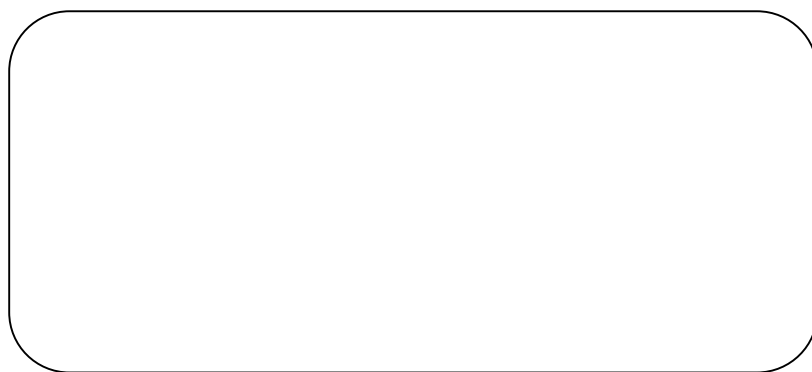




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# **Monetary Policy Transmission in Romania\***

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The opinions expressed in this paper are the authors' alone and they do not engage the National Bank of Romania in any way.

# *Contents*

Summary .....	5
INTRODUCTION .....	6
1. THE STRUCTURE OF THE TRANSMISSION MECHANISM OF THE MONETARY POLICY .....	7
1.1. The strategy of the monetary policy .....	7
1.2. The operational framework of the monetary policy .....	10
1.3. The structure and characteristics of the financial system .....	12
2. THE TRANSMISSION OF MONETARY POLICY IMPULSES .....	16
2.1. The transmission of policy impulses to financial prices.....	16
2.2. Some aspects regarding the transmission of monetary policy impulses to macroeconomic behaviors .....	17
CONCLUSIONS .....	22
REFERENCES .....	23
APPENDIX.....	25
CHARTS.....	35

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## **Summary**

The goal of the present paper is to identify the main features of the monetary transmission mechanism in Romania. The methods employed for the analysis of the two segments of the monetary transmission mechanism are distinct. In the case of the transmission of monetary policy impulses to the financial variables, we employed an empirical analysis based on Vector Error Correction regressions. The reliability of these results is, however, impaired by the shortness of our data sample. For the analysis of the connection between the financial sector and the real economy – the second segment of the transmission mechanism – the incipency of the National Bank of Romania's (NBR) monetary transmission mechanism has constrained us to use theoretical intuition alone.

The results of the empirical evaluation show that the NBR directly affects the banks' time deposit rate through the sterilization operations interest rate. On the other hand, the short-term credit rate does not seem to directly respond to the NBR interest rate impulses, however it does respond to the interest rate on deposits. This feature can be explained by the fact that in the present configuration of the Romanian monetary framework, the NBR interest rates represent an opportunity cost of bank lending, which makes the impact of the former rather ambiguous. Also featured by the empirical analysis is the influence of the central bank on both deposit and short-term credit rates through its required reserve mechanism.

The intuitive analysis of the second segment of the monetary transmission mechanism reveals the fact that the establishment of the traditional transmission channels of the monetary impulses is still in its embryonic phase due to the protracted financial disintermediation experienced by the Romanian economy. Given these circumstances, the monetary authority continues to significantly influence macroeconomic behavior through its exchange rate channel and its foreign currency acquisitions. On the other hand, starting with the year 2000 the credit channel and especially the interest rate channel have started to show signs of recovery. The functioning of the credit channel continues, however, to be undermined by the structural excess liquidity of the system, by the substitution phenomenon of the domestic currency credit by the foreign currency credit and by moral hazard. Although the interest rate channel is also affected by some of these phenomena, its role in the transmission of monetary policy impulses is continuously growing. However, it seems that in the Romanian economy the interest rate channel is currently working through the nominal rather than the real level of the interest rate. With the recovery of the two traditional channels, the firms' and households' balance sheet channel is also likely to shape up and consolidate, thus increasing the future effectiveness of monetary policy.

## INTRODUCTION

The attempt to identify the present transmission mechanism of the monetary policy conducted by the National Bank of Romania (NBR hereinafter) is confronted, especially on the empirical side, with a number of pitfalls. The main difficulties are coming from the absence of a clearly defined theoretical framework, but especially from the permanent nature of the structural and institutional transformations in the Romanian economy. These transformations have induced relatively frequent changes and atypical forms of the channels by which monetary policy impulses are transmitted to the economy, also affecting their overall effectiveness. Furthermore, the delays – relative to other EU accession countries – in the introduction and expansion of the principles and mechanisms of market economy and in the process of macroeconomic stabilization meant that the traditional links between the monetary framework and the real economy have evolved much slower and are, as a consequence, still in their incipient phase.

This context reduces considerably the potency of the analysis and of the empirical quantification of the transmission channels of monetary policy. Major difficulties arise both in the definition of the way the central bank influences liquidity and financial market prices and in the way monetary conditions influence the activity of the financial intermediaries. The greatest problems are encountered, however, in the identification and the evaluation of the impact that the financial variables have on the macroeconomic behaviors and spending decisions. This link has been seriously clouded and altered in the transition period due to the protracted economic decline<sup>1</sup> and the persistently high and volatile inflation, both of which led to the progressive decline in the financial depth of the economy. It is only starting with the year 2000 that, along with the halt of economic contraction, we can distinguish a slight recovery process in the financial intermediation and in the monetary framework-real economy link.

As a consequence, the present work focuses on the most recent period and makes a more extensive use of theory and economic intuition in its endeavor to identify the most important elements of the monetary transmission mechanism. An empirical evaluation was used exclusively for the analysis of interest rate formation in the banking sector. Even in this case, however, the short sample of relevant data available does not allow us to draw too robust conclusions<sup>2</sup>.

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<sup>1</sup> In the 1990-1999 period the Romanian economy saw a nearly continuous reduction of GDP. The exception was the 1993-1996 growth interlude, but this proved to be unsustainable as in 1997 the country fell back into severe recession.

<sup>2</sup> The sample includes the period October 1999 - May 2002. Prior data has been deemed too noisy because of several distortions persisting until 1997, like: the incomplete liberalization of the foreign exchange market, the central bank's policy of directed credit, the issuance of government securities by the method of subscription. Moreover, until late 1999, the inter-bank money market interest rates were strongly distorted by the severe liquidity and solvency problems of two of the major state-owned banks.

## **1. THE STRUCTURE OF THE TRANSMISSION MECHANISM OF THE MONETARY POLICY**

Both literature and empirical evidence stress the necessity and importance of the monetary authority's knowledge of the monetary transmission mechanism.

At the same time, however, the past years' experience of the Romanian economy has emphasized the importance for the monetary policy to have a coherent and functional mechanism of exercising its influence over the macroeconomic behaviors which are most relevant for the achievement of its main objectives. In this period, the Romanian monetary authority could not enjoy the benefits of proper implementation conditions of its monetary policy as the transmission mechanism of this policy was – and still is – in its incipient phase. The belated nascence and interconnection of the crucial elements of the transmission chain are to some extent responsible for the low effectiveness of monetary tools in controlling inflation in Romania, although the major responsibility in this respect lies with the slow pace of structural reforms. Presently the NBR's transmission mechanism is more clearly shaped on its central bank-banking system segment, whereas the connection between the financial variables and the real economy has only started to fall into shape in the second part of the year 2000, once the prolonged disintermediation process was stopped. The nature of the relation between the monetary variables of the NBR and the financial elements which directly influence the non-financial sector depends, on the one hand, on the monetary policy strategy and its operational framework and, on the other hand, on the structure and functioning of the financial system. The second connection also depends on the features of the real economy.

### **1.1. The strategy of the monetary policy**

The recent years' experience shows that only a limited number of central banks have adopted and implemented a "pure" strategy of monetary policy, most of them opting for "hybrid" approaches. In its turn, the National Bank of Romania has *de jure* adopted monetary targeting, but its *de facto* monetary policy strategy can be characterized as eclectic.

The fundamental objective of the NBR's monetary policy is to maintain price stability<sup>3</sup>. In order to reach this goal, the central bank uses money supply as an intermediate target and monetary base as its operational target. In recent years, however, this analytical framework of the monetary policy has cohabited with a strongly managed float exchange rate regime aiming to reconcile the objective of disinflation with that of preventing the deterioration of the economy's external position, which might have occurred in the case of an excessive real appreciation of the ROL<sup>4</sup>.

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<sup>3</sup> The National Bank of Romania Act stipulates that "the NBR's key objective is to ensure the stability of domestic currency with a view to maintaining price stability". This fundamental objective will be restated according to the EU legislation by the amendment of the present Act as late as 2004.

<sup>4</sup> The annual inflation rate (estimated until September 2002) never went below 19 percent in the last 12 years.

Thus, the exchange rate has become a quasi-operational objective of the monetary policy, but also an anti-inflationary quasi-anchor, especially in 2001. A relative consistency of this monetary framework was achieved through a prolonged capital control policy, which will be gradually abandoned by 2007<sup>5</sup>.

Besides the conflict of objectives to which it was forced to adapt, the monetary targeting strategy had to adjust its characteristics to the structural excess of liquidity that has appeared and magnified in the system starting with 1997, despite the restrictions on capital movement. The sterilization of this liquidity surplus has placed the central bank in the atypical and unfavorable position of net debtor. In this context, both the nature of money supply and the way monetary base is controlled by the central bank have changed. The supply of high-powered money has become mainly exogenous, stemming from the central bank's voluntary purchases of foreign exchange from the market. Although it is not part of any currency board arrangement, the net foreign assets (NFA) of the Romanian National Bank presently cover more than twice the level of the monetary base (see Chart 1). At the same time, however, through the also voluntary absorption of the excess liquidity from the system, the NBR aimed to reduce the level of reserves to that of the banks' demand, thus accomplishing a re-endogenization of money supply, at least partially or imperfectly.

The effectiveness of this endogenization of the high-powered money supply was in this period dependent on the activism of the central bank, but also on the banks' behavior and on the particular functioning of financial markets. All this has rendered some aspects specific to the nature and role of the central bank's interest rate, as well as to the transmission path of the impulses of monetary policy to the relevant financial variables. This is because in a banking system characterized by a structural surplus of liquidity, the most relevant central bank interest rates have lost their significance as the marginal cost of funds raised by banks, becoming an opportunity cost of all other banking investments.

Considering the way that the NBR has controlled the monetary base as well as the formation of the policy interest rate, two separate stages can be detected in the last few years:

**A)** The period from 1997 to the beginning of 2000, when due to the arbitrage opportunities offered to banks by the imperfections of various segments of the financial market (the foreign exchange market, the government securities market and the deposits market – including deposits with the central bank) and in order to achieve a firm monetary control, the NBR was forced to act as a price taker (being – along with the Treasury – in a captive position *vis-à-vis* the banking system). Due to the strict monetary control, the inter-bank interest rates followed closely the course of the NBR interest rates. In this context, neither of these two types of interest rates – extremely high and distorted as an effect of interest rate arbitrage – could pass as a relevant monetary policy variable, given their small impact on the deposit and credit markets. In a most

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<sup>5</sup> The phasing of the capital account liberalization has been decided through bilateral negotiations between the Government of Romania and the European Commission.



unusual manner, the returns on the inter-bank market were generally higher than the real sector lending rates, commercial banks imposing an extremely high (depreciation) risk premium on the NBR deposit rates, thus making the implementation of monetary policy a very expensive exercise (see Chart 2). At the same time, although the monetary control was relatively tight, its effectiveness in the transmission of monetary policy impulses was seriously diminished by the contraction of bank lending, the growing financial disintermediation and the demonetization of the economy<sup>6</sup>. The control over the operational target of monetary policy has remained efficient only in preventing speculative drives on the national currency, initiated by commercial banks as a method of putting pressure on the central bank's and the government securities' interest rates.

