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Financial Repression and Credit Rationing under Currency Board Arrangement for Bulgaria

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SUMMARY: THIS PAPER REVIEWS THE FOLLOWING THEORETICAL RELATIONSHIPS: AVAILABILITY OF CREDIT CHANNEL, CURRENCY BOARD ASYMMETRIC EFFECTS ON PRIVATE AND STATE OWNED FIRMS; CREDIT RATIONING AND COMMERCIAL BANK INTEREST RATE SPREAD; COMMERCIAL BANK EXCESS RESERVES DYNAMICS AND INTEREST RATES. MONETARY RESTRICTIONS UNDER A CURRENCY BOARD REGIME ARE APPROXIMATED WITH GOVERNMENT DEPOSIT GROWTH IN THE BALANCE SHEET OF THE ISSUE DEPARTMENT. THE PAPER ASSUMES LOW INTEREST RATES AS FINANCIAL REPRESSION IN THE CONTEXT OF MCKINNON SHAW HYPOTHESIS. FURTHERMORE, IT EXAMINES THE INFLUENCE OF GOVERNMENT DEPOSIT ON COMMERCIAL BANK EXCESS RESERVES, RESERVE MONEY AND MONEY SUPPLY. VAR MODELS ARE INTRODUCED WITH FOCUS ON TWO BASIC TESTS IN MODERN ECONOMETRIC STUDIES: VARIANCE DECOMPOSITION AND IMPULSE RESPONSE FUNCTION. THE ANALYSIS IS BASED ON BNB WEEKLY MONETARY STATISTICS AND COVERS THE PERIOD FROM THE LAUNCH OF CURRENCY BOARD ON 1 JULY 1997 TO END APRIL 1998.

I. Objects of the Study and Working Hypotheses

The first year since currency board introduction in Bulgaria provides sufficient ground to draw theoretical conclusions, which otherwise would have been only intuitive, and give some practical recommendations to facilitate currency board operation.

The *object* of this study is to analyze the effects of currency board operation on money supply and commercial bank lending activity.

The present paper builds on the following *working hypothesis*: within the context of the model of currency board introduced in Bulgaria, a possibility for a quasi monetary policy (conscious or unconscious) exists based on the specific structure of the Issue Department balance sheet. The latter reflects on money and credit supply. Major tools of this policy are the government's deposit on the Issue Department liabilities side, commercial bank required reserves with the BNB and the base interest rate. Currency board transmission channels imply the classical models of asymmetric information, credit rationing and financial repression.

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The hypothesis focuses on the following *tasks*: analysis of currency board effects on credit in the economy (sort of a modified credit chan nel); financial repression under currency board arrangement and credit rationing (through interest rates below their natural levels and com mercial bank required reserves with the BNB), and finally on the pos sibilities of manipulating money supply through government deposit at the central bank's Issue Department.

This study builds on the fundamental assumption that *imperfect in formation and uncertainty underlie financial relations.*

Information problems derive primarily from the lack of channels for transmission of information, its asymmetry, as well as from significant transaction costs associated with its processing and transmission. Im balances in money, credit and financial markets are information imbal ances, and crises in these markets are information crises. Uncertainty comes secondary and it cannot be described by probability distribution: objective and subjective (Knight, F., 1923).

These two fundamental aspects of business activity imperfect in formation and uncertainty underlie the Austrian analysis of money, credit and finance (Bom Baverk, E., 1888; Menger, K., 1892; Mises, L., 1912; Hayek, F., 1931, 1933; Lahman, L., 1986)[1]. Modern analyses of financial systems are in the paradigm of 'asymmetric information' (Mishkin, F., 1996, 1998)[2].

[1] See the fundamental article, based on imperfect information and uncertainty, on the natural evolution and biological dynamics of institutions (Alchian, A., 1950). See also Goodhart, Ch., 1989.

[2] For a detailed review of the mechanisms of asymmetric information, see Nenovsky, N., K. Hristov, 1997.

Box 1

Asymmetric Information

Asymmetric information is generally a situation in which one party to a financial contract possesses less information than the other. For example, borrowers know more about potential returns and risks associated with projects undertaken by them than creditors. Asymmetric information poses two major problems for the financial system: the *moral hazard prob lem* and the *adverse selection problem*.

Adverse selection arises prior to contractual execution. Borrowers who are ready to assume greater risks seek credit more actively. Those willing to assume greater risks are ready to obtain credit under any terms, as they perceive their probability of repaying the loan to be low. Thus borrowers who are less likely to fulfil their obligations need be selected. In this case, due to adverse selection problem and increased probability of extending credits to more risky borrowers, creditors may decide to refuse credits even to low risk borrowers. To minimize the problem of adverse selection, therefore, creditors should be able to distinguish between 'good' and 'bad' credit risk.

While the problem of adverse selection arises prior to contractual ex ecution, *moral hazard* derives from post contractual relations. The moral hazard problem is induced by borrowers having incentives to invest in high risk projects. If the project generates higher profits, they will then benefit more, while creditors will suffer heavier losses if the project fails. Moreover, borrowers are encouraged to use extended funds for purposes other than those agreed upon under the contract. The conflict of interests between creditors and debtors arising from the moral hazard problem im poses constraints on creditors' lending activity. This leads to levels of credit and investment below the optimal level for the economy. Creditors impose constraints on borrowers' behavior so that the latter should not in crease the risk of default on the loan. In this case creditors may monitor borrowers' activity and control the observance of constraints when bor rowers fail to perform.

The paper is organized as follows: the theoretical basis of analysis and relevant literature are presented at the beginning. Then it proceeds with data, models and empirical research. Finally conclusions are drawn and recommendations for the better operation of the currency board are given.

II. Theoretical Basis of the Study

1. Credit Channel and Credit Rationing

The credit channel of monetary policy transmission became very popular in the mid 80s as an alternative and supplement to the trans mission mechanism through interest rates or through the exchange rate. In practice, it is deeply woven into the texture of liberal tradition of economic thought. In his book on the business cycle entitled 'Prices and Production' (1931) F. Hayek relates business cycles to the effects of money on the real economy, in particular emphasizing its effect through consumer and investment credits. He was inspired by the works of Menger, K. (1892), Wicksell, K. (1898, 1913 1922) and Spietnoff, A. (1923) who argued that interest rates, saving and invest ment were the backbone of business activity.

Later on Bernarke, B. (1983), Bernarke, B., M. Gertler (1995) re vealed the existence of a monetary transmission mechanism concen trating on asymmetric information and transaction costs of managing financial contracts (the classical agent principal relationship). Mon etary transmission through the credit market involves two major chan nels: the *bank lending channel* and the *balance sheet channel.*

The bank lending channel is based on commercial banks' special role in the financial system in view of the advantages the banks have in their relations with small firms, whereby asymmetric information is most clearly displayed. Commercial banks have specific advantages to other financial intermediaries in collecting information on borrowers: they establish long term relationships with their clients and are able to monitor borrowers' accounts. Diamond (1984) shows that banks are capable of monitoring borrowers at lower costs than individuals, which enables them to fight more successfully with moral hazard problems. In addition, Stiglitz and Weiss (1981) argue that banks have additional advantages in curbing risks assumed by borrowers: they induce changes in borrower behavior as they threaten to reduce the provision of funds in the future.

