports and imports-to-GDP ratio (*Open*) is likely to be less exposed to the external crises.

4 External Crises Anticipation

There is one important property regarding the fit of equation (2) that should be discussed at this point. Use of any instrumental variables (IV) estimation method or GMM may introduce a problem with *weak instruments* as explained in Stock and Watson (2003)[9].

The possible problem with weak instruments provides good grounds for carrying out the actual estimation of the projections described in equation (2) explicitly, although the focus here is not upon producing models for crises' predictions. Thus we check whether the weak instrument problem is present when estimating equation (3) by GMM. Table A2 in the Appendix presents the estimations of a linear probability model of equation (2) for the vector of crises-identification dummies using the one-step estimation method and the heteroscedasticity robust

[9] For further details see e.g. Stock, Wright and Yogo (2002), Staiger and Stock (1997), Pagan and Robertson (1998), Hall et al. (1996) or Wang, and Zivot (1996).

covariance matrix. Further, the information set $\boldsymbol{I}_{t-1,i}$ includes only lagged values, within a range of one to four lags, such that $E\left(\boldsymbol{\xi}_{t,i} \mid \boldsymbol{I}_{t-1,i}\right) = 0$ is satisfied. The span of the lag length is chosen so as to represent medium-to-long term conditions in the economies. The estimation of equation (2) is carried out for both minimum and maximum lag length applied to the set of instruments.

Stock, Wright and Yogo (2002) suggest that an instrumental variable or a vector of instrumental variables should be categorized as weak if the *F*-test that the coefficients of the instruments available for $\boldsymbol{d}_{t,i}$ are zero is less than 10. As one can observe in Table A2 the magnitude of the *partial F*-test is far larger than 10. Table A3 in the appendix provides summary statistic when the minimum lag length of the instruments is used. Both partial *F*-tests seem to suggest that the instruments as a set are relevant and the weak instrument problem is not likely to occur here. Nevertheless, those instruments that do not contribute to explanatory power of the auxiliary regression for either of the $\boldsymbol{d}_{t,i}$'s are excluded from the instrument set used for GMM. Furthermore, it seems that inclusion of more lags of the instruments significantly increases the ability of the auxiliary model to forecast the $\boldsymbol{d}_{t,i}$.

5 Estimations

In this section an equation similar to (1) is first estimated under the assumption of the vector $\boldsymbol{d}_{t,i}$ being weakly exogenous. Given the annual frequency of the data the growth in GDP appearing as the RHS variable in (1) stands for medium-term growth rather then log-run growth that is usually modeled as five-year averages of the growth rates (see e.g. Barro, 2001). Hence, we try to model rather *growth cycle*

characteristics of the GDP growth than its long-run component, as the latter is explained by fundamentals with low variation at the frequency used here (e.g. fertility rate, schooling rate, etc.). Pagan (1997) shows that major growth cycle characteristics can be generated by using the following model:

$$growth_t = c + \theta_1 growth_{t\text{-}1} + \theta_2 gdp_{t\text{-}1} + v_t \tag{4}$$

We thus use this model as our basic specification and further include the crises identification dummies. The vector $\boldsymbol{x}_{t,i}$ of the control variables in (1) hence contains $growth_{t-1,i}$ and $gdp_{t-1,i}$. The time trend t is further included to represent a trend in growth sometimes observed in the growth series of emerging market countries. The estimated equation is thus of the following form:

$$growth_{t,i} = \boldsymbol{\pi}_0 \boldsymbol{d}_{t,i} + \boldsymbol{\pi}_1 growth_{t-1,i} + \boldsymbol{\pi}_2 gdp_{t-1,i} + \boldsymbol{\pi}_3 t_i + \boldsymbol{\pi}_4 c_i + \boldsymbol{\zeta}_{t,i} \tag{5}$$

where c_i are the intercepts. All the coefficients $\boldsymbol{\pi}_j$ are restricted to be common for all the countries since the interest here is only in common (general) properties of such estimations for the given sample of countries.

