

The Real Economy after Episodes of Financial Crises in Central and Eastern Europe

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Abstract: The occurrence of the most critical international economical and financial crisis of the 21st century brought into the spotlight the damages that crises can bring to our economy. After its burst in the autumn of 2007, the crisis has spread all over the world through the Contagion Effect, and has led to an accelerated and sharp deterioration of economic activity. The effects of the episodes of financial crises have on the real economy seemed to be more important and persistent in some specific countries. For this reason we focused our attention upon eight European transition countries and a sample of thirteen financial crises. The aim of this study is to perform an econometric analysis of the effects of episodes of financial crises on real output (GDP) for eight economies from Central and Eastern Europe (CEE) using an ARDL equation and an impulse response function. The main findings of the paper suggest that, in the case of the CEE economies analyzed, financial crises have an important and long-lasting effect, lowering the real output by about 12-14%.

Keywords: financial turbulences; real GDP; CEE; ARDL equation

JEL Classification: F43; G01; G19

1 Introduction

The financial crisis which started off in the autumn of 2007 in the United States and then spread throughout the world through the contagion effect has led to an increased deterioration of economic activity in most world economies. Its occurrence reopened the debates concerning the real effects of a financial crisis (regardless of the form they take) on economies and their duration. The focus of this paper is on the impact of different episodes of financial crises on a specific panel of economies from Central and Eastern Europe; more specifically, the research paper investigates the cases of Bulgaria, Estonia, Latvia, Lithuania, Poland, the Czech Republic, Romania and Hungary.

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This study aims to conduct a qualitative and empirical analysis, focusing on the case of eight economies from Central and Eastern Europe, of the effects of episodes of financial crises on real output. In our scientific approach we focus, at the same time, on the losses generated in the economy by an episode of financial crisis and we ask ourselves if these losses are permanent or if they can be recovered on a medium or long term. This paper is part of a wider analysis of the effects of financial crises (seen as adverse effects of economic globalization) on the monetary policy instruments used by the central banks throughout the world in order to ensure financial and price stability.

2 Theoretical Considerations

The financial crisis which started off in the autumn of 2007 in the United States and then spread throughout the world through the contagion effect has led to an increased deterioration of economic activity in most world economies. Its occurrence reopened the debates concerning the real effects of a crisis on economies and their persistence.

Economic literature, in general, associates financial crises with major economic declines (Reinhart and Rogoff, 2009); among the first impact studies concerning the real effects of a crisis on economies, it is worth mentioning those belonging to (Bagehot, 1873). We take note, however, in economic literature, of a couple of studies which mention a null or modest effect of financial crises on the performances of an economy (Boyd *et al.*, 2005) and the examples given are generally those of developed countries affected by minor (local) crises. As concerns the real effects of currency crises (one of the forms of manifestation of financial crises), according to the traditional view, a real depreciation, in the case of a nominal rigidity, favors exports and boosts output and employment. An illustrative example in this respect is the study conducted by Demirguc-Kunt *et al.* (2006), who identified a positive impact for 40% of the analyzed currency crises.

Financial crises affect real economy through *massive depreciations of the currency and increases in the prices of the imported factors of output and of output costs*. Financial crises affect, at the same time, the behavior of economic agents through *the increase of uncertainty in relation to future profits and the decrease of the level of investments and consumption*. In addition, banking crises, as a form of manifestation of financial crises, produce a decrease at the level of investments through the distress of credit intermediation and of the payments system, following the diminution of the values of securities.

These effects turn out to be more visible and more persistent for emerging countries. Actually, emerging economies are more vulnerable to factors which lead to the occurrence of crises, such as, for example: the exposure of banks and of

private economic agents to *maturity mismatches* and *currency mismatches*, distress at the level of international capital markets, banking panic or sudden stops of the entry of foreign capital. These statements are supported by solid empirical evidence in economic literature. Moreover, specialized studies have shown that the effects of financial crises on economic activities are bigger for emerging economies than for developed economies. For example, Hutchison and Noy (2005) analyzed the effect of currency and banking crises on economic output for developed, as well as for emerging countries. They noticed, in the case of emerging countries, an average decrease of output of 8% (for a period of over 2 years), whereas, in the case of developed countries, the average decrease of output was of only 2% (for a period of 1 year). In a study conducted by Dell' Ariccia *et al.* (2008), one could see that emerging economies registered a level of real effects of banking crises bigger by 1.5 percentages than the level registered by developed economies. At the same time, Reinhart and Rogoff (2009) noticed that the decrease at the level of the GDP, following the manifestation of a financial crisis, is much bigger for emerging economies than for developed ones.

