

Financial dollarization in Russia: causes and consequences

Alexey Ponomarenko, Alexandra Solovyeva, Elena Vasilieva¹

Abstract

We review different aspects of financial dollarization in Russia applying the main relevant theories to analyze the dynamics of various dollarization's indicators. The econometric model of short run dynamics of deposits and loans dollarization during the last decade is estimated. We find that the ruble's appreciation rate was the main driving factor behind the de-dollarisation that occurred and also behind the later episode of return of dollarization. We estimate the overall (as well as sectoral) currency mismatches for the Russian economy. The results show the gradual improvement of the net foreign currency position of the public sector, where significant accumulation of international reserves by Central Bank of Russia (CBR) and the repayment of government debt have taken place. At the same time, the evidence of significant currency risk vulnerability of the non-banking private sector is presented. We conduct the preliminary analysis of the impact of financial dollarization on the economic performance of emerging markets in conditions of financial turmoil. Our findings seem to confirm the hypothesis of amplification by dollarization of the adverse effect caused by the financial crisis, although clearly further research of these issues is needed.

¹ Research and information department, Central Bank of Russia. E-mail: paal1@cbr.ru (A. Ponomarenko), sas8@cbr.ru (A. Solovyeva), vea2@cbr.ru (E. Vasilieva). The views expressed in this paper are those of authors and do not necessarily represent the position of the Bank of Russia.

Introduction

The analysis of dollarization processes is an important element of central bank's research agenda due to the fact that overall economic performance as well as the implementation of monetary policy may be substantially affected by changes in currency preferences of economic agents. Dollarization of the economy has a strong influence on banking system's stability against liquidity and solvency risks alongside with the accumulation of external debt by different sectors of the economy and the demand for national currency. Therefore the analysis of dollarization processes is crucial for the conduct of monetary policy since the existence of dollarization of itself restrains the ability of the central bank to act as a lender of last resort and makes its liquidity management more complicated thus impeding the achievement of monetary policy's ultimate goals, particularly during sudden stop episodes. Dollarized economies are highly exposed to the risk of the origination of currency and financial crises that could threaten financial stability and disturb the macroeconomic balance. Consequently the problem of financial dollarization is closely related to the issues of exchange rate policy and financial stability.

The currency substitution processes have always been an important feature of the Russian economy. The hyperinflation that occurred in early 1990s and the number of sharp depreciation episodes (the most significant one being the currency crisis of 1998) determined the demand for the reserve currency that could be used for savings purposes. In subsequent years, however, ruble's appreciation has caused the intensive de-dollarization process, only to be followed by another shift to foreign currency assets in late 2008. Simultaneously with these developments the other aspects of financial dollarization have manifested themselves. In conditions of rapidly growing economy, under-developed banking system and under heavily managed exchange rate regime the excessive reliance on foreign money markets has resulted in the creation of significant amount of foreign currency linked liabilities. It made the economy vulnerable to currency depreciation risks and determined the need of the Central Bank of Russia's actions aimed at stabilizing foreign exchange market in the late 2008 and early 2009.

The aim of this paper is to analyze the drivers behind these processes and review possible consequences. The paper is structured as follows. *Section 1* provides the general description of dynamics of various dollarization indicators in Russia. In *Section 2* the econometric models of short run dynamics of deposits and loans dollarization during the last decade are presented. In *Section 3* we conduct a balance-sheet analysis and estimate currency mismatches for the sectors of the Russian economy. In *Section 4* we propose a number of hypotheses of how dollarization might have affected real sector's performance in view of financial crisis. We compare the measures of financial dollarization along with other macroeconomic indicators in Russia with respective indicators of other emerging market economies. Finally, *Section 5* concludes.

1. Financial dollarization in Russia: evolution and its determinants

Dollarization processes are peculiar to many emerging markets as well as to a number of transition economies where foreign currency substitutes national currency as a store of value, unit of account and means of payment. In the 1990s a great number of restrictions on transactions on foreign exchange market were lifted in Russia and in many other transition economies. At the same the country had been going through a very long period of macroeconomic instability evolving against the backdrop of sharp devaluation of national currency and galloping inflation that in turn hampered the functioning of all sectors of the economy. In conditions of a dramatic drop in ruble's purchasing power the role of foreign currency (mainly the USD) had increased considerably.

In the course of last ten years the dynamics of dollarization of Russian economy was unstable going through periods of both accelerated growth and reduction in foreign currency demand. These processes were largely conditioned by current macroeconomic situation, pursued exchange rate policy, gradual liberalization of exchange control, integration of Russia into global financial system, development of Russian stock market as well as the external conjuncture whose impact on the movement of foreign exchange flows into Russia has become particularly evident lately. Current global financial and economic crisis that in Russia has spilled over into the destabilization of banking system thereby leading to drastic changes in credit organizations' balance sheets has drawn attention to the issue of financial dollarization and risks associated with currency mismatches.

Traditionally the term "dollarization" implies a substitution of national currency by the US dollar that is used as a medium of exchange, store of value and unit of account. After the formation of European Monetary System with the introduction of a single currency (euro) the new term "euroization" had appeared (it is completely analogous to "dollarization"). The phenomenon of "euroization" was quite typical for a number of transition economies including Russia. In our study we will use the term "dollarization" to describe the substitution of national currency by any foreign currency.

In this paper we consider different aspects of financial dollarization in Russia: we assess the level of dollarization on the basis of various indicators, explore the causes of dollarization by applying the econometric analysis, estimate currency mismatches for different sectors of Russian economy and evaluate macroeconomic effects of financial dollarization.

As it is indicated in recent studies (see e.g. Levy, Yeyati (2005); Neanidis, Savva(2009); Basso et al.(2007)) there are three main causes of dollarization:

1. Real return differential – when the real return on investment in foreign currency exceeds that on investment in national currency. Depreciation rate can be regarded as the main determinant of the return on investment in foreign currency.

2. Borrowing cost differential – when the cost of credit denominated in foreign currency is lower than the cost of national currency denominated loan. Meanwhile interest rate differentials

(difference between domestic and foreign interest rates) and expectations of subsequent exchange rate dynamics are of primary importance.

3. Underdevelopment of domestic financial markets that forces economic agents to enter international money markets.

To a certain extent all these causes were inherent in Russian economy over recent years and had triggered a rise (or fall) in dollarization level at different times.

Deposit dollarization

We use the ratio of foreign currency deposits to total deposits with the banking system as indicator to measure the degree of dollarization. As it can be seen for Figure 1 the level of deposit dollarization in Russia was unstable (the share of foreign currency deposits in total deposits has ranged from 43 to 12,5%). On the basis of available statistics we can note that from 1995 up to 2010 Q2 there were two dramatic spikes in the level of deposit dollarization both of which were associated with crisis episodes of 1998 and 2008-2009 respectively. The period from 1999 to 2007 on the contrary was characterized by gradual decline in deposit dollarization level.

When analyzing dollarization one usually examines separately two types of dollarization, namely currency substitution (the usage of foreign currency for transaction purposes) and financial dollarization. To analyze financial dollarization some studies employ portfolio approach (see for example Ize, Yeyati, 2005) the main idea of which consists in the analysis of dollarization dynamics by comparing real returns on investment in national and foreign currency. In general real return on investment in national currency is determined by inflation rate while real return on investment in foreign currency – by expected changes in real exchange rate. This theory is confirmed by a number of studies devoted to the analysis of causes of dollarization in developing countries and transition economies where it is argued that substantial inflation rates, the dynamics of exchange rate and high degree of financial and macroeconomic destabilization are primary causes of dollarization.

On the whole these factors of dollarization were typical for Russian economy at the beginning and in the middle of 1990s. Later on as the inflation was falling and ruble exchange rate was stabilizing² the level of deposits dollarization had been decreasing. Russian crisis of 1998 that produced a rise in inflation rates and devaluation of national currency also led to almost instantaneous increase in the degree of deposit dollarization.

Over the post-crisis period from 2000 to 2007 in spite of volatile dynamics of ruble money supply and foreign currency deposits (Figure 2) the level of deposit dollarization had been falling persistently – starting from its maximum value of 40-43% at the end of 1998 to the minimum of 12-13% at the beginning of 2008. It should be noted that after the introduction of euro economic agents started to form their foreign currency assets (both in cash and non-cash

² From the middle of August 1995 to August 1998 CBR was implementing the policy of managed floating by maintaining the ruble exchange rate within the limits of exchange rate band.

funds) in two currencies. At the same time despite the prevalence of the US dollar the share of euro denominated assets was gradually rising. Thereby the overall level of deposit dollarization (as well as the dynamics of foreign currency in circulation) was affected not only by the ruble-to-dollar exchange rate but also by ruble-to-euro rate. Therefore starting from the midst of 2007 foreign currency deposits' growth rates began to rise against the background of rising inflation and weakening of the ruble against the euro (while the ruble continued to strengthen against the US dollar) (Figure 3). It should be observed that the level and the dynamics of dollarization of both households' deposits and non-financial organizations' deposits were quite comparable.

Latest world financial crisis which had manifested itself in Russia most apparently in the second half of 2008 reversed the upward movement of deposit dollarization. Under these circumstances CBR and Russian government as well as central banks and governments of other countries were challenged to take emergency measures to stabilize foreign exchange markets and to avert the crisis of banking and financial system. Large-scale foreign currency sales on domestic foreign exchange market in order to suppress sharp ruble's depreciation. By the beginning of 2009 the level of deposit dollarization measured as a share of foreign currency deposits in total deposits was close to 32-33%. During the years 2008-2009 the total volume of foreign currency deposits of households and non-financial organizations in dollar terms has almost tripled. High rates of ruble depreciation and an increase in devaluation expectations were the major factors that have stimulated a massive expansion of foreign currency demand. Consequently this resulted in acceleration of foreign currency deposits growth rates, reduction of ruble money supply and rise in net foreign currency position of banking sector. Despite the substantial rise in interest rates on ruble denominated deposits³, starting from November 2008 the level of deposit dollarization began to surge dramatically. The recommencement of ruble appreciation together with the real sector recovery and decreasing inflation rates in late 2009-2010 that helped to reduce the uncertainty led to the gradual decline of deposits dollarization once again. Yet by the middle of 2010 the level of deposit dollarization was still above the pre-crisis level.

Foreign currency in circulation

Sizeable increase in the volume of foreign cash purchases by households during the crisis had a strong influence on the flow of funds from ruble to foreign currency.

The level of dollarization of the economy can also be estimated through the total volume of foreign cash that circulates domestically. However, here arises the problem of statistical measurement of such dollarization indicator. Estimates of the volume of foreign cash that circulates outside the banking system presented in this paper are based on CBR's statistics, namely International Investment Position of the Russian Federation, Balance of Payments of

³ Interest rates on ruble denominated deposits had been increasing since June 2008. Their growth accelerated after Bank of Russia had raised interest rates on its operations against the background of ruble's devaluation. A surge in interest rate differential (between rates on ruble and foreign currency denominated deposits) occurred in January-May 2009. At a later date this differential has come down a little bit but still it was at its maximum level since the beginning of 2001.

the Russian Federation and monthly reporting forms on banks' foreign cash transactions. According to this data the volume of foreign cash in circulation in Russia has been steadily decreasing since the year of 2003 (Figure 4). Ruble devaluation at the end of 2008 had triggered unprecedented growth of demand on foreign cash. As a result the total volume of foreign cash outside the banking system increased from 21 billion US dollars at the middle of 2008 to 54,2 billion US dollars at the beginning of 2009.

As from February 2009 as foreign exchange market started stabilizing the level of foreign cash in circulation began to fall though their values were still markedly above their averages over 2007-2008. Thus the dynamics of ruble exchange rate together with inflation rates (especially at the initial stage of transition and during crisis episodes) can be regarded as the main factors that determine the level of deposit dollarization and the dynamics of foreign currency in circulation.