Some transformation to eliminate the individual effects can be also used, although this operation affects the degrees of freedom. Differencing is employed here for such a purpose. Since the estimated panel is dynamic an appropriate estimation method has to be employed. We can group all the RHS variables in equation (5) into a vector $\boldsymbol{x}_{t,i}$ assumed to be endogenous within the system considered here. When equation (5) is transformed into differences the regression assumption or applied moment conditions become $E\left(\Delta\boldsymbol{\zeta}_{t,i} \mid \Delta\boldsymbol{x}_{t-1,i}\right)$ which is no longer equal to zero. To see this:

$$
\begin{aligned}
E\left(\Delta\boldsymbol{\zeta}_{t,i}\Delta\boldsymbol{x}_{t-1,i}\right) &= E\left(\left(\boldsymbol{\zeta}_{t,i}-\boldsymbol{\zeta}_{t-1,i}\right)\left(\boldsymbol{x}_{t-1,i}-\boldsymbol{x}_{t-2,i}\right)\right) \\
&= E\left(\boldsymbol{\zeta}_{t,i}\boldsymbol{x}_{t-1,i}-\boldsymbol{\zeta}_{t,i}\boldsymbol{x}_{t-2,i}-\boldsymbol{\zeta}_{t-1,i}\boldsymbol{x}_{t-1,i}+\boldsymbol{\zeta}_{t-1,i}\boldsymbol{x}_{t-2,i}\right) \qquad (6) \\
&= E\left(\boldsymbol{\zeta}_{t-1,i}\boldsymbol{x}_{t-1,i}\right) \neq 0
\end{aligned}
$$

The last line is due to the fact that $E\left(\boldsymbol{\zeta}_{t,i}\boldsymbol{x}_{t,i}\right) \neq 0$. Clearly, when the dynamic panel is transformed into *differences* all the predetermined variables in equation (5) have to be instrumented, i.e. valid and relevant instruments have to be found. The instruments can be employed in a traditional way or applied as so called GMM instruments as suggested by Arellano and Bond (1991). We use the latter hereafter since the GMM instruments enable to dynamically operate with the time span of the instrument set. Two estimation methods are employed here, the first being traditional GMM and the second essentially similar to the Arellano and Bond procedure. Further, both of these methods use the heteroscedasticity robust covariance matrix estimator with the small sample correction as derived by Windmeijer (2000).

Table 1 presents the estimations of equation (5) in levels (GMM) and when transformed into differences (Arellano and Bond procedure) under the assumption of weakly exogenous external crises. When the latter is performed *growth* and *GDP* are used as the GMM instruments starting in period $t-2$.

****** Table 1 Here ******

The controls for growth cycle properties appear to be highly significant in both estimations and so does the joint trend in growth when the estimation in levels is performed. All the external-crises identification dummies seem to affect the growth cycle in a manner suggested by theory. Namely, reversals in current account hinder economic growth by 1.6 to 1.8 percentage points in the current year and this effect is

found to be highly significant. Even though the effect of currency crises ranges between negative 0.5 to 1.3 it is not significant at common levels. The joint occurrence of the two crises is likely to be associated with a top up of negative 3.5 percentage points for both the events. But again, this nonlinear effect is only marginally significant.

In the next step both equation (1) and (2) are considered so that now the external crises are endogenous within the system and only the linear projections of the identification dummies into the plane spanned by the information set, $E\left(\boldsymbol{d}_{t,i} \mid \boldsymbol{I}_{t-1,i}\right)$, are deemed to be valid regressors in equation (3). Now both *levels* and *differences* are estimated using GMM. *growth* and *GDP* are used as the GMM instruments starting in period $t-1$ and $t-2$ when estimating in levels and differences, respectively. All the other instruments belonging to the information set $\boldsymbol{I}_{t-1,i}$ are employed as the GMM instruments within the lag range of $t-1$ to $t-4$ for the levels and $t-2$ to $t-4$ for the differences. The estimations are presented in Table 2:

****** Table 2 Here ******

Again the controls for growth cycle properties appear to be significant and affect growth in the expected manner. The effect of current account reversals is found to be significant, of about 1.7 percentage points. The currency crises, on contrary, appear to be insignificant although their coefficient indicates a rather negative impact on growth. The additional effect from the joint occurrence of the two crises is again estimated as negative of about 3.6 and 5.1 percentage points for levels and differences, respectively.

5.1 Discussion of the Results

Given that the external crises consist of some anticipated and unanticipated parts then the associated identification dummies have similar interpretations. Assume for now that the information set $\boldsymbol{I}_{t-1,i}$ is large enough to contain all the important information about fundamentals upon which agents base their anticipation about the crises occurrence. One can conclude from the performed estimations that most of the harmful effects of the current account reversals come from the unsound development or functioning of the economy, i.e. the economy itself. Such a finding, if valid, would imply that the reversals owing to the so called *contagion* or *herd behavior* are less detrimental to economic performance. In other words, after accounting for the common reversal-growth shocks the reversals still seem to have an important negative effect on growth similar to that estimated under the weak exogeneity assumption.

