Capital Account Liberalization and Currency Crisis in Post-Communistic economies

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Abstract

After the Russian crisis in August 1997, its adverse impact spread into the Post-Communistic countries essentially via several channels, which caused the collapse of domestic currency regimes. An essential factor in helping the spread of the currency speculative effect was the removal of capital control regulations in the earlier 90s. To analyse and answer the research question, the paper constructs multi-country investigation. Probit Panel model was adopted to analyze the multi-country study of post-communistic countries. Evidently, the analysis of this panel pointed out that those countries with free capital flows experience a lower likelihood of currency crisis, if the sequence of CAL reformed is adjusted to economic performance of the economy. Furthermore, outcomes from analysis suggest that speed and sequence of the capital account liberalization process is one of the most important factors to increase the probability of crisis and it should be adequate to country conditions of macroeconomic and political fundamentals.

Keywords: Capital Account Liberalization, Currency Crisis, Exchange rate regime.

Introduction

As financial globalization has been strengthened to cause a link between Capital Account Liberalization (CAL) and currency crisis in emerging market economies amidst integration and development of international institutions such as, the International Monetary Fund (IMF), European Union (EU) and the Organization for Economic Co-

operation and Development (OECD). The last two decades have shown a trend, which currency and banking crises accompanied during or after the CAL process, in particular in developing and emergency economics.

CAL is one of the key issues in transition countries, given that a crucial part of the process is moving towards a free market-oriented economy which is opening to the outside world – not only for trade in goods and services, but also for capital flows as well. Moreover, the opportunity to access direct investment and access to international financial markets is important in facilitating the modernization of transition countries' economies by providing access to technology, markets and financial resources. At the same time, CAL can cause vulnerability in terms of exchange rate volatility and financial system stability (Bakker et al, 2002). In this context, Central Eastern European Countries (CEE), Baltic States, Caucasus and Commonwealth of Independent States (CIS) appear to provide attention-grabbing case studies to analyse the connection between CAL process and currency crisis episodes.

Since the fall of the Berlin Wall, most of these countries have transformed their economy from a totally closed and centrally planned to an almost fully integrated economy with a global market and with liberalization of capital and trade regulations. Furthermore, most of these countries have experienced speculative attacks on their currency over the past fifteen years, thereby forcing them to seek help from the IMF or World Bank programs. Moreover, their economy has transformed from communism to a market economy, privatization processes and restructuring of state banks, which render it more complicated. After the collapse of the Former Soviet Union in the 1990s, their social structure and political environment have changed, leading to macroeconomic problems, such as fiscal deficit, unemployment and high inflation. Furthermore, due to political integration with neighbors and with similar economic systems and structure, devaluation in one of the neighboring countries can lead to increased speculation against the domestic currency of another country (Taci and Buiter, 2003).

In this context the question is, what could be the likely CAL process effect on the currency crisis in CEE, Baltic States, Caucasus and CIS? To answer this question these aspects have to be considered, First, what is the theoretical explanation for the currency crisis and what is the proof to show that it can be influenced by CAL. Secondly, is there any single-country empirical evidence that can interpret the negative or positive

correlation between CAL and currency crisis events? Finally, can a cross-country test extend the correspondence between CAL and the risk of a currency crisis?

The remainder of this paper has been structured into five sections. Section 2 gives a brief overview of empirical studies. Section 3 describes the empirical strategy and also introduces the dataset and variables used in the empirical model and delineate the estimation strategy. Section 4 presents estimation results that examine the economic growth impact on the probability that capital liberalization occurs, and derives its indirect effect of financial crises on the CAL process. Section 5 concludes and discusses the empirical evidence and links this to the results of other empirical studies.

Literature review

Many policymakers and economists are concerned that the main source of international financial instability and currency crisis is the volatility of capital flows. Since the global financial crisis in 2007–2008, its consequences in the transition markets have given rise to even greater debates. Ostry et al. (p. 121, 2010) support the view that the International Monetary Fund now views the use of capital controls as a viable policy option to restrict surplus capital flows. On the other hand, empirical literature provides mixed results regarding the effectiveness of capital controls in emerging economies from currency crises.

The literature shows that the appropriate sequencing of financial liberalization could be in several ways. However early lifting of controls on the capital account may destabilise the economy. For example, McKinnon (p.117, 1993) argues that decontrol of the CAL should be at the end of the reform sequence, following domestic financial liberalization, bank reform, and trade liberalization. Particularly, he supports the view that a rapid inflow of capital may result in real appreciation of the exchange rate, making it difficult for domestic tradable producers "to adjust to the removal of protection". Consequently, the result of a big injection of capital at the time of liberalization can increase the amount of imports while decreasing the exports and make wrong price signals in private markets.

Some researchers believe that capital account should be liberated following the liberalization of the current account and the domestic financial system. Others have suggested that there should be

simultaneous liberalization of the current and capital account (McKinnon 1993, Saxena and Wong 1999). In practical view, the IMF and OECD liberalized the capital flows by using a two-step procedure (the IMF's Articles of Agreement and OECD Code Liberalization). The first step included liberalization of direct investment, long-term capital movements and trade transactions. The second considered the liberalization of short-term financial transactions and inter-bank market (Griffith, Gottschalk and Cirera 2000, IMF 2005).