Loan dollarization

During last ten years the level of loan dollarization on the balance sheets of Russian banks (Figure 1) normally was higher than the level of deposit dollarization (with exception of years 2001 and 2002). Over this period it has ranged from 70% to 22% (for deposit dollarization this range is from 43% to 12,5%). Besides in contrast to deposit dollarization the degree of loan dollarization varied greatly among two sectors of Russian economy, namely households and non-financial organizations. The share of foreign currency loans in total volume of loans obtained by individuals was the lowest (by the middle of 2008 its value had gone down to 11%) as compared with similar ratio for non-financial organizations the value of which was quite high and did not fall below 25% (Figure 5).

Differences in levels of loan and deposit dollarization and in some cases divergent dynamics of these indicators are determined by differences in motives of saving or borrowing in foreign currency. When analyzing currency mismatches it is necessary to take into account not only domestic loan dollarization but also external financial dollarization (when residents call for funds on international financial markets) since excessive indebtedness of non-financial organizations and banks to both domestic banks and external financial organizations denominated in foreign currency endangers financial stability in case of sharp depreciation of national currency. So despite the general downward tendency of domestic loan dollarization (over the period from 2000 to the midst of 2008 it has fallen from 50% to almost 25%) external dollarization of Russian banks and corporations has been increasing dramatically (Figure 6-7) thus creating foreign currency imbalances in the structure of assets and liabilities of these sectors.

Motives of borrowing in foreign currency strongly depend on borrowing costs and the level of development of domestic financial market (see for example Basso et al. (2007)). Rapid growth of loans obtained by Russian banks and non-financial organization on foreign financial markets (especially in period of 2005-2008) was stipulated by more beneficial terms of

borrowing abroad compared to borrowing on domestic money market under managed exchange rate regime. In addition due to the underdevelopment of domestic money market Russian banks were unable to satisfy increasing demand for loans from non-financial organizations. Therefore an increase in the degree of openness of Russian economy together with enhanced dependence on international capital markets has led to the accumulation of foreign currency liabilities. Meanwhile these foreign currency funds were used to extend ruble denominated loans as the level of interest rates on ruble denominated loans exceeded interest rates on dollar denominated ones.

By the middle of 2008 due to relying on external financing Russian commercial banks and non-financial organizations had accumulated considerable amount of foreign currency liabilities, mainly owed to non-residents (Figure 8). The world financial crisis that had been intensifying since August 2008 practically blocked access of Russian banks and corporations to external markets and thus caused serious problems with repayment of debts denominated in foreign currency. In case of abrupt change in ruble's exchange rate against the background of sudden stop high dollarization levels of banking and corporate sectors' assets and liabilities have led to the shortage of liquidity and loss of creditworthiness. Taking into account close ties between sectors of Russian economy difficulties in one sector spread rapidly to others creating threats to macroeconomic stability.

An increase in foreign currency demand and associated with it shortage of ruble's liquidity raised interest rates on interbank market for loans. Thus one-day Moscow Interbank Actual Credit Rate (MIACR) had gone up from 4,4% in June 2008 to 16,3% in January 2009 while interest rates on three- and six-month interbank loans denominated in rubles – from 5-6% to 23-28%. Russian banking system's loan supply was substantially restrained by heightened risks of that sector stemming from the following factors: high domestic borrowing costs, considerable reduction in deposits and also in funds raised on international financial markets, surge in past-due loans of non-financial organizations and households and deterioration of assets' quality. All factors listed above have led to the collapse of commercial banks' lending. Due to high exchange rate risks the demand for foreign currency loans decreased more than for ruble loans leading to the decline of loans dollarization. Yet because of re-evaluation effect that followed ruble depreciation the level of loan dollarization is still higher than the pre-crisis level.

2. Econometric analysis of financial dollarization

We conduct formal econometric analysis of deposit and loans dollarization to measure the impact stemming from different explanatory factors. We concentrate on the short-term dynamics of dollarization after 1998 for the reasons of data availability. This choice also ensures the sample's homogeneity (in terms of general macroeconomic conditions and the monetary policy regime) and still covers both the period of gradual de-dollarization before the latter half of 2008 and the partial return of dollarization thereafter. Our estimation strategy and the choice of variables are closely related to the study by Neanidis and Savva (2009) that provides a comprehensive review of modeling financial dollarization in the emerging markets.

Deposit dollarization

The regression specification for deposit dollarization equation is

$$\Delta DD_t = \alpha_1 * erf_t + \alpha_2 * dum2005 * er_comb_t + \alpha_3 * mbf_t + \alpha_4 * \Delta DD_{t-1} + \alpha_5 * \Delta DD_{t-2} + \alpha_6 + \varepsilon_t$$

ΔDD denotes the monthly change in deposit dollarization. The *erf* variable denotes the exchange rate factor⁴. The data on the structure of foreign currency deposits in Russia is not publicly available, we therefore used the weighted average of ruble's monthly depreciation rates against the USD and the euro, with weights equal to those of the bi-currency basket that was introduced as an operational target by Bank of Russia in 2005 (before 2005 the USD appreciation rate was used to construct the *erf* variable). Judging by other subsidiary indicators the weights of the bi-currency basket seem to be an appropriate measure of currency preferences in Russia. During the estimation period the weight attached to the euro in the basket has changed from 0.1 to 0.45. We have also added the *er_comb* variable, which is equal to the highest appreciation rate against ruble of the two currencies (USD and euro) at time *t*. That would allow to capture the effect of possible switching between foreign currencies if at least one of them is appreciating, instead of decreasing the overall share of foreign currency deposits. In order to capture the adaptive nature of expectations regarding the exchange rate dynamics and since the mechanical re-evaluation effect would already be captured by the *erf* variable we use the appreciation rate in the form of a backward-looking 6 month moving average for constructing of the *er_comb* variable. Clearly this switching effect is only relevant if the two foreign currencies are regarded as alternatives. That was hardly the case before 2005 when euro was still gaining popularity as a reserve currency in Russia. We therefore introduced the *dum2005* dummy variable (equals 0 before January 2005 and 1 thereafter) and estimated the coefficient for the *er_comb* variable separately for the period beginning from 2005 (initially

⁴ The changes of exchange rate were transformed in a way so that they are proportional to the mechanical re-evaluation effect which arises at time *t* (see Honohan (2007) for details). That is $erf_t = (1 - DD_{t-1}) * DD_{t-1} * (e_t / e_{t-1} - 1)$, where *e* is ruble/foreign currency exchange rate. The same transformation was applied to the monetary base monthly growth rates to produce the monetary base factor (*mbf*) variable. The *erf* and *mbf* variables for the loans dollarization equation were constructed in the same way.

the coefficient for the former part of the sample was also estimated, but proved to be insignificant and was removed from the final specification). Other variables in the model are monetary base factor (*mbf*), the lagged changes of deposit dollarization that proved to be sufficient to prevent the autocorrelation of residuals and a constant.

The KPSS unit root test indicates that all variables are stationary in levels. In order to check the robustness of the estimates and to take into account the possibility of explanatory factors being endogenous relative to deposit dollarization we conducted both standard OLS and 2SLS estimates. In the latter case we used 3 lags of dependent and explanatory variables, changes of oil prices, USD/ruble exchange rate appreciation rate and changes of loans dollarization as instrumental variables. We used the time sample from June 1999 to July 2010.

Table 1. Deposit dollarization equation

Estimation method	Coefficient estimates (White heteroskedasticity consistent <i>t</i> -statistic in brackets)					
	α_1 (<i>erf</i>)	α_2 (<i>er_comb</i>)	α_3 (<i>mbf</i>)	α_4 ($\Delta(DD)_{t-1}$)	α_5 ($\Delta(DD)_{t-2}$)	α_6 (<i>C</i>)
OLS	1.93 (5.45)	0.27 (2.23)	-0.49 (-6.3)	-0.07 (-1.19)	-0.13 (-2.31)	-0.00 (-0.77)
2SLS	1.85 (3.55)	0.35 (2.28)	-0.53 (-2.98)	-0.09 (-1.19)	-0.17 (-2.75)	-0.00 (-0.61)

All the estimates are statistically significant and show expected signs. Deposit dollarization increases (more than the mechanical effect would imply since the coefficient is higher than unity) in response to ruble's depreciation against the bi-currency basket. The presence of a foreign currency displaying positive appreciation rate on the preceding period contributes to the dollarization growth. Generally the results are quite robust in respect to the estimation method. On the basis of these results we may conclude that the main driving factor behind the deposit dollarization dynamics had been the fluctuations of the ruble exchange rate. In the course of our research we have also tried adding the variables of inflation rate and interest rates differential into the model but found both being statistically insignificant. The former result could be explained by the fact that although the hyperinflation episodes could be regarded as an important determinant of the overall level of financial dollarization its short-term dynamics are not closely linked to inflation rate (in particular when there is no clear relationship between inflation and nominal exchange rate fluctuations). The latter result could be explained by the (quite fair) perception of the households that the difference of yields (in ruble terms) on foreign currency and ruble deposits was also mainly determined by the exchange rate fluctuations.

Loan dollarization

The regression specification for loan dollarization equation is

$$\Delta LD_t = \beta_1 * dumCRISIS_1 * erf_t + \beta_2 * (1 - dumCRISIS_1) * erf_t + \beta_3 * dumCRISIS_2 * mbf_t + \beta_4 * (1 - dumCRISIS_2) * mbf_t + \beta_5 * \Delta nfa_t + \beta_6 * \Delta LD_{t-1} + \beta_7 * \Delta LD_{t-2} + \beta_8 + u_t$$

ΔLD denotes the monthly change in loan dollarization. The *erf* variable denotes the exchange rate factor estimated on the basis of ruble's depreciation against the bi-currency basket in the same way as the respective variable in the deposit dollarization equation. We expect the sign of this variable to be positive capturing both mechanical re-evaluation effect and the banks' attempts to shift the exchange rate risks towards borrowers.

At the same time we recognize that the behavior of the borrowers was markedly different over the reviewed period. While during the earlier part of the sample the borrowers seemed to perceive the exchange rate risks negligible this attitude changed in the latter half of 2008 when the expectations of ruble's depreciation had spread. The occurrences of fall in demand for foreign currency loans during currency crisis are well-documented (see for example Hale and Arteta (2009)) and we believe that was also the case for Russia. In order to capture this effect we estimate the *erf* coefficient separately for two sub-samples by introducing the *dumCRISIS_1* dummy variable (equals 1 on the period from September 2008 to September 2009 and 0 in other periods).

The *mbf* variable denotes the monetary base factor. This variable is meant to capture the effect of increase in ruble loan supply that occurs due to monetary expansion. However while there is a close link between monetary base and ruble deposits the relationship between monetary base and ruble loan supply is by far less evident. This relationship was particularly unstable in 2009-2010 as loans contracted despite the renewal of monetary base growth (Figure 9). We therefore estimate the monetary base effect separately for pre- and post crisis periods by introducing another dummy variable - *dumCRISIS_2* (equals 1 on the period from September 2008 to July 2010 and 0 in other periods).

We have also added the Δnfa variable (the changes of banks' net foreign assets measured as percentage of banks' total deposits) to check for possible currency matching behavior of the banks (see Luca and Petrova (2008)). We have used 3-month changes of banks' net foreign assets judging on the properties of the time series (monthly changes are rather volatile and would have been very close to white noise without even signs of autocorrelation) and allowing for lagging adaptation of banks to emerging currency mismatches. Other variables in the model are the lagged changes of loan dollarization that prevent the autocorrelation of residuals and a constant.

In order to ensure the stationarity and exclude the excessively volatile fluctuations of loan dollarization in 1999 the sample was set to June 2000 – July 2010. As in the case of deposit dollarization regression we conducted both OLS and 2SLS estimates using 3 lags of

dependent and explanatory variables, changes of oil prices, USD/ruble exchange rate appreciation rate and changes of deposit dollarization as instrumental variables.