Nevertheless, a similarly strong claim regarding currency crises and the joint crises cannot be made since the inference about these two events is rather uncertain and the effect of the currency crises appears to be in general insignificant. This finding may be due to their different regional effects since the theory tells us that generally even a significant depreciation of an exchange rate should have a rather expansionary effect on economic performance.

6 Regional Effects of Currency Crises

To say more on the effect of currency crises from the regional perspective the equation (3) is estimated again using regional dummies interacting with the coefficients of the currency-crises and the join-crises dummies. Here three regions are

considered, namely, those of Central and Eastern Europe (CEE), Latin America (LA) and Asia. In all the other respects this estimation is similar to the preceding one. The results are reported in Table 3 below[10]:

****** Table 3 Here ******

It seems that unless accompanied by the current account reversals the currency crises have no significant negative effects on economic performance in Latin America and Asia. Furthermore, the estimations for LA propose a positive effect of currency crises on growth although largely insignificant. On the other hand, there appears to be no nonlinear effect from the joint occurrence of the two crises in CEE and currency crises occurrence brings about an enormous output loss ranging between 5 to 9 percentage points.

To summarize the effect of the joint crises in the light of the regional specifics a naïve calculation of their effects on growth is presented using one minus the p-value in Table 3 as weights. The estimations for CEE suggest that occurrence of the joint crises amounts to a negative effect of 7.2 percentage points in the current year $(1.52 + 9.19 - 3.55)$ for levels and 6.1 for differences $(1.32 + 4.81 - 0.02)$. The joint crises in LA seem to result in a 5 $(1.53 + 0.04 + 3.42)$ to 7.7 $(1.32 + 0.11 + 6.24)$ percentage point loss in output growth in the current year, for levels and differences, respectively. Finally, a similar event in Asia is expected to hinder economic growth by 4.08 $(1.32 + 0.15 + 2.40)$ percentage points in the year of its occurrence based on the estimates in levels and 7.35 $(1.32 - 0.15 + 6.18)$ percentage points when estimated in differences.

[10] The partial F test associated with the regional crises dummies are far from suggesting possible problems with weak instruments and are not reported for brevity.

7 Anticipated and Unanticipated Components

This section provides a simple test of what portion of the external crises can be attributed to a shock that is predicable given the information set available to markets and a shock that is unpredictable when referring to the information set. The former is deemed to be the anticipated component of external crises whereas the latter the unanticipated component of the crises. As discussed above, one can test the relative importance of the two components by taking the estimates of equation (1) and (3), and testing the hypothesis $\boldsymbol{\alpha}_1 = \boldsymbol{\beta}_1$.

Following this idea, one may want to use the estimates of equation (2) from Table 4 as the appropriate candidates for the betas, $\boldsymbol{\beta}_1$, in the proposed test. These estimates allow for the heterogeneity in the regional effects of currency crises that appeared to be significant. The accompanying alphas, $\boldsymbol{\alpha}_1$, needed for the test have to be obtain by allowing for the heterogeneity of the coefficients when equation (1) is estimated. The resulting estimates of equation (1), when allowing the regional effects of the currency and joint crises to differ, are reported below:

****** Table 4 Here ******

Now we want to formally compare the corresponding coefficients from Table 3 and Table 4 to see whether there is any significant part of the external crises that is due to unpredictable shocks, i.e. whether the external crises possess an unanticipated component. The test of H0: $\boldsymbol{\alpha}_1 = \boldsymbol{\beta}_1$ is carried out by computing the t-statistic for the difference between two means from samples with different variance. This is a familiar formula:

$$\boldsymbol{t} = \frac{\hat{\boldsymbol{\alpha}}_1 - \hat{\boldsymbol{\beta}}_1}{\frac{1}{(T-k)^2}\sqrt{s_{\alpha}^2 + s_{\beta}^2}} \tag{7}$$

where T is the sample size, k the number of explanatory variables and s^2 is the relevant estimate of the sample variance. We set α_0 and β_0 to zero in the general version of the formula above and assume that the match-pairs data are normally distributed. The results of such a test for the estimates in *levels* and *differences* are provided in Table 5 and Table 6, respectively.