Several studies point out that before an economy can benefit from free access to international capital market they must have institutional safeguards (Mathieson et al 1993, Kaminsky et al 2003, Kawai et al 2003). They pointed some satisfactory pre-liberalization conditions: a sound macroeconomic policy framework, a fiscal policy in consistence with the choice of exchange rate regime (Saxena and Wong, 1999; Schneider, 2000); an independent monetary policy based on indirect policy tools and flexibility in exchange rate management. In addition, governments must be sure about the acceptable level of inflation, the current account balance and foreign exchange reserves towards the capital account liberalization process (Schneider, 2000). Moreover, Fisher (1997), Prasad, Kenneth, Wei (1998) and Kose (2003) argue that countries need to have a strong domestic financial and banking system, including strong supervision and prudential regulations covering capital adequacy, good lending standards and asset valuation, effective loan recovery mechanism, transparency, disclosure and accountability standards, and provisions ensuring that insolvent institutions which are dealt with promptly financial collapse. Pepinsky (p. 544-559, 2012) studies the question, do currency crisis lead government to liberalize capital flows in order to make international market trusted them. He employed instrumental and policy variables, with direct affect capital policy. Also, international variable outside of governments' control, which he refers to as "Northern interest rates". The outcome of his research is that currency crises lead governments to control capital flows as a form of self-help. Lastly, Glick and Hutchison (2006) investigate the effectiveness of capital control in emerging markets and developing economies in 69 countries over 1975-2004, using a probit equation estimation methodology with random effects and macroeconomic variables. They found that capital account liberalization has not efficiently isolated economies from currency crises at any time during their sample period. Moreover, they argue that growth of GDP and

limitation of real overvaluation is the main factor to prevent currency crisis, not capital controls. However, capital control can increase the probability of currency crises and affect real GDP growth and real exchange rate overvaluation, therefore countries have weak fundamentals.

To sum up this literature review, it is difficult to find unequivocal theoretical and empirical direct benefits that accrue to an economy, after cross-border capital flows have been liberalized especially for emergency markets. In order to investigate this topic for emergency markets, the empirical analysis have been divided into two parts: (i) case studies and (ii) a panel cross country analysis.

Methodology

In this paper many methodologies are implemented trying to answer the question regarding the link between CAL and currency crisis. However, in order to answer it, this research paper uses a method introduced by Glick, Gua and Hutchison (2004). It is based on an econometric model, particularly on the probit model with some modifications, mainly because there are different areas of regional interest and data availability problems. On the other hand, the reason for choosing this methodology is that it is comparatively a more reliable measure and involves the multi-country-level analysis of the linkage between CAL and currency crisis. In addition, this approach investigates the possibility of a correlation between CAL and the political economic environment.

Firstly, this research illustrates a simple analysis of unconditional and conditional frequencies of currency crisis/CAL episodes. The calculations are based on the methodology proposed by Glick, Guo and Hutchison (2005).

Secondly, the research uses a probit model (one of the binary outcome models) to estimate $y_{xt} = 1$ as a function of the independent variables. In our case, this model is based on the assumption that CAL, as a policy choice or dependent variable, is correlated with macroeconomics, financial and institutional policy and the financial crisis. The propensity score equations are generally estimated to study the problem of sample selection bias, which is related to the systematic differences between countries that do and do not liberalise the capital account. Specifically, only countries with stable economic/political situations are likely to

liberalise capital control. However, such countries are also less likely to experience currency crises due to their good macroeconomic fundamentals.

The probit panel model is a cross-time-country panel (in which each individual x is a country and the time is in years) with the discrete dependent variables y_{xt}. These dependent variables are represented by a binary choice variable, $y_{xt} = 1$, if the event happens for individual x at time t, and by $y_{xt} = 0$ if the event does not happen. In fact, if P_{xt} is the probability that an individual participates in an event at time t, this is usually modelled as a function of some of the explanatory variables (x_{xt}):

$$P_{xt} = \Pr(y_{xt} = 1) = \Phi(X_{xt}\beta) \ (1)$$

where $\Phi(X_{xt}\beta) = \int_{\infty}^{x_{xt}} \frac{1}{\sqrt{2\pi}} e^{\frac{-u^2}{2}} du$ is the cumulative distribution function for standard normal variable and u is the standardized random variable.

The propensity score model considers the probability of CAL events with regards to three main categories of control variables (x_{xt}): economic variables, structure variables and political variables. At this rate, if the incident of CAL occurs in country x, then $CAL_{xt} = 1$, otherwise $CAL_{xt} = 0$. There are two types of selection equation models *Benchmark Probit* model with three main categories of variables $P_{xt} = \Pr(CAL_{xt} = 1) = \Phi(X_{xt}\beta)$ and then *Augmented Specification Probit model* with an additional currency crisis or economic dummy variable are as follows:

Benchmark Probit Model

$$\Pr(CAL_{xt} = 1) = \Phi(\beta_0 + \beta_1 X_{xt}) \ (2)$$

Augmented specification probit model:

$$\Pr(CAL_{xt} = 1) = \Phi(\beta_0 + \beta_1 X_{xt} + \beta_2 Crisis_{x,t-1}) \ (3)$$

After estimating the models, we can predict the probability that $y_{xt} = 1$ for each observation.

$$P_{x,t} = \Pr(CAL_{xt} = 1) = F(X'_{x,t}\beta) \ (4)$$

The predicted probabilities are limited between 0 and 1, which indicates the likelihood of $y_{xt} = 1$. If the predicted probability is greater than 0.5 we can predict that $y_{xt} = 1$, otherwise $y_{xt} = 0$. Moreover, we can observe for goodness of fit measures showing the percentage of correctly predicted values. We can create the following table:

	Actual $y_{xt} = 1$	Actual $y_{xt} = 0$
Predicted $\hat{y}_{xt} = 1$	True	False
Predicted $\widehat{y_{xt}} = 0$	False	True

We have four cases of 0/1: two of them are correct predictions and two of them are wrong predictions. The per cent correctly predicted values are the proportion of true predictions to total predictions. However, there are two issues that might arise in these equations: heterogeneity and cross-section dependence. This type of correlation may arise from globally common shock that have heterogeneous effects across countries, such as the global financial crisis in 2007. Alternatively, it can be the result of a local spill-over or contagion effects between countries or regions (Eberhard and Teal 2011).