In this context, European transition economies (countries belonging to Central and Eastern Europe or *CEE*) are of particular interest from the perspective of the real effects of a financial crisis. Moreover, we must see whether the losses generated in the economy (in the case of CEE countries) by a financial crisis are permanent or whether they are recovered in the short or long run.

3 Particularities of the Countries from Central and Eastern Europe

The former socialist countries belonging to Central and Eastern Europe registered significant changes in their economic structures, changes that are visible primarily in the higher living standards and in their increasing integration in the European bloc. It is worth mentioning, nevertheless, the imbalances which exist with regard to the pace of these processes. For example, Estonia, Latvia, Lithuania, Poland, the Czech Republic, Slovakia, Slovenia and Hungary joined the EU in 2004, whereas Bulgaria and Romania adhered to this group in 2007. Slovenia adopted the unique European currency in 2007, whereas Slovakia is scheduled to adopt the euro in 2009. Although they have some similarities with developed economies, the CEE countries continue to present the characteristics specific to emerging markets. In addition, structural reforms, which may increase the degree of resistance of economies to financial shocks, are still in the process of implementation, thus increasing the probability for the effects of the financial crises to be bigger and to last more in time.

The global financial crisis which erupted in the autumn of 2007 exposed the intrinsic weaknesses of the growth model specific to the CEE countries. Excess external funding generated a very big external debt and enabled a fast expansion of

credit, especially of foreign currency credit. At the same time, the high internal demand in many CEE countries led to overheating, with inflationist pressure and substantial (unsustainable) current account deficits. The decrease of liquidities at an international level and the pressure exercised on the exchange rates drew attention in these countries on the risks of an increased independence in relation to the already highly volatile foreign capital.

Returning to the matter of the large external imbalances (the deficits in current and capital accounts) of the CEE economies, these were generated by the rapid GDP growth, which was strongly and increasingly based on domestic demand and financed by capital inflows. As we can see in Figure 1 most CEE countries have encountered significant external imbalances in the period before and during the crisis. Exceptions are the cases of the Czech Republic and Poland for whom the current and capital account deficits didn't fall below 10% of GDP.

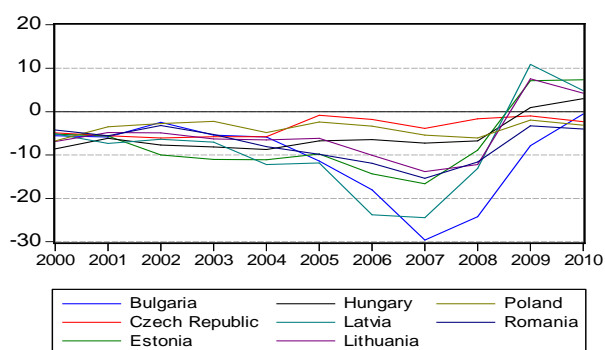


Figure 1. Combined current and capital account deficit in the CEE economies during the 2000-2010 period (% of GDP)

Source: authors' calculation using Eurostat data

Given the fact that most CEE countries, except for Poland, were affected by severe recession starting with 2009, we wonder whether the sudden stop of economic growth is lasting or whether the economies will register an ascending trend in the close future. In many of the CEE countries, the international financial crisis increased the volatility of the exchange rate and affected the budgets elaborated by the governments, thus causing significant imbalances at the level of economies.