****** Table 5 Here ******

****** Table 6 Here ******

Several observations can be drawn from Table 5 and Table 6. The effect of current-account reversals, that appeared to be similar across considered regions, does not seem to have an unanticipated component when referring to the level estimates. However, the estimates in differences counteract this finding by rejecting the null of no unanticipated component in the reversals' effect on growth. Therefore, one cannot draw any general conclusion in this case even though the coefficient estimates seem to be fairly close. According to the earlier findings the impacts of currency crises themselves and when combined with current account reversals vary across the regions.

We consider first the result for Central and Eastern Europe. The magnitudes of the overall and anticipated effects appear to be reasonably close for CEE. However, the performed test rejects the null of no unanticipated component both for estimates in levels and differences. One can thus conclude that the unanticipated component of the currency crises is significant in CEE, and accounts for about 12 to 28 percent of the total impact of currency crises on growth. The effect of the joint crisis in CEE appears to be insignificant on aggregate. There is only mild evidence

that this non-linear effect of the reversals and currency crises may possess an unanticipated component. This observation comes from level estimates and is associated with a (possibly) positive non-linear effect.

When looking at the results for Latin America the effect of currency crises appears to be insignificant on aggregate. On the other hand, there seems to be a significant evidence of an unanticipated component in the effect of the joint crisis on growth. For level estimates the unanticipated component appears to be negative whereas for estimates in differences positive. It appears that in the latter case the unanticipated component of the joint crisis counteracts the effect of the anticipated component and thus reduces the total negative impact of the joint crisis on growth in LA.

As in the LA case the currency crises themselves are found to be insignificant for the Asian region. Further, only the estimates in levels reveal a strong negative impact of the joint crises on growth which is however estimated with low precision. When the test is applied presence of an unanticipated component is not rejected at 10 % significance level. This unanticipated component accounts for 9 percent of the total negative effect of the joint crises on growth in Asia.

8 Conclusion

This paper has examined anticipated components of external crises within a two-equation system that allows for the possibility of a common shock to growth and the identified external crises. The effects of anticipated components of external crises on growth are estimated using GMM and compared to estimates of the crises effects

under the assumption of their weak exogeneity. At the later stage of the estimation the effect of some of the crises is allowed to vary across the regions of Central and Eastern Europe, Latin America and Asia.

The estimated effect of current-account reversals on growth appeared to be similar across considered regions of about 1.63 to 1.73 percentage points when the reversals dummies are treated as weakly exogenous. The range of this effect has changed from 1.35 to 1.57 when the possibility of a common shock to growth and the reversal dummies is taken into account. Since the formal comparisons of the estimated effects of the reversals on growth under the two scenarios do not produce identical results one cannot draw any general conclusion about the importance of the unanticipated component of the reversals for growth.

The effect of currency crises appears to vary across the regions of Central and Eastern Europe, Latin America and Asia. Unlike in Central and Eastern Europe the currency crises in Latin America and Asia, unless accompanied by the current account reversals, appear to have no significant negative effects on economic performance. On the other hand, the concurrent occurrences of both the external crises have harmful impacts on growth in all the regions. A naïve calculation suggests that the joint crises amount to a negative effect of about six to seven percentage points in Central and Eastern Europe, four to seven percentage points in Latin America and four to seven percentage points in Asia.

The unanticipated component of the currency crises is significant in CEE, and accounts for about twelve to twenty eight percent of the total impact of currency crises on growth. The unanticipated component in the effect of the joint crisis on growth appears to be significant in Latin America, however, its direction differs for

the estimates in levels and differences. The estimation of the unanticipated component for Asia lacks overall precision and, if significant, it accounts for nine percent of the total negative effect of the joint crises on growth.