**B)** Starting with mid-2000, however, due to the drastic reduction of arbitrage opportunities on the money market, the NBR has regained its price-making role and, accordingly, the short-term interest rate has become an additional quasi-operational objective of the monetary policy. The commercial banks' retreat to their initial captive position in relation to the central bank cannot be explained by the removal of the structural excess of liquidity, but by the quasi-permanent excess supply on the foreign exchange market and the substantial remission in the Treasury's dependence on bank funding due to its increased access to external and non-bank financing of the budget deficit. In this situation, the central bank has regained its ability to set its own interest rates, thus influencing retail interest rates and signaling the orientation of its monetary policy. This signaling is slightly delayed since the decisions to change the NBR rate are not pre-announced. The recovering credibility of the monetary authority backed by the tempering of inflation has made it possible for the NBR – through the new framework of monetary policy – to more efficiently influence inflationary expectations, its interest rate becoming the ad-hoc anchor of these expectations. The National Bank of Romania sets its interest rate based on the actual and the targeted inflation rate and, more recently, based on bank lending developments, seeing however that the real time deposit interest rates remain positive<sup>7</sup>. However, as an effect of fiscal domination, the NBR's interest rate decisions attach an important role to the public debt management policy and to the T-bills interest rates. Once the NBR rates were exogenized, however, the effectiveness of the transmission of monetary policy impulses to the inter-bank rates has declined as the central bank managed to sterilize the excess liquidity only partially. This could be explained by some distortions induced by the monetary policy instruments, the diverging expectations regarding future inflation or the future changes in monetary policy, the volatility and unpredictability of the autonomous factors of liquidity or by the banks' own faulty management of liquidity. As a result, monetary policy impulses are to a lesser extent conveyed through the inter-bank market, which is anyway much thinner than the market of deposits attracted by the NBR. In June 2002, the volume of liquidity deposited with the NBR was 90 percent of the overall inter-bank deposit market.

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<sup>6</sup> These phenomena are related to the economic contraction, the high and volatile inflation rates and to some bank failures that have increased the banks' risk aversion.

<sup>7</sup> Starting with 2001, the interest rates have been set on a descending trend due to sustained disinflation.

In both periods under scrutiny, the strict implementation of the “golden rule” of monetary policy and of “pure” monetary targeting in Romania was not possible either due to the deepening of financial disintermediation, which increased the instability and unpredictability of the money demand function (under the influence of structural shifts) or to the insufficient capability of the NBR to exert a non-accommodative control over the monetary base (as a net debtor), or perhaps to the simultaneity of both reasons (reflected in the instability of the money multiplier). This strategy has allowed the monetary accommodation of price increases generated by the structural causes of inflation. Boțel (2002) confirms this idea, showing that the monetary accommodation has occurred through the money multiplier. At the same time, he shows that monetary factors were irrelevant for the explanation of industrial production dynamics.

The significant influence of the NBR over the evolution of the exchange rate and, later on, over the entire structure of banking returns – by fixing its own interest rate – have enhanced the discretionary character of the monetary policy framework. The latter element was meant to compensate for the lack of effectiveness of the quantitative monetary rules. Against this background, the monetary policy strategy is gradually heading towards an inflation targeting type of approach<sup>8</sup>. The instability of the money demand and the unpredictability of the evolution of credit, monetary base and M2<sup>9</sup> have become more significant in the recent period as the Romanian economy seems to experience a phenomenon of “financial infusion”<sup>10</sup>. All this has diminished the role of monetary aggregates in conducting monetary policy and, as a result, the exchange rate and – more recently – the policy interest rate have become better indicators of the monetary policy stance.

## **1.2. The operational framework of the monetary policy**

The configuration and the effectiveness of the operational framework of monetary policy has been constrained, on the one hand, by the immaturity and the disequilibria of the money market and, on the other hand, by the aforementioned conflict of monetary policy objectives. Apart from its promoted adequacy to the concrete conditions of the domestic money market, the construction of the NBR operational framework in the more recent period has also considered the objective of gradual harmonization with the operational framework of the ECB. In effect, the monetary policy instruments that the NBR can *de jure* dispose of are almost identical to those used by the ECB. Their nature, functions, characteristics and effectiveness in transmitting the monetary policy impulses are nevertheless somewhat different from those of the ECB instruments.

Besides the fact that they have only recently become the most important instruments of monetary policy, open market operations are used almost exclusively to drain the structural excess of

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<sup>8</sup> According to official documents negotiated between the Government of Romania and the European Commission, depending on the specific prerequisites being fulfilled, Romania is to adopt inflation targeting by the end of 2004.

<sup>9</sup> The NBR’s M2 objective has been often missed because of the unpredictable velocity of money. In the 1997 - 2000 period, money velocity was higher than the M2 target would have allowed for, whereas in 2001 the improvement of the velocity was more significant than expected.

<sup>10</sup> See Stone (1998) for a definition of the term.

liquidity. The most important instruments in this respect – considering both the volume and the frequency of use – are the fixed term deposits with maturities ranging from one-two weeks to one-three months<sup>11</sup>. Repurchase agreement operations with government securities are also extensively used for sterilizing excess reserves. The volume of liquidity presently drained by the NBR open market operations is far greater than banks' current account holdings with the central bank<sup>12</sup>.

Both types of operations take place through variable interest-rate tenders. In the second part of 2000, the central bank succeeded in imposing an interest rate cap on these operations. Hence, the interest rate caps for the one- and three-month maturities have become implicit key rates of the monetary policy. Their change – although not pre-announced – is nevertheless the strongest signal the banks can get regarding the direction of monetary policy.

The monetary control and the absorption of liquidity achieved through these operations are however not perfect, the banks' willingness to invest in NBR assets depending on several factors. These factors induce a relative volatility of liquidity conditions and especially of inter-bank money market interest rates. As an effect of the imperfect monetary control, sometimes the course of interest rates is considerably deviating from the NBR yields. At the same time, due to the high liquidity surplus, the size of the inter-bank money market is much smaller than the volume of operations between commercial banks and the central bank. In these circumstances, the inter-bank segment has an insignificant role in the propagation of monetary policy impulses as they are transmitted directly to the lending and deposit rates (for details, see the econometric evaluation in the Appendix).

Given the structural surplus of liquidity, the NBR's standing facilities are only partially fulfilling their functions, being unable to counter the distortions induced by other instruments. The interest rate corridor of lending and deposit facilities is relatively broad<sup>13</sup> in order not to discourage transactions on the inter-bank market. The reverse of this situation is that interest rates are allowed to fluctuate rather wildly.

The NBR's interventions on the foreign exchange market currently represent its most important money creation instrument. Starting with the second part of 2001, the intervention tactics of the central bank has changed in the direction of lowering the frequency of foreign exchange acquisitions. The purpose of this change was to discourage the speculative capital inflows by increasing the unpredictability of the short-term evolution of the exchange rate. This also led, however, to the partial loss of the advantage that a predictable pattern of the ROL exchange rate (against the US dollar) brought as a quasi-anchor of inflationary expectations. The increased unpredictability of the exchange rate can also be attributed to the high volatility of the

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<sup>11</sup> The extension of the maturity of NBR deposits to three months was achieved in June 2001 based on the increased structural liquidity surplus, on continuous disinflation and on the alleviation of inflationary expectations.

<sup>12</sup> Banks' current account holdings with the NBR slightly exceed the level corresponding to the reserve requirements linked to deposits in national currency (22 percent in September 2002).

<sup>13</sup> The interest rate on the credit facility is 45 percent and that on the deposit facility, 5 percent.

euro/dollar parity. Given the Romanian economy's combination of a dollar-friendly mentality and an increased dominance of euro-denominated external trade flows, the NBR started to use an informal euro-dollar basket as a benchmark for its interventions.

The required reserve mechanism clearly reflects the constraints that the operational framework has been facing in recent years. The NBR assigned the required reserve mechanism the monetary control and liquidity management function aiming at the (partial) absorption of the structural surplus of liquidity. The required reserve ratio for domestic currency deposits was raised three times during 1999 (from 15 percent up to 30 percent) and the daily fluctuations of liquidity were limited to 110 percent of the required level of reserves. Also, the period for which required reserves must be kept was reduced to two weeks. These measures were meant to enforce a tighter monetary control, to make the central bank's monetary policy less costly and to help counter speculative attacks on the domestic currency and implicitly on the NBR interest rates. Required reserves were also imposed for foreign currency deposits with the purpose of stopping and possibly reversing the dollarization phenomenon and reducing the foreign currency deposit multiplier.

The rigidity and austerity of this mechanism have nevertheless diminished the effectiveness of the transmission mechanism as a whole. Its most important negative effects were the narrowing of the inter-bank market, higher volatility of the interest rates on this market (see Chart 2) and an increased interest rate spread (see Chart 3) as banks transferred the costs implied by this mechanism mostly to depositors<sup>14</sup>. In order to reduce these distortions, the required reserves bear interest rates that are slightly higher than the average rate paid by banks for their sight deposits. Also, beginning with 2001, the required reserve ratio was reduced several times, to the level of 22 percent (in September 2002). At the same time, beginning with August 24, 2002, the required reserve mechanism has been made much more flexible<sup>15</sup> in order to fulfill its role as a money market interest rate stabilizer.

### **1.3. The structure and characteristics of the financial system**

The characteristics of the financial system are important from the perspective of both segments of the monetary transmission mechanism (MTM). The structure and the functioning of this system determines the way the monetary policy impulses are incorporated in the liquidity and in the financial market prices as well as the way they are subsequently transmitted to the macroeconomic behaviors.

The Romanian economy is characterized by a low financial depth and its financial system is bank-oriented, with commercial banks owning over 90 percent of total assets held by financial institutions. The slow advances of macro stabilization and real sector restructuring have

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<sup>14</sup> See NBR (2001).

<sup>15</sup> The most important modifications that the new regulation brought to the required reserve mechanism involved the elimination of the daily fluctuation limits of banks' reserves and the extension of the observance and maintenance periods to one month.

considerably delayed the diversification of financial institutions in the transition period. At the same time, the collapse of some important financial institutions, partly as a result of inefficient regulation and supervision of financial activity temporarily shook the credibility of the financial sector. Although since 2001 the general public's confidence in the banking sector has been recovering, it seems very likely that the public's financial culture in using alternative instruments of savings will take longer to develop. The only saving instruments competing with bank deposits in the last years were the government bonds and Treasury certificates issued by the Ministry of Public Finance. The capital market continues to be extremely thin, total capitalization of the stock exchange market – although on an upward trend – reaching no more than 5.9 percent of GDP in 2001.

The low diversification of the financial system – in terms of both financial institutions and financial products – makes the transmission of monetary policy impulses much more sensitive to the characteristics and functioning of the banking system. Besides the fact that it covers almost exclusively the financial intermediation in the Romanian economy, the banking system experienced a severe demonetization and disintermediation phenomenon until 2000. In this period, the traditional channels of the MTM (the credit channel, the interest rate channel) were almost entirely obstructed, so that the impact of monetary policy on spending decisions was to a great extent diminished. Starting with 2001, the disintermediation phenomenon was stopped and a slight increase in the financial depth of the economy became apparent, but its level has remained among the lowest. The ratio of M2 to GDP was 23.4 percent and that of total bank credit was 10.2 percent by the end of 2001 (see Chart 4). The recovery of bank credit has nevertheless helped improve the transmission of monetary policy impulses, through both the credit channel and the interest rate channel.

As a result of the restructuring and privatization of some state-owned banks, the banking sector is currently dominated by privately owned banks, especially foreign-owned banks. The assets ratio of the state-owned banks to total assets has fallen from 71 percent in 1998 to 42 percent in 2001. Over the same time period, the assets ratio of foreign banks and bank subsidiaries in total assets has increased from 20 percent to 55 percent. This massive presence of foreign banks could benefit the banking system by improving its corporate governance and by enhancing competition in that system, with a potentially favorable impact on lending rates. On the other hand, the presence of foreign banks may deter to some extent the transmission of monetary policy because of their wider access to external finance, which might make them less keen on raising their funds on the domestic market. At the same time, these banks show a propensity to give credits in foreign currency, thus reducing the effectiveness of monetary policy. Another side effect, which has been proven for the Romanian economy – perhaps due to its high sovereign risk – is that of the foreign banks' exposure limits with respect to NBR and Treasury investments. This makes the achievement of monetary control more difficult, foreign banks avoiding to place all their reserves in NBR instruments or to make use of its deposit facility.