Table 2. Loan dollarization equation

Estimation method	Coefficient estimates (White heteroskedasticity consistent t-statistic in brackets)							
	β_1 (<i>dumCRISIS_1</i> * <i>erf_t</i>)	β_2 ((1- <i>dumCRISIS_1</i>) * <i>erf_t</i>)	β_3 (<i>dumCRISIS_2</i> * <i>mbf_t</i>)	β_4 ((1- <i>dumCRISIS_2</i>) * <i>mbf_t</i>)	β_5 (Δnfa_t)	β_6 (ΔLD_{t-1})	β_7 (ΔLD_{t-2})	β_8 (<i>C</i>)
OLS	0.55 (3.58)	1.21 (3.66)	-0.07 (-1.16)	-0.06 (-1.04)	-0.01 (-0.83)	0.24 (2.05)	0.1 (1.06)	-0.00 (-1.8)
2SLS	0.43 (1.9)	1.23 (1.44)	-	-0.16 (-1.22)	-0.01 (-0.63)	0.22 (1.77)	0.12 (1.08)	-0.00 (-0.79)

The estimates provide the evidence of the time-varying exchange rate effect (which is higher than pure mechanical re-evaluation effect in normal times and significantly lower it during the crisis). That is in line with our suppositions regarding the changes in the borrowers' behavior in the late 2008 and until mid-2009 when they were decreasing the demand foreign currency loans in response ruble's depreciation. The monetary base effect coefficient is small and has low statistical significance. When estimated with 2SLS the β_3 coefficient had wrong (positive) sign, was clearly statistically insignificant and was therefore removed from the final specification. That may indicate the presence of a less straightforward relationship between monetary expansion and loan supply. Finally we get a vague evidence of currency matching behavior – the coefficient of Δnfa shows that the banks would increase the loan dollarization in response to the growth of their foreign liabilities (the statistical significance of this variable is extremely low though). We have also tried including the changes of deposit dollarization into the model to represent another factor that may cause currency matching behavior. Its coefficient proved to be statistically insignificant, had the wrong sign when estimated with 2SLS and was eventually removed from the model. Another variable that could be relevant for the dynamics of loan dollarization is the spread between ruble and foreign currency loans' interest rates. This time series is non-stationary so could only be added to the model in differences. If included it is statistically significant and has positive sign, but eventually we have opted for excluding it from the model in order to have more economically meaningful interpretation of the results.

3. Balance-sheet analysis and currency mismatches

To assess the implications of financial dollarization for financial fragility we employ the balance-sheet analysis. The methodology of the balance-sheet analysis was devised by Allen and others (2002). The aim of this analysis is to measure vulnerabilities arising from mismatches in the structure of assets and liabilities at a sectoral level and assess subsequent macroeconomic risks. Balance-sheet analysis can be considered as an important complement to more traditional methods of assessing financial stability based on analysis of flow variables, such as fiscal and current account balances. It is also widely used for financial crisis prediction.

We apply the balance-sheet analysis in order to estimate currency mismatches among sectors of Russian economy over a period from 2000 to 2009. Our goal is to determine what sectors were largely exposed to exchange rate risks during global financial crisis of 2008.

We consider four sectors, namely government, Central Bank, banking sector and private non-banking sector. The latter consists of households, non-financial commercial organizations and non-banking financial organizations. We can not examine them separately due to the lack of data. The main source of data is the statistics of the Bank of Russia, notably Credit Institutions Survey, Banking System Survey, Review of the Banking Sector of the Russian Federation and External Sector Statistics. Some data gaps remain but these positions are believed to be negligible.

For every sector we select foreign currency accounts that can be regarded as claims or liabilities of this particular sector to other sectors including external sector (see tables 3-6). As a basis for construction of these accounts we take the foreign currency balance sheet of a partially dollarized economy presented in Reinhart and others (2003). In order to take into account the specificity of Russian economy we exclude some accounts that we consider negligible or irrelevant but also add some accounts that are found only in Russian practice.

We exclude foreign currency-linked government debt to private non-banking sector because we assume that this sector does not hold foreign currency denominated sovereign bonds or if it does this position is negligible. We also assume that all of private non-banking sector's foreign currency bonds are owned by the non-residents. Therefore, they are already included in external foreign currency liabilities of this sector. In Russia banking sector does not generally issue credit to government. Thus we exclude foreign currency net bank credit to government from balance sheets of government and banking sector respectively. By assuming that all foreign assets of government are held in the Bank of Russia as international reserves we are able to exclude this account from the balance sheet of government. Finally, we exclude reserve requirements on foreign currency bank deposits from the balance sheet of the Bank of Russia because all reserves irrespective of currency in which deposits are denominated are held in the Bank of Russia in rubles.

In December 2008 commercial banks were allowed to place foreign currency on deposit in the Bank of Russia. Therefore we include foreign currency deposits held at Central Bank in balance sheets of banking sector and the Bank of Russia as assets and liabilities respectively.

After we have built foreign currency balance sheets we estimate net foreign currency positions defined as foreign currency assets minus foreign currency liabilities. All foreign currency assets and liabilities are denominated in rubles, while net foreign currency position is calculated in percentage of GDP. Net foreign currency position can be considered as an indicator of a sector's vulnerability to movements in the exchange rate. In particular, if net foreign currency position is negative, this means that this sector is vulnerable to exchange rate depreciation. Using net foreign currency positions for each sector we estimate net foreign currency position for private and public sectors and finally for Russian economy as a whole.

Our findings indicate that starting from the year 2000 net foreign currency position of Russian economy (Figure 10) has been improving steadily. It has risen by about 40 percent of GDP since 2000 to some positive 22 percent of GDP. We can conclude that on aggregate level Russian economy was vulnerable to exchange rate depreciation up to the year 2004 when net foreign currency position became positive. Further increase in net foreign currency position created a significant risk in case of ruble's appreciation. However, the dynamics of net foreign currency positions among sectors of Russian economy shows very dissimilar trends.

The government's net foreign currency position (Figure 11) has improved drastically since 2000. The sharp fall in net foreign currency exposure from 47 percent of GDP in 2000 to just under 3 percent of GDP in 2009 reflects a reduction in external foreign currency debt, mainly due to early repayments of debt to Paris Club and International Monetary Fund financed from the Stabilization Fund. Ruble's appreciation that occurred between 2003 and 2007 has also contributed to this drop. Thus, net foreign currency position in this sector gives no reason for concern.

Net foreign currency position of the CBR (Figure 12) has almost quadrupled over the period under review. The persistent growth of net foreign assets up to the year 2007 was driven by several factors. An increase of the Bank of Russia's international reserves reflects large purchases of foreign currency in response to strong capital inflows and pressure on the ruble to appreciate. Conversion of foreign currency holdings into rubles by individuals and companies reflecting a fall in deposit dollarization has also contributed to this build-up of reserves. Enduring budget surpluses stemming largely from substantial tax revenues from the export of oil had led to the accumulation of the Stabilization Fund which was invested mainly in foreign currency denominated assets. Since the Stabilization Fund is held on the CBR's balance we consider it as a part of the CBR's foreign currency assets despite the fact that it is in government ownership. A slight dip in net foreign currency position in two subsequent years can be regarded as a result of two opposite effects. Measures of the CBR to stabilize the foreign exchange market in face of a huge capital outflow have led to the fall of its net foreign assets.

However, this decline was smoothed over by sharp ruble's devaluation. Thus the whole sector is subject to significant exchange rate risk in case of ruble's appreciation.

Net foreign currency position of banking sector (Figure 13) had been deteriorating up to the end of 2007 mainly as a result of substantial increase in external foreign currency liabilities. In fact since the significant part of foreign assets of the banking sector were in form of claims on domestic non-banking private sector (that were likely to become illiquid in case of sharp ruble's depreciation) the banking sector seemed quite vulnerable to exchange rate risks. In 2008 there was a considerable growth in foreign currency assets relative to foreign currency liabilities so that net foreign currency position turned out to be positive. This hike in foreign currency assets was mainly due to reallocation of the CBR's foreign currency reserves via direct purchases of foreign currency by commercial banks. Moreover, commercial banks were allowed to open foreign currency deposits in the CBR that had become another foreign currency asset of the banking sector. Net foreign currency position of a banking sector at the end of 2009 was about 3 percent of GDP which allows us to consider exchange rate risk of this sector to be minor.

Over the period from 2000 to 2007 net foreign currency position of private non-banking sector (Figure 14) had been gradually deteriorating and by the end of the year 2007 it had reached minus 17 percent of GDP. This decrease reflects a gradual decline of the foreign currency assets of this sector, including foreign currency deposits, along with accumulation of external foreign currency liabilities and can be considered as a direct consequence of ruble's appreciation started at the end of 2002. An increase in foreign currency deposits and external foreign currency assets led to some improvement in net foreign currency position at the end of 2008. The next year saw a marginal deterioration. As a result, net foreign currency liabilities constitute more than 10 percent of GDP thus making this sector quite vulnerable to ruble's depreciation.

Negative foreign currency position of non-banking private sector allows us to draw a conclusion that this sector has suffered the most from ruble's devaluation at the end of 2008. Exchange rate risk vulnerability of the banking sector can be considered as moderate. Due to its substantial positive net foreign currency position we can conclude that the public sector is well protected against the consequences of ruble's depreciation. At the same time this makes it quite vulnerable to ruble's appreciation.

4. Financial dollarization and macroeconomic performance

While assessing the consequences of financial dollarization most studies concentrate on domestic liability dollarization. One type of studies considers liability dollarization of banking system and its impact on financial sector. Calvo and others (2004) argue that liability dollarization of banking sector is the key determinant of the probability of sudden stop where sudden stop is defined as large and unexpected fall in capital inflows. The intuition behind this is the following. If the share of foreign currency denominated obligations within the banking system is high then the depreciation of national currency could trigger uncertainty about the solvency of the banking system leading to bank runs in expectation of bank bankruptcies. Some banks would be unable to roll over their foreign currency debts thus causing a sharp deterioration of financial account.

Another implication of banking system's liability dollarization for financial sector performance is that it can reduce the availability of credit and hence increase banking spreads. Honohan and Shi (2005) point out that while attracting foreign currency deposits commercial banks need to hedge the currency risk and may not be able to pass it on by lending foreign currency to local borrowers who do not have foreign currency receivables. Therefore they would reinvest some of the deposited foreign currency abroad. Honohan and Shi estimate that banks place offshore as much as half of increased foreign currency deposits received. The flight into foreign currency nominated assets for hedging purposes may only intensify during the financial turmoil. Consequently domestic lending declines and spreads between loan and deposit interest rates go up.

Next type of studies examines liability dollarization of non-financial corporations and its effects on real economy. In particular, Bordo and others (2009) show in a comprehensive study that foreign currency debts are associated with crises and lower the output growth. Janot and others (2008) find that Brazilian firms with large foreign currency liabilities have reduced their investment rates more than other comparable firms right after national currency depreciation. Ostry and others (2010) provide some evidence of how larger foreign liabilities in the emerging market economies are associated with steeper economic growth decline during the recent financial crisis.

The aim of our analysis is to assess whether differences in the level of liability dollarization of banking sector and non-financial organizations across emerging market economies prior to current global financial crisis could explain dynamics of mentioned above indicators during this crisis, namely financial account, supply of credit, banking spreads and investment. Since the relationship between dollarization and this list of indicators becomes more apparent in case of the depreciation of national currency (or in the presence of depreciation expectations) we look for emerging economies that have faced significant exchange rate risks during recent financial crisis.

Initially we consider 24 emerging market economies (the list of countries is given in Appendix 1 National currency of each of these countries had depreciated more than 10 percent against the USD during the period from the end of 2007 to the beginning of 2009. Although some of the countries under review (such as Croatia and the Baltic states) were maintaining the fixed exchange rate against euro during this period we presume that the increased uncertainty regarding the exchange rate risks might as well have affected the performance of these economies. The main source of data is the International Financial Statistics of International Monetary Fund. Some gaps were partially filled using Central Banks' statistics. However, data gaps remained. Therefore, the sample of countries varies from indicator to indicator. For each country we construct two pre-crisis dollarization measures. The first is liability dollarization of the banking system which is equal to foreign currency deposits minus net foreign assets as a share of broad money. The second – liability dollarization of non-financial corporations measured as foreign currency loans plus external debt as a share of GDP. All measures are constructed as of December 2007 and denominated in national currencies.