Appendix

****** Table A1 Here ******

****** Table A2 Here ******

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Tables

Table 1: Growth Regressions with Weakly Exogenous External Crises

Variable	Levels		Differences	
	Coefficient	**p-value**	**Coefficient**	**p-value**
GDP(-1)	-0.153027	0.000	-0.363189	0.000
Growth(-1)	0.337988	0.000	0.164146	0.026
REV	-1.63918	0.005	-1.82354	0.024
CC2510	-1.34253	0.270	-0.510348	0.772
CC2510*REV	-3.47163	0.188	-3.53686	0.201
Year	0.433086	0.009	NA	-
Constant	-845.964	0.010	0.650688	0.000
R^2	0.3003546	-	0.3447067	-
Sargan Test	NA	-	44.40	**[1.000]**
Resid AR(2) Test	0.8386	**[0.402]**	-1.265	**[0.206]**
#Observations	357	-	311	-

The Estimation Methods are the 1-step method for Levels and 2-step method for Diffrences. The reported p-values are calculated using finite sample adjusted robust standard errors. *, ** - represent rejections of the corresponding null at the 5 % and 1 % significant level, respectively.

Table 2: Growth Regressions with Endogenous External Crises

Variable	Levels		Differences	
	Coefficient	**p-value**	**Coefficient**	**p-value**
GDP(-1)	-0.151098	0.000	-0.264886	0.000
Growth(-1)	0.334692	0.000	0.226526	0.000
REV	-1.72643	0.011	-1.66475	0.006
CC2510	-1.15127	0.369	-0.426924	0.735
CC2510*REV	-3.63218	0.163	-5.10907	0.011
Year	0.419340	0.013	NA	-
Constant	-818.684	0.014	0.831537	0.000
R^2	0.30020	-	0.23717	-
Sargan Test	42.07	**[1.000]**	42.75	**[1.000]**
Resid AR(2) Test	0.4527	**[0.651]**	-1.555	**[0.120]**
#Observations	357	-	311	-

The Estimation Method is the 2-step method. The reported p-values are calculated using finite sample adjusted robust standard errors. *, ** - represent rejections of the corresponding null at the 5 % and 1 % significant level, respectively.

Table 3: Growth Regressions with Endogenous External Crises II

Variable	Levels		Differences	
	Coefficient	**p-value**	**Coefficient**	**p-value**
GDP(-1)	-0.146825	0.000	-0.238513	0.000
Growth(-1)	0.328020	0.000	0.176338	0.001
REV	-1.71188	0.004	-1.82756	0.003
CC2510	-1.36395	0.263	-0.398682	0.730
CC2510*REV	-3.38536	0.203	-5.08548	0.016
Year	0.416231	0.011	NA	-
Constant	-812.886	0.012	0.708840	0.000
R^2	0.300093	-	0.2518873	-
Sargan Test	43.18	**[1.000]**	44.37	**[1.000]**
Resid AR(2) Test	0.4515	**[0.652]**	-1.763	**[0.078]**
#Observations	357	-	311	-

The Estimation Method is the 2-step method. The reported p-values are calculated using finite sample adjusted robust standard errors. *, ** - represent rejections of the corresponding null at the 5 % and 1 % significant level, respectively.

Table 4: Growth Regressions with Endogenous External Crises – CC Split

Variable	Levels		Differences	
	Coefficient	**p-value**	**Coefficient**	**p-value**
GDP(-1)	-0.148532	0.000	-0.262044	0.000
Growth(-1)	0.337937	0.000	0.233030	0.000
REV	-1.57854	0.034	-1.35804	0.029
CC2510 - CEE	-9.19160	0.000	-5.37826	0.106
CC2510 - LA	0.179106	0.772	0.438405	0.754
CC2510 - Asia	-0.488734	0.703	0.466838	0.686
CC2510*REV - CEE	4.85866	0.269	-0.296766	0.951
CC2510*REV - LA	-4.86787	0.298	-7.03784	0.113
CC2510*REV - Asia	-4.69808	0.489	-7.37021	0.162
Year	0.408980	0.023	NA	-
Constant	-798.299	0.025	0.804437	0.000
R^2	0.31663	-	0.23563	-
Sargan Test	41.53	**[1.000]**	36.36	**[1.000]**
Resid AR(2) Test	0.3351	**[0.738]**	-1.594	**[0.111]**
#Observations	357	-	311	-

The Estimation Method is the 2-step method. The reported p-values are calculated using finite sample adjusted robust standard errors. *, ** - represent rejections of the corresponding null at the 5 % and 1 % significant level, respectively.

