2. LIQUIDITY, THE OCTOBER 2008 SPECULATIVE ATTACK AND THE CENTRAL BANK REPUTATION[1][2]

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Abstract

This paper discusses the causes that led to an increase in the average interbank money market rate far above the policy rate in the period 17 October-5 November 2008. Data do not support the assumption that interest rate volatility was generated by inadequate liquidity management in the banking system or by banks' collateral volume and interbank collateral structure.

I present a method of identifying a currency crisis and use it to show that the high interest rate volatility was the result of a speculative attack on the Romanian leu. This has altered liquidity flows between credit institutions, thus entailing a higher interest rate. The paper also shows that the central bank tailored its liquidity management to counter the speculative attack and create favorable conditions for the interest rate to return to normal levels. It explains the logic and the reasons behind the speculative attack and shows the role that central bank reputation played during this episode and in the buildup of risks in the run-up to the global financial crisis.

Keywords: financial crisis, speculative attack, central bank credibility, foreign rezerves

JEL Classification: **F31; F32**

[1] *The opinions expressed herein are those of the author and do not necessarily reflect the views of, nor may be construed as binding upon the National Bank of Romania*.

[2] This study was first published in Romanian under the title "Lichiditatea, atacul speculativ din octombrie 2008 şi reputaţia băncii centrale" (April 2011) at http://www.bnro.ro/Studii,-analize,-puncte-de-vedere-4009.aspx and it was included in my book "Politica monetară: ipostaze neconvenţionale (Monetary Policy: Unconventional Approaches)", Curtea Veche Publishing (2012).

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1. Introduction

Prior to being hit by the global financial crisis, Romania's economy was flooded with foreign capital. A consequence of the massive capital inflows in the period 2004-2008 was the nearly 6.5 time growth in banks' external liabilities, from EUR 3.8 billion to EUR 24.5 billion[4]. Ever since the beginning, the external financing bonanza has triggered a clear-cut gradual downtrend in lending and deposit rates, as well as in the average interbank money market rate.

This trend was temporarily discontinued shortly after the crisis made its debut in Romania in October 2008. It was then that increased volatility of the average interest rate on interbank money market transactions became manifest (unless otherwise specified, the average interest rate on interbank transactions shall hereinafter be referred to as the "interest rate"). This indicator rose unexpectedly in the period 17 October-5 November 2008 to levels ranging between 22 percent and 43.6 percent, as compared to the 10.25 percent policy rate. Subsequently, the interest rate reverted to the levels seen before the increase in volatility and re-entered a downward trend.

High volatility on the interbank money market led to an ex post increase in real rates, causing a short-lived shift of the purchasing power from debtors to creditors and potentially depressing economic activity. This process, referred to as "the balance sheet channel of monetary policy" in modern literature (e.g. Bernanke and Gertler, 1995)[5], prompted some investors and credit institutions to blame the National Bank of Romania (NBR) for its presumable lack of transparency and inadequate liquidity management.

The paper explores the causes behind the rise in interest rate volatility in the period 17 October-5 November 2008. Section 2 explains the increase in the interest rate, in line with the quantitative and structural changes in liquidity. Section 3 gives an overview of the methodology attesting that in October 2008 there was a speculative attack on the leu. This altered liquidity flows between credit institutions, sending the interest rate higher. The paper also shows the manner in which the NBR tailored its liquidity management so as to counter the speculative attack and bring the interest rate back to normal levels. Section 4 explains the logic and the reasons behind the speculative attack, highlighting the role that central bank reputation played during this episode and in the buildup of risks in the run-up to the crisis. Section 5 concludes.

[4] Other consequences in the period 2004-2008: private sector external debt rose by about four times, from 12 percent to 45.6 percent of GDP; the economy expanded, on average, more than 5 percent per annum; the current account deficit widened from 8.4 percent to 12.3 percent of GDP; the NBR's foreign exchange reserve increased from EUR 6.3 billion to EUR 25.9 billion; the leu strengthened by 24 percent, from RON/EUR 4.1 in January 2004 to RON/EUR 3.1 in July 2007, sparking a frenzy of lending in local and especially foreign currencies; financial intermediation augmented from 16.6 percent to 39.3 percent of GDP; banks came to hinge on external financing, with their share of foreign liabilities in total assets advancing from 7 percent to 13 percent; the loan-to-deposit ratio across the banking system rose from 0.72 to 1.37; the mismatch between companies' and households' forex assets and forex liabilities augmented.

[5] The idea that balance-sheet changes can be a monetary policy transmission mechanism was formulated by Irving Fisher (1932, 1933) in *The Debt-Deflation Theory of Great Depressions*.

2. Liquidity

In Romania, the global financial crisis did not bring about a loss of interbank market transparency, as was the case in many developed countries, but it affected the volume of the net autonomous component of liquidity and the liquidity supply composition. Some analysts presumed that the changes in the level and structure of liquidity pushed interbank rates higher in the period 17 October-5 November 2008. This is an implicit criticism to liquidity management by the central bank. Other analysts came up with the assumption that banks' volume and interbank structure of eligible collateral[6] were at odds with such changes, causing high interest rate volatility in the above-mentioned period. These assumptions will be examined one by one.

2.1. Liquidity Deficit

The first assumption we look at concerns the connection between the liquidity deficit of the banking system[7] and interest rate volatility. We first show the cause for the liquidity deficit and, subsequently, examine whether there is a positive correlation between the latter's size and the interest rate.

The decline in private capital inflows was among the first knock-on effects (and signals) of the global financial crisis on the Romanian economy. In the banking system, this brought about a drop in the net autonomous component of liquidity below the liquidity demand. The crisis also triggered a weakening of liquidity demand, but to a much lower extent. This may be seen in Figure 1, which compares the percentage deviation of liquidity demand[8] from its average in the period 24 August-23 September (middle line) to the decline in the net autonomous component of liquidity against liquidity demand (lower line).

The decline in the net autonomous component of liquidity below the liquidity demand translated into a liquidity deficit starting 3 October. The latter's change against its average volume in the period 24 August-23 September 2008 is set out in Figure 2.

The onset of the liquidity deficit caused a major change to the central bank-commercial banks relationship, since the former turned from a net debtor to a net creditor of the banking system until March 2010. The liquidity deficit entailed an automatic increase in the NBR's liquidity supply. The increase is equal to the difference between the demand for liquidity and the net autonomous component of liquidity. Thus, given the breakeven point of demand for and supply of liquidity, a

[6] Only the government securities issued by the Ministry of Finance were eligible back then.

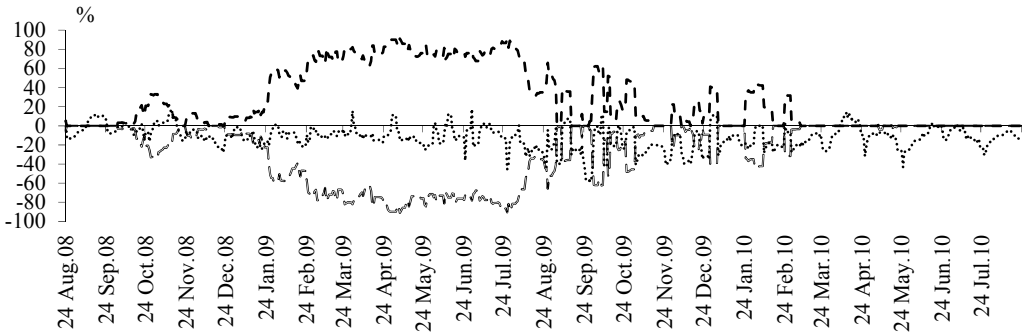
[7] The liquidity deficit of the banking system (LS) is defined as follows: $LS = AC - R < 0$, where: R = reserves, AC = net autonomous component of liquidity. When the banking system faces a liquidity deficit, the central bank is a net creditor, i.e. the net liquidity position (LP) is positive: $LP = I_S - I_D > 0$, where: I_S = the value of instruments whereby the central bank provides liquidity (in brief, supply-side instruments) and I_D = the value of instruments whereby the central bank drains liquidity (in brief, demand-side instruments). The relationship between LS and LP is as follows: $LS + LP = AC - R + I_S - I_D = 0$.

[8] By definition, demand for liquidity (D) is equal to liquidity supply (S), so that $D = R + I_D = S = AC + I_S$.

decline in the net autonomous component of liquidity is offset by the attending increase in central bank's liquidity supply[9].

Figure 1

Dynamics of liquidity, its autonomous component and of supply-side instruments



····· daily changes in the equilibrium level between demand for and supply of liquidity as compared to its average level in the period 24 August-23 September 2008

— — – decline in autonomous liquidity component relative to total liquidity supply

– – – share of supply-side instruments in total liquidity supply

Source: Author's calculation based on NBR data

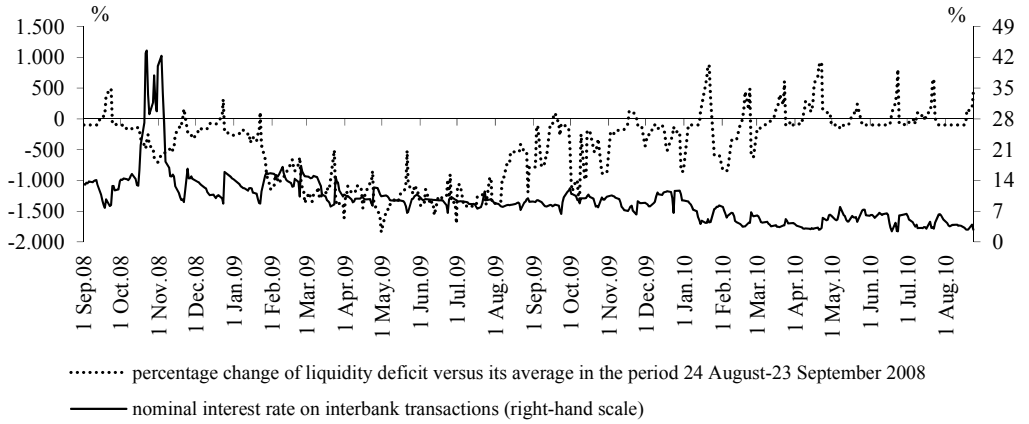
In Figure 1, this "mirror" change is illustrated by the lower line (decline in the net autonomous component of liquidity against the demand for liquidity) running counter to the upper line (the share of central bank's liquidity provision in total liquidity supply). These two lines have zero value in the periods when the net autonomous component of liquidity is the only source of liquidity supply.