This paper assesses the impact of financial crises on certain economies from Central and Eastern Europe, more specifically on: Bulgaria, Estonia, Latvia, Lithuania, Poland, The Czech Republic, Romania, Hungary. The main characteristics which differentiate these specific economies from CEE from other emerging economies are : 1) the CEE countries analyzed have gone through a deep and unprecedented process of transformation, from planned to market economy;

this involved, amongst others, significant investments in assets, as well as in human resources, multiple changes of the economic integration model, etc. 2) the economies that are part of this study participate to the economic integration process; the CEE economies analyzed are EU members (an economic area with a high degree of integration on the market of goods, services, capital and, to a certain extent, of the workforce) and have adopted European standards at the level of their economic policies, institutions and government model. Moreover, the CEE states studied will adopt, after meeting the convergence criteria specified in the UE treaty, the unique currency, the Euro.

Separated from the communist bloc, the CEE economies initially collapsed (see Figure 2). However, by the middle of the '90s, due to various reasons (like the process of macroeconomic stabilization, structural reforms, low interest rates, a rapid development of the financial sectors, the perspective of EU membership etc.), the real GDP started to increase again in all the analyzed countries, reflecting primarily the results of the macroeconomic stabilization process and of an extensive range of structural reforms.

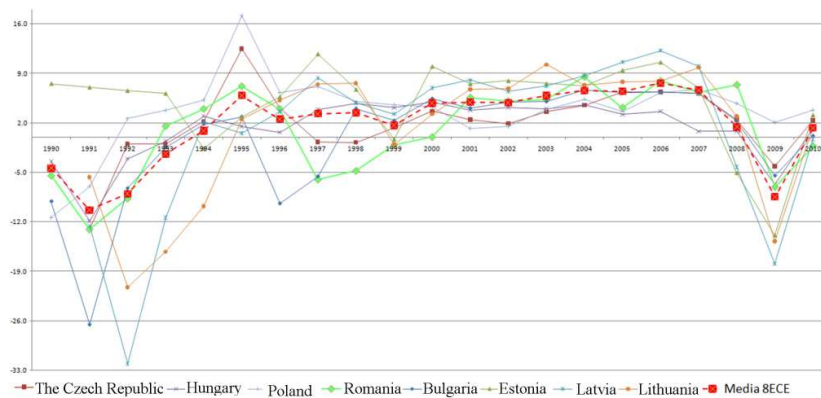


Figure 2. Annual growth of real GDP in the CEE countries during 1990-2010 (%)

Source: authors' calculation using World Economic Outlook database

For example, the average of the annual increase of the real GDP for the CEE economies over the 1994-2008 period was 4.7%, with a fast acceleration starting with 2000, of approximately one percentage point per year, reaching its maximum value, of 7.6%, in 2006. We may notice, at the same time, a strong decrease of the analyzed indicator, from 6.6% in 2007 to 1.4% in 2008 to -8.5% in 2009. Despite all these, 2010 brought economic growth equal to more than 1% in the studied countries.

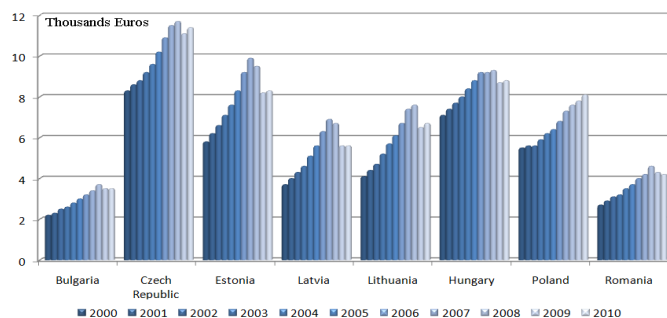


Figure 3. Real GDP per capita in the CEE economies (thousands of Euros per capita)

Source: authors' calculation using Eurostat data

The significant economic performances of the 8ECE countries were also reflected in the process of real convergence, described herein as the level of real GDP *per capita* in terms of PPP (see Figure 3).

4 Used Data and Research Methodology

This paper uses a sample of data on eight countries from Central and Eastern Europe (Bulgaria, Estonia, Latvia, Lithuania, Poland, the Czech Republic, Romania and Hungary) starting with 1989 and ending with 2010 (annual data).