Table 5: Growth Regressions with Weakly Exogenous External Crises – CC Split

Variable	Levels		Differences	
	Coefficient	**p-value**	**Coefficient**	**p-value**
GDP(-1)	-0.151353	0.000	-0.264103	0.000
Growth(-1)	0.341776	0.000	0.236887	0.000
REV	-1.63699	0.005	-1.73667	0.002
CC2510G0	-10.3893	0.000	-7.45804	0.000
CC2510G1	-0.002906	0.995	0.869966	0.302
CC2510G2	-0.116334	0.770	0.649328	0.243
CC2510REVG0	6.14089	0.068	2.00987	0.503
CC2510REVG1	-4.80944	0.011	-4.93859	0.000
CC2510REVG2	-5.25711	0.447	-8.06618	0.102
Year	0.429346	0.011	NA	-----
Constant	-838.683	0.012	0.833497	0.000
R^2	0.3171	-	0.2396	-
Sargan Test	NA	-	328.8	**[1.000]**
Resid AR(2) Test	0.6247	**[0.532]**	-1.564	**[0.118]**
#Observations	357	-	311	-

The Estimation Methods are the 1-step method for Levels and 2-step method for Diffrences. The reported p-values are calculated using finite sample adjusted robust standard errors. *, ** - represent rejections of the corresponding null at the 5 % and 1 % significant level, respectively.

Table 6: Signifinace of the Unanticipated Component of External Crises – *Level* Estimates

Region=X	CEE		Latin America		Asia	
Variable	**Coeff**	**t-test**	**Coeff**	**t-test**	**Coeff**	**t-test**
REV	-1.6370 (0.5829)***	-1.1527 **[0.2494]**	-1.6370 (0.5829)***	-1.1527 **[0.2494]**	-1.6370 (0.5829)***	-1.1527 **[0.2494]**
E(REV)	-1.5785 (0.7426)**		-1.5785 (0.7426)**		-1.5785 (0.7426)**	
CC(X)	-10.389 (0.2292)***	-8.7096 **[0.0000]*** **	0	NA	0	NA
E(CC(X))	-9.1916 (2.547)***		0		0	
CCREV(X)	6.1409 (3.359)*	1.830 **[0.0680]***	-4.8094 (1.871)***	-2.570 **[0.0110]*** **	0	NA
E(CCREV(X))	0		0		0	

The t-test is calculted as described in (6). The H0 is $\hat{\boldsymbol{\alpha}} - \hat{\boldsymbol{\beta}} = 0$ and the corresponding p-values are reported in the square brackets. The standard error of a relevant coefficient is in the parentheses.

Table 7: Signifinace of the Unanticipated Component of External Crises – *Differences*

Region=X	CEE		Latin America		Asia	
Variable	**Coeff**	**t-test**	**Coeff**	**t-test**	**Coeff**	**t-test**
REV	-1.7367 (0.5683)***	-7.8181 [0.0000]***	-1.7367 (0.5683)***	-7.8181 [0.0000]***	-1.7367 (0.5683)***	-7.8181 [0.0000]***
E(REV)	-1.3580 (0.6191)**		-1.3580 (0.6191)**		-1.3580 (0.6191)**	
CC(X)	-7.4580 (0.6082)***	-10.6900 [0.0000]***	0	NA	0	NA
E(CC(X))	-5.3783 (3.320)*		0		0	
CCREV(X)	0	NA	-4.9386 (1.304)***	7.8988 [0.0000]***	-8.0662 (4.917)*	-1.6769 [0.0941]*
E(CCREV(X))	0		-7.0380 (4.423)*		-7.3702 (5.261)	

The t-test is calculted as described in (6). The H0 is $\hat{\boldsymbol{\alpha}} - \hat{\boldsymbol{\beta}} = 0$ and the corresponding p-values are reported in the square brackets. The standard error of a relevant coefficient is in the parentheses.

Table A1: Identification of Current Account Reversals, Currency Crises and Their Joint Occurrence in Emerging Markets 1992-2001