The "mirror" change indicates that, by definition, there can be no correlation between the change in interbank rates and the size of the liquidity deficit. Figure 2 shows the lack of any correlation, as relatively small liquidity deficits are associated with large interest rate changes, whereas relatively wide shortages are related to relatively small interest rate changes. Therefore, it was not the size of the liquidity deficit that led to higher interest rates in the period 17 October-5 November 2008.

[9] Considering that AC - R + I_S - I_D = 0 and demand for liquidity is equal to liquidity supply (D = R + I_D = S = AC + I_S), the ensuing central bank liquidity supply (I_S) is equal to or higher than the liquidity deficit depending on whether I_D is equal to or higher than zero, respectively.

Figure 2

Liquidity deficit and interest rate



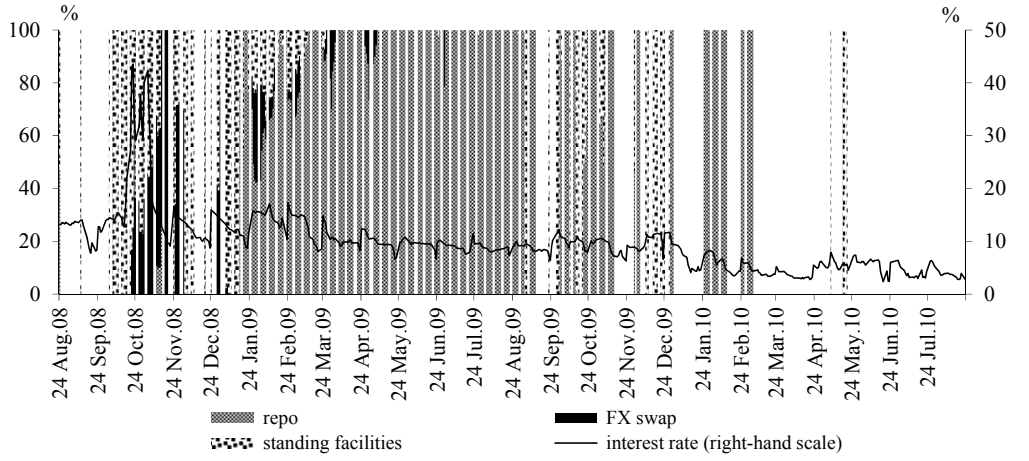
Source: Author's calculation based on NBR data

2.2. Liquidity Supply Structure

The second assumption concerns the influence of the NBR's liquidity supply structure on interest rate volatility. The overnight lending facility has the shortest maturity (from the end of the day to the beginning of the next) of the liquidity-providing instruments, which also include repo transactions and FX swaps. The wider the share of the lending facility in the NBR's liquidity-providing operations is, the closer the banks' decision-making horizon to the current day. This means that overreliance on the lending facility prevents banks from making longer-term forecasts.

Figure 3

Share of instruments in NBR'sliquidity supply



Source: Author's calculation based on NBR data

In the period October-November 2008, some banks criticized the central bank for not engaging in repo transactions, which would have allowed for longer forecast horizons. Figure 3 shows that, from 3 October to 20 October 2008, liquidity was provided exclusively via banks' recourse to the lending facility. The interest rate surged from 16.3 percent to 43.6 percent during 16-22 October.

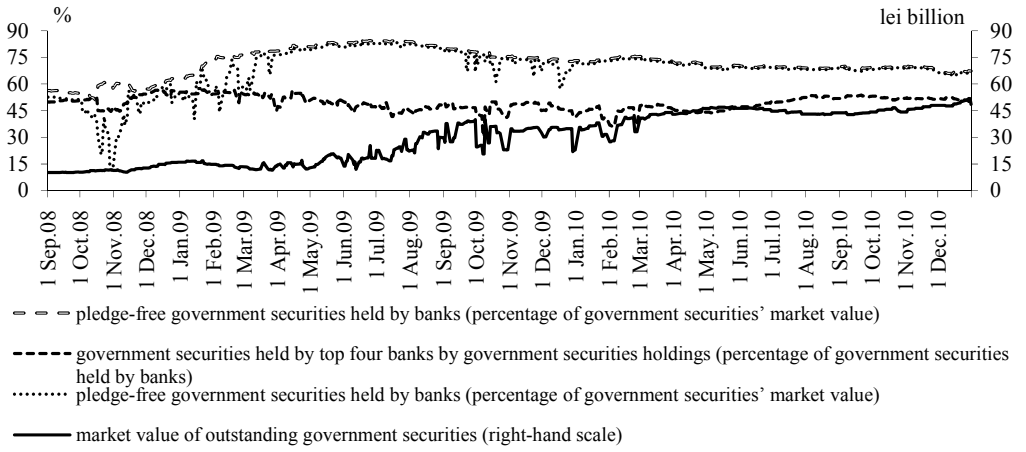
From 20 October onwards, the central bank also accommodated the demand for liquidity from a small number of banks by performing FX swaps (banks' foreign currency sales), but no repo transaction was conducted until 10 November. By shortening the forecast horizon to one day, the frequent recourse to the lending facility made banks feel they were operating as if they were dealing with a liquidity deficit.
While providing a good explanation for this idea, the prevalence of this instrument does not explain why the interest rate did not post higher volatility during other periods (e.g. 24 November 2008-16 January 2009), when the lending facility and FX swaps were the only liquidity-providing instruments.

2.3. Collateral Volume

The third assumption with regard to the increase in the interest rate concerned the scant amount of government securities that banks could use in obtaining liquidity from the central bank. Indeed, the long-lasting liquidity surplus that had preceded the emergence of the liquidity deficit prompted banks to minimize their holdings of relatively low-yield government securities.

Figure 4

Government securities (GS) held by banks



Source: Author's calculation based on NBR data

The comparison between Figure 4 and Figures 1 and 2 shows that banks stepped up their government security purchases as the net autonomous component of liquidity was declining. As the liquidity deficit widened, banks pledged the available

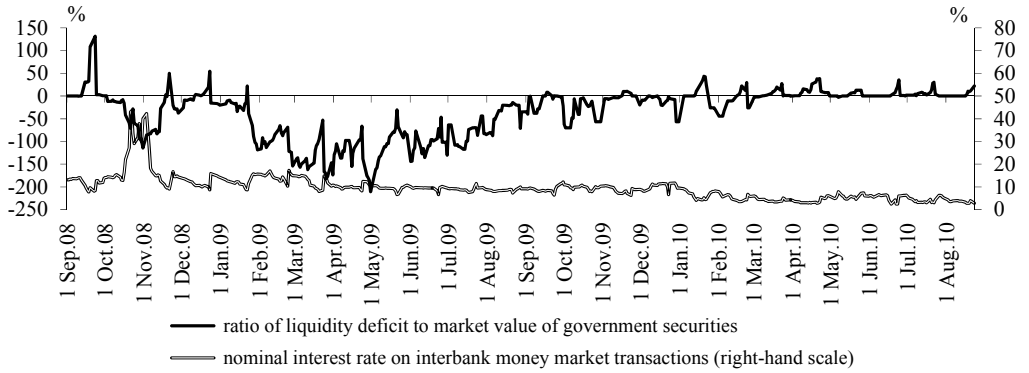
government securities in order to have access to the lending facility (see also Figures 1 and 2 in Annex 2).

Thus, October through November 2008, when the interest rate was on the rise, the value of government securities[10] exceeded the liquidity deficit, except on 31 October (Figure 5).

This means that the value of government securities available to the banking sector was sufficient to fully bridge the liquidity deficit. Conversely, despite the larger volume of government paper, starting February 2009 the ratio of the liquidity deficit to the value of government securities went up, without pushing the interest rate higher. These developments show that it was not the shortage of government securities that contributed to higher interbank money market volatility.

Figure 5

The nominal interest rate and the ratio of liquidity deficit to market value of banks' government security holdings



Source: Author's calculation based on NBR data

2.4. Concentration of Government Security Holdings

The fourth assumption is that there was a mismatch between liquidity needs and the value of government securities held by each bank. The liquidity deficit and the government paper holdings were unevenly distributed among banks. In October 2008, the top-four banks by value of government securities in their portfolios accounted for 48.5 percent of total government securities held by banks (hereinafter refered to as "concentration"). In early October 2008, the liquidity deficit was relatively small and the asymmetry produced no effects. Each bank held enough securities to have recourse

[10] What is meant here by the value of government securities is: (a) the market value plus interest accrued by the current date in the case of coupon securities; (b) issuance value plus discount by the current date for discount securities; and (c) banks' quotations for coupon securities that can be reopened (the so-called benchmark securities with long maturities, whose interest is set on the issuance date and the issued amount may be supplemented).

to the lending facility for relatively low amounts. Thus, interest rates remained at normal levels.

However, the daily liquidity deficit rose at a quick tempo starting 17 October. Its daily average for the period 17 October-5 November was seven times higher than the average recorded in the period 3-16 October. Consequently, money market transactions dropped, on average, by about 29 percent. An increasing number of banks adapted to the situation and resorted to the lending facility, causing the amount of provided liquidity to expand. In the absence of an adequate volume of government securities eligible for collateralization, some banks were compelled to sell foreign currency to the central bank in order to make current payments.

Finally, the banks that failed to cover their liquidity needs via foreign currency sales borrowed money from banks boasting a liquidity surplus. They competed against foreign entities which had previously initiated FX swaps and had an ongoing need for local currency in order to reverse the swaps[11]. The banks reporting a liquidity surplus took advantage of such market conditions to send interest rates sharply higher.

The concentration of government security holdings had a limited contribution to the higher interest rates. This may be inferred from exploring the dynamics of the value of government securities (reflecting particularly portfolio shifts) and of the liquidity deficit in line with the interbank money market rate after the October 2008 episode.

Against the October 2008 average, in the period 28 January-30 April 2009 the liquidity deficit widened, on average, by 417 percent (peaking on 30 April 2009, see Figure 2), whereas banks' holdings of government securities rose in value by only 68.3 percent. During the reported period, the concentratin of government security holdings advanced, on average, from 45.4 percent in the period 17 October-5 November 2008, when interest rates were highly volatile, to 53.2 percent[12]. However, no interest rate disruptions were manifest in that period, which shows that the concentration of government security holdings was not the culprit for high interest rate volatility in the period 17 October-5 November 2008.