The indicators are constructed in the following way. For each country banking spread series is obtained by subtracting deposit rate from lending rate (monthly data). Then we calculate averages for two periods, notably 2006-2007 and 2008- 2009. After that we obtain the difference between these two averages and normalize by dividing this difference by standard deviation of the whole series that starts in January 2000. The outcome of all this operations is called the banking spreads indicator.

We consider total loans provided by the banking system as a share of GDP as a proxy for the supply of credit. Using quarterly data for this series (note, GDP for each quarter is calculated as the moving sum of GDP for three previous quarters and the value of GDP for current quarter) we calculate annual growth rates. Then the procedure continues in the same way as for banking spreads except that the time series for the supply of credit indicator starts in the first quarter of 2005.

To measure the dynamics of investment we take the real value of gross fixed capital formation by dividing the latter by the Consumer Price Index (quarterly data). Then we again calculate annual growth rates and repeat the procedure to obtain the indicator of investment activity.

Finally, to compute the sudden stop indicator we use data on financial account as a share of GDP from 2000 to 2009. Then we calculate the average for 2006-2007, subtract it from the average value corresponding to the period of 2008 – 2009 and divide by standard deviation of the whole series.

After we have calculated all indicators and dollarization measures we proceed to graphical analysis. We plot four scatter diagrams for each indicator and its corresponding liability dollarization measure along with simple linear trend. Observations that correspond to Russia are marked with red. Due to the endogeneity problem any relationship between some

indicator and its corresponding dollarization measure can not be interpreted as causal. As we have already noted the number of observations varies considerably due to the lack of data.

As it can be seen from Figure 15 there is a positive relationship between the banking spread indicator and the liability dollarization of the banking sector. At the same time Figure 16 indicates that the latter has negative correlation with the supply of credit indicator. In other words countries with larger level of banking sector's liability dollarization at the end of 2007 have experienced larger increase in banking spreads and more significant reduction in the supply of credit. Thereby this confirms our hypothesis that dollarization can restrain the availability of credit. As of Russia we can say that given its level of banking sector's liability dollarization Russia has undergone slightly higher than expected reduction in the availability of credit.

Figure 17 demonstrates a negative relationship between the banking sector's liability dollarization and the sudden stop indicator. That is the higher level of banking sector's liability dollarization corresponds to deeper deterioration of financial account. This justifies our hypothesis that dollarization can be considered as one of the key determinants of a sudden stop. Russia can be labeled as outlier because it has relatively low level of dollarization but by far quite significant fall in financial account.

Finally, from Figure 18 we can conclude that the correlation between investment activity indicator and the liability dollarization of non-financial corporations is negative as we expected. However, due to the lack of data we have rather small number of observations. Thus it can be quite possible that the effect of dollarization on investment activity has not become apparent in full.

5. Conclusion

We have examined the dynamics of deposits and loans dollarization in Russia. We found that the ruble's appreciation rate (against the USD and the euro) was the main driving factor behind the deposits de-dollarisation that occurred and also behind the later episode of deposit dollarisation. Loans dollarization was also found to depend positively on the ruble's depreciation rate, although during the financial crisis the exchange rate effect was estimated to be smaller than mechanical re-evaluation effect (reflecting the decrease of demand for foreign currency loans). There is also only vague evidence of currency matching behavior by the banks. This type of behavior together with substantial borrowing abroad has led to the creation of large currency mismatches in the real sector's balance sheet. In conditions of financial turmoil (and ensuing capitals flows reversal and depreciation pressure on the national currency) this situation could threaten the macroeconomic stability of the Russian economy. This was one of the reasons for the Bank of Russia to undertake costly measures and conduct the "controlled depreciation" spending a significant amount of foreign exchange reserves in the process. On the whole one can say that Bank of Russia's actions together with stabilization efforts of Russian government had made it possible to hinder the spreading of financial crisis any further, although that was the banking sector which has benefited mostly from these actions. Nevertheless we suppose that large currency mismatches in the Russian economy and the uncertainty they have originated might have contributed to the severity of capital inflows sudden stop, drop of credit growth rates and investment activity contraction. Thereby in order to sustain financial and macroeconomic stability it is vital to proceed with the analysis of dollarization processes and currency mismatches that would allow us to reveal risks arising from accumulation of foreign currency assets and liabilities by different sectors of Russian economy.

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Appendix

Appendix 1

Russia, Romania, Poland, Macedonia, Croatia, Lithuania, Hungary, Latvia, Estonia, Czech Republic, Ukraine, Kazakhstan, Georgia, Albania, Belarus, Armenia, Kyrgyz Republic, Bulgaria, Thailand, Mexico, Brazil, Argentina, South Africa, Turkey

Table 3

Government	
<i>Assets</i>	<i>Liabilities</i>
Foreign currency assets held abroad	Foreign currency net bank credit
	External foreign currency debt
	Foreign currency-linked domestic debt

Table 4

Central Bank	
<i>Assets</i>	<i>Liabilities</i>
Net foreign assets	Reserve requirements on foreign currency bank deposits
	Foreign currency deposits of banking sector

Table 5

Banking sector	
<i>Assets</i>	<i>Liabilities</i>
Foreign currency bank loans	Foreign currency bank deposits
Foreign currency assets held abroad	External foreign currency liabilities
Foreign currency-linked government debt	
Foreign currency net credit to the government	
Foreign currency deposits held at Central Bank	

Table 6

Private non-banking sector	
<i>Assets</i>	<i>Liabilities</i>
Foreign currency cash holdings	Foreign currency bank loans
Foreign currency assets held abroad	External foreign currency liabilities
Foreign currency bank deposits	Domestic foreign currency bonds
Foreign currency-linked government debt	