Data construction and descriptive statistics

There was an intensive debate over the costs and benefits of capital account liberalisation over the last century. A subsequent development of extensive empirical literature and real-life events has created an opportunity to jointly research and investigate the existence of CAL and the currency crisis. Among these studies, there are both single-country and multi-country analyses. This research we use data from 19 countries to estimate the panel data. Turkmenistan, Tajikistan and Uzbekistan were excluded as the result of a data availability.

A several criteria was chosen to this country selection. Since the collapse of the communism in the soviet bloc, nineteen countries transformed their economies from totally closed and centrally planned ones to nearly fully integrated ones, with global markets and liberalised capital and trade regulations. Also, the privatisation processes and the restructuring of state banks faced several complications. Furthermore, the social structure and political environment have changed, leading to macroeconomic problems such as fiscal deficits, unemployment and high inflation. Moreover, a political integration with neighbours and similar economic systems and structures caused devaluations in neighbouring countries currencies and then increase the possibility of speculation against this currencies (Taci and Buiter, 2003). A majority of case studies analysis concentrates on the second half of the 1990s. During this period, the globe experienced several currency crises,

including the Asian crisis of 1997, the Mexican crisis of 1994 to 1995 and the Brazilian crises of 1999. This research concentrates in particular on the Russian currency crisis of 1997 to 1998 and its effect.

In order to investigate the liberalization process impact on currency crisis probability, we defined the control variables, variable of interested and dependant variables. The dependent variable measure a probability of CAL process and at this stage, if a CAL incident occurs in country x, then $CAL_{xt} = 1$; otherwise, $CAL_{xt} = 0$. Also, there are three main categories of control variables (x_{xt}): economic variables, structure variables and political variables. Lastly, the variable of interested is defined similar to CAL measures but with respect to event of currency crisis.

CAL Measures

In practice, there are few indicators available to analyse CAL process which can be divided into main two categories such as qualitative and rule-based, though some attempt to go beyond an on/off categorisation to reflect the intensity with which controls are imposed. The most widely known and used are capital account restriction measures which are drawn on data assembled by the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). This IMF's report allows to construct an on/off indicator of the existence of rules or restrictions that inhibit cross-border flows where "0" is 'never restricted' to capital flows and then "1" means 'always restricted'. This paper, thus, constructs the binary measure of CAL this way and then used into a probit equation model estimations. In order to illustrate the liberalization process in CEE countries, Baltic States, Caucasus and CIS countries, we compute the average value of Chinn and Ito's index and presents in Figure 1 and 2. Evidently, it is visible that the Baltic States did not impose any restrictions on capital controls over time, with slight fluctuations. It is clear that among sample countries, the most liberalized is Estonia, Latvia and Czech Republic and so forth. In contrast, CIS countries have certain level of restrictions on capital flows.

As Glick, Guo and Hutchison (2004) states it is rational to use only rules-based measures rather than quantitative measures. A usage of a quantitative measure is not effective because such measures do not allow to identify what increase or level of interest rate or a capital flow rate indicates whether a country has liberalised its capital account. Other on/off measures, such as the OECD Code of Liberalization of Capital Movements and the Montiel-Reinhart Intensity Measure (1999), are not

available for this country sample. However, there are significant concerns regarding the quality of IMF data on CAL. Since IMF data consider the occurrence of administrative controls, they do not distinguish between restrictions on capital outflow and restrictions on capital inflow.

In this paper, we chose to use two on/off measures: Chinn and Ito's (2013) measure and Glick, Guo and Hutchison's (2004) measure. Glick, Guo and Hutchison's (2004) measure seemed to fit the analysis as its concentrates on the regulation of capital transactions. Chinn and Ito's (2013) measure calculates four dummy variables: i) a variable indicating the presence of multiple exchange rates, ii) a variable indicating restrictions on current account transactions, iii) a variable indicating restrictions on capital account transactions and iv) a variable indicating a requirement of the surrender of export proceeds. The higher value of the index for capital "openness" by Chinn and Ito's (2013) implies greater country openness to cross-border capital transactions. Rather than using Chinn and Ito's (2013) original measure, we constructed our dummy variables for capital transaction regulations using Glick, Guo and Hutchison's (2004) index methodology.

However, during the 1995 to 1996 research period, the IMF's AREAER was modified. In particular, AREAER reports published by individual countries through 1996 described only the existence (or not) of restrictions on capital transactions. Those published in 1996 reported 10 separate categories of capital transactions. However, since 1997, all reports have included 11 categories for controls on capital transactions. Based on this information, Glick, Guo and Hutchison's (2004) index was calculated as follows: for the year 1995, the index indicated "0" if there was any "restriction" on payment for capital transaction, and "1" otherwise. For the period from 1996 to 2013, the index was defined such that the capital account was to be restricted if the index equalled "0", controls were in place for five or more categories of capital transaction restrictions and "financial credits" was one of the categories restricted. Otherwise, the index was defined as "1", meaning that the country had liberalized its capital control restrictions. Table 1 presents the list of countries with CAL episodes for the period between 1995 and 2013.