3. The Speculative Attack on the Leu

If none of the examined factors can provide a good explanation for the interest rate volatility, other factors should be contemplated. It is assumed that high interest rate volatility in the period 17 October-5 November was caused by a speculative attack on the leu. This had a tremendous impact on the liquidity surplus management in some banks, sending the interest rate higher. Further on, the section presents the methodology employed in identifying the speculative attack and comparing it to

[11] Through such contracts, speculators exchanged the principal and a fixed interest payment in euro for an equal principal and a fixed interest payment in lei at the exchange rate of the transaction date. Upon completion of the swap, borrowings (principals) were reconverted without being affected by the exchange rate. Upon expiry of the contract, speculators buy the principal in lei that must be repaid. If the assumed depreciation becomes a fact, the received principal in euro expressed in terms of the new exchange rate will be higher than the principal in lei.

[12] 53.6 percent in the period 6 November 2008-30 April 2009.

previous or subsequent potential attacks. Moreover, we reveal the mechanism whereby the speculative attack led to higher interest rates.

3.1. Definition

It is true that some officials, analysts, journalists and politicians attributed the weaker leu in October 2008 to a speculative attack since the very start, but no one could explain its underlying reason or how this could have driven the interest rate higher. The relatively fast and steep weakening of the leu was most likely all it took to make such assertions. However, this is a faulty approach, since even faster and steeper depreciation episodes than that seen in October 2008 – for instance, in December 2000 and January 2009 – were not defined as speculative attacks.

There are various definitions for currency crises, an overview of which is provided by Glick and Hutchison (1999). They highlighted two common features that are equally relevant to this paper. First, "currency crises are typically defined as 'large' changes in some indicator of actual or potential currency value." The latter is captured by including "episodes of speculative pressure in which the exchange rate did not always adjust because the authorities successfully defended the currency by intervening in the foreign exchange market or raising domestic interest rates" (Glick and Hutchison, 1999, p. 6. Among others, they quote Frankel and Rose, 1996, Eichengreen, Rose and Wyplosz, 1995, and Kaminsky and Reinhart, 1999).

Second, "alternative criteria have been employed in the literature for identifying 'large' changes in currency value" (Glick and Hutchison, 1999, p. 6) in the form of a threshold. "Some studies employ an exogenous threshold rate of depreciation common to all countries in the analysis […], while others define the threshold in terms of country-specific moments […]". Glick and Hutchison (1999) proposed their own definition, opting for "an indicator of currency crises constructed from 'large' changes in an index of currency pressure, defined as a weighted average of monthly real exchange rate changes and monthly (percent) reserve losses […] Large changes in exchange rate pressure are defined as changes in our pressure index that exceed the mean plus 2 times the country-specific standard deviation" (Glick and Hutchison, 1999, p. 7).

In this study, we define a method for identifying a currency crisis based on our conception that, in the case of a managed floating exchange rate arrangement, a speculative attack is first expected to generate "large" changes in currency value over relatively short periods of time (several days). These days of sharp depreciation should fairly quickly be followed by the central bank's relatively large net forex sales (percent reserve losses[13]), reflecting its effort to defend the currency against a speculative attack. At the same time, the central bank presumably manages liquidity so as to mitigate the impact of the attack, resulting in relatively high interbank money market rate increases.

Thus, large subsequent increases in these three indicators – exchange rate, net percent forex sales and interest rate – over a relatively short period of time are indicative of a currency crisis. Where the exchange rate does not adjust because the

[13] By excluding reserve losses generated by net forex sales. The phrases "net forex sales" and "reserve losses" shall hereinafter be used interchangeably.

central bank defends the currency, but percent reserve losses are followed by large interest rate changes, we are rather dealing with episodes of speculative pressure.

3.2. The Method Employed

We take a two-step approach to decide whether October 2008 saw a speculative attack on the leu. First, we set the succession and the size of exchange rate percentage changes, percent reserve losses and interest rate changes. This exercise spans the period marked by high interest rate volatility (17 October-5 November) and in the vicinity of this period by ±1 month. Second, we introduce criteria to identify whether the changes are relatively large or not compared to similar episodes. The findings from the previous step serve to define the criteria.

During the first step, the following developments were found relevant for October 2008:

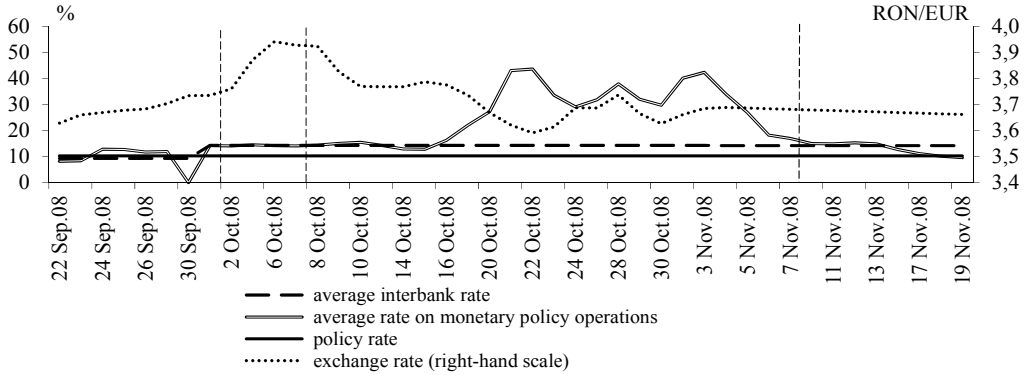
a) the high interest rate volatility was preceded by a significant depreciation of the leu (Figure 6). During the first four trading days of October (1-6 October, in calendar terms), the leu depreciated daily to reach RON/EUR 3.94 on 6 October from RON/EUR 3.73 on 30 September. The 4-day cumulated depreciation totaled 5.6 percent in nominal terms, i.e. 1.36 percent per day, on average. RON/EUR 3.94 was the highest daily reading for both October and the last 45 months;
b) the high exchange rate volatility was followed by the resumption of net forex sales by the NBR. During 6-31 October, NBR's net forex sales came to account for 3.6 percent of forex reserves. Consequently, the leu started to appreciate, reaching RON/EUR 3.59 on 22 October and remaining until 19 November 2008 below the value recorded at the moment the speculative attack started; and
c) the money market rate exceeded the mean for the period January 2005-December 2010 plus more than 3 times the standard deviation in 14 consecutive trading days during 17 October-5 November. In this period, the interest rate exceeded the mean plus 6 times the standard deviation, on average.

The sequence of these changes is the expected one, hinting at a speculative attack. However, in order to tell whether the changes in the three indicators (exchange rate, interest rate and reserve loss) are relatively large, we need a benchmark for each indicator. The respective benchmark will also be used to check on other episodes similar to that seen in October 2008.

Exchange rate. We define two parameters for the exchange rate: (i) the "critical period" and (ii) the "critical acceleration". The critical period is defined as the number of days for which the depreciation of the currency is calculated and which ensures the identification of ongoing and fast-paced depreciation episodes (the fastest average daily depreciation rates). We will refer to the average daily rate of the ongoing depreciation of the leu during the critical period as "acceleration". The critical acceleration is the value that the acceleration should exceed to indicate an accelerated depreciation. Due to the managed floating, both parameters are influenced by central bank interventions, and therefore are country-specific.

Figure 6

Exchange rate and interest rates



Source: Author's calculation based on NBR data

Defining the size of the critical period is conditional upon two restrictions. First, the number of days cannot be too large, because the acceleration would exceed the critical acceleration in either a too small number of cases or in none. Second, the number of days should not be too small, as a central bank does not react immediately to fast-paced depreciation episodes. Since it depends on central bank interventions, the critical period may be viewed as a measure of the central bank's tolerance vis-à-vis the faster depreciation.

In order to determine the critical acceleration that defines a fast-paced depreciation during the critical period, the paper builds on the fact that relatively large depreciations reflecting a speculative attack are rare. Currency crises have been relatively rare globally, i.e. every 11 years on average in the 1975-97 period (Glick and Hutchison, 1999). Hence, the selected daily average depreciation should be large enough to single out rare events, but also small enough to avoid the omission of an attack. For instance, if one searched only for daily average depreciation episodes larger than 1.36 percent, the "October 2008" moment could not be singled out.

Net (percent) forex sales. These sales depend on the size of reserves, the depth of the foreign exchange market, the intensity of the attack, the global financial conditions, etc. For this reason, the relative loss of reserves which may be incurred in the case of a speculative attack or during the managed floating process is country-specific. The loss of reserves in October 2008 might have been augmented by the global financial crisis that broke out in 2007. Therefore, while identifying similar episodes, the benchmark for the percent reserve losses may be obtained by diminishing the level reported in October 2008. If, despite easing the limits, the only identified moments are those acknowledged as "leu crises", the "October 2008" moment may all the more be considered as a speculative attack.

Interest rate. In this case, we also assume that currency crises are rather rear than frequent events. These points to a low likelihood of an interest rate hike triggered by liquidity management geared towards fighting a speculative attack. It is reasonable to

admit that an interest rate change is large if it exceeds the mean plus 2 standard deviations. In the case of a normal distribution, this means that in less than 2.3 percent of the number of trading days on the interbank money market the interest rate exceeds the mean plus more than 2 standard deviations.

By using the previously defined criteria, one can assert that the changes in the exchange rate, the percent reserve losses and the changes in the interest rate in certain periods are similar to those recorded in October 2008 provided the following conditions are jointly met (the benchmark):

1) the leu depreciated for four days in a row (the critical period is equal to four days) and on the fourth day the RON/EUR exchange rate reached a 12-month high. During the critical period, the acceleration amounted to at least 1 percent (which means that, on the fourth day, the cumulated exchange rate index equaled at least 1.0406399 – value referred to as "critical value")[14];
2) during the month when the cumulated depreciation index exceeded the critical value, the central bank's net sales surpassed 2 percent of forex reserves; and
3) the interest rate exceeded the mean plus more than 2 times the standard deviation for at least three days in a row, in a period of at most 30 days since the beginning of the fast-paced depreciation causing the cumulated depreciation index to reach or go past the critical value.

In order to make sure that all conditions are in place, we will proceed as follows: (i) first, we will identify the days and months, respectively, when the exchange rate, on one hand, and the forex sales and the interest rate, on the other hand, fulfilled the stated quantitative criteria; and (ii) subsequently, we will check whether the dates thus identified meet the time criteria (the 30-day period, etc.), with a view to establishing the "moments" when the criteria were simultaneously fulfilled for the three variables.