In order to achieve the primary objective of this paper, we intend to apply the methodology initiated by Romer and Romer (1989) and subsequently developed by Furceri and Zdzienicka (2011) for the purposes of assessing the impact of monetary shocks on output. In more concrete terms, we wish to estimate an autoregressive equation with distributed lags, also called ARDL function, by using as dependent or endogenous variable “the increase of the gross domestic product”, and as independent or exogenous variable “the financial crisis”. Starting from here, we will calculate the impulse response functions under the form of a chart, estimating the confidence bands with the help of the Monte Carlo simulation (by using 1000 trials) in order to quantify the medium and long term effects of financial crises on the economies included in the panel. This method supplements the previous attempts of evaluating the costs generated by financial crises by taking into consideration short and long term impact. Although there are studies which associate some banking and foreign currency crises with short term output losses, few of them analyzed whether these losses were recovered in the medium and long run. Traditional approaches (initiated by Kaminsky and Reinhart, 1999; Calvo and Reinhart, 2000) take into consideration regressions of the *output*, with various control variables, real time variables and deviations (real growth, real GDP per capita) and *dummy* variables of the financial crises for the panel data of developed

and emerging economies (for example, studies conducted by Barro (2001), Bordo *et al.* (2001), Demirguc-Kunt *et al.* 2006).

The use of *impulse response functions* in order to distinguish between the short term and long term effects of final crises on the real GDP is a novelty, the pioneers of this methodology being Cerra and Saxena (2008). The method was used afterwards by European Commission to evaluate the impact of the 2007 financial crisis on potential growth, and more recently, by Furceri and Zdzienicka (2011) to assess the impact of financial crises on output for 11 European transition economies.

Table 1. Financial crisis episodes in the 8CEE countries

Country	Systemic banking crisis	Currency crisis	Public debt crisis	The starting point of the financial crisis
Bulgaria	1996 – 2002	1996	1990-1991	1990, 1996 2008
Estonia	1992 – 1999	1992	-	1992, 2008
Latvia	1995 – 1996	1992	-	1992, 1995, 2008
Lithuania	1995 – 1996	1992	-	1992, 1995, 2008
Poland	1992 – 1995	-	-	1992, 2008
Czech Republic	1996 – 1998	-	-	1996, 2008
Romania	1990 – 1993	1996	-	1990, 1996, 2008
Hungary	1991 – 1995	-	-	1991, 2008

Source: authors' calculation using World Economic Outlook database; including Laeven and Valencia (2008), Cecchetti (1999), Furceri and Zdzienicka (2011) and Frydl (1999) for determining the starting point and the duration of the financial crisis

For the purposes of this analysis, we will use the IMF database (Laeven and Valencia, 2008) for the financial crisis episodes from the 1990-2007 period, to which we will also add the international financial crisis which broke out in 2007 (we will refer to 2008). Table 1 lists the episodes of financial crisis used in this study.

In order to determine the impact and duration of the effects of financial crises on economic growth, we will use an autoregressive equation. An autoregressive equation with distributed *lags* of the order p and n or ARDL (p,n), for a scalar variable y_t has the following structure (equation 1):

$$y_t = c + \sum_{i=1}^p a_i y_{t-i} + \sum_{i=1}^n b_i x_{t-i} + \varepsilon_t \tag{1}$$

where,

c is the intercept,

ε_t is the error term, a scalar of zero mean,

x_t is column vector with dimension K ,

a_i is a scalar while b_i is a vector.

The model which we intend to estimate is an ARDL (p, n) model presented in the form of equation 2.

$$\Delta \text{LPIB}_{i,t} = c_i + \sum_{j=1}^p a_j \Delta \text{LPIB}_{i,t-j} + \sum_{j=1}^n b_j \text{CF}_{i,t-j} + \varepsilon_{i,t} \quad (2)$$

where,

$\text{LPIB}_{i,t}$ is the natural (or Napierian) logarithm function of real output (PIB_t) for country i at moment t ,

c_i is a constant and it is used to capture the specific characteristics of a country (i) that are unobservable,

$\text{CF}_{i,t-j}$ is a dummy variable which takes the value 1 if a country (i) is passing through an episode of financial crisis in moment t and 0 if otherwise,

a_i and b_i are parameters which explain the influence of the observed variables upon the dependent variable ($\Delta \text{LPIB}_{i,t}$).