Natural advantages of banks in collecting and processing informa tion and reducing the moral hazard problem explain the importance of banks in the financial markets. *Moreover, the harder the gathering of in formation from private firms in so called emerging financial markets, the more significant the banks become for the financial systems of these countries.*

Information problems explain why securities markets are often a rather insignificant source of external financing for nonfinancial enter prises. The better the quality of information about firms, the higher the probability of getting finance through securities issue. As the countries with emerging financial markets have significant difficulties in collect ing information on private firms, the securities markets play an insig nificant role in corporate financing.

The credit channel of monetary policy transmission (through com mercial banks) emphasizes the fact that money supply contraction leads to a more sizable contraction of bank credit supply relative to contraction of other types of debts.

This transmission mechanism is based on the dual nature of com mercial banks which hold reserve backed deposits and provide credit to the economy. Contraction of commercial bank reserves induced by monetary authorities policy reduces their lending ability. In practice, banks cannot eliminate the effect of the shock on reserves by restruc turing their portfolios and preserving the level of credit unchanged. Thereby small and medium size firms, being strongly dependent on bank credit, cannot ensure other sources of funding and reduce their investment.

There is another form of a credit channel concentrating on the sup ply of funds from all financial institutions and markets without stress ing the special role of commercial banks (Oliner, S., G. Rudebusch, 1996). The so called *broad credit channel* confirms the assumption that all forms of external financing of firms are imperfect substitutes for in ternal funds (contrary to the theorem on neutrality of different types of financing (Modilliani, F., M. Miller, 1958).

Asymmetric information between creditors and debtors leads to a premium paid for external financing over the price of own funds (eq uity). The premium is designed to make up for creditors' expenses on evaluating investment projects, monitoring borrowers and giving effect to contract execution. The price of own (internal) funds of the firm $\mathbf{r_1}$ may be decomposed:

$$\mathbf{r_1 = r_f + \Theta},$$

where $\mathbf{r_f}$ is the risk free interest rate (often employed as a monetary policy tool) and $\mathbf{\Theta}$ is *the risk premium which is specific for a given firm*.

In 'perfect' capital markets with external funds being the 'marginal' source of financing, investments exceeding internal funds **F** should also be accessible at an interest rate of $\mathbf{r_1}$. Firms tend to default on loans ex

tended by external creditors rather than on those made by sharehold ers. This moral hazard demands that the price of external funds be higher than $\mathbf{r_1}$ and include a risk premium $\mathbf{\Omega}$ (*general premium for all firms reflecting the risk of change in post contractual borrower behavior*).

The dynamics of the risk premium $\mathbf{\Omega}$ depends on two factors. First, $\mathbf{\Omega}$ increases with the amount of credit. Other conditions being equal, the bigger debt amount increases the moral hazard. The relationship between the premium $\mathbf{\Omega}$ and the size of the debt determines the up ward slope of the credit supply curve $\mathbf{S_1}$ (see Chart 1). Let the total amount of external financing be **B**, that is investments **I** less own funds, then $\mathbf{B = I \quad F}$.

Second, the risk premium $\mathbf{\Omega}$ also increases with the increase in risk free interest rate (Gertler, M., G. Hubbard, 1988). This relates to the fact that an increase in interest causes a decrease in the discount value of debtor collateral which increases the moral hazard.

These two factors may be written as: $\mathbf{\Omega = = \Omega\ (B, r_f)}$ where $\mathbf{\partial\Omega/\partial B}$ and $\mathbf{\partial\Omega/\partial r_f}$ are positive.

Dependence of risk premium $\mathbf{\Omega}$ on risk free interest rate in the economy means that disturbances in the credit market enhance mon etary shocks in the economy (underlying assumption in the broad credit channel theory). Chart 1 shows that an increase in risk free in terest rate raises the cost of external financing by $\mathbf{\partial r_1/\partial r_f + \partial\Omega/\partial r_f}$, where the second term of the expression is the amplifying effect itself. An increase in the risk free interest rate shifts the funds supply curve from $\mathbf{S_1}$ to $\mathbf{S_3}$ and investments contract from $\mathbf{I_1}$ to $\mathbf{I_3}$. The fall in invest ment is accelerated by the increase in $\mathbf{\Omega}$ for external funds. It is this factor that shifts the funds supply curve to $\mathbf{S_3}$, not to $\mathbf{S_2}$. Thus widening of the spread between bank interest rate and the interest rate on other external funds for the firm amplifies the effect of change in $\mathbf{r_f}$.

We can summarize that, given a broad credit channel, the price of external financing relative to that of internal financing increases with money supply contraction. This change in the relative price of credit makes investment more vulnerable to fluctuations in internal funds with contracted money supply. As a result, under a broad credit chan nel the correlation between investment and internal (own) funds of firms facing the imperfections of credit markets increases with money supply contraction.

The *balance sheet channel* of monetary policy transmission is based on the assumption that the financial premium paid by the borrower is

determined by his financial position. The bigger the borrower wealth, defined as a sum of his liquid assets and collateral, the lower the risk premium. The higher net worth of borrowers allows for potential con flict of interests with creditors to be reduced. This is possible either by financing most of the projects with equity, or by putting up more collat eral as a guarantee provided by the recipients of loans. As the financial position of borrowers affects the size of risk premium and general loan terms, fluctuations in borrower balance sheet become a determinant of investment decisions.

Changes in money supply affect not only the market interest rate but also reflect, directly and indirectly, on borrower financial position. Money supply contraction worsens firms' balance sheets in two ways.

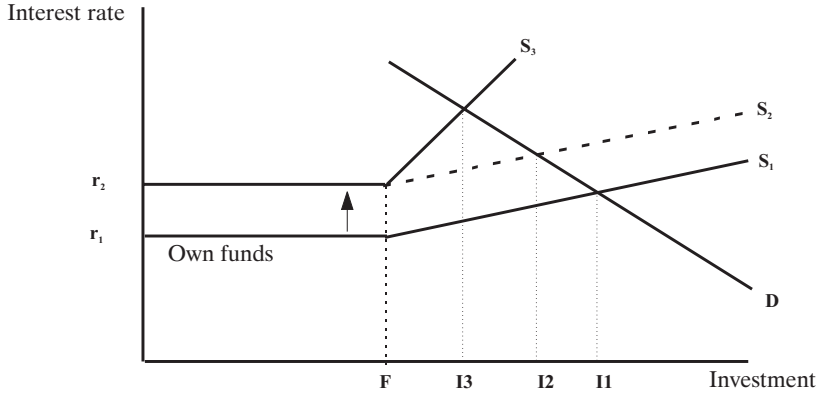
First, as firms hold short term or floating rate debts, increasing in terest rates directly increase their interest expenses, reduce net cash flows and worsen their financial position.

Second, increasing interest rates are associated with falling asset prices, thus reducing the collateral value put up by the recipients of loans.

Furthermore, money supply contraction may reduce cash flows and collateral value indirectly by lowering consumer spending which leads to a fall in a firm's sales revenue. As fixed and quasi fixed expenses (wages, interest payments, rents) adjust rather slowly in the short run, financial gaps emerge. This lessens a firm's value and worsens its bal ance sheet.