In order to illustrate the liberalization process in CEE countries, Baltic States, Caucasus and CIS countries, we compute the average value of Chinn and Ito's index and presents in Figure 1 and 2. Evidently, it is visible that the Baltic States did not impose any restrictions on capital

controls over time, with slight fluctuations. It is clear that among sample countries, the most liberalized is Estonia, Latvia and Czech Republic and so forth. In contrast, CIS countries have certain level of restrictions on capital flows.

Country	Glick, Guo and Hutchison's Index	Chinn and Ito's Index
Armenia	1998-2013	2000-2013
Azerbaijan	2008-2013	2008
Belarus		
Bulgaria	2006-2013	2007-2013
Czech Republic	1998-2005,2013	2002-2013
Estonia	1998-2013	1998-2013
Georgia	2005-2013	2013
Germany	1998-2004	1990-2013
Kazakhstan		
Kyrgyz Republic	1998-2009	2005-2008
Latvia	2000-2013	2003-2013
Lithuania	2002-2013	1997-2007
Moldova		
Poland		
Romania	2002-2013	2007-2013
Russian Federation	2010-2013	
Slovak Republic	2000-2013	
Turkmenistan		
Slovenia	1999-2009	2007
Tajikistan	1998	
Ukraine		
Uzbekistan		

Note: the blank cell indicates the occurrence of capital control implementation, the number indicates the years of capital account liberalization episodes.
Table 1. Capital Account Liberalization episodes calculating according to different methods
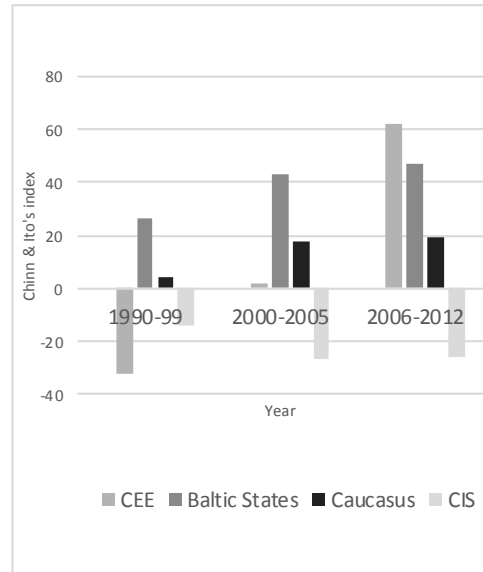
Fig. 1. Comparison of capital openness in CEE, Baltic States, Caucasus and CIS countries
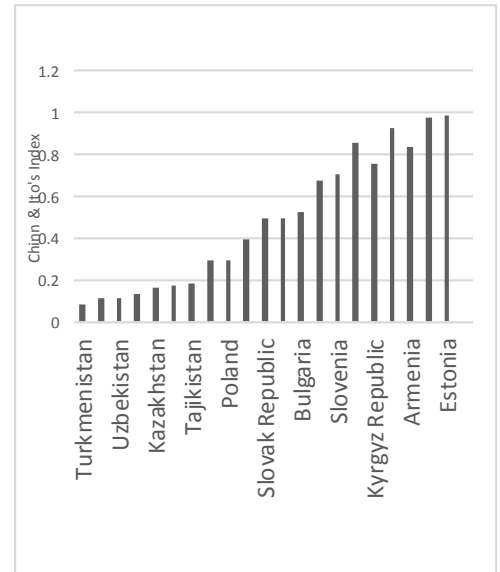

Figure. 2. illustrates the mean of CAL by country, based on Chinn & Ito's index for the research group of countries for the period between1995-2013

Definition of Currency Crises

In order to identify currency crisis, we used three different measures of currency crisis and banking crisis episodes to obtain reliable estimation results. A first column in Table 2 is Ahluwalia's indicator (2000), which considers two kinds of parameters: monthly change of foreign reserves minus gold and nominal exchange rate. The second measure is Cera and Saxena's indicator (1998), which used three different parameters: monthly changes in foreign reserves, interest rate and nominal exchange rate. All variables drawn from the International Monetary Fund's International Financial Statistic CD and monthly interest rate from Thomson Reuter's database (line ae for exchange rate, line 11d for foreign reserve).

To provide a clear diffination between currency crisis and speculative attack Eichengreen, Rose and Wyplosz's (1996) classification was adopted. A speculative attack is defined as $MPI_{xt} > \mu_{MPI_{xt}} + 1.5 * \sigma_{MPI_{xt}}$, where μ is the mean of the Market Pressure Index (MPI) in country x, and σ is the standard deviation of MPI. On the other hand, the

definition of currency crisis is described as $MPI_{xt} > \mu_{MPI_{xt}} + 3 *$ $\sigma_{MPI_{xt}}$ (Kaminsky, Lizondo and Reinhard, 1998). Thereafter, for each country-year this measure was constructed as a binary measure of currency crisis, as defined "1"-crisis, "0"- no crisis. Also we imposed a 24-month window on the data with the aim to reduce the change of capturing of the same currency crisis episodes.

Using this methodology, 14 currency crises episodes were identified over the 1995-2013 period according to different methods of calculation of currency crisis. In order to see the relationship with banking crisis we used data from Luc Laeven and Fabian Valencia's (2012) research. In total, they identified 147 banking crises, of which 13 are borderline events, over the 1970–2011 period.