We will test the number of *lags* for the equation (2) starting from ARDL (1,1) and we will increase their number until an additional *lag* no longer produces an effect on the analyzed variable. When it existed, heteroscedasticity was corrected, and the problem of self-correlation with regard to the dependent variable is solved by involving the values of *lags* as explanatory values.

All the necessary information is taken from the *IMF International Financial Statistics* and *World Economic Outlook*. The data are analyzed using the panel data approach and consists of annual observations from the period 1989-2010 for the 8 CEE economies. The episodes of financial crises (currency crisis, banking crisis and sovereign debt crisis) are presented in Table 1 one along with the sources of the data.

5 Results

During the first stage, we have estimated an equation of the impact and persistence of financial crises on the real GDP in the 8 analyzed ECE economies (equation 3) by using a single *lag*, namely ARDL (1, 1).

$$\Delta \text{LPIB}_{i,t} = c_i + a_1 \Delta \text{LPIB}_{i,t-1} + b_0 \text{CF}_{i,t} + b_1 \text{CF}_{i,t-1} \quad (3)$$

The econometric estimates specific to this equation are presented in Table no. 2. According to the econometric findings in Table 2, at the level of the data panel, the increase of the value of the indicator “real GDP” is influenced both by the economic growth registered during the previous year and by the *dummy* variable which describes the financial crisis episodes. We may notice a visible contemporary effect of financial crises on the increase of the real GDP.

All the parameters corresponding to the exogenous variables in equation (3) are statistically significant at a confidence level of 99%. The value of *F-statistic* is 29.7 and the probability associated with it is smaller than 0.001%, which makes the estimated equation statistically significant for a confidence level of 99%. The analyzed variables account for approximately 36% (values of the determination coefficients R^2 and \bar{R}^2) of the behavior of the dependent variable (that is, the modification of the logarithm values of the increases of the real GDP), the difference being caused by other factors included in the error term ($\varepsilon_{i,t}$). According to the *Durbin Watson stat* (DW) test, the value of 1.75 is below the limit (of approximately 2), which means that there is not serial correlation of the errors.

Table 2 Econometric estimations for the ARDL (1, 1) equation

Dependent Variable: $\Delta LPIB_{i,t}$				
Method: Pooled Least Squares				
Date: 07/08/11 Time: 00:09				
Sample (adjusted): 1992 2010				
Included observations: 19 after adjustments				
Cross-sections included: 8				
Total pool (balanced) observations: 152				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.023776***	0.006389	3.721128	0.0003
$\Delta LPIB_{i,t-1}$	0.501132***	0.065563	7.643500	0.0000
$CF_{i,t}$	-0.041998***	0.011340	-3.703489	0.0003
$CF_{i,t-1}$	-0.016468***	0.011969	-3.775943	0.0009
R-squared	0.375834	Mean dependent var		0.022526
Adjusted R-squared	0.363182	S.D. dependent var		0.068660
S.E. of regression	0.054791	Akaike info criterion		-2.944614
Sum squared resid	0.444306	Schwarz criterion		-2.865039
Log likelihood	227.7907	F-statistic		29.70550
Durbin-Watson stat	1.751762	Prob(F-statistic)		0.000000
Note: ***, ** and * denotes significance at 1%, 5% and at 10% confidence level				

In conclusion, regarding the estimated ARDL (1, 1) equation, both the real output growth from the previous year (which was affected or not by a financial crisis) as well as the financial crisis dummy variable with one lag, affect economic growth at time t . We now focus our attention on assessing the impact and the persistence of

financial crises on real GDP in the 8CEE economies (equation 4) using 2 lags, i.e. ARDL (2, 2).