Chart 1

BROAD CREDIT CHANNEL



The monetary policy credit channel is very closely associated with the understanding of credit rationing based on uncertainty. Financial markets and financial intermediaries play a critical role in the economy, shifting financial flows from individuals to firms with good investment prospects. If the financial markets and financial intermedi aries fail to do this effectively, sources of economic growth will be un dermined.

The classical basis of credit rationing is developed by Modigliani, F., D. Jafee (1969), and also by Stiglitz, J., and Weiss, A. (1981). Asymmetric information and the adverse selection problem associated with it result in isolating a fraction of borrowers from the credit market, even if they indicate a willingness to pay a higher interest rate and put up more collateral than demanded[3].

Increasing interest rates on credits and increasing collateral require ments both increase the risk to bank portfolios since low risk investors are isolated, on the one hand, and borrowers have incentives to invest in more risky projects, on the other. This lowers bank profits. In these circumstances there will be no market instrument capable of equating the demand for loanable funds with the supply of loanable funds.

Credit restrictions imply reducing the number of credits made by banks, not reducing the amount of credits or setting the interest rate as an increasing function of the loan amount. With a change in money supply, credit rationing affects the level of investment not through the interest rate mechanism but through the availability (accessibility) of credit.

The existence of spontaneous (unplanned) and forced (planned, segmented) rationing is shown in Charts 2 and 3,

where

$\mathbf{C}^{d}$ is demand for credit;

$\mathbf{C}_1^{s}$ is supply of credit under uncertainty for risk free clients;

$\mathbf{C}_2^{s}$ is supply of credit under uncertainty for risky clients;

$\mathbf{C}^{s}$ is supply of credit under complete information and sound credit market.

The credit supply in a setting of uncertainty and asymmetric infor mation is cubic shaped, derived by Stiglitz and Weiss (1981).

With *spontaneous rationing* (Chart 2) credit clients are not distin guished, but at a given level of the interest rate $\mathbf{i}_1$ banks will reduce credit, consistent with asymmetric information the supply of credit

[3] See the innovative study by Akerlof, G. (1970).

Chart 2

SPONTANEOUS RATIONING

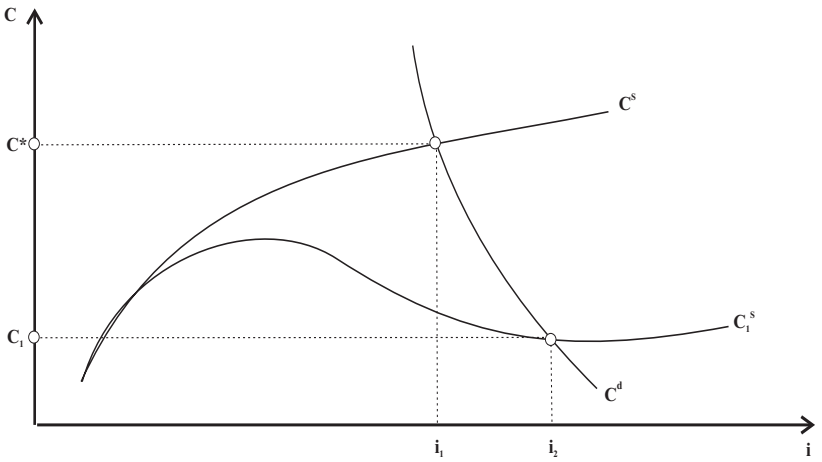
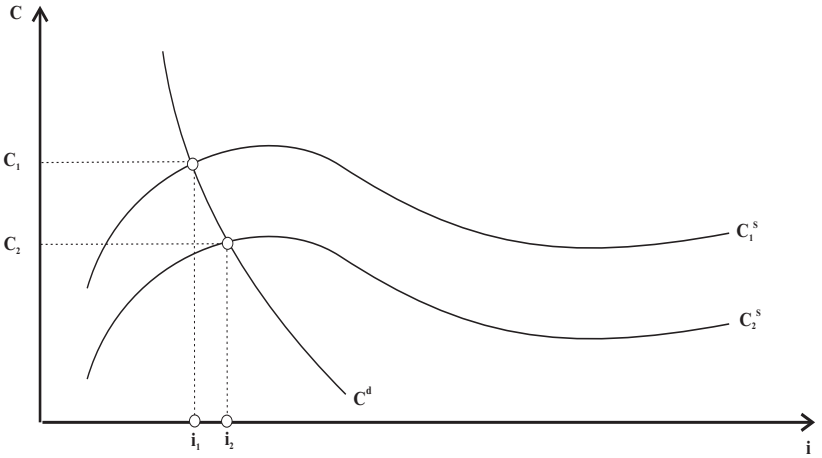


Chart 3

FORCED RATIONING



breaks into $\mathbf{C_1^s}$ instead of following the classical trajectory $\mathbf{C^s}$. This re lates to the fact that high interest rates attract high risk projects. For credit demand $\mathbf{C^d}$ loans will be made at $\mathbf{i_2}$ and rationing is expressed in the quadrant $\mathbf{C^*C_1}$.

The other alternative is for the bank to set *different levels* of interest rates depending on the riskiness of individual clients. This is shown in Chart 3 where credit supply is distinguished between two groups of cli ents: risky $\mathbf{C_2^s}$ and risk free $\mathbf{C_1^s}$. Therefore commercial banks use dif ferent interest contracts for different clients $\mathbf{i_2}$ for risky clients and $\mathbf{i_1}$ for risk free clients. If the bank is able to set an interest rate according to an individual client's risk, then there will be no rationing. This is im possible, however, as credit supply curves are a discrete multitude and the element of rationing is always present.

2. Financial Repression and Interest Rates

Economic history reveals that financial intermediation and the fi nancial sector have been growing at faster rates than the growth rate of the economy as a whole, their relationship is positive and the passage through particular stages of financial growth is indispensable (Gurley, J., E. Shaw, 1960; Goldsmith, R., 1968; Cameron, R., 1972). A delay in the development of the financial sector means an even *more significant* overall delay in the development of a given country (Coricelli, F., 1996).

The paradigm of financial repression (Shaw, E., 1973; McKinnon, R., 1973; Kapur, B., 1976) became very popular in developing coun tries in the 80s as an alternative to the Keynesian view on the role of the state in generating economic growth. The theory of financial re pression provides a convenient starting point to explain the problems of countries in transition to a market economy.

Generally, financial repression or suppression of the financial sector is a result of state interference in monetary and financial relations. Fi nancial repression is expressed in three directions: artificially low inter est rates, high commercial bank reserve requirements and quantitative credit restrictions. Actually the *Shaw McKinnon* approach is very close to the liberal view on finance and money in the context of which au thors like Wicksell, K. (1898), Fisher, I. (1911), Hayek, F. (1931), Salin, P. (1990) have always stressed the risks of manipulating nominal interest rates and their being segregated from the natural level[4]. The

[4] Immediately we avail of the opportunity to refer to the 'pernicious' and widely used *IS LM macromodel*, which assumes that interest rates can be manipulated so as to influence

latter results from a dynamic consumer choice, different psychological propensity to current consumption or, to put it in other words, from the free choice to spend or save[5].