Table 2 illustrates banking and currency crisis episodes for a group of countries researched over time. Leaven et al.'s definition of a currency crisis builds on Frankel and Rose's (1996) approach. They define a currency crisis as a nominal depreciation of the currency vis-à-vis the U.S. dollar of at least 30 percent that is also at least 10 percentage points higher than the rate of depreciation in the year before. For countries that meet the currency crisis criteria for several continuous years, the first year of each 5-year window has been used to identify the crisis. Using this approach, 218 currency crises can be identified during the 1970–2011 period, of which 10 episodes occurred during 2008–2011.

Overall, they found that banking crises frequently occur together with currency or sovereign debt crises, and presented the frequency with which simultaneous crises occur, including twin crises or triplet crises (the simultaneous occurrence of banking, currency, and sovereign debt crises; see Figure 3). Additionally, Kaminsky and Reinhart (1999); Reinhart and Rogoff (2011) also argue that it is common for banking crises to precede currency and sovereign debt crises.

Country	Ahluwalia (2000)	Cerra and Saxena (1999)	Luc Laeven & Fabian Valencia
Armenia	1994		1994
Azerbaijan			1995
Bulgaria	1996	1996	1996,1997
Belarus	1999	1999	1995
Czech Republic	1990	1997	1996-2000
Germany			2008
Estonia			1992-1994
Georgia	1998		1991-1995
Kazakhstan	1998	1994,1998	2008
Kyrgyz Republic	1998		1995-1999
Lithuania			1995,1996
Latvia			1995-1996,2008
Moldova	1998	2003	
Poland		1996,2011	1992-1994
Romania		2008	1990-1992
Russian Federation	1998	1998,2008	1998,2008
Slovak Republic			1998-2002
Slovenia		1999	1992,2008
Ukraine	1995,1998	1998,2008	1998-1999,2008

Table 2. Currency crisis episodes in analyzing countries according to different currency crisis methods.
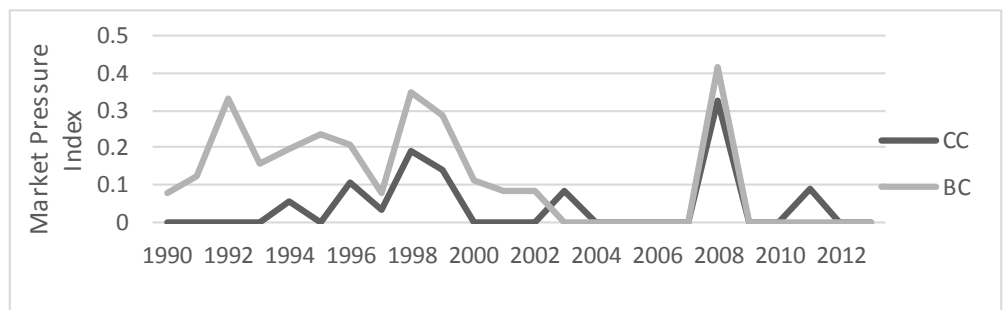
Note: BC- Banking crisis index based on Luc Laeven's database, CC- Market Pressure Index based or Speculative attack based on Cera and Saxena index.
Fig. 3. Comparison between Market Pressure Index and Banking Crisis episodes

Descriptive statistics on Currency Crises and CAL

The unconditional and conditional frequencies of the crises was computed to investigate the link between currency crisis and CAL process in 22 countries over the period 1995-2013. Unconditional frequency does not consider any assumption about the capital restriction condition. The conditional frequency considers whether the incidents of currency crisis exist during or after the liberalization of capital account.

To calculate unconditional frequency: Cerra and Saxena's currency crisis index and Chinn and Ito's CAL index (2013) measures was employed. The unconditional frequency is computed as number of "crisis" or "liberalization in place" observations and then divided by the total number of country-years in observation. This frequency was calculated for the whole period 1995-2013 and for 5-year intervals except for the 2007-2013 sub-sample (see Table 3).

Categories	1995-2013	1995-2000	2001-2006	2007-2013
Currency crisis*	6	14	1	5
Number of crisis	14	9	1	4
CAL**	34,59	15,45	52,72	55,3

Note: *- Number of crisis divided by total country years (Cerra and Saxena Index). **-Number of country-years with CAL divided by total country-years with available data (Glick, Guo and Hutchison's Index)

Table. 3. Currency crisis and CAL unconditional frequency (in %)

According to Table 3, a frequency of currency crisis episodes were comparatively low, appearing only in 6 per cent of the observations. However, the lowest frequency was for the period 2001-2006 with 1 per cent, while the highest was 14 per cent for the period 1995-2000. Nevertheless, the frequency with respect to CAL was very high at 35 percent on average during the whole period. The highest frequency point was in the last sub-sample for the period 2007-2013 at 55.3 per cent.

The conditional frequency of currency crisis episodes was calculated by considering if crises happened during the period in which the country liberalized the regulation of capital flows and also adopting Glick, Guo and Hutchison's (2004) methodology (see Table 4).