Figure 1

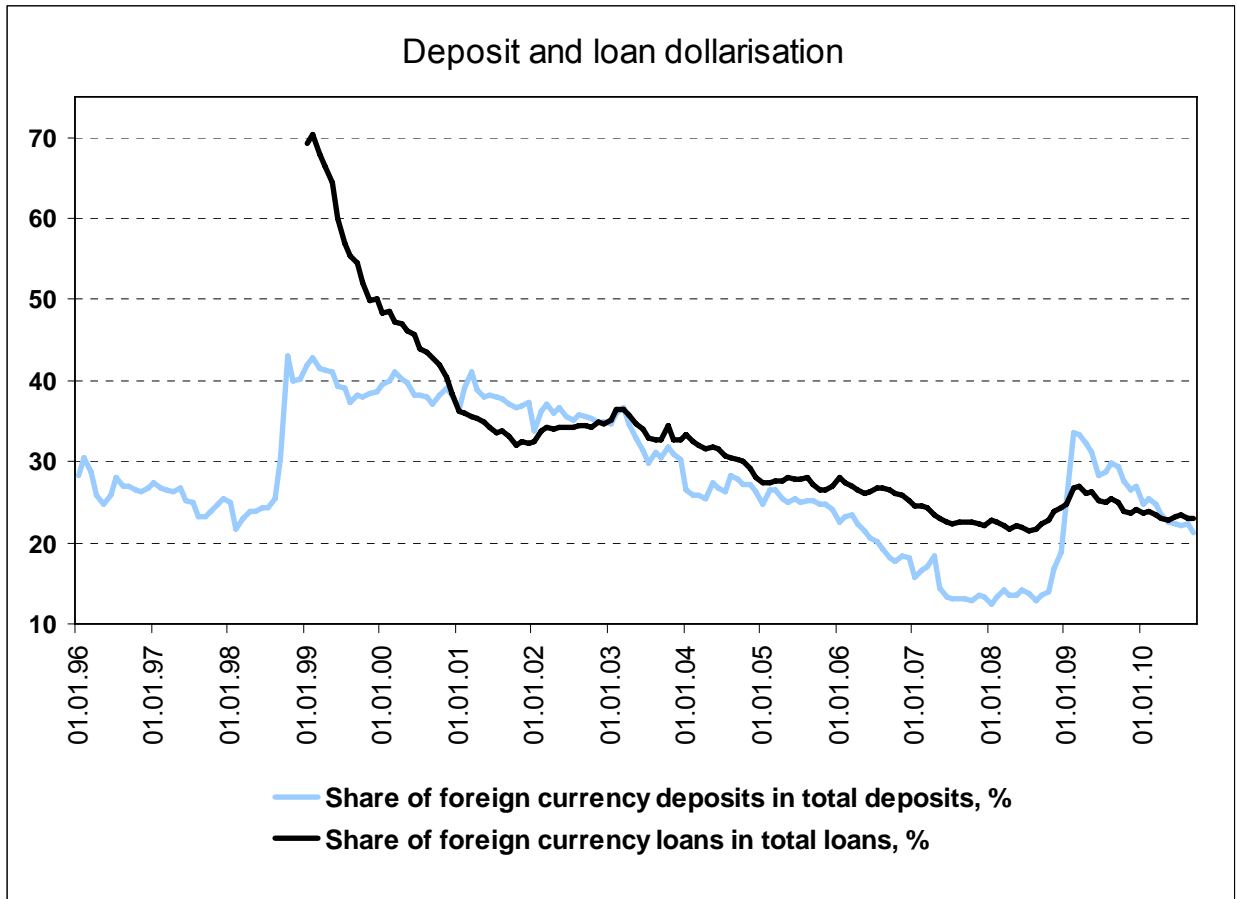


Figure 2

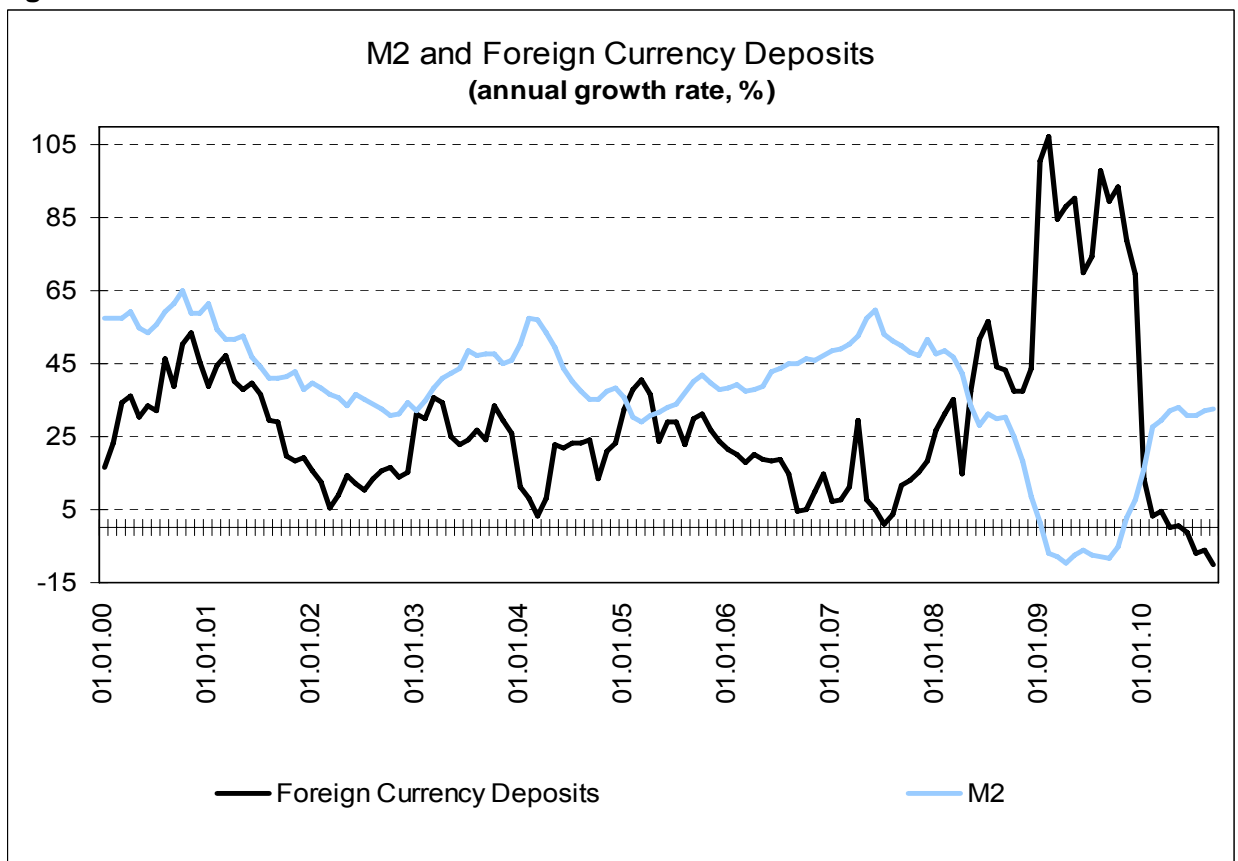


Figure 3

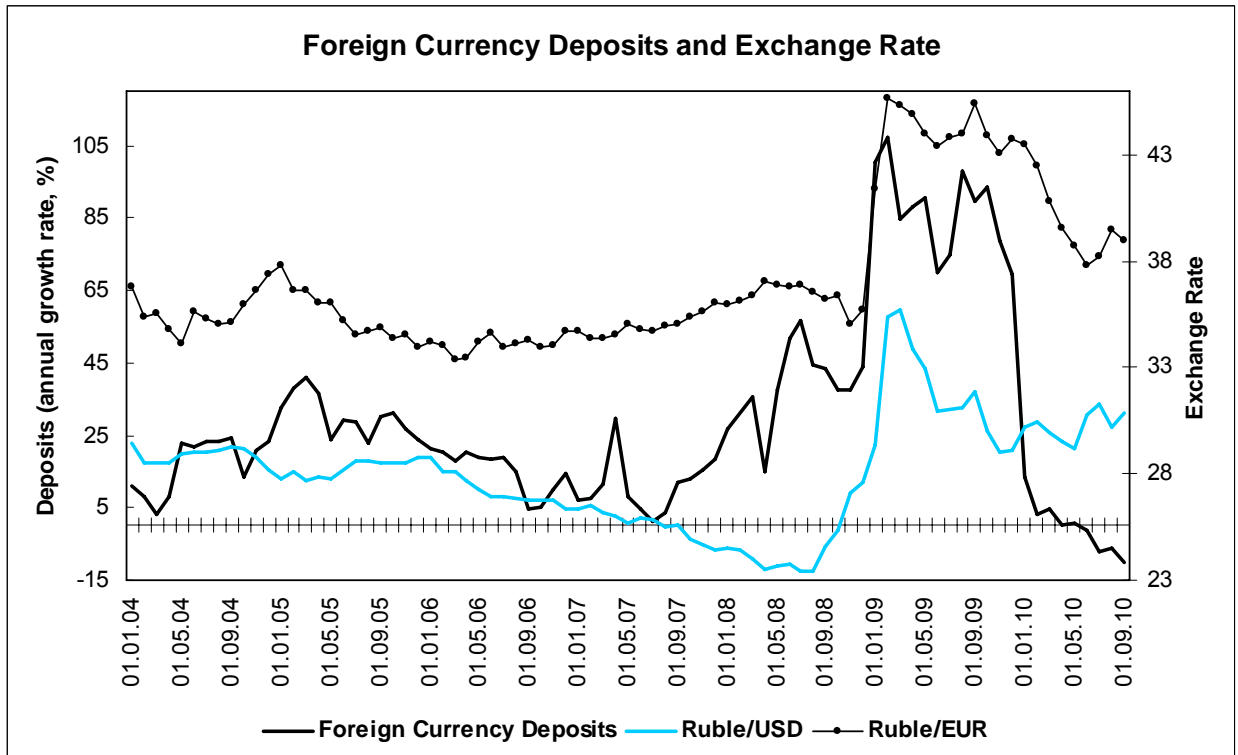


Figure 4

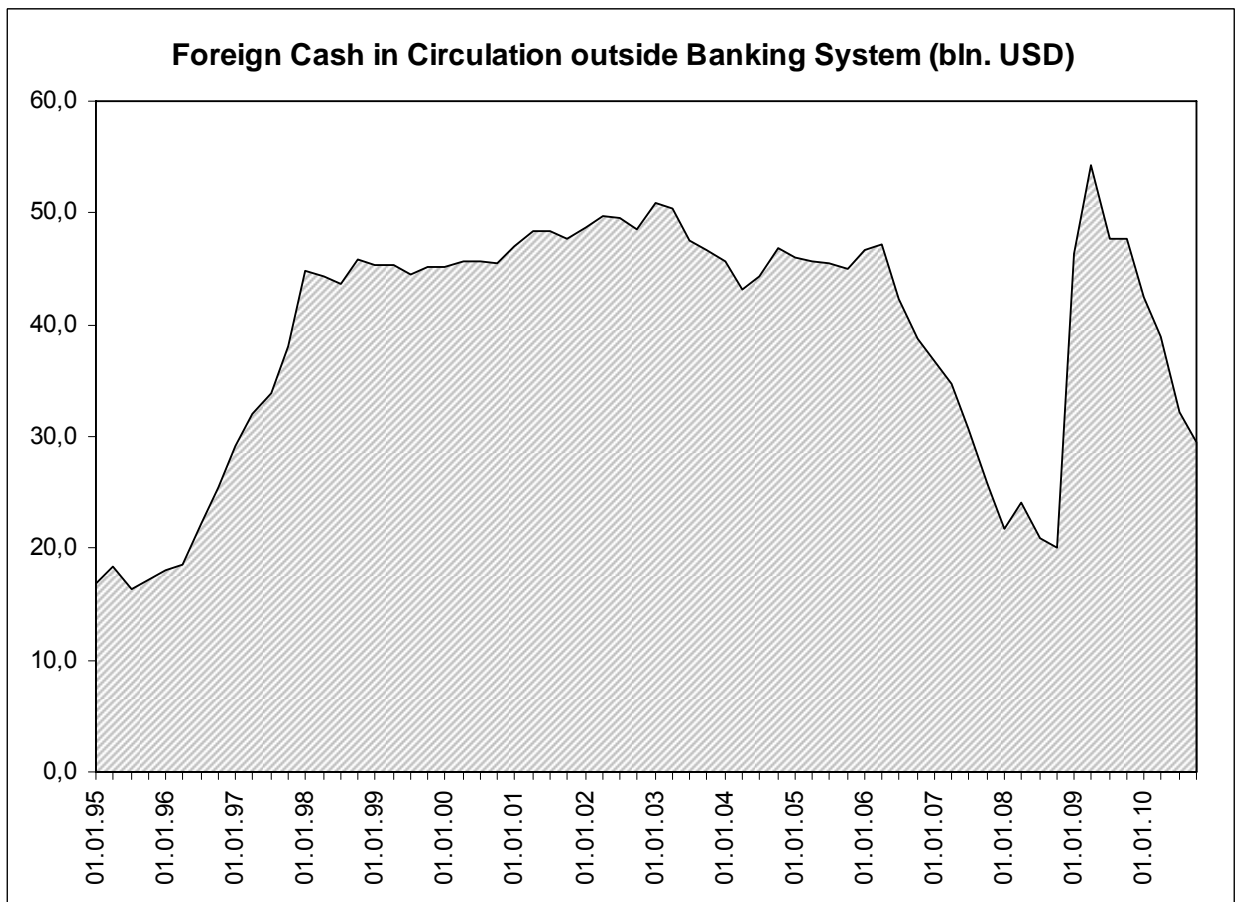


Figure 5