Interest rates below their natural levels encourage forced consump tion, limit investment in qualitative and quantitative terms, and sup press economic growth. The interference of the state is accomplished in three ways: by manipulating nominal interest rates (modification of money supply at short term static prices), by administrative control on deposit rates or by nationalizing financial intermediaries (primarily banks). This relates to the fact that the state apparatus is assumed to know better what should be the amount of investment and where to place forcibly accumulated savings. Low real interest rates impede monetization of the economy and development of the financial system.

If the actual interest rate is below the natural level, credit is rationed both qualitatively and quantitatively. Less attracted funds in the bank ing system result in less credits in general. Besides, the banks, by maxi mizing profits and market share, ration credit themselves and selection of projects deteriorates. In the models of Stiglitz, J. and Weiss, A. (1981), the interest rate applied is the major signal of project riskiness; thus it serves as a filter for projects. If it is not consistent with the mar ket interest rate, however, its information power loses significance.

High commercial bank reserve requirements are another component of financial repression. This is an extra expense which stalls bank lend ing activity. In the spirit of liberal tradition the latter may be viewed as an unjustifiable[6] confiscation of private resources. Hypothetically it is assumed that central bank bureaucracies have better knowledge and

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human choice of consumption and saving. It should be mentioned here that it is impos sible to determine whether an interest rate is above or below its natural level. This would mean that we outweigh the market. The same is true for our estimate of the base interest rate in Bulgaria. Apriori we cannot argue that it is below its natural level as much as we cannot assert that it is at natural levels. We can judge it aposteriori based on credit ration ing.

[5] When financial repression and credit rationing dominate, *self financing* becomes a ma jor financial source of growth. Money enters *directly into the production function and be comes a necessary and supplementary factor* for growth. The production function will be: $\mathbf{Y=\alpha_0 K^{\alpha 1} L^{\alpha 2} M^{\alpha 3} e^{\varepsilon}}$, where **Y**, **K** and **L** are the traditional designations for income, capital and labor, and **M** is an approximation of money (a monetary aggregate, monetization in dicator, etc.). In this context monetization of the economy is a prerequisite for economic growth.

[6] The only arguments in support of minimum required reserves are usually related to maintaining the stability of the banking system which is assumed to be not self regulating.

skills than private institutions[7].

Credit supply is in general a function of the demand for household deposits and of the dynamics of commercial bank required reserves. The latter lower the credit to money ratio and slow economic growth (Kapur, B., 1976, Mathieson, D., 1980). According to McKinnon, R. (1982), economic growth is maximized when reserve requirements are completely eliminated (the two studies by Sellon, G., S. Weiner, 1996, 1997, are in the same vein). Elimination of minimum required reserves would raise commercial bank profitability and help them optimize re source allocation. Thus reserves allocated by the banks themselves will reflect the state of the money market and their settlement needs. Prac tice shows that elimination of required reserves and/or their replace ment by other liquidity requirements is the exclusive result of political will (Rich, G., 1998).

Here may come the traditional arguments for the banking system and money as public utility, of banking system *integration* and exter nalities. Without discussing in detail these arguments, we would like to note that *even if all of these arguments were true the state interference in the banking sector intensifies externalities, asymmetric information, its channels and provokes systemic financial crises. In this sense elimination of commercial bank required reserves would ease the banking system, making it more stable and effective.*

3. Monetary Policy under Currency Board Arrangement

The classical currency board involves abandonment of monetary policy and discretion. This is a specific form of monetary constitution where money supply is determined by the automatic mechanism of the balance of payments dynamics. In the case of the Bulgarian model of currency board this is only partly true.

It may be argued that there exists a specific type of transmission mechanism in the context of the Bulgarian currency board. Monetary

[7] The problem with bureaucracy is that besides pursuing common goals it strives to maxi mize its principal function (in this context is the desire for reelection), particularly serious with monetary and issuing activities (Niskanen, W., 1983). Definitely one may argue that monetary bureaucracy increases as the central bank expands its goals and available tools. *In this sense the currency board is a step forward to reducing bureaucracy.* There exists a counter tendency, however, of a self protecting bureaucracy in the sense that by reducing its monetary functions the central bank concentrates more on its internal and administra tive structure.

Box 2

Monetary Policy through Government Deposit

The aggregated balance sheet of the Issue Department includes the fol lowing items:

Assets	*Liabilities*
F	**C**
	R
	G
	B

where

F are foreign exchange reserves of the Issue Department;

C is currency in circulation;

R are commercial bank reserves;

G is the government deposit;

B is the Banking Department deposit (net value of the currency board);

Let **H** be reserve money, then **H = C + R = F G B**.

The classical form of money supply is:

$\mathbf{M^s = m\ H = m\ (F\ \ G\ \ B)}$,

where **m** is the traditional multiplier, $\mathbf{m = (1+c)/(c+r)}$.

Differentiating the partial derivative, showing the response of money stock to government deposit growth, is written as:

$\mathbf{\partial\ M^s/\partial\ G = \ \ m < 0}$.

This indicates unequivocally that, other conditions being equal, govern ment deposit growth reduces money supply by the value of the multiplier[8].

The full model of money supply is as follows:

$\mathbf{M^s = m\ H = m\ [F(G)\ \ G\ \ B(G)]}$,

where net foreign assets and the Banking Department deposit are also a function of the government deposit. Then the derivative is:

$\partial M^s/\partial G = [(\partial F/\partial G) \ \ 1 \ \ (\partial B/\partial G)]m < 0$.

The general effect of **G** on money stock depends on the joint responses of **F** and **B** to changes in **G**.

[8] The Banking Department deposit will be the object of another study to analyze its role of a supplementary variable in the money market, besides the interest rate, that balances money demand and supply.

policy is taken over by fiscal policy and the government has the possi bility of manipulating money supply through its deposit at the Issue Department. The dynamics of this deposit may be interpreted as an *in dicator (measure) of the government's monetary policy* and plays the role of a buffer between changes in the monetary base and foreign ex change reserve dynamics. A growth in this deposit constrains reserve money and its dramatic fluctuations cause sharp changes in reserve money dynamics. Essentially it performs sterilizing functions and in jects or withdraws liquidity in and out of the economy.

The existence of this deposit gives advantages of the public sector to the private sector because only the former is backed by the reserves of the Issue Department which constitute public wealth[9].

The government's deposit at the Issue Department reflects budget ary dynamics and receipts from the IMF. Also it is the result of govern mental policy in the government securities market (the volume of is sues). The deposit affects money supply in two ways: through volumes by reducing reserve money, and through prices by the impact of the nominal base interest rate[10]. This directly reflects on real interest rates (Fry, M., 1995) and, in turn, on motives for saving and investment, on the quantity and quality of investment, and hence on economic growth.

In this mechanism we may *discover* the two classical transmission channels of monetary policy under a central bank: directly through the monetary base and through the interest rate (Mishkin, F., 1996, 1997).

III. Models

1. Variables and Statistical Data

The paper examines the period from the introduction of the cur rency board in Bulgaria on 1 July 1997 until April 1998 inclusive, es sentially *the first year of currency board operation*. *Weekly* indicators from BNB monetary statistics and the balance sheets of the Issue and

[9] A similar phenomenon of covert monetary policy through the budget existed at the early stage of operation of the Hong Kong currency board, Walters, A. (1989). Of note is the extremely strong *variance of government deposit* at the Issue Department: 48.64%. Even though such a dynamics is conceivable, it may be dangerous.