3.2.1. The Exchange Rate Dynamics

The forex market became functional as late as 1997 and the current account convertibility came into effect starting 1998. Therefore, the meaningful period for the purpose of this paper is 1999-2010.

Figure 7 shows the cumulated exchange rate index for the previous four days. In the period 4 January 1999-31 December 2010, the four day-cumulated exchange rate index exceeded the critical value in 22 cases (days)[15]. But only in eight out of 22

[14] Some might contemplate a critical period longer than four days (while maintaining the critical acceleration). After having checked whether critical periods of five or six days might have been more appropriate for identifying similar events to that seen in October 2008, we came to the conclusion that, in the case of Romania, a faster than 1 percent acceleration for critical periods longer than four days can be very seldom reported. During 1999-2010 (3,059 trading days), no acceleration faster than 1 percent was recorded for a six-day period. There were only two instances of acelerations faster than 1 percent for a critical period of five days.

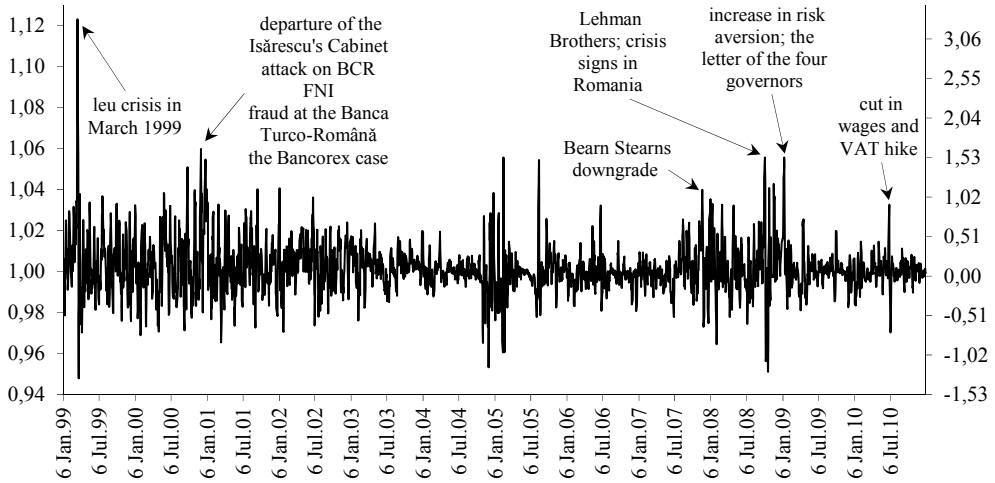
[15] Out of the 22 cases when the acceleration exceeded 1 percent, three occurred at a time when large capital inflows were reported, namely on 17 February 2005 and on 15 and 16 August 2005. For the latter two dates, the faster than 1 percent acceleration reflects massive net purchases by the central bank shortly after the adoption of the inflation targeting regime in order to have a weaker leu in the run-up to the anticipated large capital inflows that could have triggered the appreciation of the leu. These net purchases reached 5.92 percent of the

cases, the index simultaneously reflected a continuous increase in the exchange rate level and a 12-month high, thus meeting our standard on the critical acceleration. These data are shown in Table 1.

The data shown are closely linked to significant economic events. In March 1999, the leu witnessed the deepest crisis since the liberalization of the forex market, during which the contagion effects of the crisis in Russia (September 1998) played a significant part. In 2000, when general and presidential elections took place, Romania also witnessed the fraud at the Banca Turco-Română (the case, signaled in June 2000, was solved on 30 April 2002), the FNI collapse (May), the run on the BCR (May-June), and the departure of the Isărescu Cabinet (December). The October 2008 reading was preceded by the Lehman Brothers collapse on
15 September and the emergence of the crisis signals in Romania. In January 2009, risk aversion went up, contributing to the rise in forex market volatility in Central and Eastern Europe. In response to heightened risk aversion, the governors of the central banks in the Czech Republic, Hungary, Poland, and Romania signed a joint letter informing the general public of their decision to fight the high volatility on the forex markets in their respective countries, including via interventions in foreign exchange markets (see Figure 7).

Figure 7

Cumulated exchange rate index (left-hand scale) and the average daily rate for the last four days (percent, right-hand scale)



Source: Author's calculation based on NBR data

average level of reserves in February 2005 and 8.05 percent of reserves in August 2005. That is why they are irrelevant to our paper. Selecting a five-day critical period and a 1 percent critical acceleration would have pinpointed two moments: 18 March 1999 and 17 August 2005, the latter being unacceptable.

Table 1

Dates when the four day-cumulated exchange rate index exceeded the critical value (the acceleration was faster than 1 percent), hinting at a continuous increase in the exchange rate in the four days and a 12-month high

Date	Index value	Maximum acceleration (%)	Exchange rate (RON/EUR)
18 March 1999	1.123	2.94	1.6642
27 September 2000	1.051	1.25	2.1323
4 December 2000	1.059	1.46	2.25
27 December 2000	1.055	1.34	2.4
6 October 2008	1.056	1.36	3.941
9 January 2009	1.045	1.12	4.2127
12 January 2009	1.051	1.24	4.2684
13 January 2009	1.056	1.36	4.2985

Source: Author's calculations based on NBR data.

3.2.2. Net Forex Sales

The theory recommends raising interest rates during a currency crisis and lowering them in the immediate aftermath of the crisis (Christiano, Braggion and Roldos, 2009). However, in response to the significant depreciation episodes of the leu, the central bank resorted to forex sales, which exceeded 2 percent of forex reserves in 17 cases, i.e. on the dates shown in Table 2. Annex 1 depicts the breakdown of the central bank's forex sales and purchases by frequency and magnitude during 1999-2010.

Table 2

Months when net forex sales exceeded 2 percent of the forex reserve volume

Date	Net forex sales (% of forex reserve)	Month's maximum acceleration (%)	Date	Net forex sales (% of forex reserve)	Month's maximum acceleration (%)
February 1999	4.4	0.78	December 2008	3.2	0.49*
March 1999	11.5	2.94	January 2009	3.2	1.36
November 1999	4.1	0.59	February 2009	3.4	0.38
January 2001	3.1	0.99*	March 2009	2.2	0.11*
January 2002	2.1	1.00*	September 2009	4.4	0.21
November 2003	2.1	0.27	December 2009	5.5	0.20*
January 2004	2.0	0.44*	May 2010	4.2	0.37*
January 2008	2.2	0.87*	July 2010	3.3	0.42*
October 2008	3.6	1.36			

* Average depreciation rate during the critical period, which cannot be deemed as "an acceleration" (the depreciation was not continuous for four days in a row).
Source: Author's calculations based on NBR data.

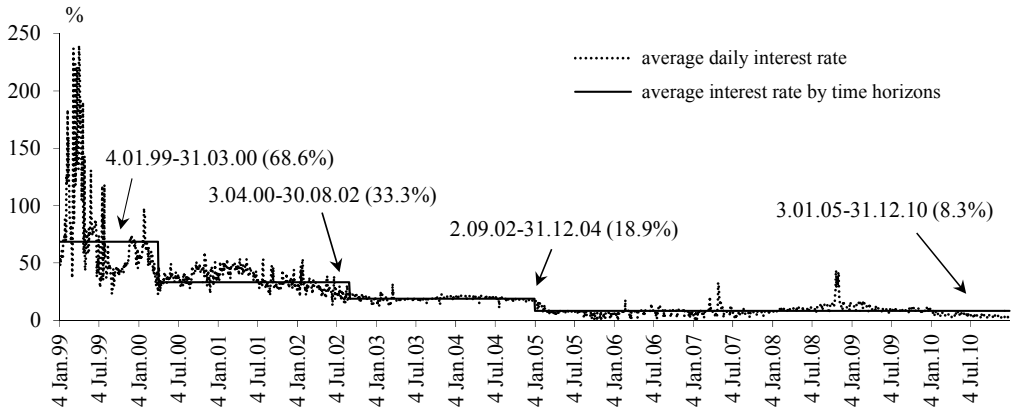
The data in Table 1 and Table 2 show only a small number of months when accelerations faster than 1 percent coincided with net sales larger than 2 percent of forex reserves. In particular, accelerations faster than 1 percent which led to a 12-month high of the RON/EUR exchange rate concurrently with net forex sales in excess of 2 percent of forex reserves were reported only in March 1999, October 2008 and January 2009.

3.2.3. Interest Rate Changes

The nominal interest rate followed a downward path in the period 1999-2010. Nevertheless, certain sub-periods may be identified during which interest rate deviations from the mean are as small as possible. Figure 8 shows these periods.

Figure 8

The average daily nominal interest rate on the interbank money market



Source: Author's calculation based on NBR data

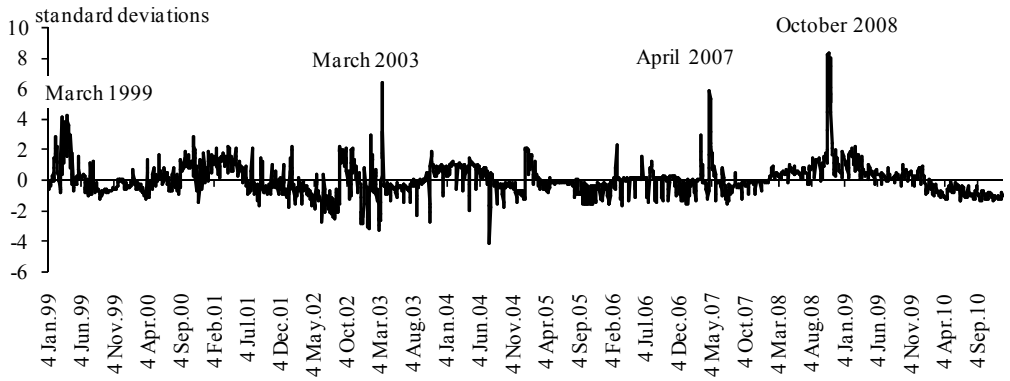
By normalizing the interest rate for the above-mentioned periods, we identified the moments when it exceeded the mean plus 2 standard deviations (Figure 9). There were 70 such cases, out of which 55.7 percent emerged in the period 1999-2003, 17.1 percent in the period 2004-07, 24.3 percent in the period October-November 2008, and the remaining 2.9 percent in the period January-February 2009. On 21 and 22 October 2008, the normalized interest rate exceeded the mean plus 8 standard deviations, reaching a peak for the period 1999-2010.