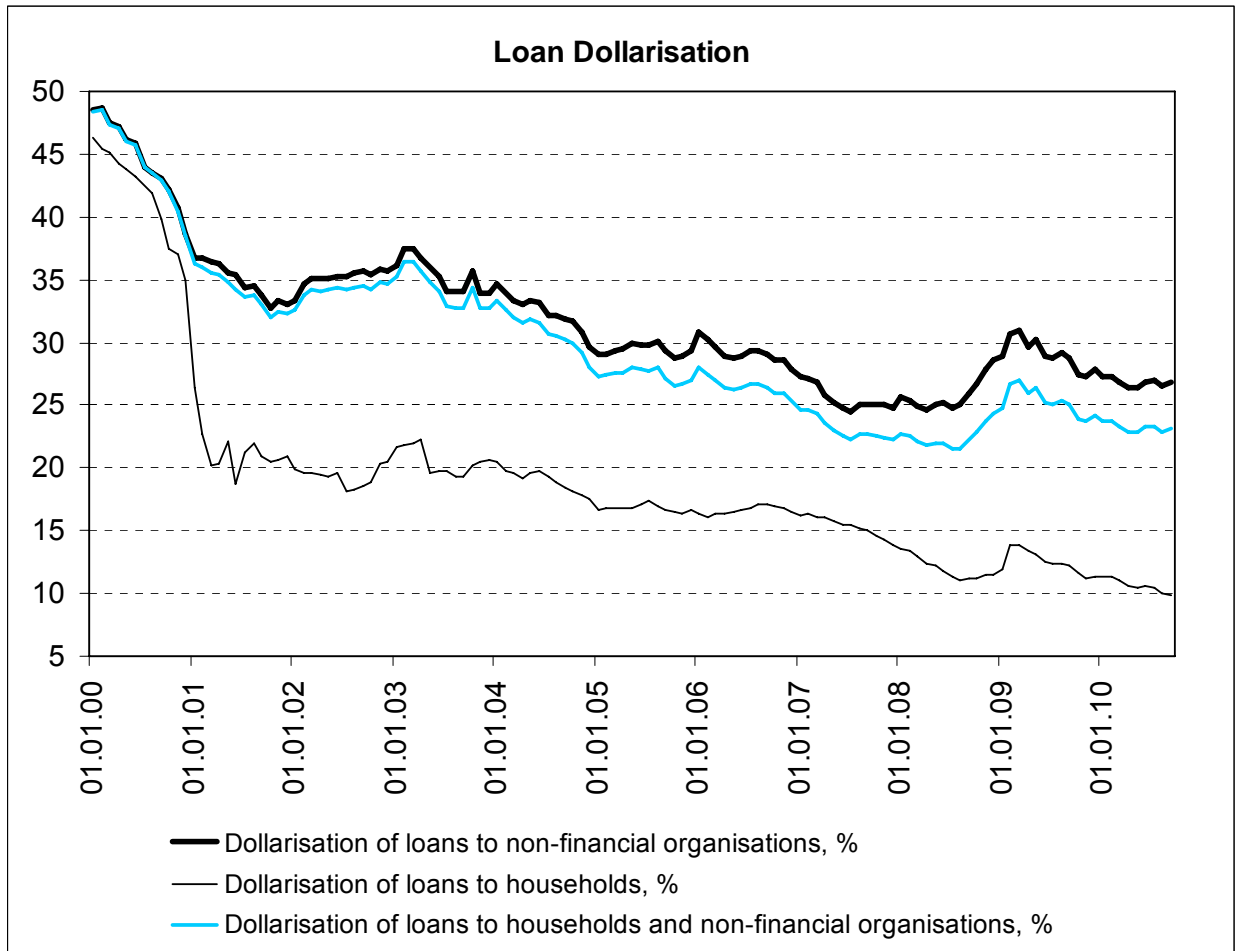


Figure 6

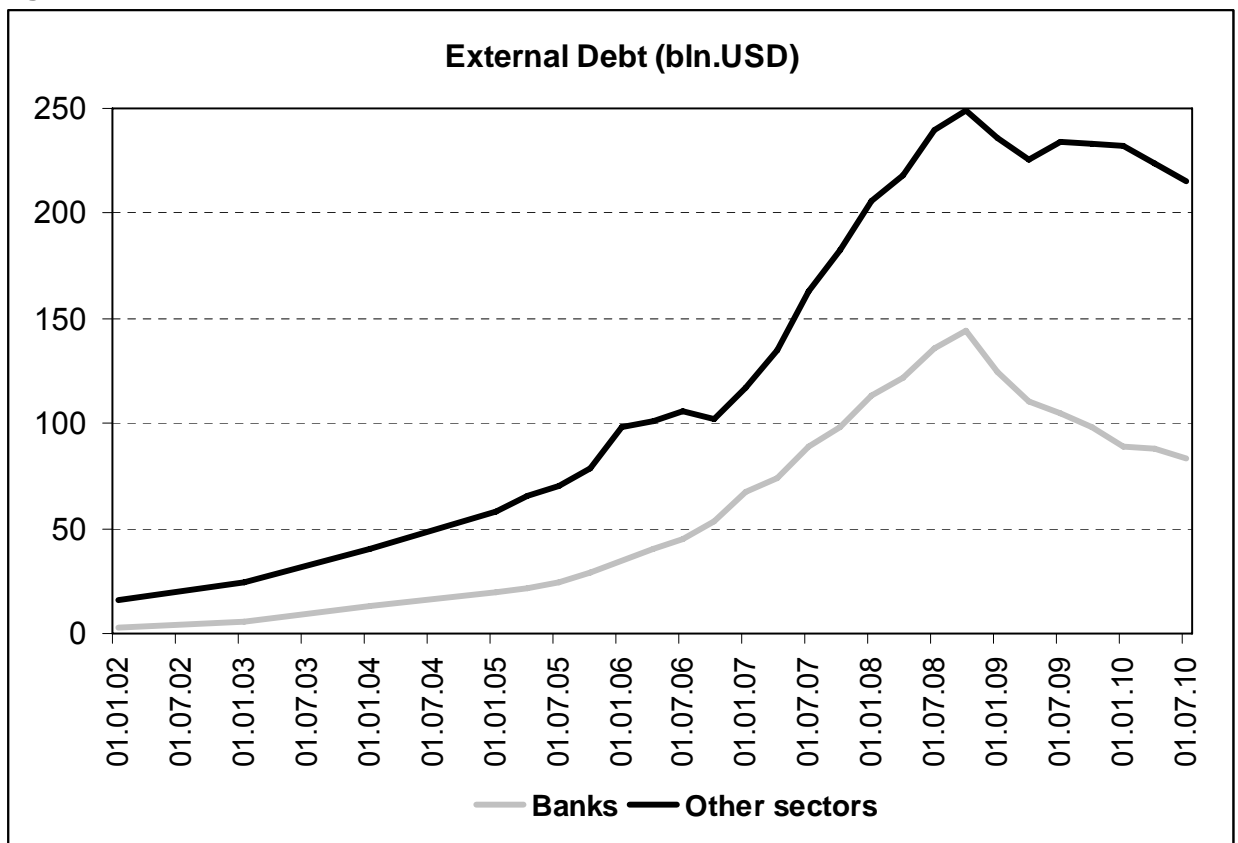


Figure 7

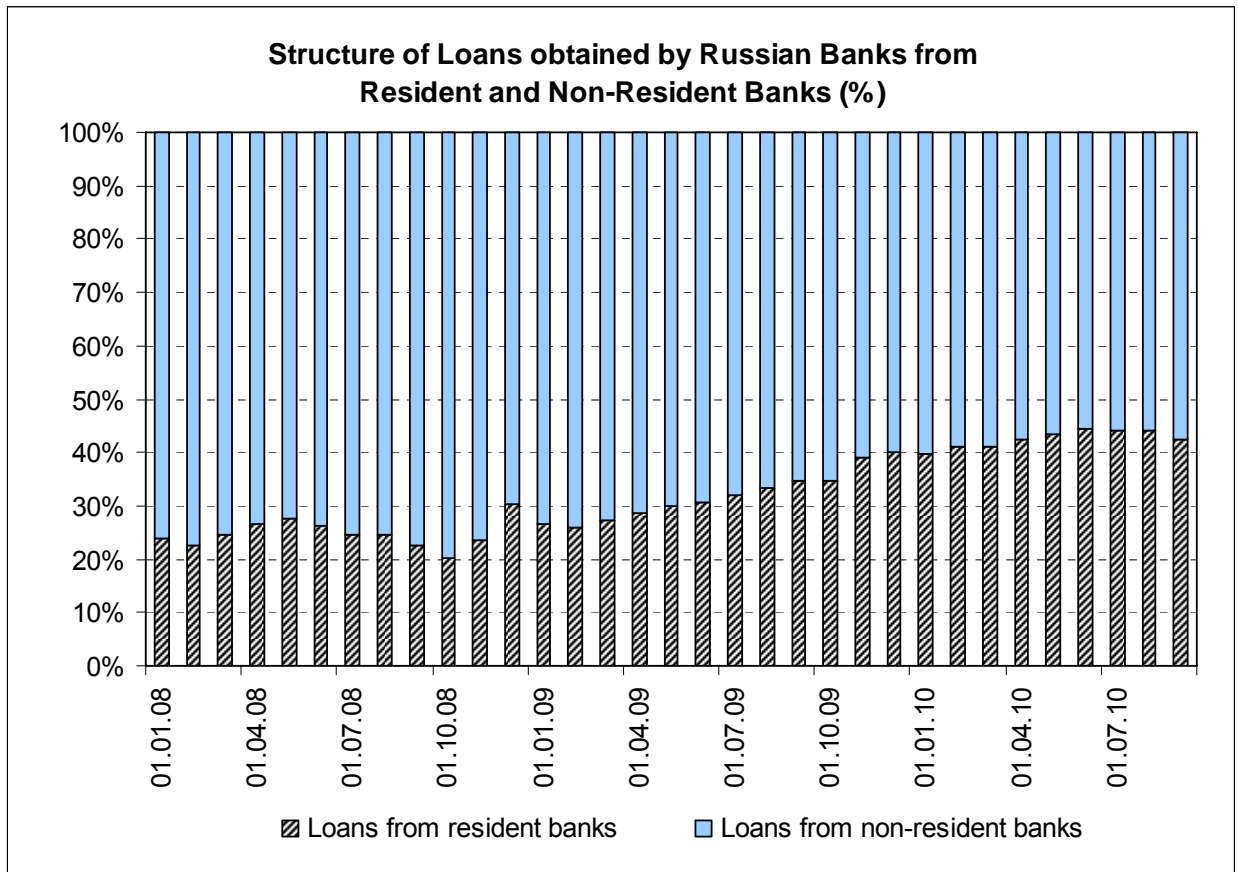


Figure 8

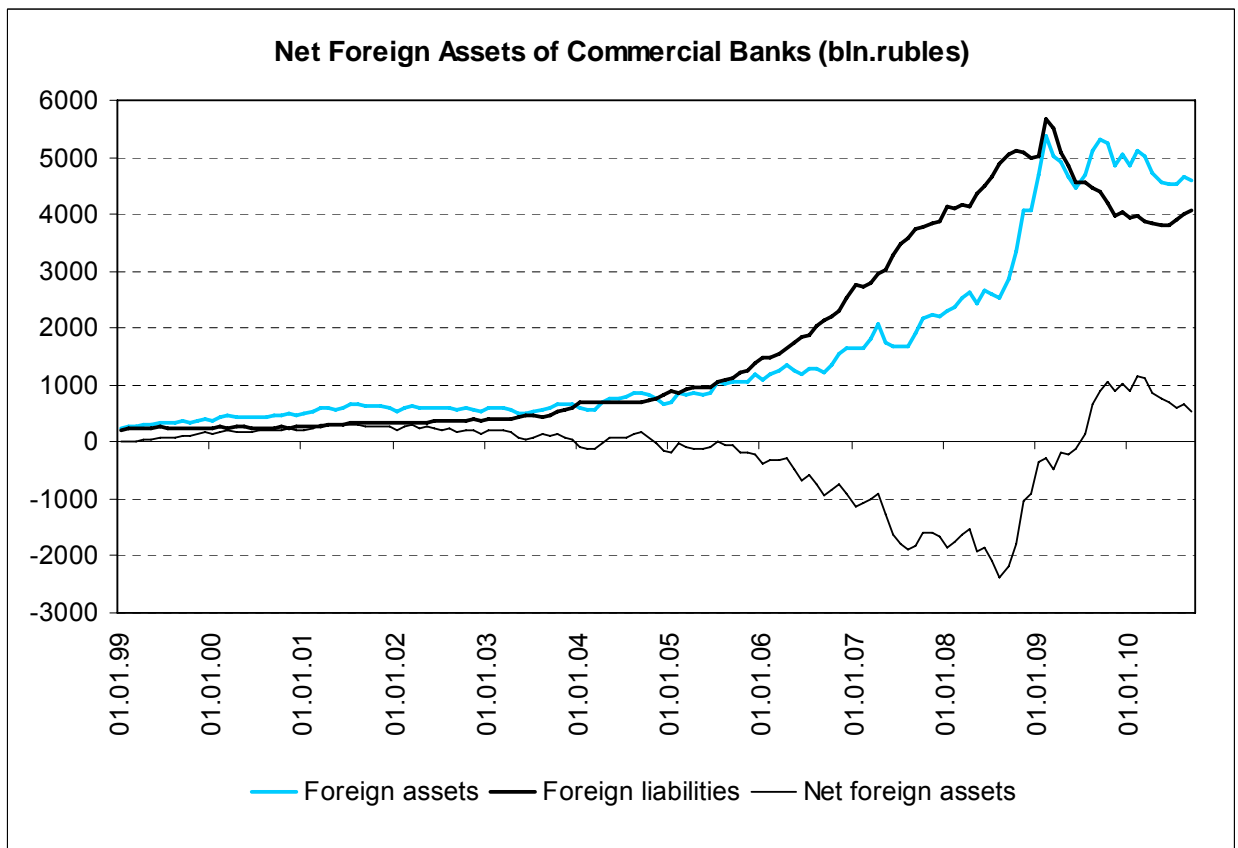


Figure 9
 Money and loans multipliers⁵ (01.01.2004=100%)