Another characteristic of the Romanian banking system is its relatively high concentration<sup>16</sup>. This sometimes allows a few institutions to act as oligopolists<sup>17</sup>, having a major influence on the system's and the market's liquidity and on the corresponding financial returns (interest rates and exchange rate). In these circumstances, the impact of the monetary policy is felt and transmitted further by banks unevenly. Likewise, the response of deposits/loans interest rates to these impulses is unequal and asymmetric, the concentration of the banking system being one of the factors behind the large interest rate spreads.

Given the structural excess liquidity, the prolonged contraction of credit and the high required reserve ratio imposed on foreign exchange denominated resources, the Romanian banking system as a whole has based its funding on residents' deposits and to a lesser extent on foreign resources<sup>18</sup>. Although in 2002 foreign liabilities seemed to have picked up some steam (their share in total liabilities reaching 7.4 percent by the end of September), their contribution in financing banking activity remains inferior compared with other banking systems. The banks' low propensity of substituting non-residents' resources for domestic deposits narrows the channel by which the external markets can influence domestic financial variables, giving away more room for maneuver to the monetary policy actions of the NBR.

At the same time, however, the Romanian banking system is characterized by a high degree of dollarization, which disturbs the transmission mechanism of monetary policy. This dollarization is apparent on both the liability and the asset side (see Chart 5).

The consolidation of the banking system and its functioning on a healthy basis represent a positive aspect in the present framework of the monetary policy implementation. Prior to the 1997-1999 period, the majority of banks didn't face hard budgetary constraints, so that a tightening of the monetary policy did not necessarily translate into the worsening of credit conditions, given the banks' perception that they would be eventually bailed out. By the end of 1998, non-performing loans represented as much as 58 percent of outstanding loans, the majority of them being concentrated in the state-owned banks' portfolios<sup>19</sup>. As a result of the restructuring of the financial system, of the improvement of regulations (including the adoption of a new law on bank failure and of new regulations for the classification of loans and for provisioning) and of the strengthening of bank surveillance, the share of non-performing loans in total non-government credit was severely reduced (from 25 percent in 1997 to the current 3 percent). Also, the aggregate solvency indicator exceeds the current 12 percent limit imposed by NBR regulations.

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<sup>16</sup> In the 1999-2002 period, 5 banks were holding between 79.8 percent and 87.3 percent of domestic currency deposits, between 75.7 percent and 94.1 percent of domestic currency credits and between 71.1 percent and 78.7 percent of the domestic currency-denominated non-government credit.

<sup>17</sup> Especially since the NBR acts as a net debtor of the banking system.

<sup>18</sup> The ratio of foreign liabilities to total bank liabilities diminished, from 10 percent in 1997 to approximately 5.9 percent by the end of 2001.

<sup>19</sup> See Ion Drăgulin and Cristian Bichi (2002).

The maturities of loans and deposits in the Romanian banking system remain generally short and variable interest rates are used for both operations. For deposits, one month is the most usual maturity and for loans the most contracts are those concluded for less than 1 year<sup>20</sup>. Recently, the National Bank of Romania and the Ministry of Finance have succeeded in prolonging the maturities on their instruments: the central bank also takes now 3-month deposits, whereas the Treasury has started issuing 2-year bonds. The yields on these instruments have become more relevant for commercial banks' setting of their own interest rates. The short maturity of financial contracts and the possibility of adjusting interest rates before that maturity allow a faster transmission of NBR interest rate changes to both new loans/deposits and the average interest rates. This feature reduces the transmission lag of monetary policy.

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<sup>20</sup> Unfortunately, we currently do not hold a proper reporting system regarding the term structure of deposits and loans.

## **2. THE TRANSMISSION OF MONETARY POLICY IMPULSES**

Due to the causes mentioned in the introduction to this paper, which make the necessary information unavailable for a more thorough analysis, the two segments of the MTM are approached in different ways. We applied an econometric analysis only to the monetary policy-financial prices segment, leaving the similar, more in-depth analysis of the financial prices-macroeconomic behavior segment to future work.

### **2.1. The transmission of policy impulses to financial prices**

The econometric evaluation of the interest rate mechanism in the banking system (see the Appendix) confirms most of our intuitive observations. A small exception is represented by the correlation between the inter-bank interest rate (excluding NBR operations) and the NBR sterilization interest rate, which was deemed more powerful by the econometric analysis. This result could have something to do with the time aggregation of the data (as monthly averages) and the sample period considered for the analysis. In order to deal with the first potential issue, the analysis has also considered a sample of daily observations. The analysis of this detailed sample has found a relatively weaker correlation between the inter-bank interest rate and the NBR rate, but it has also emphasized the importance of another explanatory variable, namely the deviation of liquidity from the required level of reserves. The fact that the NBR is unable to consistently absorb the excess reserves from the system and, thus, to maintain the inter-bank rates within a close range to its own rates can be attributed to a number of factors: (i) the discrepancy between the signal sent by the NBR and the banks' own inflationary expectations; (ii) the distortions induced by the required reserve mechanism and by other central bank and banks' internal regulations; (iii) the attractiveness of other banking investments (foreign exchange, government securities, loans); (iv) the volatility and unpredictability of the autonomous factors of liquidity (mainly government deposits and banknotes)<sup>21</sup>; and (v) the banks' insufficient ability to manage their own liquidity.

Concerning the interest rate on time deposits, the econometric analysis confirms 3 of its major determinants: the central bank deposit rate, the required reserve ratio and the interest rate on Treasury certificates issued for households. It seems thus that the banks have been particularly sensitive to the lowering of the interest rates on sterilization operations that the NBR pursued in the last two years. Given that these interest earnings are part of their revenues, the banks responded with cuts in the time deposit interest rates in order to preserve their interest margins and their profits. On the other hand, last year's successive cuts in the required reserve ratio have reduced the banks' associated costs, thus alleviating the downward pressure on the deposit rates. In the stage of the mounting required reserve ratio (throughout 1999), the banks used to transfer these costs to the depositors. As expected, the third factor – the interest rate on the Treasury

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<sup>21</sup> See Chart 6.



certificates issued for households – exerts a considerable direct influence on deposit rates, given the competitive nature of their relationship on the financial investments retail market. Treasury certificates represent – along with the investments in foreign currency – the most important investment alternative to bank deposits.

According to econometric evaluations, the bank-lending rate is determined mainly by the deposit rates and the required reserve ratio. The relevance of the bank deposit rate seems to be an indicator of the particular attention that banks attach to the average cost of funds when setting their lending rates. This seems highly plausible if we consider the prevailing structural liquidity surplus and the absence of central bank funding of commercial banks. As with the deposit rates, the required reserve ratio is a factor in determining credit rates, its latest decline pushing the lending rates in the same direction.

Contrary to theoretical predictions, the econometric tests have not included the NBR rate among the meaningful determinants of the lending rates. This atypical feature can nevertheless be explained by the relatively ambiguous impact of the NBR rates. On the one hand, these rates represent an opportunity cost of bank loans – as these loans are substitutes for commercial banks' investments with the central bank –, which means that the cuts in the NBR rate are not consistently followed by reductions in the lending rates as the banks continue to pursue their profit-maximizing goals. On the other hand, the lending rate indirectly incorporates the influence of the NBR rate through the time deposit interest rate. The latter's decline makes the average cost of funding drop, thus allowing banks to cut their lending rates – although this cut rarely equals the reduction in deposit rates.

## **2.2. Some aspects regarding the transmission of monetary policy impulses to macroeconomic behaviors**

In the Romanian economy, the traditional transmission channels of monetary policy are still in their incipient phase. For a rather long period of time, the most important means of money creation has been the banks' foreign currency purchases from the public and its resale to the central bank. Thus, the access to domestic currency denominated resources was to a large extent conditioned on the holding of foreign currency denominated assets, resulting in an asymmetric allocation of liquidity across the economy.

Even if the relative importance of this specific channel has weakened, it is still generating a great part of the monetary expansion. The sources of the foreign currency offered for sale are still only partially identified (exports, current transfers, direct investment), the assumption being that an important part of it comes from the Romanian workers' foreign remittances which are repatriated in rather informal ways. Under these circumstances, the role of the traditional process of deposit multiplication was considerably diminished. Currently this process is undergoing a slight recovery.

This particular feature of the monetary mechanism also added to the potency of the exchange rate channel, which has influenced in its multiple ways, both direct and indirect, the macroeconomic behaviors. The exchange rate has been in recent years the monetary variable with the fastest and strongest impact on inflation and inflation expectations. Nevertheless, the adoption of a foreign exchange regime favoring the lowering of inflation expectations and the acceleration of disinflation has been restricted in recent years, particularly by the slow pace of the reforms aimed at enhancing the external competitiveness of the Romanian economy. Hence, the managed float exchange rate regime pursued up to date by the NBR. In the last few years, the impact of the exchange rate was significant through: (i) the effects of the changes in the relative prices of goods and services and (ii) the ways in which the changes in this variable have affected the wealth of the private sector as well as its debts, along with those of the public sector. At the same time, the expectations component of the exchange rate has had a major impact on the economic agents' decisions, the automatic indexation of numerous prices in the economy based on that variable becoming a widespread procedure.

According to empirical observations, it appears that in the last year the exchange rate pass-through has witnessed a slight modification, as the direct influence of the exchange rate has come to prevail over that of inflation expectations (see Chart 7). For that reason, among others, the NBR has informally changed the exchange rate benchmark of the ROL, preferring an EUR/USD basket to the sole use of the US currency. It is worth mentioning that, due to several factors – including the massive interventions in the forex market – the traditional short-term correlation between the interest rate and the exchange rate is yet to be emphasized on the Romanian market.

The credit channel and, implicitly, the interest rate channel have been almost inactive, due to both supply and demand factors. On the demand side, the tightness of monetary policy in response to the high and volatile inflation placed the interest rates near prohibitive levels for the general public, while the widespread lack of financial discipline allowed economic agents to use arrears as an alternative to bank loans.

On the supply side, the general economic instability and the slow pace of real sector reforms induced a highly prudent and risk averse attitude on the part of commercial banks. This behavior was enhanced by the banks' limited capacity and experience in contract enforcement and debt collection (a large stock of bad debt had already been accumulated before this prudent approach was adopted). As a result, banks displayed an increased reluctance to extend loans. This behavior was possible owing to the profit opportunities from foreign exchange market speculations (until the middle of 1999) and especially from the low risk – high return combination secured by the NBR and Treasury instruments<sup>22</sup>. The banks' investments in these two types of instruments amounted in the 1999-2000 period to about 21 percent of their total portfolio of domestic assets (see Chart 8). Including the banks' reserves deposited with the central bank, these investments

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<sup>22</sup> Until the middle of 2000, government securities were offering higher yields than non-government loans.

represented as much as 39-42 percent of total assets. Under these circumstances, non-government credit accounted for only about 39 percent of the banks' domestic assets (see Chart 9).

Lending was partially revived beginning with the second half of 2000 and especially in 2001. In that latter year, non-government credit denominated in ROL grew 20 percent in real terms and 9.7 percent in the first nine months of 2002. However, the functionality of the credit channel remains restricted.

The functioning of the credit channel of the MTM is constrained by at least one of the two conditions identified by the literature<sup>23</sup>. Regarding the condition that a significant number of firms should be dependent on bank financing, the picture of the Romanian economy seems rather clear. One could say that in the last two years the dependence of some companies on bank credit has increased as a result of the relative hardening of budget constraints for a number of them (a relative reduction of arrears in some sectors). At the same time, the newly formed small- and medium-size firms – on the background of macrostabilisation progress and enhanced credibility of economic policies – are also contingent on bank credit. Furthermore, given the existing restrictions on capital movement and the poor rating of Romanian companies in general, only a few big firms – of which some benefiting from governmental guarantees – have succeeded in raising funds from the international capital markets, either by issuing bonds or applying for syndicated loans. Also, the issues of domestic non-government debt securities are almost nonexistent<sup>24</sup>. In addition, the alternative financing through leasing companies offers relatively similar conditions to those on the credit market because the majority of such companies is owned and therefore financed by banks. All this pleads for the credit channel. As for households, taking on consumption credit is still a rather new and not very widespread behavior due to the lack of the specific culture, but also due to the relatively small number of people who can actually afford to pay the high interest rates. The general public continues thus to be a net supplier of funds to the banking system (see Chart 10)<sup>25</sup>.