Table 3 shows the months when the interest rate exceeded the mean by more than 2 times the standard deviation for at least 3 consecutive days. For comparison purposes, Annex 3 presents the months when the interest rate exceeded the mean plus one standard deviation for at least three days in a row.

The data in Tables 1-3 point to a single moment similar to the "October 2008" moment, namely March 1999[16]. The identification of a single event in a nine-year period before the "October 2008" moment (the frequency is similar to that found by Glick and Hutchison, 1999) and its association with financial crises strengthen our conviction that October 2008 saw a speculative attack on the leu.

Figure9

The normalized value of the nominal interest rate compared to a normal distribution with a zero mean and unit



Source: Author's calculation based on NBR data

Table 3

The months when interest rates exceeded the mean plus 2 standard deviations for at least three days in a row

Month	Maximum deviation (standard deviations)
March 1999	4.2
Aprilie 1999	4.2
November 2000	2.8
January 2005	2.1
October 2008	8.3
November 2008	8.0

Source: Author's calculations based on NBR data.

3.3. The Speculative Attack and Liquidity

The speculative attack provides new information on the role played by liquidity in the emergence of interest rate volatility. It gives a proper explanation on why some

[16] By maintaining the critical acceleration at 1 percent, the extension of the critical period to 5 days would not have led to identifying the "October 2008" moment, while the reduction of the critical period to 3 days would have helped identify 21 cases in which depreciation was continuous. However, when also taking into account the net forex sales and the interest rate criteria, these changes in the critical period benchmark were not conducive to identifying other moments, except for "March 1999" and "October 2008".

bankers insisted on the idea that by sterilizing market liquidity the central bank contributed to the pick-up in the interest rate during 17 October-5 November 2008. Indeed, in response to the speculative attack, the central bank resorted to forex sales, absorbing liquidity from the market in a period marked by a system-wide liquidity deficit. Yet, this cleanup was equally the central bank's decision as well as the decision of banks that bought foreign currency. Concurrently, banks resorted to the lending facility, while the central bank engaged in swaps whereby it provided liquidity to some banks.

Moreover, the speculative attack also explains well why banks with liquidity surpluses wanted to buy foreign currency in a period of liquidity shortfall. Being optimizing agents and anticipating a weaker leu in the longer run, banks with liquidity surpluses bought the foreign currency sold by the central bank in the period 6-15 October 2008 (4.1 percent of forex reserves). Thus, banks with liquidity surpluses provided less liquidity to banks with liquidity deficits or to those entities that needed to reverse the FX swaps. That is the reason why the interest rate went up.

Table 4

Forex sales by nonresidents

The rise in forex sales by nonresidents versus:	October 2008	January 2009	2009 (November*)	2010 (June*)
– the previous month (%)	35.0	17.0	7.8	15.2
– the average for the previous months (%)	43.9	-	19.9	28.8
– the average for the year (%)	50.7	-22.0	16.8	16.9

* The month when net forex sales by nonresidents reached a peak for that year.
Source: Author's calculations based on NBR data.

Finally, the speculative attack also explains well why the central bank did not engage in repo transactions. In October 2008, sales of leu-denominated swap contracts saw a very large increase versus the previous month. Moreover, the pick-up in the sales of lei by nonresidents[17] on the forex market was also considerable, although of a lower magnitude than the aforementioned increase. Table 4 shows the developments in the volume of nonresidents' forex sales. The increases seen in October 2008 are far larger than the peaks reported in 2009 and 2010, hinting at a highly visible speculative component of transactions (see also footnote 8).

Had some banks with liquidity deficits found it best to engage in the financing of speculative operations, the supply of liquidity via repo transactions would have been at odds with the central bank's policy to fight the speculative attack via forex sales. Finally, banks with a large liquidity shortage had to sell foreign currency in order to finance their current operations, which helped fight the speculative attack.

Finally, the data in Table 4 explain well why the faster depreciation of the leu and the net forex sales in January 2009 (exceeding even those in October 2008) were not accompanied by high interest rate volatility, as in October 2008, likely to indicate a speculative attack. Compared to October 2008, in January 2009 the volume of sales

[17] The sales under the swap contracts are included in the total volume of sales by nonresidents.

of leu-denominated swap contracts was significantly lower, hinting at a normal activity of transactions in leu-denominated swap contracts. Furthermore, the rise in nonresidents' forex sales in January 2009 compared to the previous month and to the average for 2008 is lower than in October 2008, pointing to the fading of the speculative component. This enabled the normal functioning of the interbank money market, which caused interest rates to remain relatively low. In addition, after the fading of the speculative component, the central bank found it optimum to resume the provision of liquidity via repo transactions.

Our conclusion is that the high interest rate volatility in the period 17 October-5 November 2008 cannot be attributed to a failure of liquidity management to achieve the objective of stabilizing the interest rate around the policy rate. It was as a result of the speculative attack that banks facing a reserve shortage had to pay high interest rates to access liquidity.

3.4. A Comparison between the Two Speculative Attacks

Table 5 shows a comparison between the March 1999 and October 2008 speculative attacks. Data support the idea that, unlike the March 1999 attack, the one that took place in October 2008 met with failure.

In the case of the October 2008 attack, the average exchange rate in the 60 trading days following the 6 October peak equaled the level of the exchange rate at the start of the attack. On the other hand, in 1999, the average level of the 60-day period was 7.8 percent higher than the exchange rate at the start of the attack.

In 1999, after the speculative attack, the leu strengthened in real terms for at least three consecutive months, although the central bank responded through net forex purchases for four consecutive months. Conversely, in 2008, the real exchange rate depreciated for four months in a row after the end of the speculative attack, although the central bank made net sales in each of the four months.

Table 5

Parameters of the March 1999 and October 2008 speculative attacks on the leu

Parameters of the speculative attacks	March 1999	October 2008
Exchange rate at the start of accelerated depreciation (RON/EUR)	1.4819	3.7336
Exchange rate on the peak day (RON/EUR)	1.6642	3.9410
Average exchange rate in the 30 days following the peak (RON/EUR)	1.5927	3.7192
Average exchange rate for 60 days after the peak (RON/EUR)	1.5949	3.7383
Average daily depreciation during the accelerated depreciation period (%)	2.94	1.36
4-day cumulated index for the attack period	1.123	1.056
Maximum deviation of the interest rate from the mean (standard deviations)	4.2	8.3

Parameters of the speculative attacks	March 1999	October 2008
Net forex sales at t-2 (% of the forex reserve)	-3.5	0.0
Net forex sales at t-1 (% of the forex reserve)	4.4	0.0
Net forex sales in the month of the attack (t) (% of the forex reserve)	11.5	3.6
Net forex sales at t+1 (% of the forex reserve)	-2.4	1.5
Net forex sales at t+2 (% of the forex reserve)	-3.5	3.2
Net forex sales at t+3 (% of the forex reserve)	-9.0	3.2
Net forex sales at t+4 (% of the forex reserve)	-27.7	3.4
Change in reserves at t-2 (%)	...*	2.1
Change in reserves at t-1 (%)	-17.1	1.6
Change in reserves in the month of the attack (t) (%)	-5.3	1.2
Change in reserves at t+1 (%)	-2.8	2.5
Change in reserves at t+2 (%)	-26.2	-4.3
Change in reserves at t+3 (%)	-19.4	-3.8
Change in reserves at t+4 (%)	8.2	-2.6
Real depreciation (+)/appreciation (-) of the leu at t-1 versus t-2 (%)	1.4	2.4
Real depreciation (+)/appreciation (-) of the leu at t versus t-1 (%)	4.6	2.2
Real depreciation (+)/appreciation (-) of the leu at t+1 versus t (%)	-1.3	0.5
Real depreciation (+)/appreciation (-) of the leu at t+2 versus t+1 (%)	-2.9	3.5
Real depreciation (+)/appreciation (-) of the leu at t+3 versus t+2 (%)	-3.9	6.8

* Data not availabe.
Source: Author's calculations based on NBR data.

By 1999, four months after the speculative attack, the forex reserve had dropped 37.4 percent compared to the level in the month of the attack, whereas in 2008 it fell by only 8.1 percent.

The crisis of the leu in 1999 occurred during a financial crisis, as described in some models of currency crises (Diaz-Alejandro, 1985; Kaminsky and Reinhart, 1999). The October 2008 speculative attack was neither preceded, nor followed by financial crises in Romania.

4. The Reasons behind the October 2008 Speculative Attack

When speculators decide to launch an attack on a currency, they estimate that the likelihood of succeeding in weakening the respective currency is relatively high. If the attack fails, speculators incur losses. At the same time, a central bank is aware that a failed attempt to protect the currency results in credibility loss. Moreover, avoiding the

depreciation towards the equilibrium level might entail employment costs. What made speculators believe they would be successful in 2008? What prompted the NBR to believe it would succeed in fending off the speculative attack, thereby averting a currency crisis?

4.1. The Logic of the Speculative Attack

We answer these questions by resorting to the models capturing the causes and the effects of a currency crisis in a country with a fixed exchange rate or a heavily managed floating rate. These are known as first-, second- and third-generation models. As regards this approach, one might object that the NBR adopted the inflation targeting strategy, and for that reason, the currency regime can consist neither in a tightly managed floating, nor in a fixed exchange rate, as these models imply. Therefore, the explanation for the reasons behind the speculative attack based on these models requires first clearing this potential objection and second identifying the model that provides a valid explanation for the attack.

4.1.1. The Implicit Objective of the Exchange Rate

Indeed, the central bank did not resort to a tightly managed float or a fixed exchange rate regime. Nevertheless, speculators may have considered that, under the exceptional conditions of the global financial crisis, the NBR temporarily set an exchange rate level that it intended to maintain (implicit level). This shows that speculators identified an implicit external objective of the policies.

The assumption of an implicit exchange rate objective is plausible, given that the NBR has a reputation for being sensitive to the magnitude of the leu depreciation/appreciation. For example, Figure 10 shows that in the pre-crisis period, when large capital inflows tended to strengthen the leu, the central bank made large forex purchases[18]. By contrast, during the crisis, when the leu tended to weaken, the central bank resorted to forex sales[19].