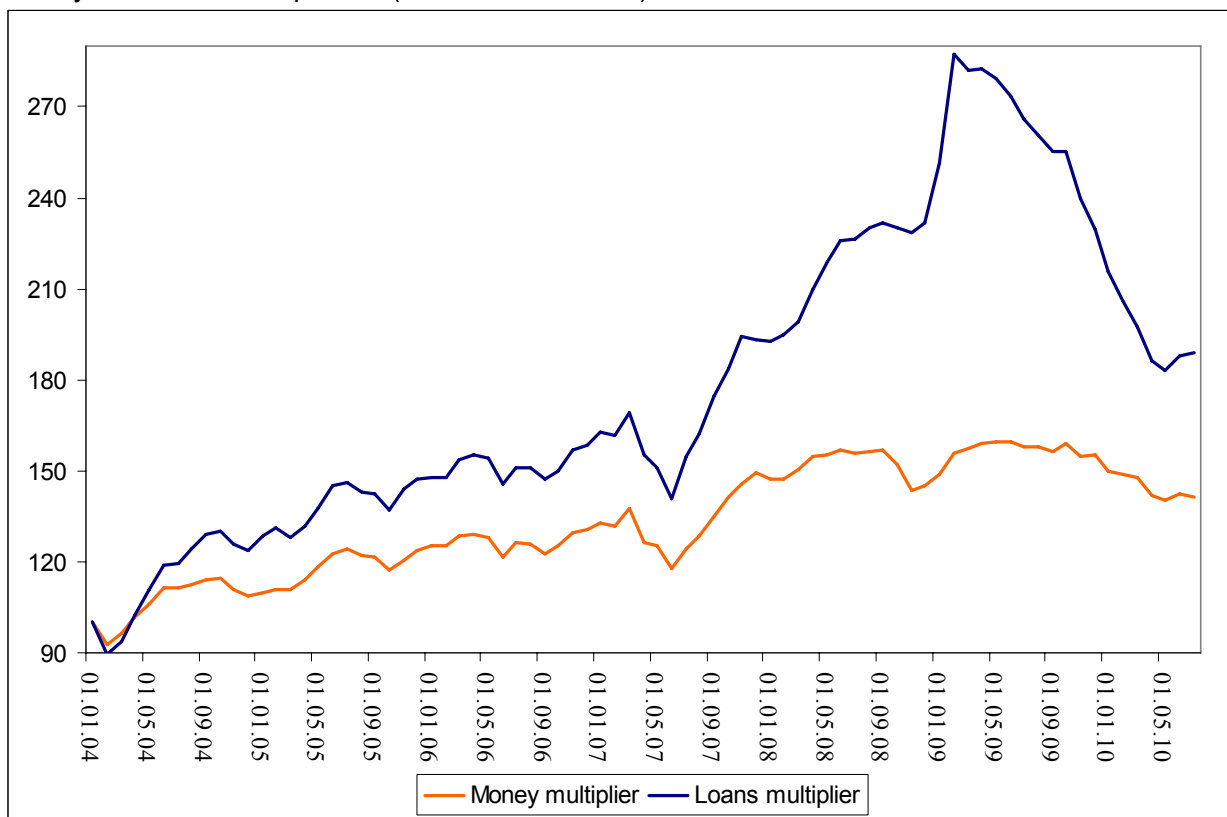
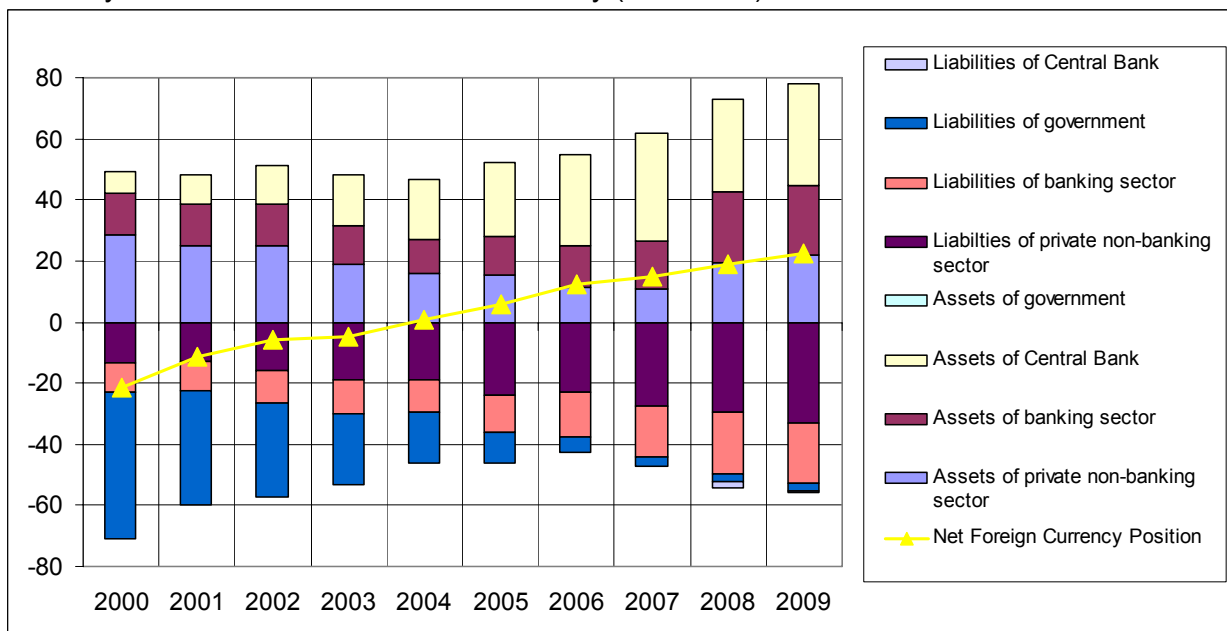


Figure 10
 Currency mismatches of the Russian economy (% of GDP)



⁵ Estimated as M2 to monetary base and ruble loans to monetary base ratios respectively.

Figure 11
Currency mismatches of government sector (% of GDP)

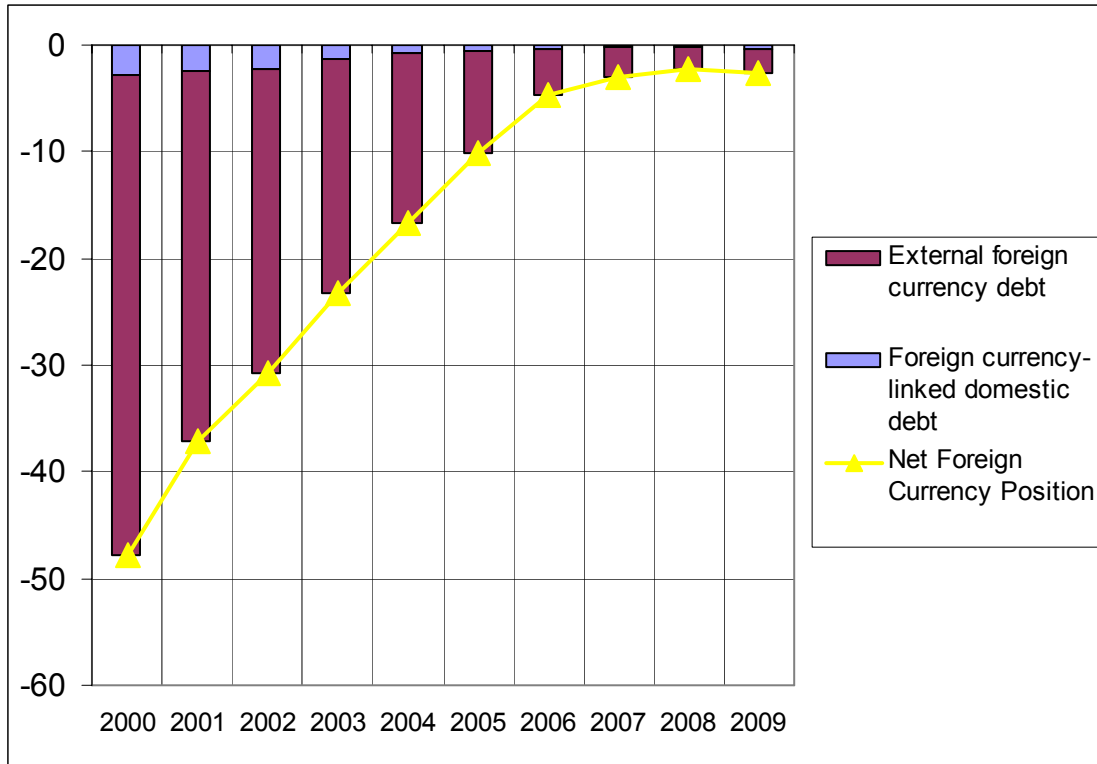


Figure 12
Currency mismatches of the Central Bank (% of GDP)

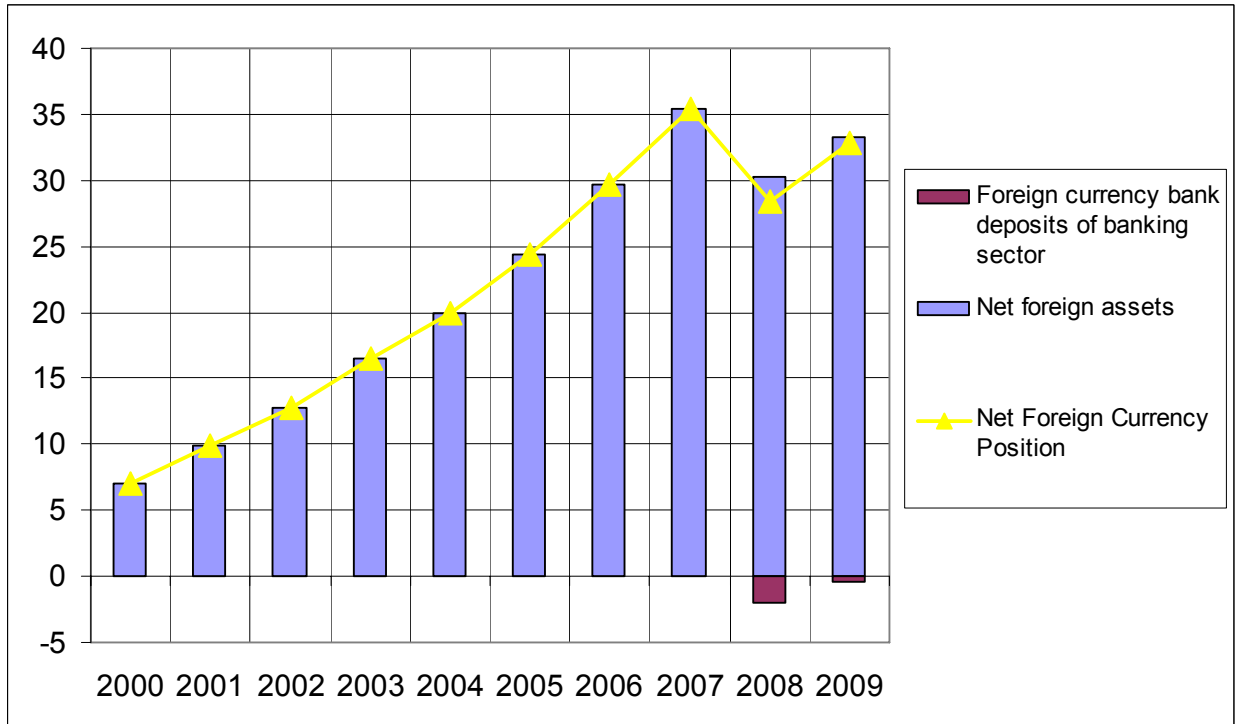


Figure 13
Currency mismatches of the banking sector (% of GDP)

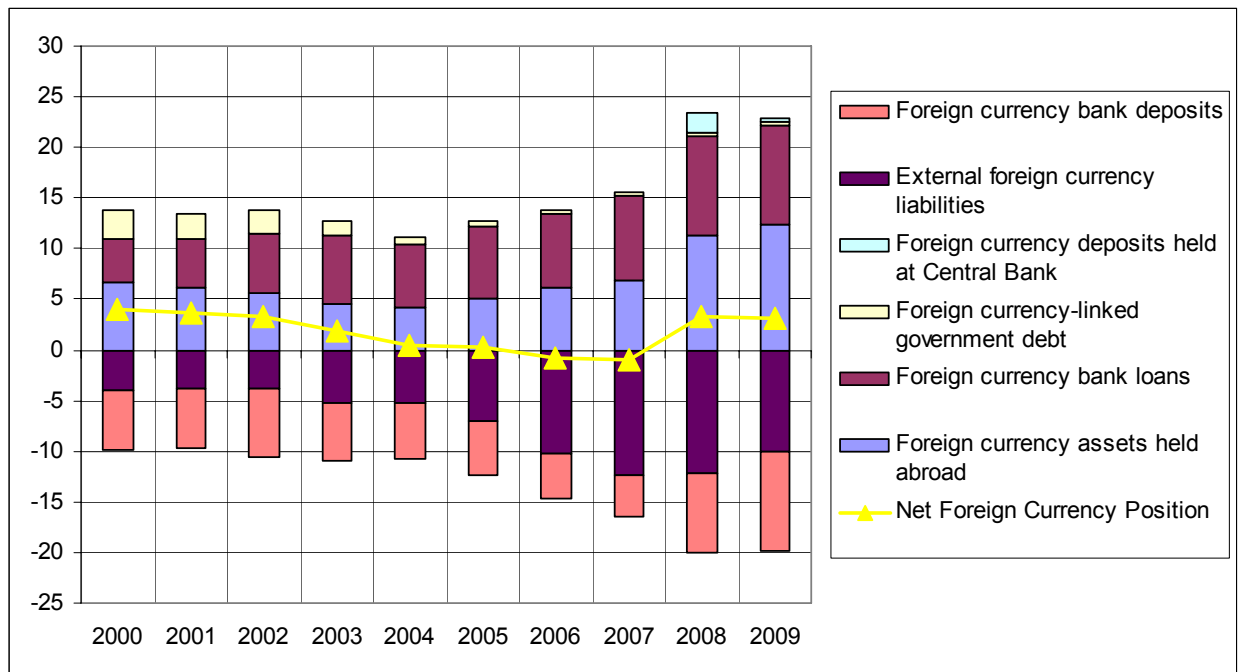


Figure 14
Currency mismatches of the private non-banking sector (% of GDP)