[10] The base interest rate, given the peculiarities of Bulgaria's currency board, does not perform the typical functions under a discretionary central bank. Pursuant to Article 35 of the Law on the BNB, the Managing Board of the BNB determines only the method of set ting the base interest rate. Actually, the level of this rate depends on the primary market of government securities.

Banking Departments have been used 43 observations in total. Be cause of the different dates of publication of monetary statistics and the Issue Department balance sheet, indicators were to be reprocessed to make them compatible on a weekly basis. The following variables have been used:

DC domestic credit
DB Banking Department deposit at the Issue Department
CF credit to private sector
CG credit to government
CFG credit to state owned firms
NCF newly extended credits (short and long term) to private sector
NCH newly extended credits (short and long term) to households
NCFG newly extended credits (short and long term) to state owned firms
e BGL/USD exchange rate (weekly adjusted)
d1 interest rate spread the difference between interest rates on long term credits and interest rates on time deposits **(d1 = ilcr irtd)**
d2 interest rate spread the difference between interest rates on short term credits and interest rates on time deposits **(d2 = iscr irtd)**
i base interest rate
m money multiplier
M0 reserve money
M3 broad money (money supply)
QM quasi money
irtd interest rate on one month deposits
iscr interest rate on short term credits
ilcr interest rate on long term credits
er excess reserves of commercial banks
irdd interest rates on demand deposits
im interest rate in the interbank money market
DG government deposit at the Issue Department
CH credit to households
FR foreign exchange reserves of the Issue Department

2. Econometric Techniques

The econometric methodology used in this paper is presented on page 20. Over recent years almost all studies have been based on these techniques as they overcome restrictions of classical econometrics. Espe cially representative are the models which examine the effects of mon etary policy on the other macroeconomic variables (Barran, F., V. Coudert, B. Mojon, 1995; Grilli, V., N. Roubini, 1996; Cochrane, J., 1998, Christiano, L., 1997, etc.). Within the framework of this tradition are the fundamental works of Bernarke, B., I. Mihov, 1995, 1998, which present measures of monetary policy and the so called 'liquidity effect' of the monetary shock through a structural VAR model.

Box 3

Econometric Techniques and Types of Models Used

In testing for a unit root the **PP** (Phillips Perron) test is used, which cap tures the break in the trend, while **ADF** assumes that the trend is linear and without break (Perron, P., 1989). In the **PP** test there is no need to test for trend break, contrary to **ADF**.

Three groups of models have been used: cointegration and error correc tion, VAR and GARCH models. Their logical order is as follows: 1) The first group involves the models of cointegration and error correction. The method of determining the number of cointegration vectors is given by Johansen, S., K. Juselius (1990). 2) If there is no cointegration relationship established, then the VAR models are used where all variables are endogenous. With VAR models (Sims, C., 1972, 1980; Cochrane, J., 1994) it is important to fol low the proper order of variables in the vector: first come the most exogenous or controlled variables (Kamas, L., 1995). Within the VAR models two tests are emphasized, considered of major importance in modern econometric re search: *variance decomposition* and *impulse response function*. *Variance de composition* (similar to Granger causality) is used to make it clear how far certain variables can account for changes in the other variables. It evidences what percentage of changes in a variable is accounted for by shocks to the other variables. On its part, *impulse response function* gives indication of the magnitude of this effect. It shows how a given variable responds over time to shocks triggered by another variable. 3) The third group of tests is based on GARCH models (see the fundamental article by Bollerslev, T., 1986), de signed to capture the development of the variance of the variable itself, that is its memory. Some modifications are possible here, such as to incorporate the levels in the variance equations or to incorporate the variance or the mean square deviation in the levels' equations.

It is presumed that the variance of the residual in the structural equation is an indicator of the error made by economic agents in formulating their expecta tions of a given variable on the basis of a given model. In traditional GARCH models good news and bad news receive equal treatment. In practice, however, this is not the case. This peculiarity is better captured by so called asymmetric models (AGARCH, TARCH (GJR), EGARCH). Engle, R. and V. Ng (1993) have constructed a news model (*news impact curve*). According to these mod els, bad news (major fluctuations) have a stronger impact on the dynamics of variables in the future than good news (minor fluctuations). A comprehensive survey is presented in Bollerslev, T., Chou and Kroner (1992), Joyce, M. (1995, 1997) and Duan, J. (1997).

The present paper uses GARCH models to generate conditional variances of the variables under review.

Unit Root Test

Before continuing to modeling, we test variables for stationarity and integration (Table 1). Critical values (*McKinnon critical values* **PP**) without constant and trend are as follows: for 1% (2.62), for 5% (1.95), and for 10% (1.62). First order integrated variables with con stant and trend are designated with *, and their respective critical val ues are: for 1% (4.19), for 5% (3.52), and for 10% (3.19).

Table 1

Variable	*PP test*		*Integration and lags*	
	levels	*1Δ*	*I*	*lag*
DC	-0.76	-6.64	1	3
DB	-0.16	-5.99	1	3
CF	1.16	-7.04	1	3
CG	-2.09	-7.08	1	3
CFG	0.45	-5.1	1	3
NCF	-0.87	-68.83	1	3
NCH	-2.35	-8.91	1	3
NCFG	0.08	-7.41	1	3
e	0.29	-5.44	1	3
d1	0.85	-9.68	1	3
d2	-0.04	-8.18	1	3
i	-1.62	-3.79	1	3
m	-1.27	-18.82	1	3
M0	1.93	-8.93	1	3
M3	2.14	-5.48	1	3
QM	1.86	-7.97	1	3
irtd	-1.79	-8.18	1	3
iscr	-0.56	-6.49	1	3
ilcr	0.12	-8.15	1	3
er	-0.58	-9.45	1	3
irdd*	-11.5		0	3
im*	-15.53		0	3
DG*	-2.8	-11.23	1	3
CH*	-2.95	-9.89	1	3
FR*	-2.57	-4.7	1	3

The results from testing show that most series are first order inte grated, with the exception of **im** and **irdd** which are zero order station ary. This allows to continue modeling with first differences and loga rithms.