Speculators made their own approximation of the implicit exchange rate level presumably targeted by the central bank. This level provided certain information: its attainment would have prompted the central bank to start protecting the leu. Additionally, the difference between the current and the estimated implicit level of the exchange rate is relevant to speculators: a negative difference shows that a short-term significant depreciation may not encounter any resistance from the central bank.

However, a negative difference is not a guarantee that the central bank will not engage in fighting an accelerated depreciation over the short term, regardless of its cause. In particular, if the implicit objective estimated by speculators is high enough, a speculative attack will generate high exchange rate volatility. Accelerated depreciation

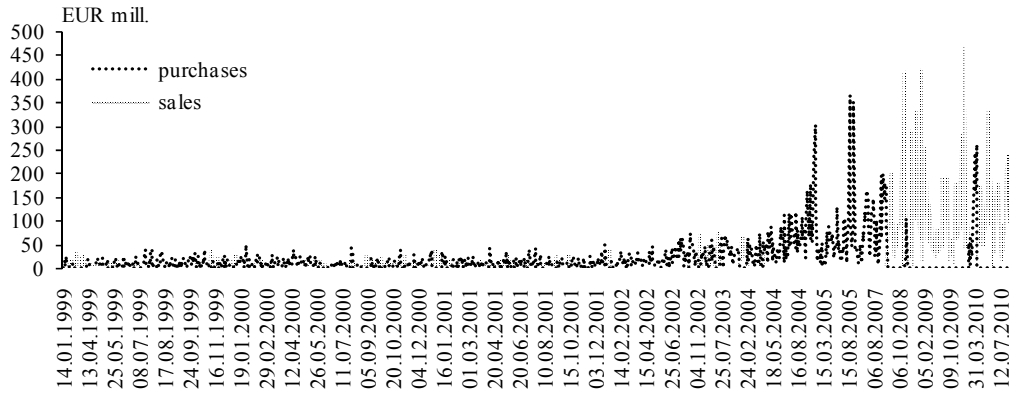
[18] In January 2004-September 2008, net forex purchases by the central bank accounted for 48.5 percent of the average forex reserve of the period, while forex purchases represented 52.8 percent of total purchases during 1999-2010.

[19] October 2008 through December 2010, net sales took 38.4 percent of the average forex reserve of the period, while forex sales accounted for 77.1 percent of total sales during 1999-2010.

is reason enough for the central bank to intervene, even if it has not assumed an actual exchange rate level that it intends to protect[20].
The central bank will combat a large and fast-paced depreciation to safeguard the objectives regarding inflation and financial stability.

Figure 10

Forex sales and purchases by the central bank during 1999-2010



Source: Author's calculation based on NBR data

Indeed, data show that the central bank was equally reactive, by counteracting accelerated depreciations, and proactive, by maintaining relatively low depreciation rates. During 1999-2010, net sales conducted by the NBR spread over 34 months and net purchases over 70 months[21]. The bulk of these net sales (purchases) reflect the managed floating of the leu. Nevertheless, the comparison between net sales, on the one hand, and the maximum accelerated depreciation of the leu and the reserve volume, on the other hand, is rather indicative of an implicit exchange rate objective.
During 1999-2004, the relatively low net sales were associated with the relatively large maximum accelerations and the somewhat low forex reserves (Figure 11). The combination of these three variables indicates that, at certain times, the central bank fought against large depreciations (a reactive stance), with the volume of reserves preventing a tighter control over depreciations.

Conversely, the period of large capital inflows created the conditions for a change in the central bank's behavior. The change was manifest in 2008-2010 when, overall, the relatively large net forex sales were associated with somewhat low maximum

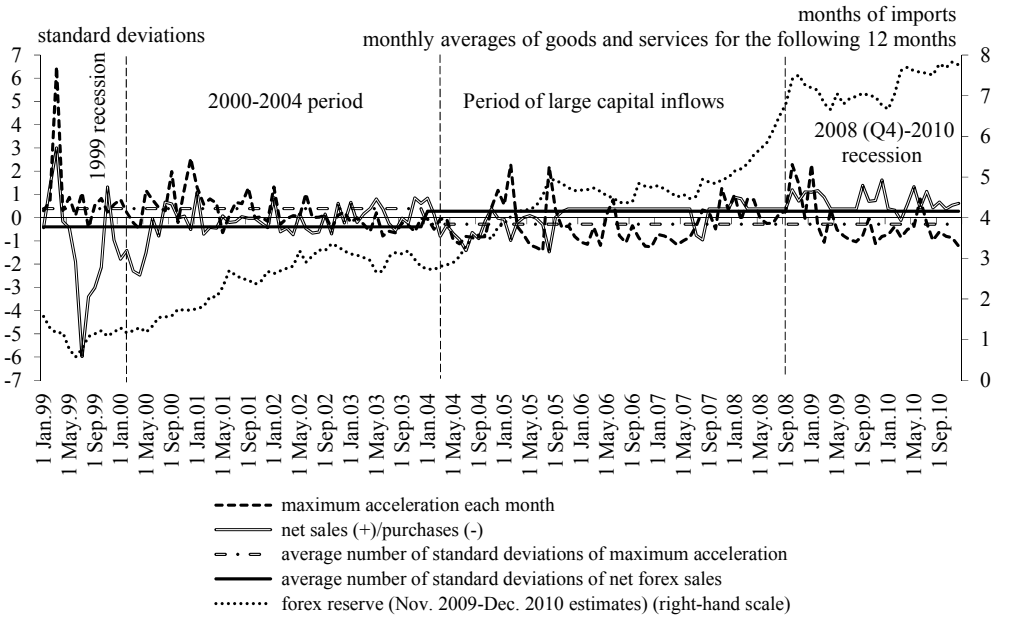
[17] Where the central bank has an implicit exchange rate objective and the implicit objective estimated by speculators is higher than the implicit objective assumed by the central bank, the latter will fight the speculative attack once the exchange rate attains the level of the implicit objective assumed by the central bank.
[21] The central bank's intervention on the forex market consisted of sales in 67 months (in 337 distinct intervention days) and purchases in 79 months (in 728 distinct intervention days).

accelerated depreciations of the leu (except for October 2008 and January 2009) and with relatively high levels of the forex reserves (Figure 11).

This combination illustrates that, by benefiting from a comfortable reserve level, in many cases, the central bank conducted relatively large net forex sales that were sufficient not only to prevent large depreciations, but also to maintain low depreciation rates (a proactive stance). This behavior was obviously unknown to the public in October 2008, when the speculative attack on the leu was launched.

Figure 11

Normalized values of net forex sales and accelerated depreciations versus a normal distribution with zero mean and unit variance



Source: Author's calculation based on NBR data

In October 2008, the central bank initiated forex reserve sales starting with the fourth trading day into the attack, when the exchange rate peaked at RON/EUR 3.94. This shows that the central bank's implicit objective was not to defend the RON/EUR 3.73 level, seen at the launch of the attack, but it did not allow the RON/EUR 3.94 level to be exceeded. It follows that the implicit exchange rate objective estimated by speculators in October 2008 was significantly higher than the RON/EUR 3.94 level, seen at the moment of the NBR's intervention.

4.1.2. Identifying the Model

Where the existence of a negative difference between the current level and the implicit level estimated by speculators does not guarantee a successful attack on the leu, additional elements are required to warrant a higher likelihood of success. We assume

that, in order to obtain these additional elements, in October 2008 speculators sought to identify whether any of the theoretical models of the currency crisis was well supported by domestic economic data. A good match of data with the concepts of a crisis model suggests a high likelihood of success in the case of an attack on the currency (Reinhart and Rogoff, 2009). But as Reinhart and Rogoff pointed out, actual crises often combine elements specific to several theoretical types of crises. Hence, overlapping data and information specific to an economy with the concepts of a certain generation of models is a difficult task.

Accordingly, following the exercise of matching facts with theory, speculators might have decided that the identified elements belonged mainly to a certain type of crisis model in Romania, while the central bank identified a different type of model. Each party acted based on the type of model identified and the consequences estimated based on the respective model type[22].

It is certain that neither speculators, nor the NBR deemed that the specifics of the Romanian economy matched first-generation models. In the early versions of these models (Krugman, 1979; Flood and Garber, 1984; Henderson and Salant, 1978) or even in the previous studies (Henderson and Salant, 1978), the exchange rate is fixed, and its collapse is caused by the unsustainable fiscal policy that yields persistent primary deficits[23]. A crisis emerges when the forex reserve reaches a critical level from which it can be swiftly depleted by speculators.

Over time, these models were adapted so as to take into account the heavily managed floating regimes and the incomplete liberalization of capital markets that limit the central bank's borrowing capacity to defend the currency (Eichengreen and Jeanne, 1998). Thus, expansionary monetary and fiscal policies generate inflation, pushing the real exchange rate to an overvalued level that cannot be defended (Obstfeld, 1986; Calvo, 1987; Drazen and Helpman, 1987; Wijnbergen, 1991; Flood and Marion, 1999). These models predict that increasing fiscal deficits, mounting debt and waning reserves are foretelling signs of the exchange rate potential collapse.

In the case of Romania, the first-generation models poorly matched the data in October 2008. Despite its reputation of being sensitive to the magnitude of the depreciation/appreciation of the currency, the central bank did not maintain a quasi-fixed level of the leu. On the contrary, as soon as the global financial crisis broke out, the leu started to weaken gradually. The exchange rate fell from RON/EUR 3.1 in July

[22] In Romania, an analysis of the various crisis models was performed by Aurel Iancu (2011). He classifies the models into two large categories: (i) models with exogenous shocks, in which rational expectations and self-regulating mechanisms ensure only a short length of crises; and (ii) models based on the financial instability hypothesis.

[23] In a fixed exchange rate regime, money supply needs to be strictly correlated with the exchange rate level. Hence, budget revenues from issuing currency are strictly limited if a certain level of the exchange rate is pursued. If budget deficits are persistently large, they will be financed either via forex reserves sales or from domestic borrowings, if we assume no capital inflows. Since the unlimited use of forex reserves or borrowings to finance persistent fiscal deficits is unsustainable, money printing becomes unavoidable. But printing money and keeping the exchange rate fixed are inconsistent goals, and devaluation must follow.

2007[24] to RON/EUR 3.73 at end-September 2008, before the unleashing of the speculative attack. The real depreciation equaled 8 percent, which significantly offset the erosion of competitiveness due to higher prices and wage hikes following excessive capital inflows 2004 through 2007. Apart from the current account deficit making up about 13 percent of GDP, neither the dynamics of public debt, nor that of international reserves or external competitiveness predicted a 5.6 percent devaluation of the leu in four days.