$$\Delta \text{LPIB}r_{i,t} = c_i + a_1 \Delta \text{LPIB}r_{i,t-1} + a_2 \Delta \text{LPIB}r_{i,t-2} + b_0 \text{CF}_{i,t} + b_1 \text{CF}_{i,t-1} + b_2 \text{CF}_{i,t-2} \quad (4)$$

We use the “trial and error” method. For reasons of space the table with the results for the equation (4) was not inserted in the paper. According to the individual tests – the *t*-statistic as well as the *F*-statistic – applied to the model, all the coefficients from the regression equation are statistically significant at a 0.1%. The analyzed variables explain almost 44% of the variation that the dependent variables has (i.e. the variance of the log of real output), the difference being caused by other factors included in the error term ($\varepsilon_{i,t}$). In conclusion, like in the ARDL (1, 1) equation, the estimated ARDL (2, 2) equation proves that economic growth at time *t* is affected by the real output growth from the previous year as well as the financial crisis dummy variable with two lags.

In equation (5) we computed the parameters for the ARDL (3, 3) model.

$$\Delta \text{LPIB}r_{i,t} = c_i + a_1 \Delta \text{LPIB}r_{i,t-1} + a_2 \Delta \text{LPIB}r_{i,t-2} + a_3 \Delta \text{LPIB}r_{i,t-3} + b_0 \text{CF}_{i,t} + b_1 \text{CF}_{i,t-1} + b_2 \text{CF}_{i,t-2} + b_3 \text{CF}_{i,t-3} \quad (5)$$

As we are introducing more lags, the effects of financial crisis on economic growth are disappearing (or at least estimates of the parameters for dummy variables are found to be statistically insignificant). According to individual tests – *t*-statistic and *F*-statistic tests – almost all of the regression equation coefficients are statistically significant at a level of relevance of 0.1%. Analyzed variables explain around 45% of the behavior of the dependent variable, the difference being caused by other factors included in the error term ($\varepsilon_{i,t}$).

Table 3. Econometric estimations for the ARDL (3, 3) equation

Dependent Variable: $\Delta \text{LPIB}r_{i,t}$				
Method: Pooled Least Squares				
Date: 07/08/11 Time: 00:13				
Sample (adjusted): 1994 2010				
Included observations: 17 after adjustments				
Cross-sections included: 8				
Total pool (balanced) observations: 136				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.028951***	0.006175	4.688040	0.0000
$\Delta \text{LPIB}r_{i,t-1}$	0.439473***	0.091953	4.779321	0.0000
$\Delta \text{LPIB}r_{i,t-2}$	-0.015370	0.097271	-0.158010	0.8747
$\Delta \text{LPIB}r_{i,t-3}$	-0.090306	0.075269	-1.199784	0.2324
$\text{CF}_{i,t}$	-0.028689***	0.010106	-2.838904	0.0053
$\text{CF}_{i,t-1}$	-0.026477**	0.012384	-2.138051	0.0344
$\text{CF}_{i,t-2}$	-0.049235***	0.011867	4.149053	0.0001

CF _{i,t-3}	-0.010772*	0.010120	-3.064411	0.0889
R-squared	0.471741	Mean dependent var		0.033003
Adjusted R-squared	0.459024	S.D. dependent var		0.052376
S.E. of regression	0.041604	Akaike info criterion		-3.464206
Sum squared resid	0.221557	Schwarz criterion		-3.292874
Log likelihood	243.5660	F-statistic		12.27918
Durbin-Watson stat	2.037696	Prob(F-statistic)		0.000000
Note: ***, ** and * denotes significance at 1%, 5% and at 10% confidence level				

When performing these calculations we must pay attention also to information criteria (*Akaike Info Criterion* and *Schwarz Criterion*) that will help us choose the correct model (their values should be as small as possible because they measure the information lost in a given model). Sometimes the author is constrained to take a critical decision when choosing between models: either chose the model with big values for the *R-squared / adjusted R-squared*, but with the sacrifice of higher values for the information criteria or a model with low values for the information criteria but with the sacrifice of small values for the R^2 and \bar{R}^2 .