3. Charts of Variable Variances

On the basis of GARCH models we derived *conditional variances* of basic variables: domestic credit variance, base interest rate variance, government deposit variance, broad money variance, Banking Depart ment deposit variance, interbank interest rate variance, variance of credit to private sector. The dynamics of variances are presented in the charts below[11]:

Chart 4

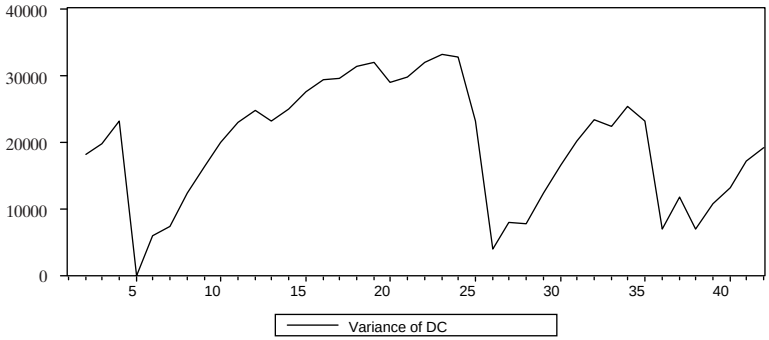
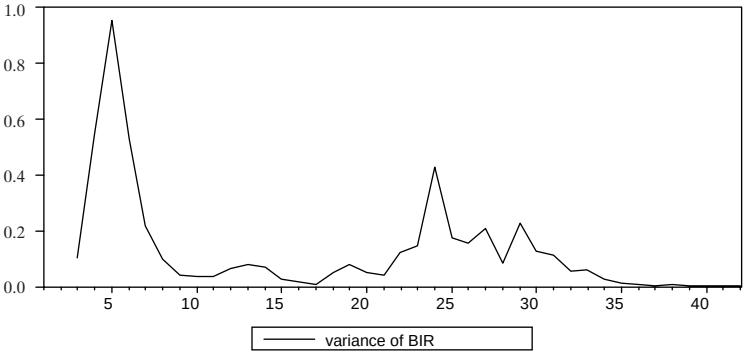


Chart 5



[11] The horizontal scale shows the weeks since currency board introduction on 1 July 1997 and the vertical shows differently normalized scales so that an indicator's dynamics is best described. Thereafter variances of variables are designated as **V** in front of the variable (i.e. **VDC** means variance of domestic credit).

Chart 6

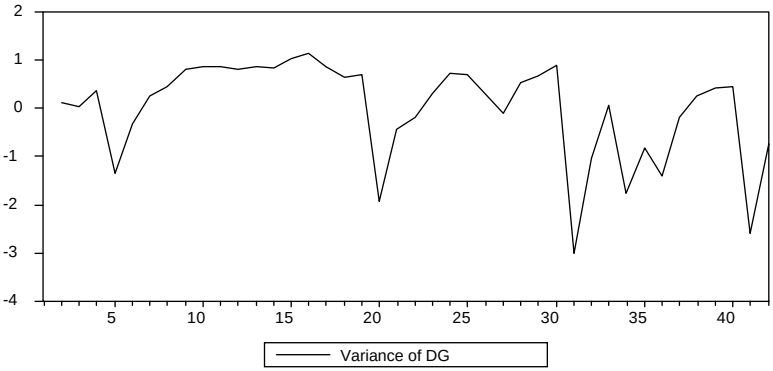


Chart 7

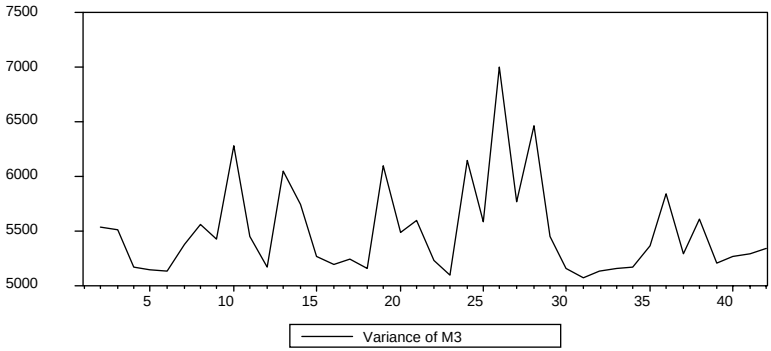


Chart 8

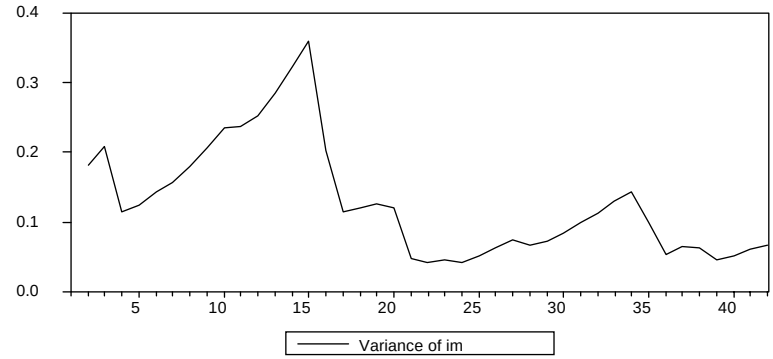


Chart 9

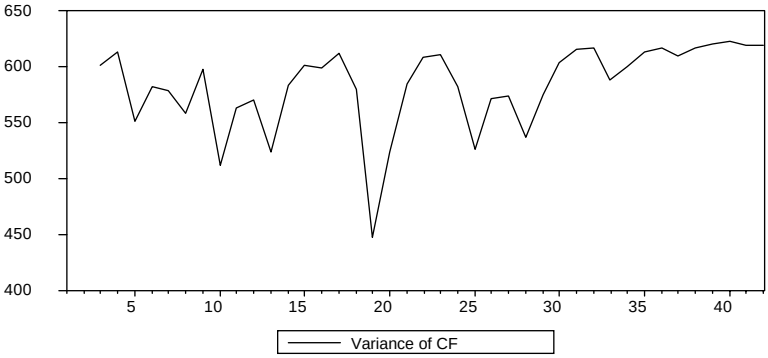
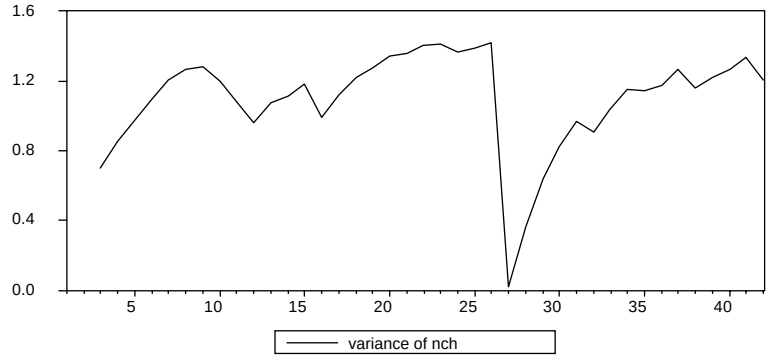


Chart 10



It should be noted that domestic credit, credit to the private sector, newly extended credits and broad money M3 display strong volatility. Credit volatility is dangerous because it usually creates problems in the balance sheets of commercial banks and provokes systemic financial crises (Hayek, F., 1931; Minsky, H., 1977; Bernarke, B., 1992; Aglietta, M., 1993).