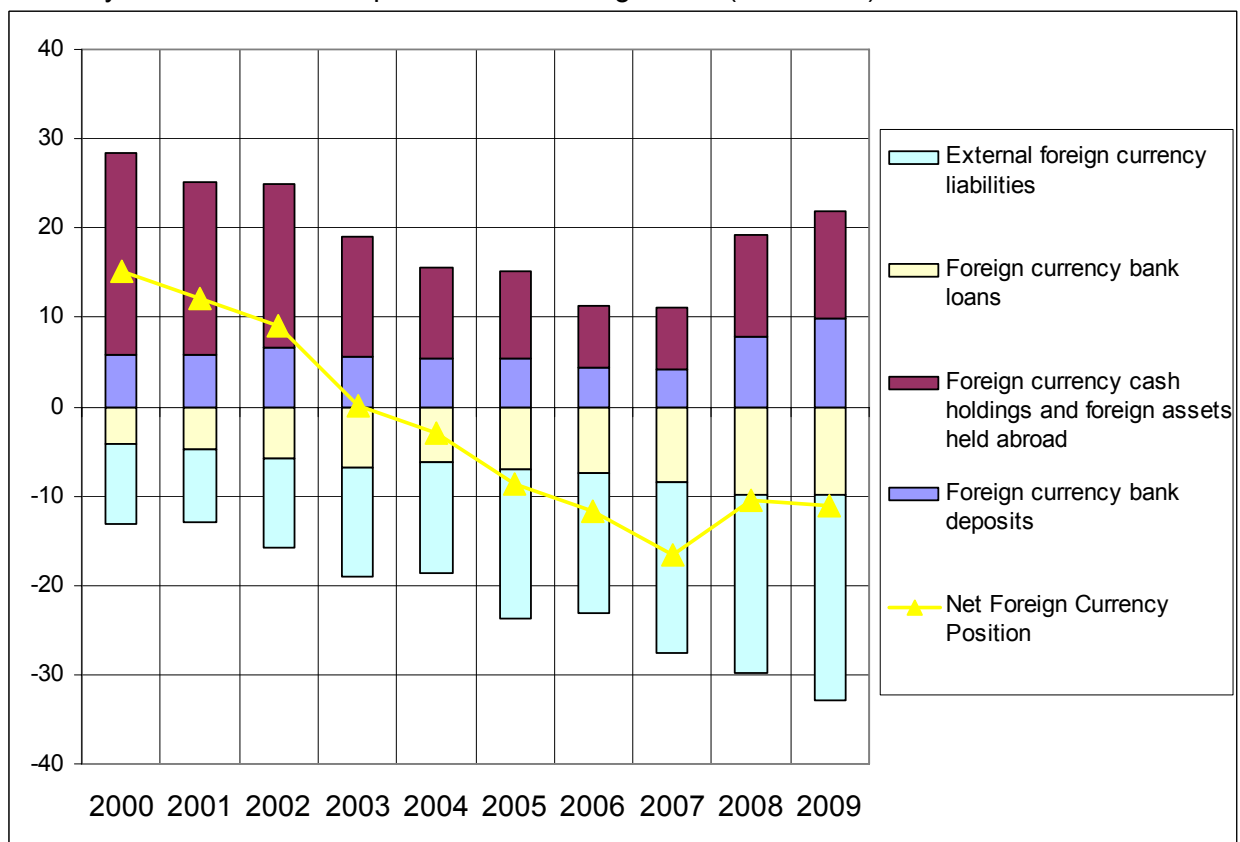


Figure 15
Banking spreads and banks' liabilities dollarization

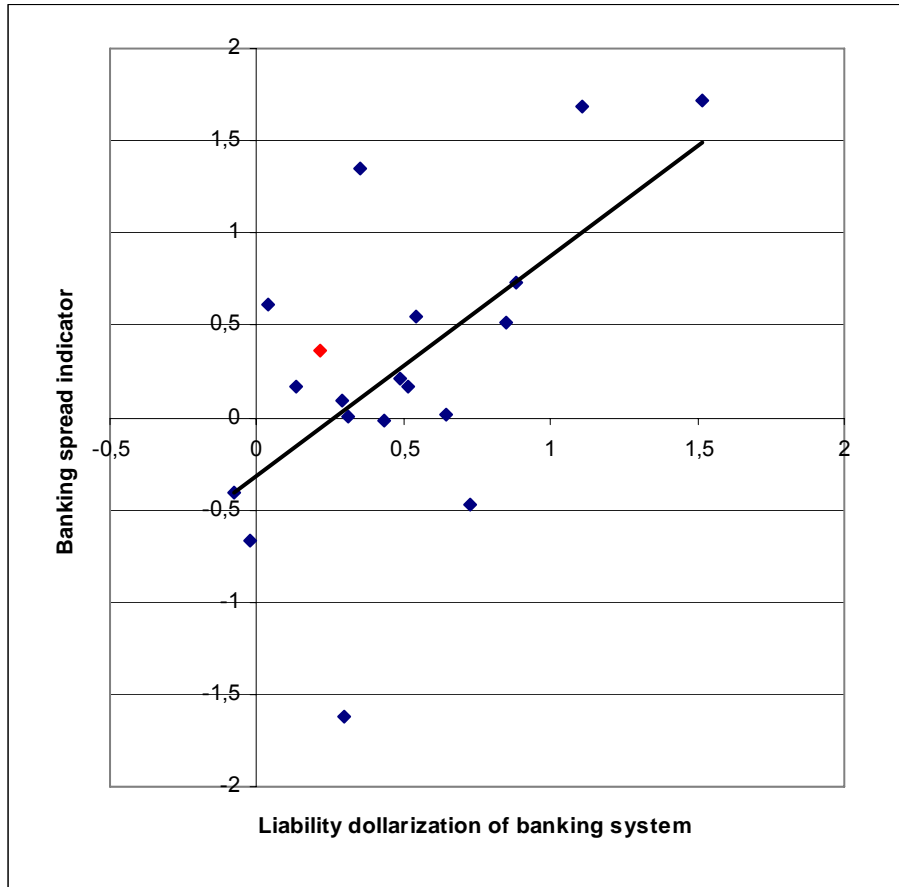


Figure 16
Supply of credit and banks' liabilities dollarization

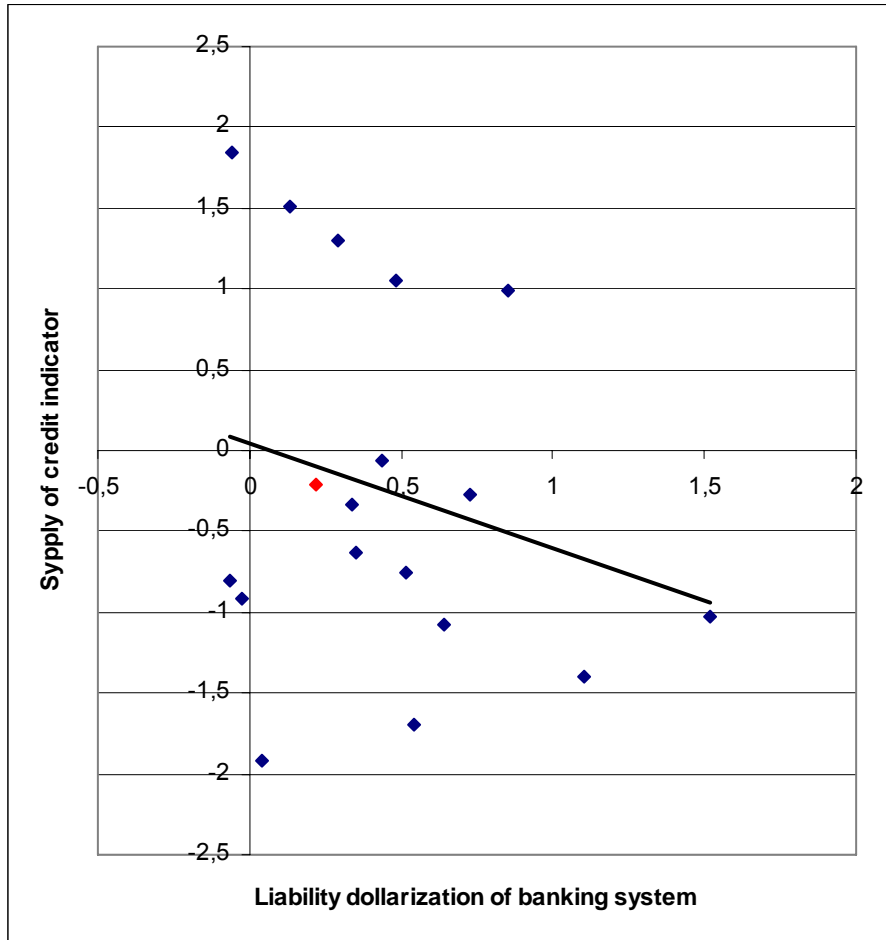


Figure 17
Sudden stop and banks' liabilities dollarization

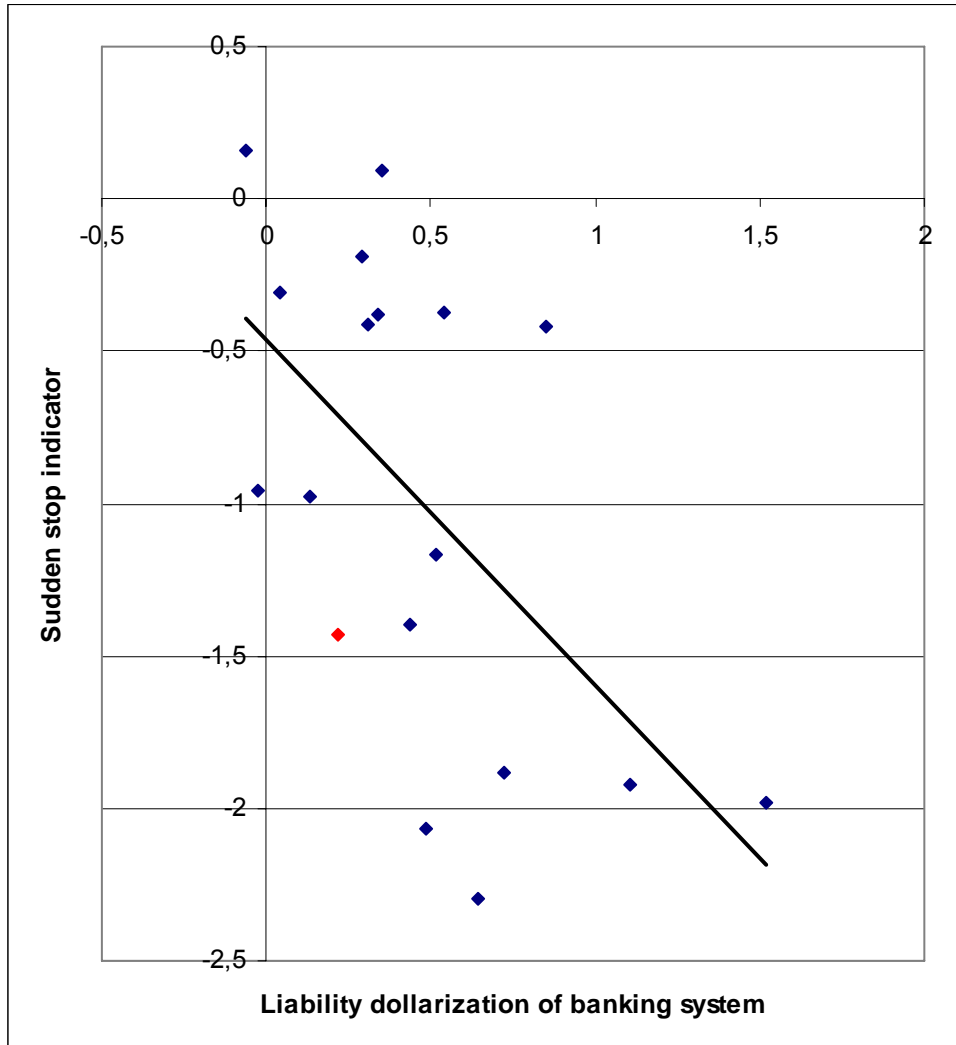


Figure 18
Investment activity and NFC's liabilities dollarization