CAL index/Currency crisis index	Chinn & Ito's Index (2013)	Glick,Guo and Hutchison's Index (2004)
Cerra and Saxena's Index (1998)	13-CC 1-CAL	7-CC 3-CAL
Luc Laeven and Fabian Valencia index (2012)	25-CC 2-CAL	8-CC 10-CAL
Ahluwalia's index (2001)	7-CC	3-CC 3-CAL

Note: The number indicates the number of currency crisis incidents, CC-indicates the capital control episodes in the year of the currency crisis incident, CAL-indicates the CAL episodes in the year of the currency crisis incident.
Table. 4. CAL and Currency crisis indexes for 22 countries for period between 1995 and 2013

Sequence of CAL	Yes*	No**
Currency Crisis andLiberalization took place during current year	0,85-GGH	2,99-GGH
Currency Crisis happened and liberalization had taken place during previous year	0,28-GGH	0-GGH

Note: *Number of currency crises for which CAL in place at end of current or previous year, divided by total number of country-years with liberalization in place, Yes-liberalization happened **- Number of currency crises for which CAL not in place at end of current or previous year, divided by total number of country-years with liberalization in place, No –liberalization did not take place, GGH- Glick, Guo and Hutchison's (2004) index
Table. 5. Currency crisis, frequency condition on CAL for 22 countries for period 1995-2013 (in percentage).

Above CAL-currency matrix presents that currency crises took place three times during the period of the liberalization of capital flows in the following cases: Romania crisis in 2008, Belarus crisis in 2008 and Slovenia crisis in 1999. In contrast, the CAL-currency matrix shows that for Luc Laeven and Fabian's index (2012), there were more currency crisis events during capital account liberalization. And then less for Ahluwalia's index (2001), just three episodes of currency crisis. The conditional measure of currency crisis assumes that controls were adopted in response to a currency crisis. In this case, the results show it did not happen and there is non-appearance of the controls at the end of

a year prior to a crisis as well as at the end of the year in which a crisis occurs (see Table 4 and 5).

Table 5 indicates that controls may not be effective for this sample of countries, in particular countries without restrictions had crisis simultaneously 0.85 percent of the time, compared to 2.99 percent for those with restriction. Therefore, the existence of capital control does not reduce the risk of currency crisis episodes (e.g. Bartolini and Drazen 1997, Glick, Guo and Hutchison, 2004). Chiefly, the Russian crisis suggest that CAL influenced the probability of currency crisis episodes. As two years before 1998, the Russian authorities had liberalized capital flows.

Empirical results

The propensity score model considers the probability of CAL events with regard to three main categories of control variables (x_{xt}): economic variables, structure variables and political variables. At this rate, if a CAL incident occurs in country x, then $CAL_{xt} = 1$; otherwise, $CAL_{xt} = 0$. There are two types of selection equation models: the *Benchmark Probit* model, with three main categories of variables $\Pr(CAL_{xt} = 1) = \Phi(X_{xt}\beta)$, and the *Augmented Specification Probit model*, with additional currency crisis or economic dummy variables. The dependent variables for these two models are taken from Chinn and Ito's CAL index because this index collected all information from two different modern calculation methodologies (Chinn and Ito, 2013; Click, Guo and Hutchison, 2004). The augmented probit specification equation uses an additional explanatory variable, which represents the lagged occurrence of currency crisis.

In order to calculate propensity scores of the likelihood of a country liberalized, capital account have been used a benchmark probit equation and the augmented specification probit equation in controlling for sample selection bias. However, while the benchmark probit equation model is similar to a version of augmented specification equation, it is assumed that it does not consider the impact of the currency crisis incident with regards to the CAL process (see Equation 5 and 6).

A robustness exercise also estimated *Augmented Probit Selection* equations with additional variables. These were comprised of a number of independent variables: potential structural, political and economic determinants of capital account liberalization. The selection of these

variables is guided by previous research in these areas such as, Milessi-Feretti (1998), Bartolini and Drazen (1997), Glick, Guo and Hutchison (2005). They found that countries with a higher level of government spending, which were more closed to international trade, and was with larger current account deficits were more likely to control or restrict capital account flows. Milesi-Feretti (1998) concluded that more frequent changes in government and more independent central banks are less likely to restrict capital accounts in developing economies. Eichengreen (2001), Glick, Guo and Hutchison (2004) and Grilli and Milessi-Ferretti (1995) suggest that political stability is associated with a lower rate of capital control regulation. On the other hand, the higher international interest rate is connected with a relaxation of capital control regulation, as the countries' authorities are less likely to be worried about the risk of a speculative attack. However, Bartolini and Drazen (1997b) found a rather different correlation and suggested that low world interest rates indicate small capital flows meaning that there is no incentive to remove the regulation of capital controls. In the case of currency crisis episodes, Edwards (1989) and Glick, Guo and Hutchison (2004) found that capital control is intensified in the years prior to the onset of a currency crisis (the case of the Russian Crisis).

Following these studies, the models included two macroeconomic variables, three economic structural variables and one political variable (see Equation 5, 6). The macroeconomic variables are the current accounts as a percentage of GDP $(^{CA}/_{GDP_{xt-1}})$ and international interest rate (r^*_{xt-1}). The economic structural variables are government expenditure and trade openness(OP_{xt-1}), which is measured by the total amount of export and import as percentage change of GDP. Another, monetary independent variable (MF_{xt}), which is called "monetary freedom" index ranges between 0 - 100 percent, the higher value of index indicates a more independent monetary policy in the country. The political explanatory variable (PF_{xt-1}) is measured in terms of political freedom, which varies between 0-3 scales, where "0" indicates the highest level of freedom.

The data for the 19 countries was drawn from International Monetary Fund's International Financial Statistics CD-ROM, World Development Indicators website and OECD database. The political freedom measure is drawn from the Freedom House website. The financial development variable was constructed as Private Credits as a percentage of the GDP ratio (FD_{xt}), which was a proxy for financial repression. High level of

private credit, ceteris paribus, may be interpreted as an indicator of greater financial depth and hence financial development.