The existence of the credit channel appears to be constrained, however, by the failure to fully comply with the second condition, namely that banks should be dependent on deposits that are subject to the regulations on required reserves. Even though both the domestic currency and the foreign currency denominated liabilities are subject to reserve requirements, given the structural surplus of liquidity in the system, the dependence of banks on such deposits is considerably diminished.

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<sup>23</sup> See, for example, Morris and Sellon, Jr. (1995).

<sup>24</sup> So far, only one leasing company and one construction company have successfully issued bonds on the domestic capital market, but the volume of financing thus raised was very small.

<sup>25</sup> Although their volume is still small, personal loans have grown in the last two years (+3.2 percent in real terms in 2000, +44.1 percent in 2001 and +103.9 percent in September 2002). The significant growth has characterized both the loans offered through bank cards (either credit cards or debit cards with an overdraft facility) and the loans offered for the purchase of durable goods or the construction/purchase of real estate (houses).

If prior to the 1997-1999 interval this condition was limited by the fact that the most important banks (state owned) were free of any hard budget constraints<sup>26</sup>, beginning with 1997, those limitations were shifted to the structural liquidity surplus. This surplus impairs considerably the functionality of the credit channel, the supply of bank loans depending to a large extent on the volume and nature of demand and also on the banks' ability to assess that demand. As bank loans are a substitute for central bank deposits, the impact of the NBR's liquidity management on the supply of loans is in effect limited<sup>27</sup>. Hence, the greatest influence on the banks' behavior seems to come from the changes in the NBR deposit interest rate. It is therefore more probable that the increase in loans from 2000 up to date has been less the result of the successive reductions (starting July 2001) of the reserve requirements rate, which did nothing but to boost redundant liquidity in the system. It was rather the reduced risk of crediting the real economy<sup>28</sup> and the decreasing profits from their alternative investments<sup>29</sup> that made banks turn their attention towards such investments. From this point of view, the transmission mechanism of the NBR's monetary policy cannot rely on an effective lending channel.

Even in the absence of the structural liquidity surplus, the lending channel would have been distorted, on the one hand by the moral hazard stemming from the fact that commercial banks continue to grant loans to state-owned companies, of which some hold explicit or implicit guarantees from the government. On the other hand, the banks have a certain capability in substituting foreign currency denominated loans for loans in national currency.

The role played by the interest rate in the transmission mechanism of monetary policy has changed simultaneously with the revival of bank credit. Prior to this revival, the balance sheet effect of the interest rate was predominant. The size and even the direction of this impact on borrowers is difficult to estimate considering that over the entire 1997 - first half of 2000 period inflation has been high and volatile and the (*ex post*) real interest rates have fluctuated between negative and strongly positive levels. The interest rate elasticity of the demand for loans was almost null and the interest rates themselves were relatively rigid thanks to the increased macroeconomic instability, the high (and adaptive) inflation expectations, as well as the attractive and risk free alternatives offered to banks by the NBR and Treasury investments. Both the demand for and the supply of loans were also affected to a great extent by moral hazard, with the latter being exposed until 1999 to adverse selection as well. Bank deposits, in their turn, exhibited the same reduced interest elasticity both due to the low level of income<sup>30</sup> and the very limited spectrum of financial investment alternatives. Under these circumstances, the negative real interest rates favored the erosion to inflation of the investments made in national currency.

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<sup>26</sup> The practice of directed credits granted to some sectors of the economy has been discontinued since 1997.

<sup>27</sup> The impact of monetary policy could depend however on the unequal distribution of the liquidity surplus, the small banks with low surplus being the most affected.

<sup>28</sup> This period was one of an improving macroeconomic environment through the accelerated disinflation and the reversal of the economic decline.

<sup>29</sup> The interest rates on NBR deposits and government securities began falling consistently in this period.

<sup>30</sup> At low levels of income, the propensity to save is more sensitive to the income and wealth effects than to the interest rate effects.

In periods of strong depreciation of the ROL against the US dollar, however, the negative real interest rates generated a more substantial substitution of the domestic currency with the foreign currency investments.

As opposed to the traditional approach, it seems that in the Romanian economy the interest rate channel is currently working through the nominal rather than the real level of the interest rate. The demand for loans seems to have developed some sensitivity to the downward movements of the nominal rate and banks have become more eager to grant loans after the nominal interest rate decline reached a certain threshold (along with the reduction of the adverse selection risk). This is the conclusion we can draw from the last two years' simultaneous surge of the volume of domestic currency credit and the relative rise of (*ex-post*) real interest rates (see Chart 11) – against the backdrop of a relatively accelerating disinflation. This sensitivity could in turn be explained, on the one hand, by a slight improvement in the credibility of economic policies meant to improve macroeconomic conditions and, on the other hand, by the persistently slower adjustment of inflation expectations in comparison with the actual process of disinflation. It is thus possible that the backward-looking nature of expectations – owing to the long experience with high and volatile inflation in our economy – has made the real interest rate channel less relevant<sup>31</sup>. Irrespective of the nominal or the real level of interest rates, the channel's effectiveness is reduced by the substitution phenomenon between the domestic currency and the foreign currency denominated loans, with the latter's costs falling due to the real appreciation of the ROL against both the US dollar and the euro (in 2001). As to the bank depositors, they continue to exhibit a low sensitivity towards the real interest rates.

The recovering trend of the credit and the interest rate channels has also improved the balance sheet channel, which in turn has also sustained the mentioned trend. Given the variable nature of bank interest rates, their decline in the last period has reduced borrowers' debts and has improved their cash-flow. The anticipation of the further decrease of interest rates in line with the expected pace of disinflation has stimulated the demand for loans as well as the banks' availability to grant them. Moreover, the interest rate elasticity of the demand for loans has increased.

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<sup>31</sup> A similar conclusion was formulated by Raoul Lattēmae (2001) with regard to the Estonian monetary transmission mechanism.

## CONCLUSIONS

The main conclusions supported by the present study – the first to attempt a thorough investigation of the monetary transmission mechanism in Romania – are the following:

1. The monetary transmission mechanism of the NBR is the outcome of the combined effect of, on the one hand, the general characteristics of the economy (size, openness) and, on the other hand, the pace and depth of structural and institutional reforms and of macro stabilization over the transition period.
2. This combination of factors has constrained the monetary policy strategy and its operational framework, which are decisive for the effectiveness of monetary policy. Both of them have been in permanent adjustment to the concrete conditions of their implementation.
3. The monetary control and the quantitative variables have lost some of their relevance for the monetary transmission mechanism. The role of the sterilization interest rates has become more important, including their capacity to signal the orientation of monetary policy.
4. The NBR interest rate has a direct influence on the time deposit interest rate. On the other hand, the NBR interest rate is not that relevant for the lending rate which is better explained by the time deposit rate. Both of the financial retail prices are however significantly determined by the required reserve ratio.
5. In recent years, the exchange rate and the NBR's purchases of foreign currency have represented the most important channel of the central bank's influence on the macroeconomic behaviors.
6. The traditional transmission channels of the monetary policy are still in an incipient stage of development. The recovery has begun in 2000, with the ceasing of bank disintermediation.
7. Although also recovering, the credit channel continues to be undermined by the existence of the system's structural excess liquidity, by the substitution of the domestic currency loans by those denominated in foreign currency and by moral hazard.
8. The real interest rate channel is less relevant for the Romanian economy. The nominal interest rate, on the other hand, has a greater influence on banks and macroeconomic behaviors.
9. The distorted nature of some of the transmission channels and the lack of effectiveness of others has constrained the monetary policy's inflation-curbing actions. The effectiveness of monetary policy has also been undermined by the structural origins of inflation.

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## **Appendix**

### **ECONOMETRIC MODELING OF THE TRANSMISSION MECHANISM OF MONETARY POLICY**

In this section, we propose an econometric analysis of the transmission mechanism presented in the body of the paper. Given the reasons outlined in the text, we confine our analysis mainly to the equilibrium relationships between the main interest rates of the Romanian banking system and the NBR's ability to influence them. The variables considered here – measured on a monthly basis – are the average interest rate of inter-bank operations, excluding the NBR's interventions (denoted as ITBKWCB), the average rate on time deposits (NBDEP), the short-term lending rate (STLEND) and the interest rate on Treasury certificates issued to households (TCERT). As monetary policy instruments, we list the average interest rate on NBR sterilization operations (RBNR hereinafter), the reserve requirements ratio (RMO) and the average deviation of reserves from those required by the RR mechanism of the NBR (CTCRT<sup>32</sup>).

Given our expectations regarding the endogeneity of interest rates and the fact that their paths are likely to comprise stochastic trends, the methodology used here is based on cointegration/error correction analysis in a multivariate framework. In this sense, we draw on the schematic representation of the transmission mechanism and the methodology presented in Johansen and Juselius (2001). A similar approach is also used in Juselius and Gennari (1999) and Juselius and Toro (1999). According to the latter, “the cointegration property is invariant to the changes in the information set”, so that we can use such an analysis for the restricted version of the transmission mechanism without the fear that the results would be dramatically changed in a full version of that mechanism.

Unfortunately, the results presented herein can be viewed as biased due to the very short sample (32 observations) we were able to construct<sup>33</sup>. The small sample hinders us from working with longer lags and more elaborated models, as well as from obtaining reliable parameter estimates given that their distribution may not correspond to the asymptotic distributions used in standard hypothesis testing. We attempt to circumvent this problem by increasing the frequency of the

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<sup>32</sup> The reserves' deviation is measured as a percentage of the RR consistent level in order to make it comparable with the interest rate variables.

<sup>33</sup> The reasons for shortening the sample to the October 1999 - May 2002 period are laid out in Footnote No. 2 in the body of the paper.

data to daily observations<sup>34</sup>. However, this introduces two other problems. Besides the fact that data is only available for inter-bank interest rates (ITBKWCB and RBNR) and the banking system's reserves with the NBR (CTCRT), the available data is very volatile as well. In econometrics this translates into heteroskedastic disturbances, which is confirmed by the significant ARCH effect detected in the univariate regression of daily inter-bank interest rates (see below). Finally, due to the short period covered both by the monthly and the daily samples and especially to the frequent changes within the operational framework of monetary policy in Romania, the results presented herein cannot be used for proper inference without analyzing the future impact of such changes<sup>35</sup>.

Having in mind these necessary precautions, we proceed with the cointegration analysis of the monthly data. As a first step, we check each series individually for its stochastic property of stationarity versus unit roots. The results of the Augmented Dickey-Fuller (ADF) tests with 2 lags (which is the maximum lag length we can afford for our VAR model), an intercept but no deterministic time trend – as we have reasons to believe the interest rates would never reach the 0 percent level, nor is a deterministic time trend relevant for such a short period of time – indicate that, at the 5 percent threshold of significance, all variables prove to be I(1), with the exception of NBDEP and STLEND which pose as I(2). The Phillips-Perron tests generally enforce the ADF test results, but in the case of the deposit rate and the short-term lending rate, the test statistics indicate a successful rejection of I(2) at 1 percent, so the 2 series are deemed as I(1).

Given the results of the unit root tests, we build our vector autoregressive model in search of a stationary combination of the following variables: STLEND, NBDEP, ITBKWCB, RBNR, RMO, TCERT. Due to the mentioned parsimony of data and to the fact that we do not expect too many lags to be significant in the transmission of interest rate signals within the banking system, we choose a VAR representation with only 1 lag. The results of the multivariate residual tests of this representation give good results: the residuals appear to be normally distributed according to the Jarque-Bera multivariate test (p-value associated with the test statistic is equal to 0.1633), homoskedastic (p-value of 0.2526) and serially uncorrelated of the orders one and two (p-values of 0.3630 and 0.1924 for the LM tests with 1 and 2 lags respectively)<sup>36</sup>. Furthermore, the roots of the characteristic polynomial are all within the unit circle, thus ensuring the stability of the system.