In equation (6) we have computed the parameters for the ARDL (4, 4) equation.

$$\Delta \text{LPIBr}_{i,t} = c_1 + a_1 \Delta \text{LPIBr}_{i,t-1} + a_2 \Delta \text{LPIBr}_{i,t-2} + a_3 \Delta \text{LPIBr}_{i,t-3} + a_4 \Delta \text{LPIBr}_{i,t-4} + b_0 \text{CF}_{i,t} + b_1 \text{CF}_{i,t-1} + b_2 \text{CF}_{i,t-2} + b_3 \text{CF}_{i,t-3} + b_4 \text{CF}_{i,t-4} \quad (6)$$

Looking at the results of the regressions for the ARDL (4, 4) and at the data presented in Tables 3 we are convinced that in order to evaluate the impact and persistence of financial crisis on GDP in the case of the 8CEE economies, 3 lags are necessary (being the fact that all 3 lags are statistically significant) in the ARDL equation. Thus, regarding the estimates of the financial crisis dummy for all the lags presented in Table 3 we can deduct that, in the case of the 8CEE economies, the occurrence of a financial crisis in moment t generates a decrease in output in the long run (in three years) by almost 11.49%. The validity of the data can be verified by using the impulse response function (which we can generate based on equation (5) and the parameters estimated and presented in table no. 3). By simulating a crisis episode with a one year' duration (the impulse), we generate the increase of the real GDP index (the response). Subsequently, this is included in a band with a confidence level of 95%, generated with the help of the Monte-Carlo simulation for 1000 trials. According to Figure 4, the impulse response function confirms the previously obtained results, namely the fact that financial crises have significant effects on the increase of the real GDP throughout three *lags* (respectively 3 years). By applying the index of Leaven and Valencia (2008), the financial crises decrease the level of growth of the real GDP by approximately 14% in the long run (a result close to the value of 11.49%, obtained by using the ARDL model).

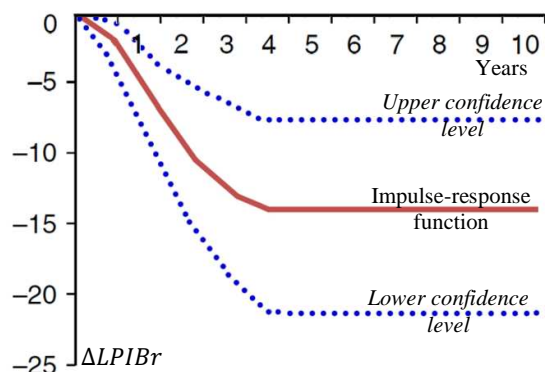


Figure 4. Impact of financial crises on economic growth in the 8ECE countries

The findings of this study are in agreement with those obtained by Furceri and Zdzienicka (2011), who quantify a cumulative loss of output of 17% as a result of the manifestation of financial crises for a number of 11 countries from Central and Eastern Europe, or with those reported by Cerra and Saxena (2008), who measure the magnitude of long-term effects of financial crises by using a data panel made up of several transition economies. At the same time, the findings confirm the observations concerning the fact that the impact of banking and twin crises (banking and currency crises) on output is bigger than the impact of currency crises Kaminsky and Reinhart, (1999).

6 Conclusions

The primary objective of this study is to assess, based on some econometric analyses, the effects of financial crises on real output for 8 states from Central and Eastern Europe. Our scientific study relies on the methodology employed by Romer and Romer (1989) and involves the estimate of an ARDL equation based on a data panel comprised of 13 financial crises which occurred in the 8ECE states over the 1989-2010 period. The findings obtained as a result of the empirical analysis led us to the conclusion that financial crises have a significant and lasting effect (on the short term, as well as on the long term) on economic growth. As concerns the 8ECE economies, in particular, the occurrence of financial crises caused a decrease of the real output of approximately 3 percentage points after a year (the contemporary effect) and of 12-14 percentage points after a 4 years' period. The findings of this study turned out to be in agreement with the ones obtained by Furceri and Zdzienicka (2011), who quantify a cumulative loss of output of 17% as a result of the occurrence of financial crises for a number of 11 countries from Central and Eastern Europe.

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