4.1.2.1. The Logic of Speculators

We assume that speculators gambled on the logic of second-generation models. In these models, the central bank and the governments optimize a welfare function (e.g., Obstfeld, 1994 and 1996) whose arguments are production, employment and banking system stability (domestic objectives), on the one hand, and the exchange rate objective (external objective), on the other hand (Eichengreen and Jeanne, 1998, p. 1). The worsening of the domestic environment might require a lower monetary policy rate or a wider fiscal deficit, which generates a conflict between the domestic and the external objectives. If the market foresees such developments, a speculative attack on the currency may be triggered sooner rather than later. In these models, the deterioration of fundamentals does not necessarily precede the currency crisis, as in the case of first-generation models. Quite on the contrary, in practice, news of a wider fiscal deficit is all it takes to unleash a currency crisis.

When the crisis hit Romania, data appeared to match the second-generation model well enough. On the one hand, it had become clear (at least to certain foreign investors) that production would plummet and unemployment would rise. On the other hand, the high ratio of short-term external debt to forex reserve, compounded by politicians voicing in unison their opposition to an arrangement with the IMF, consolidated market expectations that policies would focus on stabilizing production and employment rather than on stabilizing the currency. From this standpoint, the RON/EUR 3.73 level, reported at the time of the attack, could not be seen as a level that the central bank would choose to defend. It means that there was no exchange rate constraint and that, as we have pointed out, the implicit objective estimated by speculators went way beyond RON/EUR 3.94.

In the absence of an exchange rate constraint, policies could be resorted to for boosting aggregate demand. Virtually, a wider budget deficit was in line with employment objectives and could hardly be avoided. Prior to the crisis, governments had conceded exceedingly high social entitlements, employment and wages in the public sector. It was predictable that, given the crisis and the absence of reforms meant to unwind these excesses, the fiscal deficit would have accounted for more than 10 percent of GDP in 2009 and 2010, inducing adverse expectations on public debt, exchange rate levels and potentially higher prices (for the latter issue, see Wijnbergen, 1991; Dupor, 2000; Burnside, Eichenbaum and Rebelo, 2001a; Daniel, 2001; Corsetti and Mackowiak, 2006). As policies lacked credibility for want of an arrangement with the IMF, speculators assigned a very high likelihood to the fiscal

[20] An overvalued level caused by the massive capital inflows prior to the crisis.

slippage[25]. In this context, speculators may have believed that, a relatively sharp depreciation has became acceptable to the authorities which were focused to defend the internal objective of production and employment (for details on the role of employment in relation with the exchange rate objective, see Eichengreen and Jeanne, 1998).

Another dimension of the October 2008 speculative attack is revealed when the attack is analysed from the perspectives presented in the models of Corsetti, Pesenti and Roubini (1999), Burnside, Eichenbaum and Rebelo (2001a) or Lahiri and Végh (2003). These models have in common the idea that bad news, for instance about the banking sector, may lead to expectations about larger future fiscal deficits. The idea is that the finaciang of larger deficit might require printing money by the authorities, so that a currency crisis can occur before the fiscal deficit deterioration.

In October 2008 as well, the "bad news" about the banking system was part of the broader picture of the speculative attack. Shortly before the start of the speculative attack, rumors surfaced that the Romanian banking system might be facing troubles, despite its safe capitalization level. The head of the NBR Supervision Department declared on 8 October 2008 that "[…] no bank in the Romanian banking system […] faces […] liquidity problems and all the banks observe the prudential levels set by law and the NBR regulations. Nevertheless, there have recently been rumors about the difficulties that certain banks in Romania are facing or are expected to face, and these rumors are spread via telephone, fax and lately the internet".
This press release was issued two days after the leu had peaked at RON/EUR 3.94. Concurrently, inaccurate information emerged that the central bank was bailing out a private bank.

4.1.2.2. The Logic of the Central Bank

Unlike speculators, the NBR considered that domestic economic data better matched the third-generation models (Chang and Velasco, 2001; Caballero and Krishnamurthy, 2001; Krugman, 2002; Burnside, Eichenbaum and Rebelo, 2004; Krugman, 2002). The informational asymmetry must have been the key element underlying the different visions. Unlike second-generation models, in which depreciation is beneficial in terms of employment, in third-generation models depreciation has a negative impact on employment due to financial instability. The focus is on the impact of depreciation on private sector balance sheets, particularly in the case of foreign currency indebtedness.

It is certain that in the case of the October 2008 speculative attack on the Romanian leu, speculators did not overlook the balance sheet effect on growth, nor did the central bank disregard the positive impact of depreciation on employment. But it appears that, while speculators believed the net effect of depreciation would have

[25] At the public presentation of this paper at the NBR on 22 April 2011, Claudiu Cercel, deputy director general of BRD – Société Générale S.A., argued that the trigger of the attack was the news according to which, on 29 September 2008, the Chamber of Deputies had endorsed each article of the law on increasing wages in education by 50 percent, the nod being given by the Chamber on 30 September.

consisted in larger output, the central bank considered that the net effect would have been financial instability of the economy (which it was bound by law to fend off) and, implicitly, the decline in output.

During 2004-08, Romania witnessed large capital inflows that translated into soaring external debt incurred by households, companies and particularly banks. This rise entailed large disequilibria in the balance sheet structure due to higher foreign currency financial liabilities that were not offset by an appropriate increase in foreign currency assets. The credit risk attached to banks, companies and households soared as their incomes hinge extensively on the output of non-tradables, whose foreign currency equivalent contracts after depreciation.

Many economists, myself included, warned against the rising currency risk during 2004-2008, but the caveats faded in the face of economic agents' belief that the NBR would resort to the forex reserve in order to stave off a marked depreciation of the leu. Given this implied guarantee, banks, companies and households deemed it was to their best interest to incur currency risk, as predicted by McKinnon and Pill (1996) and Burnside, Eichenbaum and Rebelo (2001b).

Had the NBR given in to the speculative attack of October 2008, disproportionate depreciations and subsequent drops in production would have become increasingly likely. Depreciation episodes triggered by a successful attack would have dealt a heavy blow to private sector balance sheets amid surging external debt in domestic currency. Probably the net result of higher exports stimulated by a strongly depreciated leu and steep increase in debt, and the associated panick, would have been negative, resulting in a deeper and longer recession. Speculators placed their bets on the NBR accepting the depreciation in order to accommodate the growth in aggregate demand. However, the central bank chose to fend off the speculative attack so as to safeguard financial stability[26] and hence minimize the fall in output.

4.2. Creation of Conditions for a New Attack and the Arrangement with the IMF

The failure of the October 2008 speculative attack notwithstanding, the stage was set for a renewed, potentially successful attack. In 2008 Q3, expectations of a deep recession became broad-based, while anticipations of a massive cut in external financing materialized. There were rising concerns related to the capability of refinancing the private external debt maturing in 2009, which accounted for almost 80 percent of international reserves. During 5-13 January 2009, the domestic currency weakened from RON/EUR 4.03 to RON/EUR 4.3, i.e. 0.95 percent per trading day. By January 2009, the leu had lost 6 percent in real terms compared to December 2008 and as much as 20.3 percent against July 2007.

[26] The consequences of the speculative attack were manifest not only on the interbank market, but also in terms of households' confidence in the banking sector. October 2008 saw the emergence of deposit flight, as net household deposits shrank 3.1 percent for the first time in the past four years. The most visible drop was reported among deposit holders with amounts in excess of EUR 100,000 equivalent. Even though the speculative attack was repelled, the lack of confidence spanned approximately three months, with the volume of deposits reverting to its pre-crisis level in December 2008.

The conclusion of the EUR 20 billion loan agreement with the IMF, EU and the World Bank helped ward off yet another speculative attack. The exchange rate hovered around RON/EUR 4.3 until 25 March 2009, when the conclusion of the arrangement became certain for the markets. Afterwards, the domestic currency traded below 4.2 versus the single currency and remained below this threshold until June 2009. Keeping the speculative attack of October 2008 at bay and concluding the financing arrangement helped deter a currency crisis and a potentially deeper recession than that of 2009-10.

5. Conclusions

In the absence of the speculative attack, the reduction in the net autonomous component of liquidity triggered by the financial crisis could not have generated a rise in interest rates during 17 October-5 November 2008. The relatively low volume of government securities and the asymmetry of their holdings by credit institution have not made a significant contribution to the high volatility of interest rates. The latter was primarily the result of the speculative attack against the domestic currency launched on 1 October 2008.

Similarly to other episodes when the daily average depreciation of the leu over four consecutive days exceeded the 1 percent mark, the central bank's lack of intervention would have had negative consequences in October 2008 as well. Panic would have probably been the major consequence, entailing excessive depreciation of the domestic currency. Once panic had set in, the leu-denominated value of the external debt would have surged, with an overly detrimental impact on private sector balance sheets. This would have deepened the recession which, in turn, would have fuelled the depreciation, thus generating a vicious circle. The central bank's intervention prevented panic from breaking out and safeguarded financial stability. In turn, financial stability laid the groundwork for a less steep decline in output.

The NBR opted for countering the attack by selling foreign exchange, although literature shows that a central bank should raise the policy rate during a speculative attack and lower it immediately thereafter. Raising the policy rate and selling foreign currency are one and the same strictly in terms of the effects on interbank rates. Both measures are reflected in a tighter liquidity management. A hike in the policy rate is accompanied by a liquidity management that should guide the average interbank rate towards the higher level of the monetary policy rate. Forex sales are mirrored by the drainage of liquidity, which contributes to the increase in the interbank rate, as was the case in Romania in October 2008.

The economic crisis and the speculative attack of October 2008 prove there are some major lessons to be drawn in terms of central bank reputation when it comes to its sensitivity to the magnitude of the leu's depreciation/appreciation. It was this reputation that played a paramount role both in the accumulation of risks, prior to the outbreak of the crisis in Romania, and in the unfolding of the speculative attack at the onset of the crisis. Some lessons relate to the effects of this reputation, while others pertain to the causes.

As regards the effects prior to the crisis, the central bank reputation acted as an implicit guarantee that the NBR would resort to the foreign exchange reserve in order to preclude any significant depreciation of the domestic currency. In principle, any guarantee is tantamount to a lower currency risk, thus raising the optimum level of private debt at microeconomic level. The same happened in Romania as well. The implicit guarantee made both companies and households underestimate the currency risk, which fostered the reckless build-up of external private debt.