The results of the cointegration tests - both the trace test and the maximum eigenvalue test – are reported below. Given that the VAR in levels was specified with 1 lag and that the nature of the cointegration tests involve an equation with differenced data (see Johansen and Juselius (1994)

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<sup>34</sup> The daily sample covers the overlapping period of January 1, 2000 - June 28, 2002.

<sup>35</sup> For example, the market behaviour of commercial banks is very likely to change as a result of new reserve requirements regulations – see Footnote 14 in the body of the paper.

<sup>36</sup> The LM test statistic is borderline significant for 3 lags, but the significant loss of degrees of freedom hinders us from including that many lags.

for a formal analysis), we use zero lags in the specification of the test regression. Although this might involve some implausible conclusions for the error correction model, we stick to this parsimonious model, noting however that the cointegration results of the trace test are generally robust to the inclusion of further lags.

**Table 1. The results of the cointegration tests of the model with monthly data**

Trend assumption: No deterministic trend (restricted constant)				
Lags interval (in first differences): No lags				
		Trace test		
Hypothesized		Test	5 Percent	1 Percent
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value
None **	0.904049	192.0543	102.14	111.01
At most 1 **	0.823405	119.3930	76.07	84.45
At most 2 **	0.627967	65.64231	53.12	60.16
At most 3 *	0.447178	34.99035	34.91	41.07
At most 4	0.372669	16.61604	19.96	24.60
Maximum eigenvalue test				
None **	0.904049	72.66132	40.30	46.82
At most 1 **	0.823405	53.75071	34.40	39.79
At most 2 *	0.627967	30.65196	28.14	33.24
At most 3	0.447178	18.37431	22.00	26.81

\*(\*\*) denotes rejection of the hypothesis at the 5%(1%) level

As shown in Table 1, the trace test denotes the existence of 3 cointegrating relationships at the 1 percent significance level and 4 at the 5 percent significance level, whereas the max eigenvalue test accepts the null of 2 cointegrating relationships at 1 percent and 3 at 5 percent. The interpretation of these results is that the system of the 6 variables in model 1 has at least two attractors (stationary combinations), which is consistent with the assumption that interest rates move along the same lines in the medium- and long-term. In order to be able to test simultaneously the influence of central bank instruments (RBNR, RMO) on the other three relevant financial variables – namely ITBKWCB, NBDEP and STLEND – we restrict the system to 3 cointegrating relations, which is also what the 1 percent trace test and the 5 percent max eigenvalue test indicate.

Before imposing our restrictions on the whole system, however, we check the pairwise cointegration properties by testing restrictions on a single vector and leaving the other vectors unrestricted (see Johansen and Juselius, 2001):

**Table 2. Testing pairwise cointegration hypotheses on single vectors**

Hypothesis	STLEND	NBDEP	ITBKWCB	RBNR	RMO	TCERT	Test statistic ( $\chi^2$ )	Probability
H <sub>1</sub>	1	-1.17	0	0	0	0	1.498552	<b>0.472709</b>
H <sub>2</sub>	1	0	-0.73	0	0	0	4.620123	0.099255
H <sub>3</sub>	1	0	0	-0.62	0	0	6.509015	0.038600
H <sub>4</sub>	1	0	0	0	-1.33	0	0.075600	<b>0.962905</b>
H <sub>5</sub>	1	0	0	0	0	-0.55	8.459372	0.014557
H <sub>6</sub>	0	1	-0.55	0	0	0	2.578533	<b>0.275473</b>
H <sub>7</sub>	0	1	0	-0.57	0	0	1.892354	<b>0.388222</b>
H <sub>8</sub>	0	1	0	0	-1.18	0	0.096354	<b>0.952965</b>
H <sub>9</sub>	0	1	0	0	0	-0.54	0.921324	<b>0.630866</b>
H <sub>10</sub>	0	0	1	-0.96	0	0	3.787825	<b>0.150482</b>
H <sub>11</sub>	0	0	1	0	-1.95	0	0.388437	<b>0.823478</b>
H <sub>12</sub>	0	0	1	0	0	-0.76	6.821810	0.033011
H <sub>13</sub>	1	0	0	-1	0	0	10.08254	0.017877
H <sub>14</sub>	0	1	0	-1	0	0	9.956456	0.018940
H <sub>15</sub>	0	0	1	-1	0	0	3.883690	<b>0.274300</b>

The results of testing H<sub>1</sub> – H<sub>15</sub> show that the short-term lending rate cointegrates with the time deposit rate and the required reserve ratio; the time deposit rate cointegrates with the inter-bank rate, the NBR sterilization rate, the RR rate and the Treasury certificates rate, while the inter-bank rate cointegrates with the NBR rate (also, for these two variables a 1 to 1 relationship could not be rejected as in the case of H<sub>13</sub> and H<sub>14</sub>). Next, we proceed by restricting all three cointegrating vectors simultaneously. In each equilibrium relationship we assume that the bank rate (STLEND, NBDEP and ITBKWCB) is the determined variable (it has the normalized coefficients) and we impose zero restrictions based on the results in Table 2. In order to ensure economically plausible identities and to avoid the effects of multicollinearity, we purge the inter-bank rate from the specification of the cointegrating vector determining the deposit rate and the RR rate from the inter-bank rate-normalized cointegration vector. The restricted cointegrating relationships and the adjustment coefficients of the error-correction model are presented in Table 3.

**Table 3. Testing identifying restrictions on the cointegrating relations**

LR test for binding restrictions (rank =3):				Chi-square(3)	3.791098		
				Probability	<b>0.284923</b>		
Cointegrating restrictions	CointEq1 (1)	CointEq2 (2)	CointEq3 (3)	Error correction	Adjustment coefficients ( $\alpha$ )		
				Dependent var.	CointEq1	CointEq2	CointEq3
STLEND(-1)	0.0000	0.0000	<b>1.0000</b>	D(STLEND)	<b>0.1471</b>	<b>-0.3940</b>	-0.0860
NBDEP(-1)	0.0000	<b>1.0000</b>	<b>-0.5377</b> (0.02395) [-22.4544]		(0.0688)	(0.0937)	(0.1014)
					[ 2.1365]	[-4.2040]	[-0.8475]
ITBKWCB(-1)	<b>1.0000</b>	0.0000	0.0000	D(NBDEP)	0.0715	<b>-0.4618</b>	-0.0338
					(0.0465)	(0.0633)	(0.0685)
RBNR(-1)	<b>-0.9569</b> (0.0514) [-18.6059]	<b>-0.4040</b> (0.0413) [-9.7770]	0.0000		[ 1.5370]	[-7.2985]	[-0.4936]
				D(ITBKWCB)	<b>-1.1239</b>	0.3301	<b>1.5115</b>
RMO(-1)	0.0000	<b>0.7431</b> (0.0874) [ 8.4997]	<b>-0.6270</b> (0.0594) [-10.5614]		(0.1539)	(0.2095)	(0.2267)
					[-7.3035]	[ 1.5760]	[ 6.6663]
TCERT(-1)	0.0000	<b>-0.5235</b> (0.0335) [-15.6207]	0.0000	D(RBNR)	<b>-1.2608</b>	<b>0.9421</b>	<b>1.0442</b>
					(0.1833)	(0.2495)	(0.2700)
C	0.0121 (0.0225) [ 0.5370]	<b>-0.1497</b> (0.0246) [-6.0904]	<b>-0.1215</b> (0.0182) [-6.6844]		[-6.8798]	[ 3.7766]	[ 3.8673]
				D(RMO)	-0.0664	<b>-0.1605</b>	<b>0.6370</b>
					(0.0462)	(0.0629)	(0.0680)
					[-1.4381]	[-2.5536]	[ 9.3598]
				D(TCERT)	-0.0714	<b>-0.4255</b>	<b>0.2489</b>
					(0.0769)	(0.1047)	(0.1133)
					[-0.9285]	[-4.0690]	[ 2.1971]

Note: Standard errors in ( ) & t-statistics in [ ]

As set out in Table 3, the restrictions imposed on the three cointegrating vectors could not be rejected, the p-value associated with the  $\chi^2$  statistic exceeding by far even the 10 percent threshold. Also, the error correction model seems to be well specified, since the multivariate tests for heteroskedasticity, first and second-order autocorrelation and non-normal distribution are rejected at the conventional levels. The VEC model leaves in the system characteristic roots which are much smaller than one (the largest is 0.7236), allowing us to ignore the possible I(2) effects detected in the univariate ADF tests. Finally, weak exogeneity is rejected for each of the six variables.

According to cointegrating equation (1) (column two of Table 3), the interest rate on the inter-bank market has moved almost in a one-to-one relationship with the NBR sterilization rate, which is also confirmed by the failure to reject the homogeneity hypothesis  $H_{15}$  (see Table 2, last row). The error correction equation shows that the inter-bank interest rate adjusts significantly to this relationship. Any deviation from the equilibrium described by (1) – say a higher interest rate

than would imply the parity with the RBNR – is followed by an opposite movement – in our example, a decrease – of the inter-bank rate within the next period. The NBR interest rate, however, does not adjust accordingly. On the contrary, its error correction coefficient implies that once the inter-bank rate deviates from (1), the NBR rate moves in the opposite direction to that deviation. The explanation may lie with the structure of the money market, where the dominant position of the bank deposits with the NBR implies a kind of leader-follower relationship. In that case, the NBR rate pulls the inter-bank rate after itself.

The second cointegrating relationship (Cointeq2 in Table 3) describes the deposit rate as being determined positively by the NBR rate and the Treasury certificates rate and negatively by the RR rate. The burden of adjustment to this equilibrium relationship (according to the adjustment speed coefficients in column Cointeq2 of the Error correction part of Table 3) is carried by all 4 variables involved, however the Treasury certificates' yield seems to pull away from this equilibrium. On the other hand, the short term lending rate adjusts itself the same way the deposit rate does, although with a slightly smaller coefficient. The greatest adjustment, however, is made by the central bank interest rate, which follows almost perfectly the movements of the other variables towards the new steady state.

The third cointegrating relationship explains the short-term lending rates based on the time deposit rate and the RR rate. As stated above, the pairwise cointegration between the short-term lending rate and the NBR rate is rejected at the 5 percent significance level (see  $H_3$  in Table 2). On the other hand, the lending rate and the deposit rate are not adjusting significantly to this relationship, but all other variables in the system are (based on the unrestricted adjustment coefficients). Restricting the  $\alpha$  matrix of adjustment coefficients causes rejections in all cases except when the RR rate (RMO) and/or the Treasury rate (TCERT) are restricted. In those cases the coefficients on the deposit rate and the lending rate become significant, however the latter has the wrong sign<sup>37</sup>.

Notice that in the above model we have excluded an important variable that the central bank influences in its monetary policy actions, namely the liquidity conditions variable measured by the banks' current account deviation from the required reserves (or excess reserves, denoted as CTCRT). We have done so in order not to burden the already too large model (compared to our short sample) and because this variable was proved to be stationary in the monthly sample. Instead, we enhance our sample by considering daily observations and verifying the significance of this monetary control variable for the changes in the inter-bank interest rate level.