Country	Obs.	REV	%	Obs.	CC	%	Obs.	REV×CC	%
Argentina	9	0	0.0	10	0	0.0	9	0	0.0
Bahamas	4	0	0.0	10	0	0.0	4	0	0.0
Barbados	7	1	14.3	10	0	0.0	7	0	0.0
Bolivia	9	1	11.1	10	0	0.0	9	0	0.0
Brazil	9	0	0.0	10	3	30.0	9	0	0.0
Colombia	9	1	11.1	10	0	0.0	9	0	0.0
Costa Rica	9	1	11.1	10	0	0.0	9	0	0.0
Ecuador	8	2	25.0	10	3	30.0	8	1	12.5
Grenada	9	2	22.2	10	0	0.0	9	0	0.0
Guatemala	9	0	0.0	10	0	0.0	9	0	0.0
Haiti	6	1	16.7	10	0	0.0	6	0	0.0
Honduras	8	1	12.5	10	0	0.0	8	0	0.0
Chile	8	1	12.5	10	0	0.0	8	0	0.0
Mexico	9	1	11.1	10	1	10.0	9	1	11.1
Nicaragua	8	4	50.0	10	1	10.0	8	1	12.5
Panama	8	2	25.0	10	0	0.0	8	0	0.0
Paraguay	9	1	11.1	10	0	0.0	9	0	0.0
Peru	8	0	0.0	10	0	0.0	8	0	0.0
Surinam	6	1	16.7	10	3	30.0	6	1	16.7
Uruguay	8	0	0.0	10	0	0.0	8	0	0.0
Venezuela	8	4	50.0	10	2	20.0	8	1	12.5
Latin America	168	24	14.3	210	13	6.2	168	5	3.0

Continues...

Bangladesh	8	0	0.0	10	0	0.0	8	0	0.0
China, Hong Kong	4	1	25.0	10	0	0.0	4	0	0.0
China, Mainland	8	2	25.0	10	1	10.0	8	1	12.5
India	8	0	0.0	10	0	0.0	8	0	0.0
Indonesia	8	1	12.5	10	2	20.0	8	1	12.5
Korea	9	1	11.1	10	1	10.0	9	0	0.0
Laos	7	2	28.6	10	1	10.0	7	1	14.3
Malaysia	8	2	25.0	10	0	0.0	8	0	0.0
Nepal	8	1	12.5	10	0	0.0	8	0	0.0
Pakistan	8	1	12.5	10	0	0.0	8	0	0.0
Papua New Guinea	7	4	57.1	10	0	0.0	7	0	0.0
Philippines	9	2	22.2	10	0	0.0	9	0	0.0
Singapore	8	3	37.5	10	0	0.0	8	0	0.0
Sri Lanka	9	0	0.0	10	0	0.0	9	0	0.0
Thailand	9	2	22.2	10	0	0.0	9	0	0.0
Vietnam	8	1	12.5	10	0	0.0	8	0	0.0
East Asia	126	23	18.3	160	5	3.1	126	3	2.4

Continues...

Armenia	5	1	20.0	10	3	30.0	5	0	0.0
Belarus	1	0	0.0	10	1	10.0	1	0	0.0
Bulgaria	8	2	25.0	10	3	30.0	8	2	25.0
Croatia	7	3	42.9	10	1	10.0	7	0	0.0
Cyprus	8	2	25.0	10	0	0.0	8	0	0.0
Czech Republic	7	1	14.3	10	0	0.0	7	0	0.0
Estonia	9	2	22.2	10	0	0.0	9	0	0.0
Greece	6	0	0.0	10	0	0.0	6	0	0.0
Hungary	9	1	11.1	10	0	0.0	9	0	0.0
Ireland	6	0	0.0	10	0	0.0	6	0	0.0
Kazakhstan	9	2	22.2	10	2	20.0	9	1	11.1
Kyrgyz Republic	5	2	40.0	10	0	0.0	5	0	0.0
Latvia	9	1	11.1	10	0	0.0	9	0	0.0
Lithuania	7	1	14.3	10	0	0.0	7	0	0.0
Malta	9	2	22.2	10	0	0.0	9	0	0.0
Poland	8	1	12.5	10	0	0.0	8	0	0.0
Portugal	7	0	0.0	10	0	0.0	7	0	0.0
Romania	8	3	37.5	10	2	20.0	8	0	0.0
Slovak Republic	8	2	25.0	10	0	0.0	8	0	0.0
Slovenia	9	1	11.1	10	1	10.0	9	0	0.0
Turkey	8	1	12.5	10	2	20.0	8	1	12.5
Ukraine	6	1	16.7	10	2	20.0	6	0	0.0
CEE	159	29	18.2	220	17	7.7	159	4	2.5
Total	453	76	16.8	590	35	5.9	453	12	2.6