Benchmark Probit Equation

$$Pr(CAL_{xt} = 1)$$
$$= \Phi\left(\beta_0 + \beta_1\,{}^{CA}\!/GDP_{xt-1} + \beta_2\,{}^{G}\!/GDP_{xt-1} + \beta_3 OP_{xt-1}\right.$$
$$\left.+ \beta_4 MF_{xt} + \beta_5 PF_{xt-1} + \beta_6 r^*_{xt-1}\right) (5)$$

Augmented specification Probit Equation

$$Pr(CAL_{xt} = 1)$$
$$= \Phi(\beta_0 + \beta_1\,{}^{CA}\!/GDP_{xt-1} + \beta_2\,{}^{G}\!/GDP_{xt-1} +$$
$$\beta_3 OP_{xt-1} + \beta_4 MF_{xt} + \beta_5 PF_{xt-1} + \beta_6 r^*_{xt-1} + \beta_7 FD_{xt} +$$
$$\beta_7 Crisis_{xt-1}) (6)$$

where *CA*-current account, *GDP*-GDP per capita, *G*-government expenditure, *OP*-openness to world trade, *MF*-monetary freedom, *PF*-political freedom, *r**- international interest rate, *FD*-financial development index as private credit by deposit money banks to GDP (in per cent), *CAL*-0/1 dummy variable based on Chinn and Ito (2013)'s index, *Crisis*- a dummy variable based on Currency Crisis index.

Moreover, the dependent variables for these two models are taken from Chinn and Ito's CAL index, because this index collected its information from two different modern methodologies of calculation (Click, Guo and Hutchison, 2004, and Chinn and Ito, 2013). The augmented probit specification equation uses an additional explanatory variable, which is lagged occurrence of currency crisis.

Table 6 presents results of probit models estimation to predict the likelihood of capital account liberalisation. In the benchmark probit equation, higher trade openness, larger current account surpluses, higher international interest rate, higher levels of government spending, and more political stability and independence of monetary policy are associated with capital account liberalisation. All coefficient signs are statistically significant and consistent with priors. In the benchmark probit specification, the observations with a liberalised capital account is predicted correctly at 95.59 %.

Explanatory Variable	Benchmark Probit Equation	Augmented Probit Specification Equation
CA/GDP_{xt-1}	3.34** (0.29)	4.53** (0.41)
G/GDP_{xt-1}	7.06 (0.33)	4.65 (0.19)
OP_{xt-1}	0.08 (0.16)	-0.001 (-0.35)
r^*_{xt-1}	0.02** (2.63)	0.02** (2.67)
PF_{xt-1}	0.03 (0.38)	0.01 (0.14)
MF_{xt}	0.01*** (2.53)	0.07*** (1.36)
FD_{xt}		2.83 (0.47)
$Crisis_{xt-1}$		-1.72 (-2.93)
No. of observations	295	288
Per cent correctly predicted	95.59%	95.83%
Pseudo-R²	0.17	0.21

Note: The table reports estimation results of the population-averaged probit model and change in the probability of CAL in response to a unit change in the variable, evaluated at the mean of all variables (x100, to convert into percentage). Associated z-statistics (for hypothesis of no effect) based on bootstrapped standard errors in parenthesis below. Results are significant at 1%, 5% and 10%, levels are indicated by ***, **, and * respectively. Constant included. Observations were weighted by GDP per capita (in dollars).
Table 6. Probit Equation for Estimating CAL Propensity Scores

The augmented probit specification column reports combinations of our measure of financial development ($Private\ credit/GDP_{xt-1}$) as an explanatory variable in the probit model. As expected, the Private Credit/GDP ratio has a positive effect on the likelihood of capital account liberalisation. On average, a currency crisis in the previous year reduces the standardised probit index by 1.72 standard deviations. An inclusion of the lagged currency crisis and financial development in the augmented equation increases the current account and reduces government spending

and trade openness. This means that capital account liberalisation is the possible indicator for future capital liberalisation process to happen compared to the other explanatory variables playing a secondary role. When compared to Glick et al. (2004), we find the same results, except in the case of the government spending sign for the benchmark probit model. Glick et al. (2004) show that higher levels of government spending are associated with lower likelihoods of liberalisation. By contrast, our results show a positive sign, indicating a positive correlation and a higher likelihood of CAL.

Both probit equations predict the existence of capital controls with forecasting of 96% of these observations correctly, despite the pseudo-R^2 of the augmented probit model being higher (0.32) than that of the benchmark probit model (0.27). For example, we find 275 of CAL episodes, of which 274 of them have $\Pr(CAL_{xt} = 1) > 0.5$ (the model reproduces this outcome for 99.64% of the true cases), and 13 of non-CAL episodes, of which 11 of them have $\Pr(CAL_{xt} = 1) < 0.5$ (the model reproduces this for 15.38% of the true cases). Therefore, the model succeeds in accurately producing 96% of the true outcomes. Note that there were limited interest rate data for some countries, which explains the reduction of the sample size from 295 to 288 observations. These results partly support the hypothesis that countries with good macroeconomic elements are more likely to adopt CAL. Moreover the models also show that countries with independent monetary policies and economic freedoms are expected to liberalize capital flow and regulations.

Currency Crisis Equations

In order to analyse the control factors other than CAL that may affect the likelihood of currency crisis episodes, currency crisis prediction equations were constructed using various macroeconomic control variables. To implement this procedure, we followed Glick, Guo and Hutchison's (2004) identification of variables, with some modifications. The model includes six macroeconomic control variables: the log ratio of broad money to total foreign reserves, domestic credit growth, and current account to GDP ratio, GDP growth, real international interest rates and domestic money market rates. The CAL variable and the currency crisis index are used according to the same calculation methodology used in the previous equations. All of these variables are

taken from IMF's International Financial Statistic CD-ROM database. Following Glick, Guo and Hutchison's (2004) model, all variables lagged to reduce potential issues of multicollinearity and endogeneity (see Equations 7, 8).