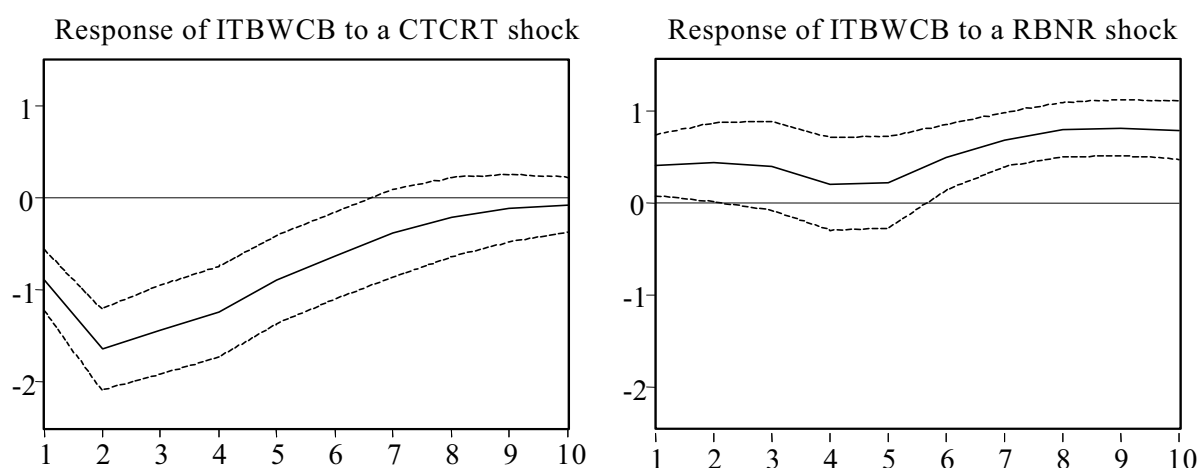
The first step is again to check for the unit root property. As was the case with the monthly data, the excess reserves variable poses as stationary. On the other hand, the daily inter-bank rate seems to be also stationary at conventional significance levels, both by the Augmented Dickey Fuller (with as large a number of lags as 15) and the Phillips-Perron tests. As for the NBR rate,

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<sup>37</sup> This could be interpreted – if we consider the downward bias of interest rates inherent in the period considered – as the “reluctance” of short-term lending rates to follow the cuts in the time deposit rates.

for lags larger than 3, the unit root hypothesis cannot be rejected. For illustration purposes, however, we include RBNR along with the other two variables in a VAR model with 5 lags<sup>38</sup> specified in levels. Given that the mutual influences between the contemporary values of the current account deviation and the NBR deposit rate are not significant restrictions (which is also confirmed by a pairwise correlation coefficient of 4.25 percent), we impose a structure to the model such that the inter-bank rate is influenced by RBNR and CTCRT, but all other influences are restricted to be 0. The reported Chi-square statistic for the LR test of over-identifying restrictions is 0.1811, with a p-value of 0.6704. Therefore, the restrictions on the contemporary relationships are shown to be valid. The estimated coefficients have the expected signs (positive on RBNR and negative on CTCRT), however the diagnostic tests of the model detect both heteroskedasticity (also in the autoregressive conditional form) and non-normally distributed residuals, whereas first-order autocorrelation is only borderline rejected at 5 percent. Given the possible misspecification of the model, the impulse response function and the variance decomposition presented below are only illustrative:

**Graph 1. Response of ITBKWCB to Structural One S.D. Innovations  $\pm 2$  S.E.**



As shown in Graph 1, the impact of the shocks in excess reserves seems to be more significant in the short-run, whereas the NBR rate influences the inter-bank rate in the longer run. This conclusion is confirmed by the variance decomposition of the forecast errors:

<sup>38</sup> Based on the FPE, AIC and HQ lag order selection criteria.

**Table 4. Variance decomposition of ITBKWCB forecast error**

Period	S.E.	Contribution of (%):		
		ITBKWCB Shock	RBNR Shock	CTCRT Shock
1	4.236732	94.61675	0.906253	4.476992
2	5.652936	87.88066	1.102842	11.01650
3	6.239273	84.31308	1.309573	14.37735
4	6.535656	81.99099	1.288043	16.72097
5	6.655433	80.73004	1.346066	17.92389
6	6.777991	80.02713	1.816650	18.15622
7	6.917399	79.54205	2.708131	17.74982
8	7.054982	78.98235	3.861968	17.15568
9	7.182896	78.41221	5.012033	16.57576
10	7.289466	77.86839	6.023779	16.10783
11	7.384533	77.26010	7.016648	15.72325
12	7.475082	76.56678	8.014123	15.41910
13	7.562044	75.78637	9.012291	15.20134
14	7.645596	74.94524	10.00920	15.04556
15	7.723947	74.10363	10.98482	14.91155

Our attempts to improve the stochastic properties of the model by increasing the number of lags, by specifying variables in logs or even by controlling for the interest rate outliers were generally unsuccessful. We could only control for the heteroskedasticity problem by specifying a univariate ARCH model. A considerable improvement is achieved however by restricting the sample to those days in which the central bank intervened in the money market and specifying an EGARCH type of model (see Table 5 below), as suggested by Perez-Quiros and Rodriguez (2000). The diagnostic tests for the residuals of this model display all the right properties, so that the standard test statistics are applicable. The results in Table 5 reinforce the conclusions from the VAR analysis, namely that contemporaneous levels of the NBR rate and the excess reserves are significant in determining the inter-bank rate, with higher lags of the former and lower lags of the latter being also significant. As expected, the relationship between the sterilization rate and the inter-bank rate is stronger than in the specification including non-intervention days, given that in such days the change of the inter-bank market rate was not conditioned by any movement in the NBR rate.



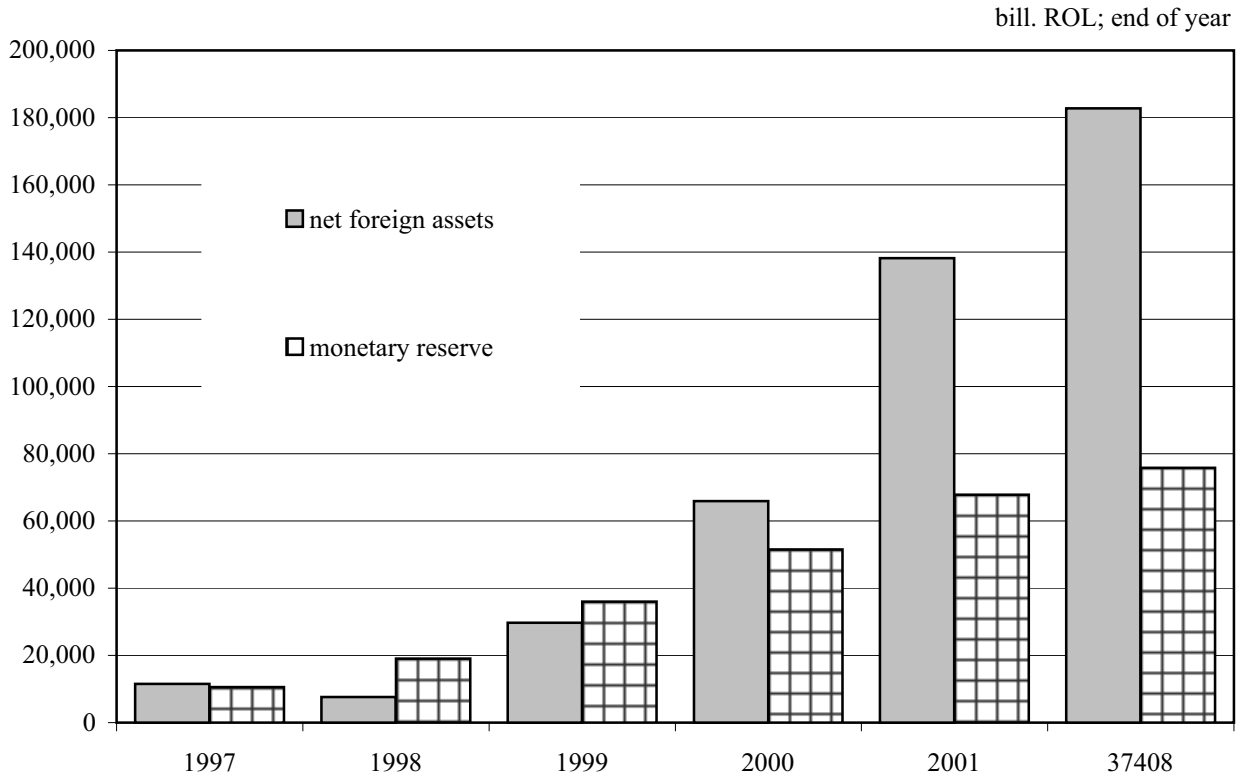
**Table 5. An EGARCH specification for the inter-bank rate equation**

Dependent Variable: ITBKWCB				
Method: ML – ARCH (Marquardt)				
Sample (adjusted): 4 414				
Independent variables	Coefficient	Std. Error	z-Statistic	Prob.
Constant	17.53689	3.469759	5.054209	0.0000
RBNR	0.473104	0.037487	12.62054	0.0000
CTCRT	-0.101477	0.027112	-3.742898	0.0002
ITBKWCB(-1)	0.589760	0.038161	15.45473	0.0000
ITBKWCB(-3)	0.160067	0.037906	4.222760	0.0000
CTCRT(-1)	-0.084072	0.034710	-2.422119	0.0154
RBNR(-3)	-0.217790	0.048896	-4.454163	0.0000
Variance Equation				
Constant	0.171140	0.119463	1.432576	0.1520
RES /SQR[GARCH](1)	0.394079	0.080289	4.908277	0.0000
RES/SQR[GARCH](1)	-0.235448	0.054365	-4.330886	0.0000
EGARCH(1)	0.808502	0.052029	15.53954	0.0000
R-squared	0.827649	Mean dependent var		34.93020
Adjusted R-squared	0.823340	S.D. dependent var		9.100356
S.E. of regression	3.824965	Akaike info criterion		5.377769
Sum squared resid	5852.144	Schwarz criterion		5.485323
Log likelihood	-1094.132	F-statistic		192.0842
Durbin-Watson stat	2.078420	Prob (F-statistic)		0.000000

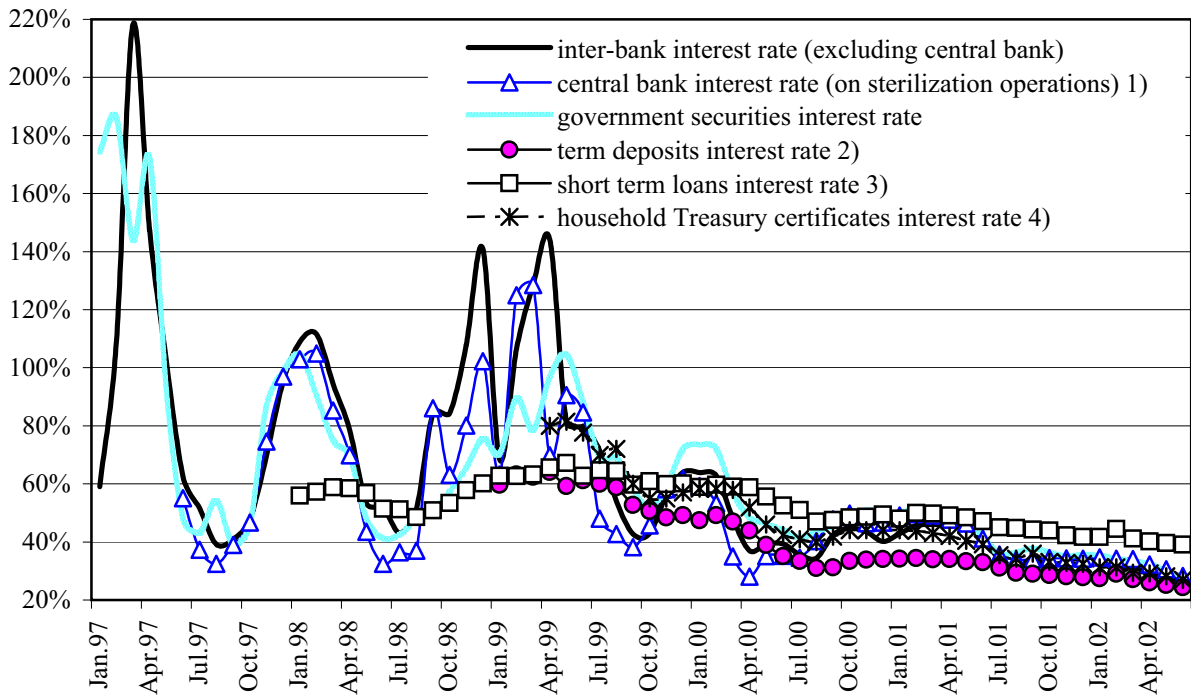
Regarding the above model, we should mention the loss of informational efficiency related to the exclusion of non-intervention days. Accordingly, the results of this model should be enhanced by further research involving other, more appropriate methods of analyzing high-frequency data.