Table A2: Auxiliary Regressions for External Crises

Variable	CC2510		REV		CC2510REV	
	Coefficient	**p-value**	**Coefficient**	**p-value**	**Coefficient**	**p-value**
GDP(-1)	-0.000452765	0.599	0.00762523	0.000	-0.000247826	0.771
Growth(-1)	-0.00231466	0.639	-0.0154405	0.010	0.000730061	0.706
NER(-1)	7.93240e-007	0.000	-1.10337e-006	0.000	-4.50075e-007	0.000
CA(-1)	-0.000287000	0.208	-0.000620701	0.056	-0.000405579	0.048
DmdDep(-1)	4.22457e-005	0.567	-0.000126860	0.363	8.04993e-005	0.137
Deposits(-1)	4.62615e-005	0.367	-0.000110201	0.017	7.04151e-006	0.776
DomCredit(-1)	1.78586e-006	0.642	5.12579e-006	0.316	-8.52001e-007	0.717
Exports(-1)	-3.76213e-008	0.988	6.51010e-006	0.090	3.18848e-006	0.036
FDI(-1)	5.25731e-005	0.552	-3.42147e-005	0.755	5.24397e-005	0.561
FERes(-1)	-1.98675e-006	0.037	-7.48794e-006	0.000	-1.28171e-006	0.149
Govbudget(-1)	-4.26191e-005	0.266	-7.80890e-005	0.359	-4.39893e-005	0.276
Govcons(-1)	-1.74454e-005	0.222	-3.85852e-005	0.436	-1.87581e-005	0.242
Imports(-1)	-2.29568e-006	0.350	2.83421e-006	0.400	2.49463e-006	0.060
infCPI(-1)	0.000458621	0.693	-0.00345497	0.023	-0.000988238	0.216
Invest(-1)	-0.00126523	0.539	0.0158796	0.000	-0.000806552	0.626
M2/FERes(-1)	-2.66417e-006	0.139	5.51242e-006	0.460	-1.47885e-006	0.181
M2multi(-1)	-0.00200059	0.371	0.00159894	0.717	-0.00175733	0.302
Open(-1)	-4.30703e-006	0.587	2.73775e-005	0.025	4.81085e-006	0.367
PI(-1)	3.27193e-006	0.951	-9.53466e-005	0.096	1.02706e-005	0.836
RER(-1)	-2.62692e-008	0.227	-4.82421e-008	0.146	7.14714e-009	0.740
Lending IR(-1)	0.000867048	0.575	0.000904175	0.544	-0.000391400	0.593
Deposit IR(-1)	0.00127657	0.627	0.00749873	0.006	0.00319334	0.207
Constant	0.0581606	0.644	-1.01426	0.000	0.0369743	0.748
R^2	0.1826747	-	0.1325799	-	0.1104842	-
Wald Joint	2319.00	**[0.000] ****	1642.00	**[0.000] ****	1755.00	**[0.000] ****
Wald Partial	1199.00	**[0.000] ****	658.10	**[0.000] ****	992.60	**[0.000] ****
Resid AR(2)	0.9530	**[0.341]**	-1.110	**[0.267]**	-0.3519	**[0.725]**
#Observations	288	-	261	-	272	-

The Estimation Methods are the 1-step method. The reported p-values are calculated using robust standard errors. *, ** - represents rejection of the corresponding null at the 5 % and 1 % significant level, respectively. The wald tests have the null hypothesis of all coeffcicients zero. The joint test included all coefficients and the partial test excluded from the test the intrument that are used for themselves, i.e. growth(-1) and gdp(-1), and the constant.

Table A3: Characteristics of the Parsimonious Versions

	CC2510		REV		CC2510REV	
R^2	0.61099	-	0.56267	-	0.66393	-
Wald Joint Test	4110. 00	[0.000]**	4963.00	[0.000]**	5493.00	[0.000]**
Wald Partial Test	1628.00	[0.000]**	2756.00	[0.000]**	3197.00	[0.000]**
Resid AR(2) test	-2.221	[0.026]*	-0.5144	[0.607]	-1.562	[0.118]
#Observations	187	-	174	-	174	-

The Estimation Methods are the 1-step method. The reported p-values are calculated using robust standard errors. *, ** - represents rejection of the corresponding null at the 5 % and 1 % significant level, respectively. The wald tests have the null hypothesis of all coeffcicients zero. The joint test included all coefficients and the partial test excluded from the test the intrument that are used for themselves, i.e. growth(-1) and gdp(-1), and the constant.

Figures

Figure 1: A Time Profile of Currency Crises Appearance During 1993-2001