4. Relations between Variances of Basic Variables (normalized scale)

Chart 11

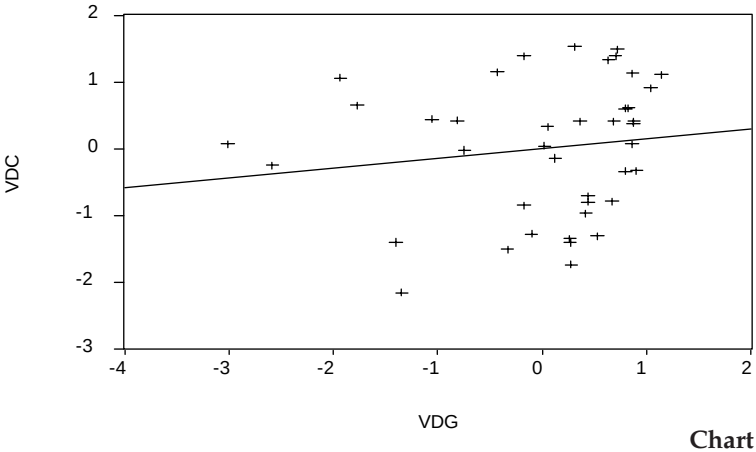
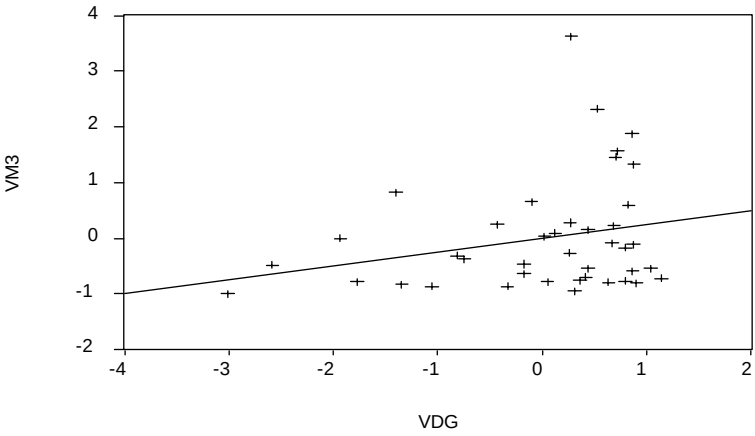


Chart 12



The two charts above show the *positive relation* between government deposit variance and variances of broad money and domestic credit. This indicates that money stock volatility and domestic credit volatility are provoked by government deposit volatility.

Chart 13

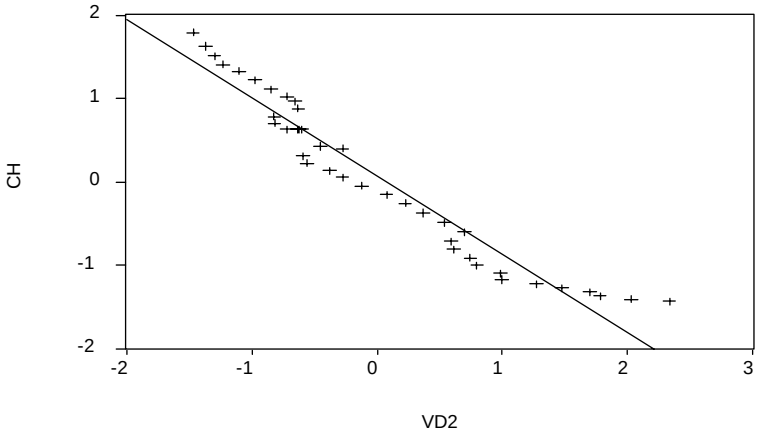
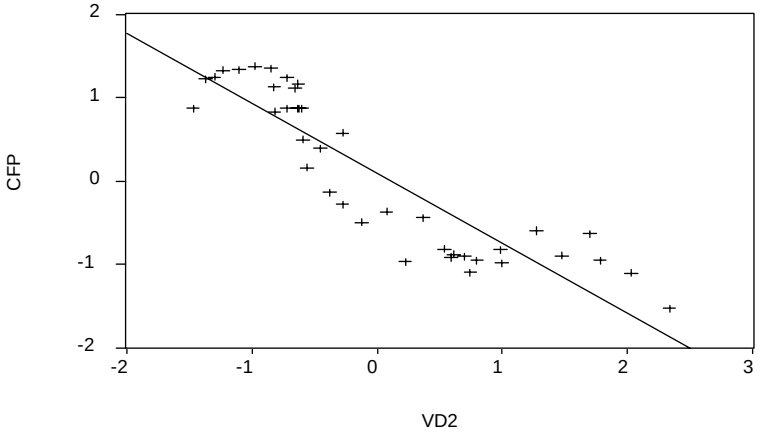


Chart 14



The two charts above show clearly that volatility of commercial bank interest rate spread (defined as **d2**) causes contraction of credit to households and private sector. Variance of interest rate spread creates uncertainty among households and private firms, thus affecting *their investment decisions*. In the setting of uncertainty households and pri vate firms are forced to resort to self finance.

5. Table of Models

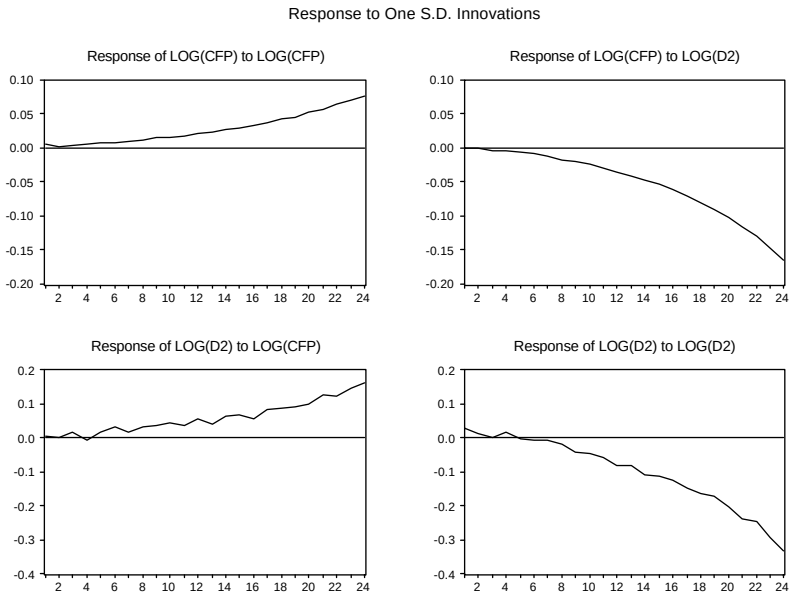
The table below summarizes the basic, tested VAR models. Vari ables are given in logarithms.