**Chart 1. Monetary Base and Net Foreign Assets**

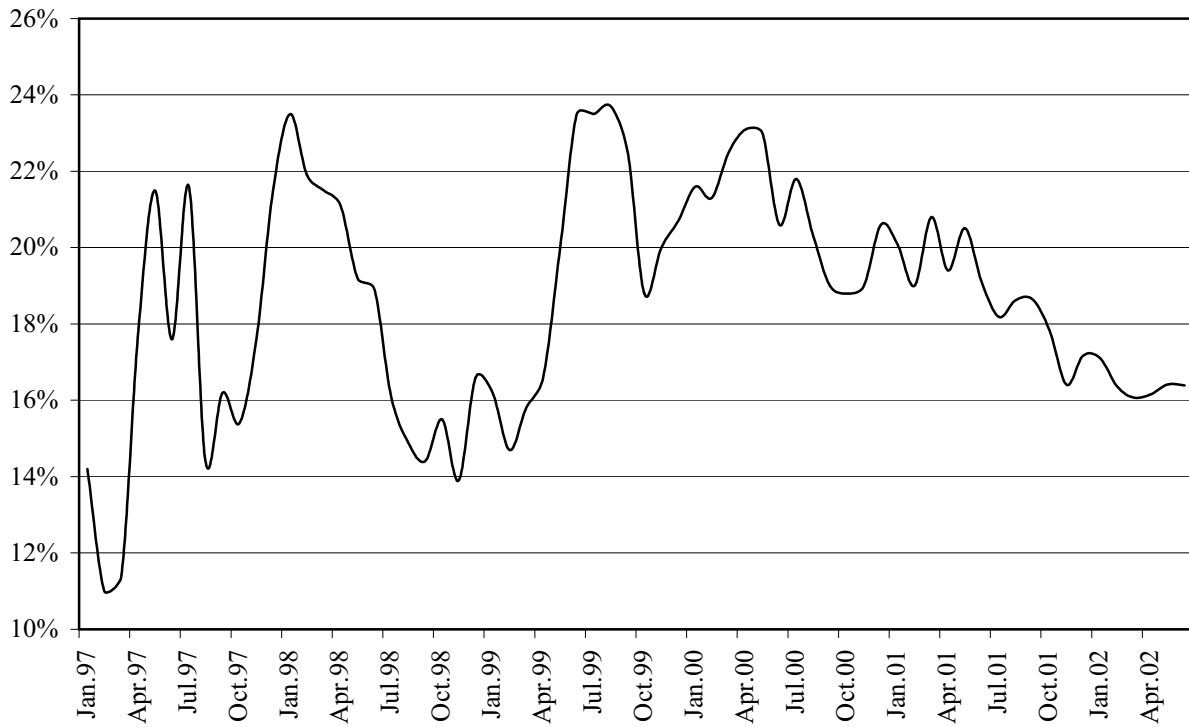


**Chart 2. Main Categories of Interest Rates**

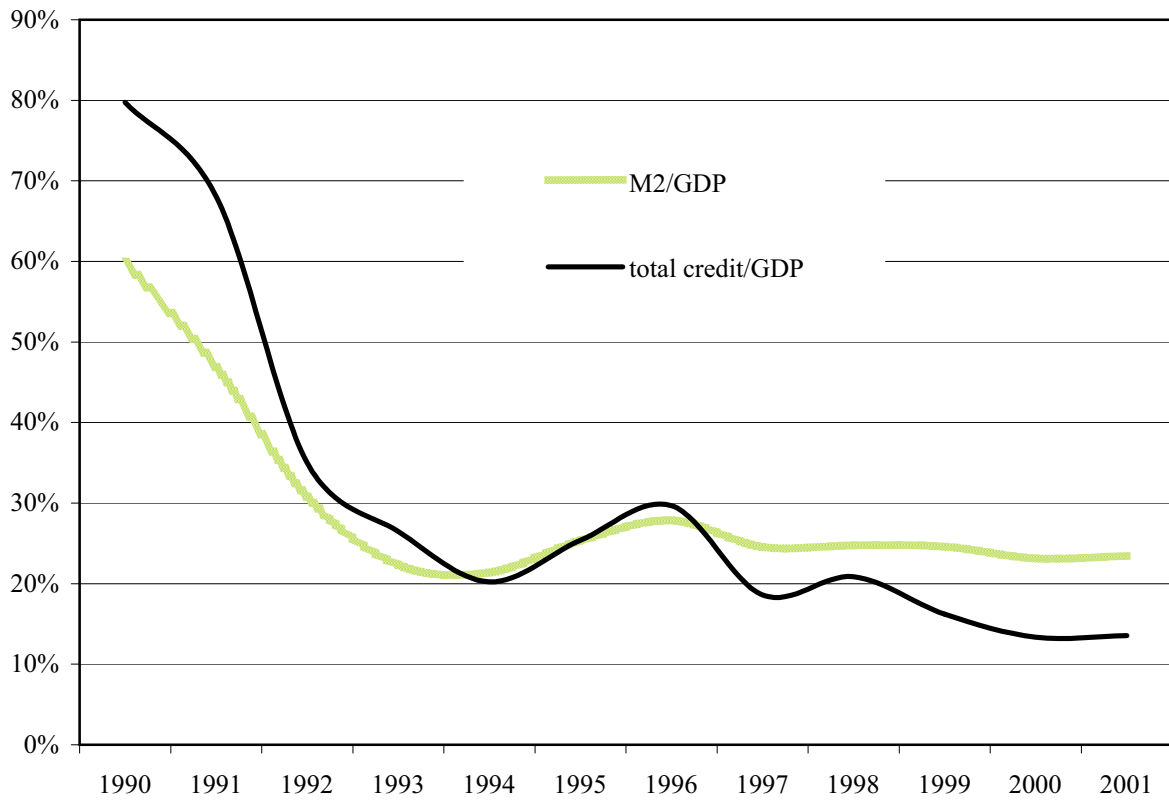


1) Starting in June 1997. 2) Available starting January 1999.  
 3) Available starting January 1998. 4) Issued starting April 1999.

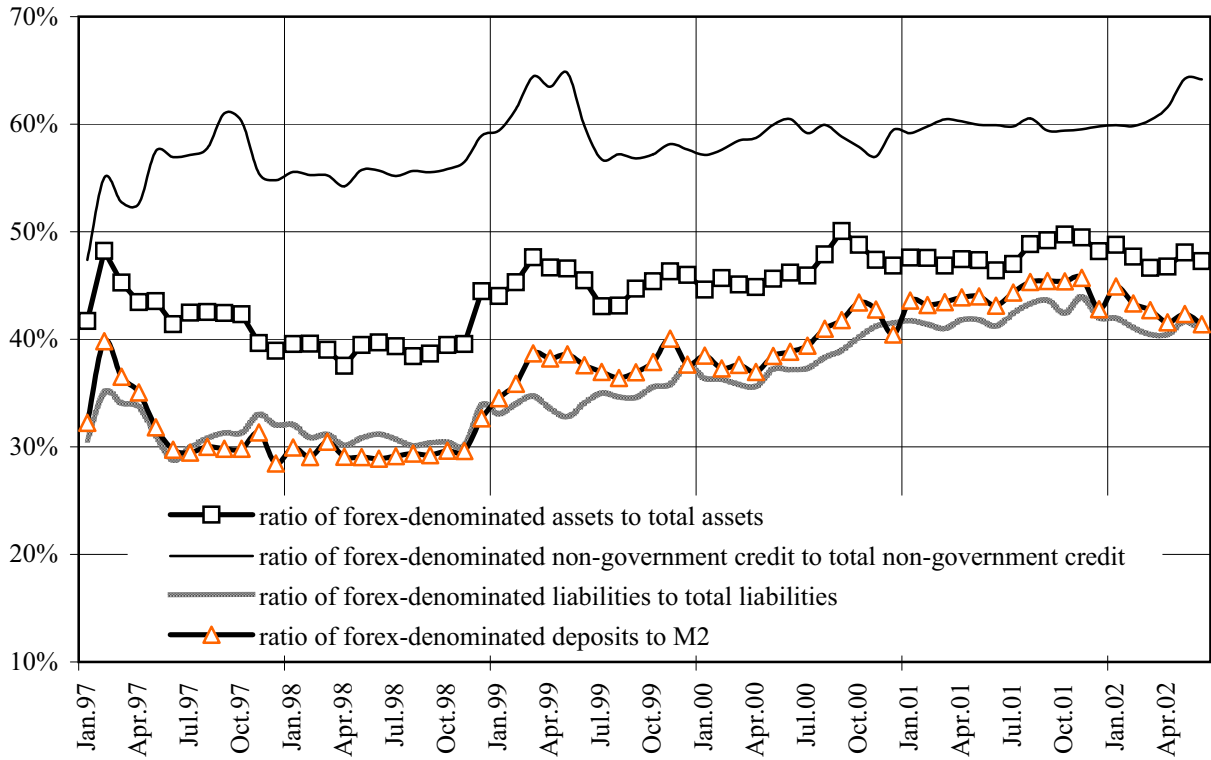
**Chart 3. Spread Between Lending and Deposit Rates**