Benchmark Probit Currency Crisis Equation

$$Pr(Crisis_{xt} = 1)$$
$$= \Phi\left(\beta_0 + \beta_1 Log\left(M2/R\right)_{xt-1} + \beta_2 {CA}/{GDP}_{xt-1} + \beta_3 \Delta DC_{xt-1} + +\beta_4 r^*_{xt-1} + \beta_5 PF_{xt-1} + \beta_5 r_{xt-1} + \beta_5 \Delta GDP_{xt-1}\right) (7)$$

Augmented Probit Currency Crisis Equation

$$Pr(Crisis_{xt} = 1)$$
$$= \Phi\left(\beta_0 + \beta_1 Log\left(M2/R\right)_{xt-1} + \beta_2 {CA}/{GDP}_{xt-1} + \beta_3 \Delta DC_{xt-1} + +\beta_4 r^*_{xt-1} + \beta_5 PF_{xt-1} + \beta_5 r_{xt-1} + \beta_5 \Delta GDP_{xt-1} + \beta_6 CAL_{xt-1}\right) (8)$$

where Log M2/Total Foreign Reserves- a log ratio of broad money to foreign reserves, CA-current account, GDP-GDP per capita, ΔDC domestic credit growth, r*-international interest rate, r- domestic money market rate, ΔGDP-GDP growth, CAL-0/1 dummy variable based on Chinn and Ito's index (2013), Crisis- dummy variable based on Hu, Makhayeva & Sulimierska's currency crisis index.

Table 7 presents the results of the currency crisis equation, which support the previous frequency calculations and a negative correlation between CAL and a currency crisis (see Tables 3, 4 and 5). These results illustrate that CAL decreases the standardised probit index by 1.29 standard deviations on average. Additionally, these results suggest that currency crises have particular features for all three generations of currency crisis models. As all coefficient of explanatory variables have the expected signs such as M2/foreign reserves, real international interest rate, GDP growth and money market rate. One unit change in broad money or international interest rate increases the probability of a currency crisis. In contract, the one unit change in the domestic interest rate or GDP growth cause lower likelihood of a currency crisis. Therefore, according to the results of both equations, we can infer that countries with liberalised capital accounts have weak macroeconomic situations that may lead to currency crises.

A percentage correctly predicted for benchmark probit equation is 97.47 percent, for the augmented specification model it is 97.39 percent, which is almost the same result, and both of them have given correct results.

Explanatory Variable	Benchmark Probit Equation	Augmented Specification Equation
$Log\left(M2/R\right)_{xt-1}$	0.25** (2.27)	0.21* (1.71)
CA/GDP_{xt-1}	1.40 (1.12)	1.01 (0.78)
ΔDC_{xt-1}	-1.45 (-0.18)	-1.24 (0.09)
r^*_{xt-1}	0.005 (0.03)	0.003 (0.18)
r_{xt-1}	-0.003 (-0.29)	-0.009 (-0.58)
ΔGDP_{xt-1}	-0.002 (-0.06)	-0.005 (-0.01)
CAL_{xt-1}		-1.29 (-1.60)
No. of observations	237	230
Per cent correctly predicted	97.47%	97.39%
Pseudo-R	0.12	0.18

Note: The table reports estimation results of the population-averaged probit model and change in the probability of currency crisis in response to a unit change in the variable, evaluated at the mean of all variables (x100, to convert into percentage). Associated z-statistics (for hypothesis of no effect) based on bootstrapped standard errors in parenthesis below. Results significant at 1%, 5% and 10% levels are indicated by ***, **, and * respectively. Constant included. Observations were weighted by GDP per capita (in dollars).
Table 7. Estimation of Currency Crisis Equation

Conclusion

This research has tried to answer whether countries with freely international capital flows without any control on international payments can be affected further by instability in financial markets, especially

when current account and balance of payment are imbalanced; particularly in CEE countries, Baltic States, CIS countries and the Caucasus. There are two main sections used in this research to find an answer to this main question, how restricted or unrestricted Capital Account Liberalization can be vulnerable to the currency crisis in the specified countries?

Firstly, this paper discusses theoretical aspects concerning links between CAL and the currency crisis. An initial discussion investigated three theoretical currency crisis generation models. Each model described different factors that lead to an increased risk of facing a currency crisis. For instance, the first-generation model concluded that a currency crisis could occur due to fiscal, monetary instability. The other two models proved that currency crisis could exist even if there are weak fiscal fundaments or imbalance on the micro level.

Secondly, this study also investigates the relation between CAL and currency episodes by looking at cross-country analysis. This analysis includes a sample of nineteen countries from CEE, Baltic States, CIS countries and the Caucasus for the period between 1995 and 2013. During this period, fourteen currency crisis occurrences happened, and in the same time six countries liberalized into fully capital control transactions. All of these crises took place in the first half of 1990s, except for those that were affected by the global financial crisis in 2007 and 2008. The results of the Probit Augmented specification models show evidently that there is a negative impact of CAL process on currency crisis for these groups of countries

Overall, the concluding point of research about these countries is that CAL process have to be implemented carefully, taking into consideration a country's macroeconomic, political, institutional fundamentals.

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