The sounder the reputation, the less efficient the public warnings issued by the central bank against overexposure to currency risk. This explains why microeconomic decisions failed to incorporate central bank warnings against excessive lending in foreign currency during 2005-08.

At the outbreak of the crisis, the politicians' concerted discourse against any financing arrangement with the IMF overlapped with the central bank's reputation as regards the exchange rate. Adding to this was the foreseeable reduction in external financing and the widening budget deficit, which combined to strengthen market expectations that policies would focus on stabilizing output and employment and less so on upholding the actual exchange rate of the leu. Based on these expectations, the markets temporarily assigned to the central bank an implicit objective regarding the exchange rate (an exchange rate level that the institution would presumably defend) which was well above the prevailing level. This paved the way for the October 2008 speculative attack.

The pre- and post-crisis effects of the central bank reputation regarding its sensitivity to the magnitude of the leu's depreciation/appreciation indicate the need for an enhanced reputation. This leads us to the causes of this reputation.

The central bank's reputation vis-à-vis the exchange rate is derived by the market from central bank interventions in the forex market. Yet it would be erroneous to assume that such interventions represent an intrinsic preference of the NBR. They are rather a consequence of the postponement or the absence altogether of adequate structural reforms, meaning that the domestic currency has come under pressure at times. There have been many such episodes starting 1990, when the central bank had to influence the exchange rate in order to make up for the lack of structural reforms or for policy inconsistency.

For instance, during 1990-96, the governments in office promoted a policy of over-appreciation of the exchange rate, thus providing implicit subsidies for imports. Along with the implicit subsidies generated by the real negative interest rates, they provided financing for unsustainable economic growth during 1993-96, followed by the recession of 1997-99.

The period 1999-2010 saw 50 months of central bank net purchases exceeding 2 percent of the foreign exchange reserves and 17 months when the institution resorted to net sales in excess of 2 percent of the same.

Most net purchases in excess of 2 percent of the reserves (conducted in 43 out of 50 months, i.e. in 86 percent of all cases) were reported during 1999-2004 and were aimed primarily at offsetting, via competitive depreciations, the lack of adjustment in the exporting sector. Some 59.6 percent of all purchases conducted by the central

bank throughout 1999-2010 date back to this time. After adopting inflation targeting in August 2005, central bank purchases accounted for 28.3 percent of the total figure.

Most net sales in excess of 2 percent of reserves spanned 10 months during 2008-10 amid the global financial crisis and the domestic government and political turmoil of 2009-10.

The period 2008-10 saw 83.7 percent of total forex sales conducted by the central bank during 1999-2010. The other net sales exceeding 2 percent of reserves spanned seven months (i.e. 41 percent of the total number of months) during 1999-2004, mainly to make up for insufficient structural adjustments considering the objectives of disinflation. It was during this time that 16.3 percent of all central bank sales of 1999-2010 were concentrated.

The numerous forex market interventions consolidated the central bank's reputation as an institution sensitive to the actual magnitude of the leu's depreciation/appreciation. An improved reputation would allow economic operators to accurately assess currency risk and the optimum level of variables that hinge on the actual magnitude of this risk, such as external debt and investment in the tradables sectors. Such an improvement in reputation was manifest November 2005 through July 2007, when the NBR refrained from any market interventions (Annex 3). Yet the central bank resumed its interventions in the forex market with the outbreak of the global financial crisis.

The issue of reputation spans the entire horizon until the euro adoption date, which marks the end of the currency risk. Until then, once the global economic crisis is over, the central bank might decide, yet again, to eliminate completely any further forex market interventions in order to maximize an objective function derived from a utility function that maximizes welfare. However, given the structural issues, episodes of excess volatility on the forex market might jeopardize both price stability and financial stability objectives. Hence, it could be optimal for the central bank to maintain the interventions aimed exclusively at countering episodes of excess volatility in the exchange rate.

Annex 1

Frequency of central bank interventions in the forex market during 1999-2010
(No. of months of interventions)

Period	Sales*	Purchases*	Net sales**
(1)	(2)	(3)	(4)
Whole period 1999-2010			
>2% of reserves	27 (11)	60 (11)	17 (50)
>1% of reserves	47 (20)	70 (20)	28 (65)
>0% of reserves	67 (42)	79 (42)	34 (70)
Prior to adopting inflation targeting			
1999-July 2005			
>2% of reserves	17 (11)	56 (11)	7 (46)
>1% of reserves	30 (20)	65 (20)	12 (60)
>0% of reserves	47 (40)	70 (40)	14 (63)
After adopting inflation targeting			
August-October 2005			
>2% of reserves	0	1	0 (1)
>1% of reserves	0	2	0 (2)
>0% of reserves	0	3	0 (3)
November 2005-June 2007			
>2% of reserves	0	0	0
>1% of reserves	0	0	0
>0% of reserves	0	0	0
July 2007-September 2008			
>2% of reserves	1 (0)	2 (0)	1 (2)
>1% of reserves	2 (0)	2 (0)	2 (2)
>0% of reserves	2 (0)	2 (0)	2 (2)
October 2008-December 2010 (crisis)			
>2% of reserves	9 (0)	1 (0)	9 (1)
>1% of reserves	15 (0)	1 (0)	14 (1)
>0% of reserves	18 (2)	4 (0)	18 (2)

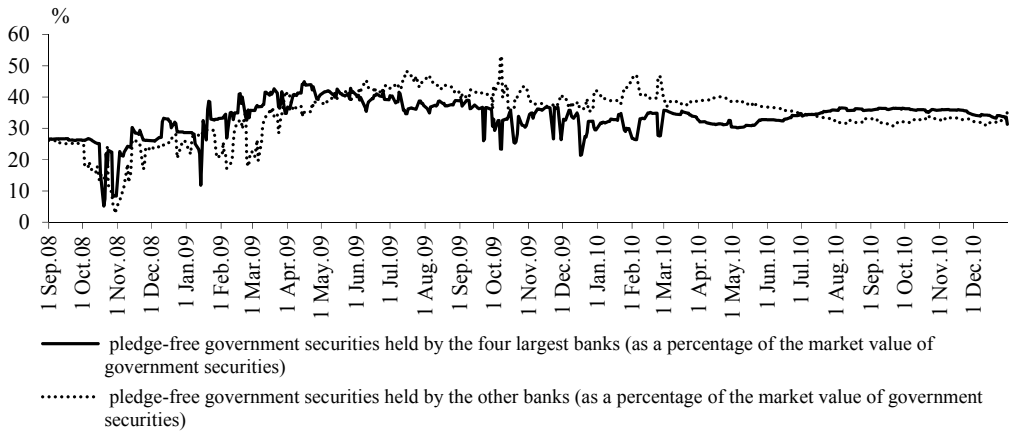
* Under headings (2) and (3), the figures in parentheses refer to simultaneous foreign currency purchases and sales in the same month of the same year.
** Under heading (4), the figures in parentheses refer to net purchases, i.e. net sales meeting the following criteria: < -2 percent of foreign exchange reserves, < -1 percent of foreign exchange reserves and < 0 percent of foreign exchange reserves respectively.
Source: Author's calculations based on NBR data.

Annex 2

Pledge-free government securities

Figure 1

Share of the market value of pledge-free government securities in the market value of government securities



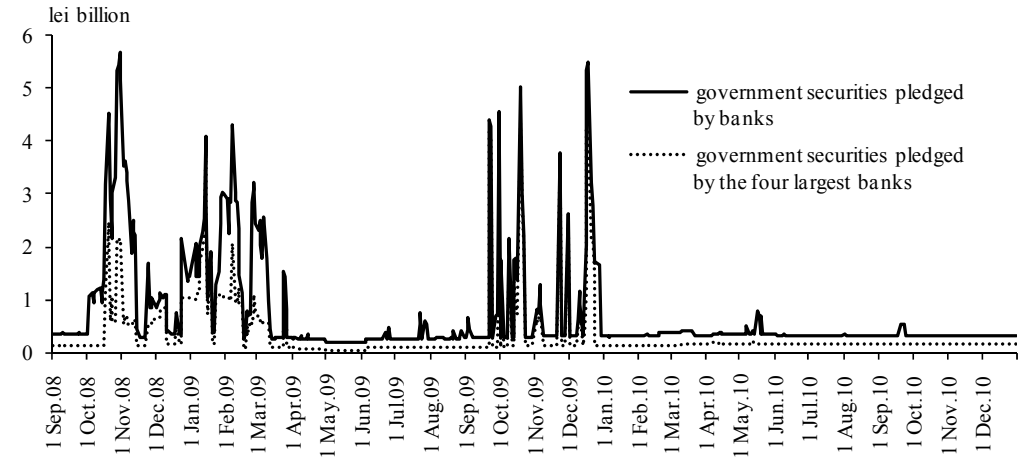
Source: Author's calculation based on NBR data

Annex 3

Months in which the interest rate exceeded the mean plus one standard deviation for at least three days in a row

Figure 2

Market value of securities pledged by banks



Source: Author's calculation based on NBR data

Month	Maximum deviation during the respective month (standard deviations)	Month	Maximum deviation during the respective month (standard deviations)
February 1999	2.8	March 2003	6.4
March 1999	4.2	October 2003	1.9
April 1999	4.2	January 2004	1.2
May 1999**	1.5	February 2004	1.2
July 1999*	1.2	March 2004	1.1
May 2000**	1.7	April 2004	1.5
September 2000	1.9	May 2004	1.1
October 2000	1.9	January 2005	2.1
November 2000	2.8	February 2005	1.6
December 2000**	1.8	February 2006*	2.3
January 2001	1.9	June 2006*	1.5
February 2001	2.1	August 2006**	1.3
March 2001	1.7	March 2007	2.9
Aprilie 2001	2.2	April 2007	5.8
May 2001	2.1	May 2007	3.1
June 2001*	1.01	April 2008*	1.01
July 2001**	2.1	August 2008	1.5
September 2001	1.4	September 2008	1.4
December 2001*	1.04	October 2008	8.3
January 2002**	2.1	November 2008	8.0
September 2002	2.2	December 2008	1.8
October 2002	2.1	January 2009	1.8
November 2002**	1.3	February 2009	2.2
January 2003	3.0	March 2009	1.6

* For one day.
** For two consecutive days.
Source: Author's calculations based on NBR data.

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