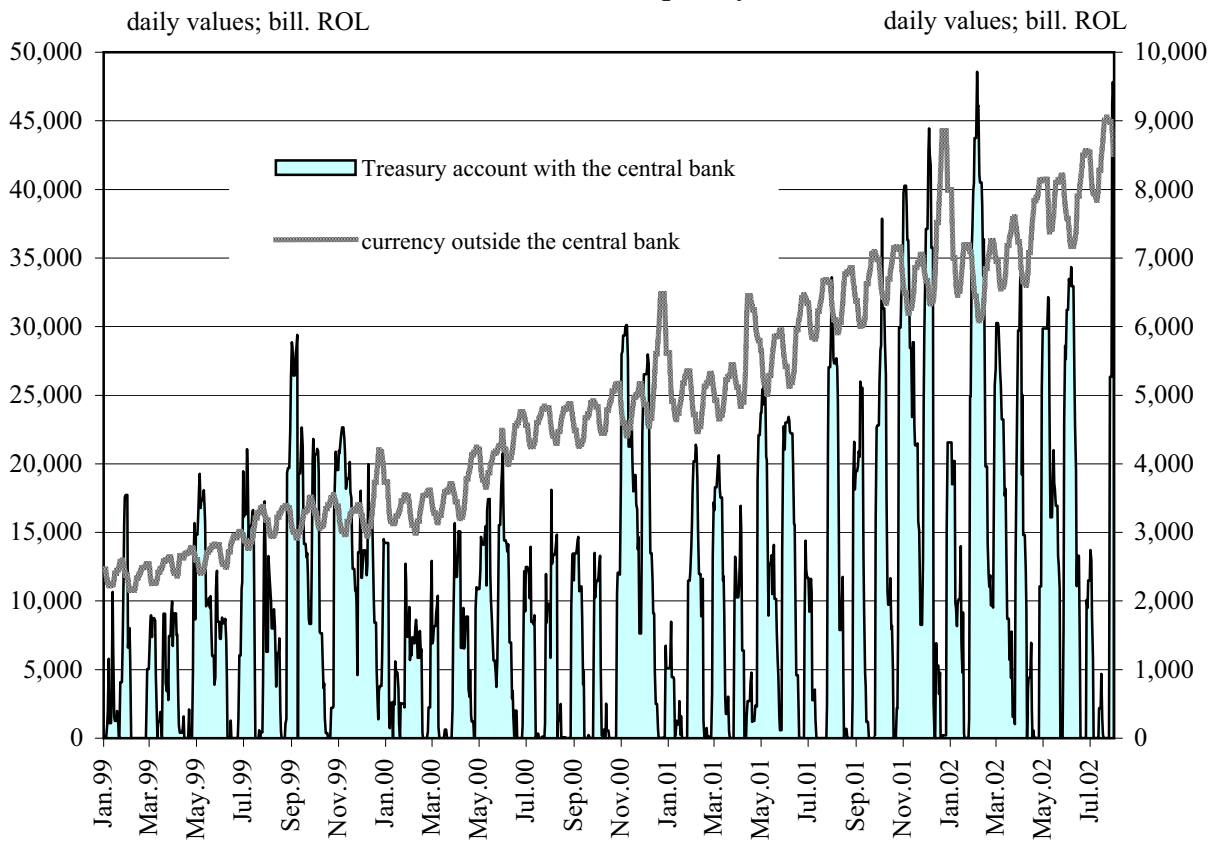
**Chart 4. Financial Depth**



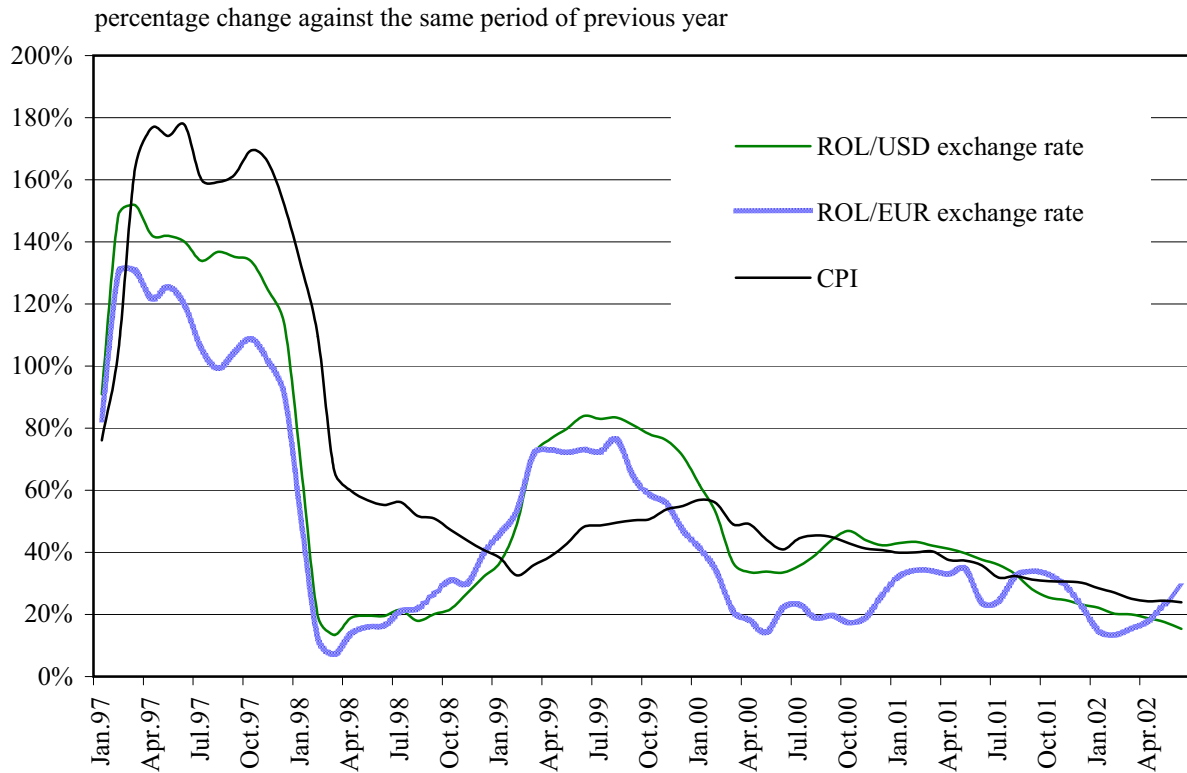
**Chart 5. Currency Breakdown of Bank Assets and Liabilities**



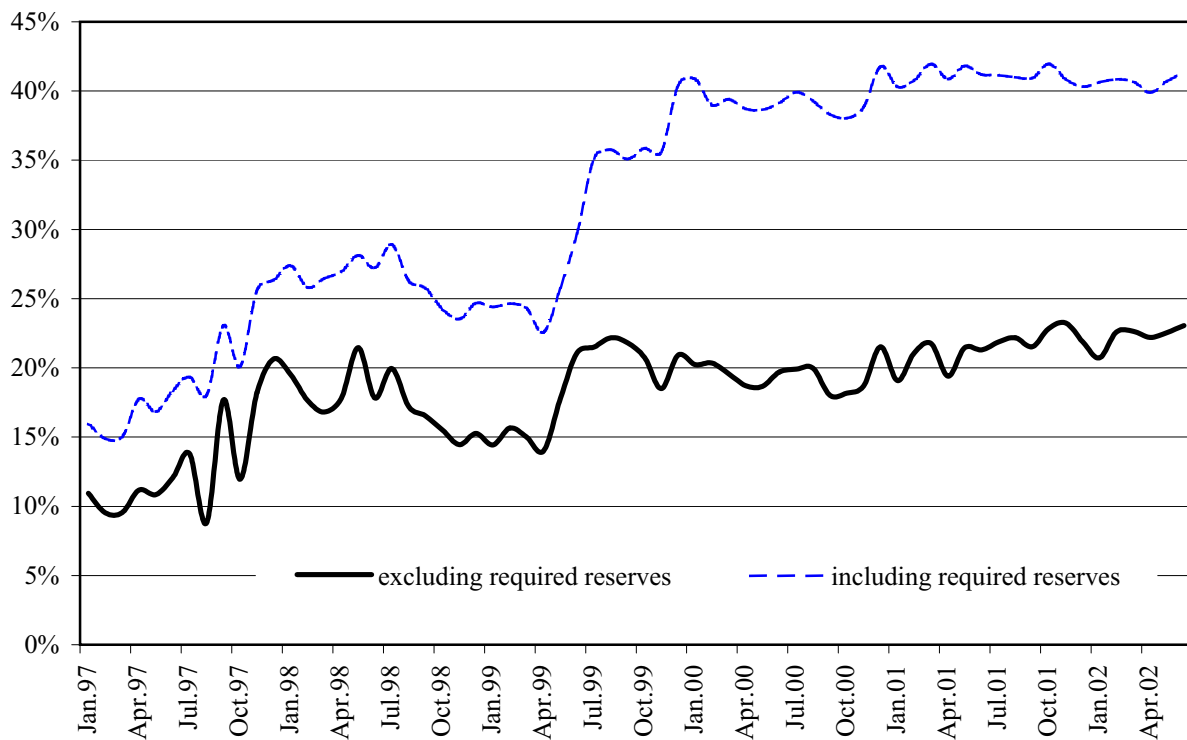
**Chart 6. Volatility of Main Autonomous Factors of Liquidity**



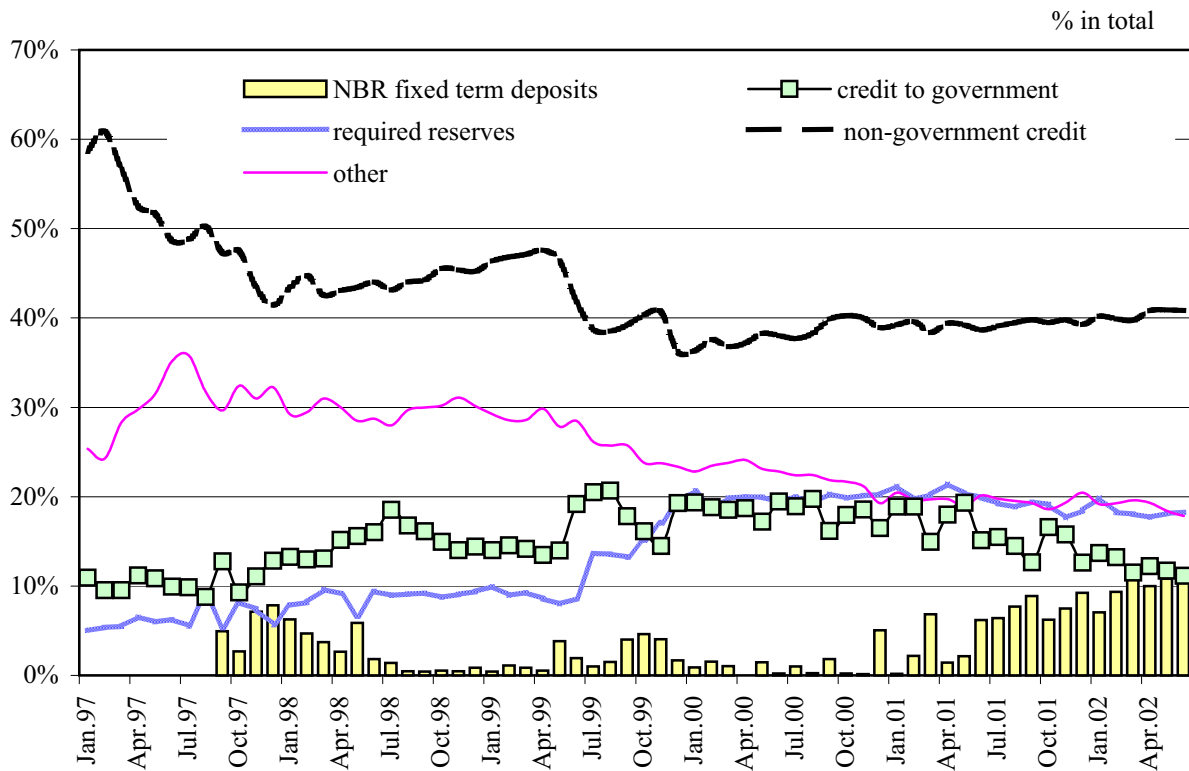
**Chart 7. Inflation Rate and Exchange Rate (year on year)**



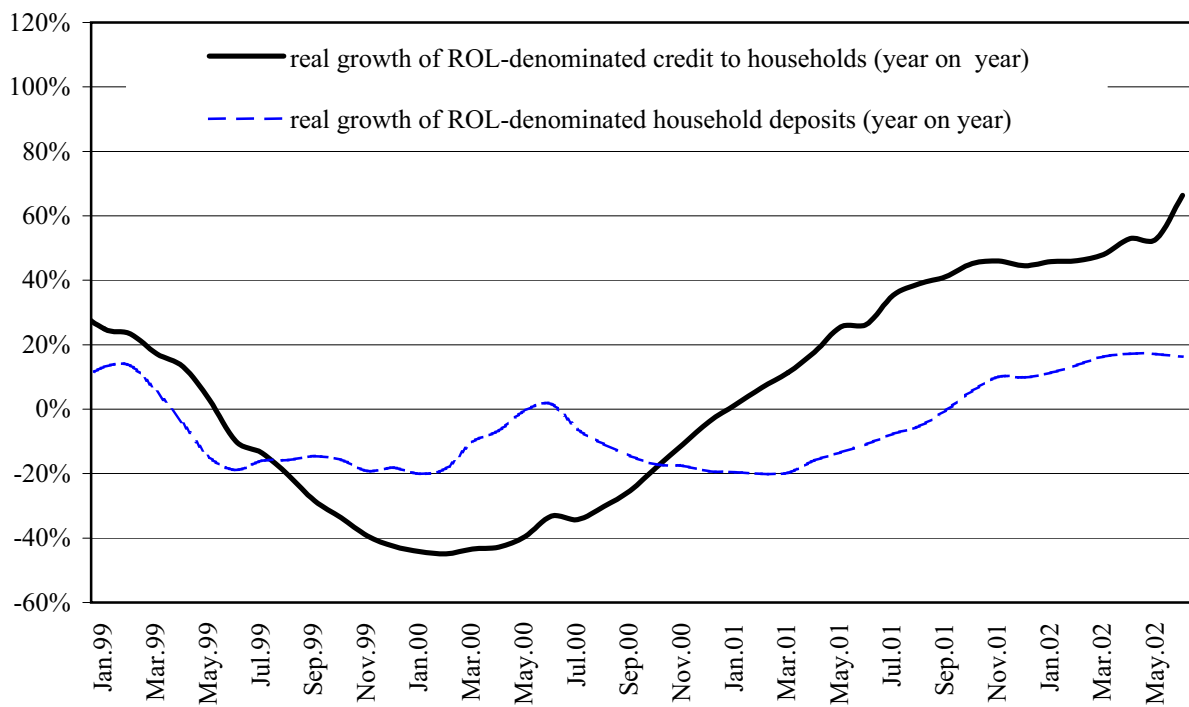
**Chart 8. Ratio of Commercial Bank's Investments in Government Securities and Central Bank Instruments to Total Domestic Assets**



**Chart 9. Breakdown of Banks' Domestic Assets**



**Chart 10. Real Growth of ROL-denominated Household Deposits and Loans with Banks**



**Chart 11. Real Ex-post Interest Rates on Loans and Growth of ROL-denominated Non-government Credit**