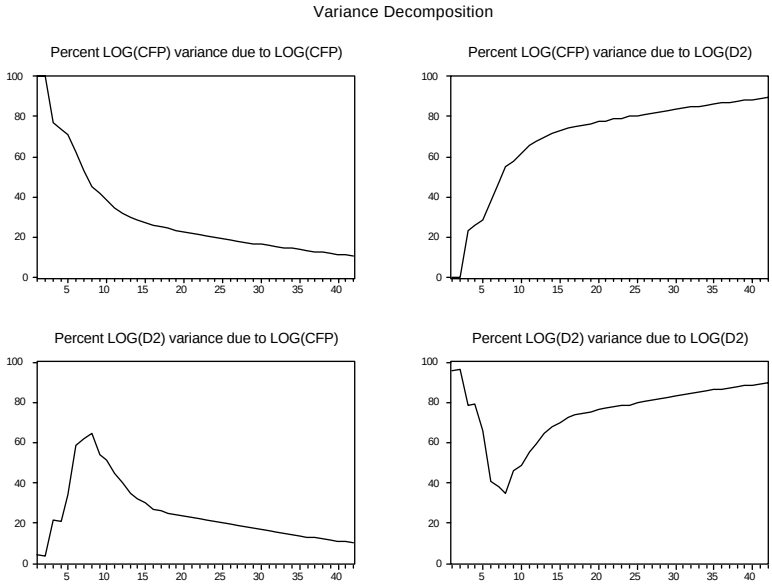
Table 2

	Dependent variable	Vector	Lags	R^2 adjusted	AIC	log likelihood
Model 1	CFP	(CFP, D2)	12	0.93	8.87	114.49
Model 2	CFG	(CFG, D2)	2	0.89	8.04	109.09
Model 3	CH	(CH, D2, E)	8	0.99	7.7	107.67
Model 4	i	(i, DG)	5	0.82	6.31	75.27
Model 5	ER	(ER, CF, CG)	4	0.93	8.81	127.61
Model 6	VDC	(VDC, VDG, VI)	6	0.87	16.38	307.71
Model 7	M3	(M3, DG, M0)	2	0.97	8.56	121.62
Model 8	NCF	(NCF, D2, DG)	2	0.94	4.08	31.83
Model 9	NCH	(NCH, D2, DG)	2	0.94	4.09	32.2

6. Variance Decomposition and Impulse Response Function for Different Models

Model 1

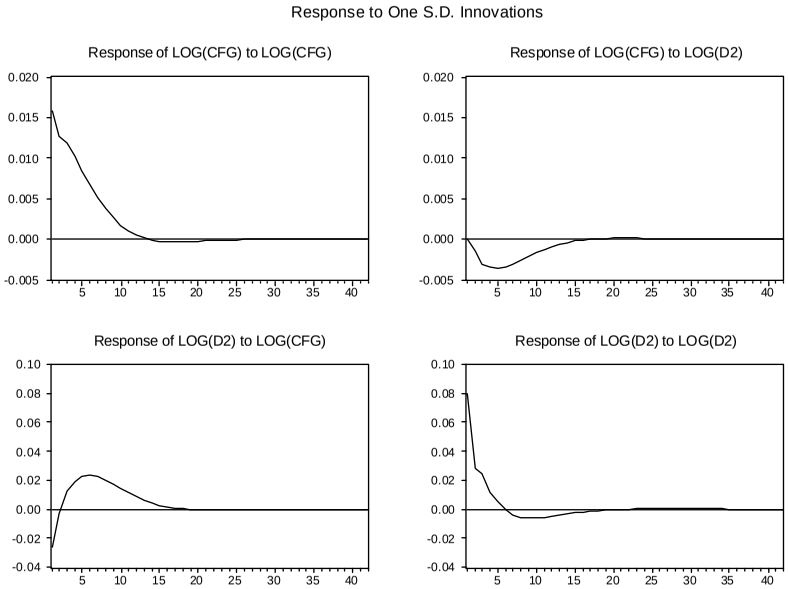


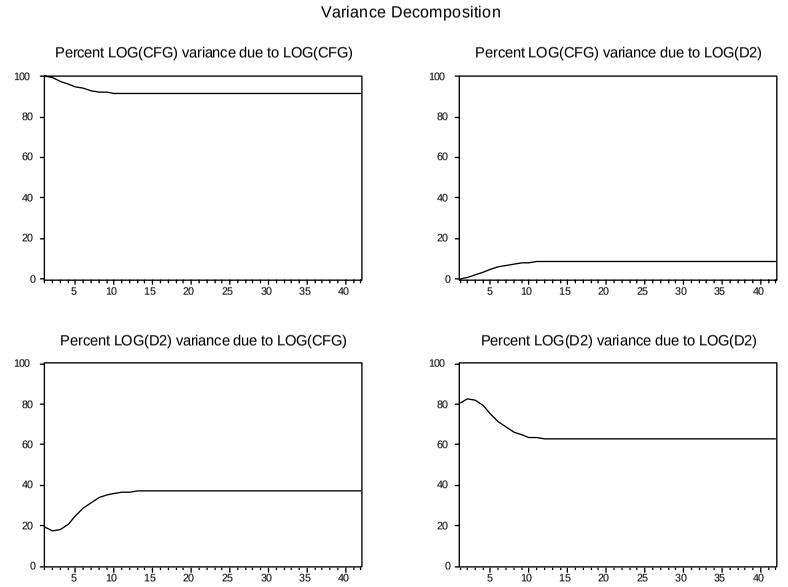


In Model 1 we measure the relation between credit to private firms and interest rate spread **d2** (the difference between interest rates on short term credits and interest rates on time deposits). The results from the model *confirm* the thesis for commercial bank credit rationing. Widening of the interest rate spread leads to contraction of credit to private firms, consistent with asymmetric information between firms and the banks. Commercial banks reduce credit to private firms due to insufficient information and the high cost of accessibility. Thus they solve the adverse selection problem, being unable to distinguish be tween 'good' and 'bad' borrowers.

The analysis based on *impulse response* shows that changes in inter est rate spread have a permanent effect on credit to private firms. The shock from widening of the interest rate spread does not subside over time and provokes a continuous decline of credit to the private sector. Concurrently, variance decomposition shows that 80% of variance of credit to the private sector is due to changes in the interest rate spread of commercial banks.

Model 2

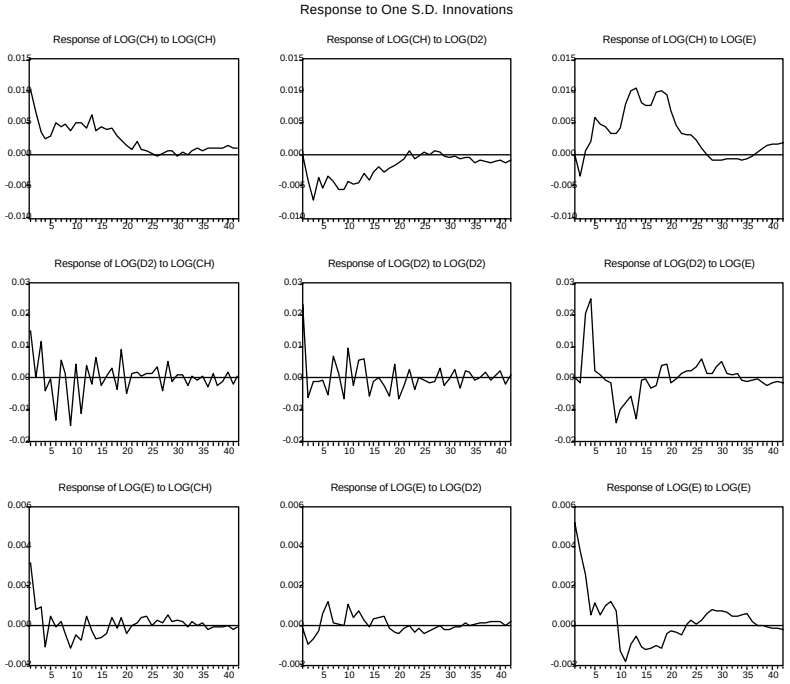

Response to One S.D. Innovations
Response of LOG(CFG) to LOG(CFG)
Response of LOG(CFG) to LOG(D2)
Response of LOG(D2) to LOG(CFG)
Response of LOG(D2) to LOG(D2)

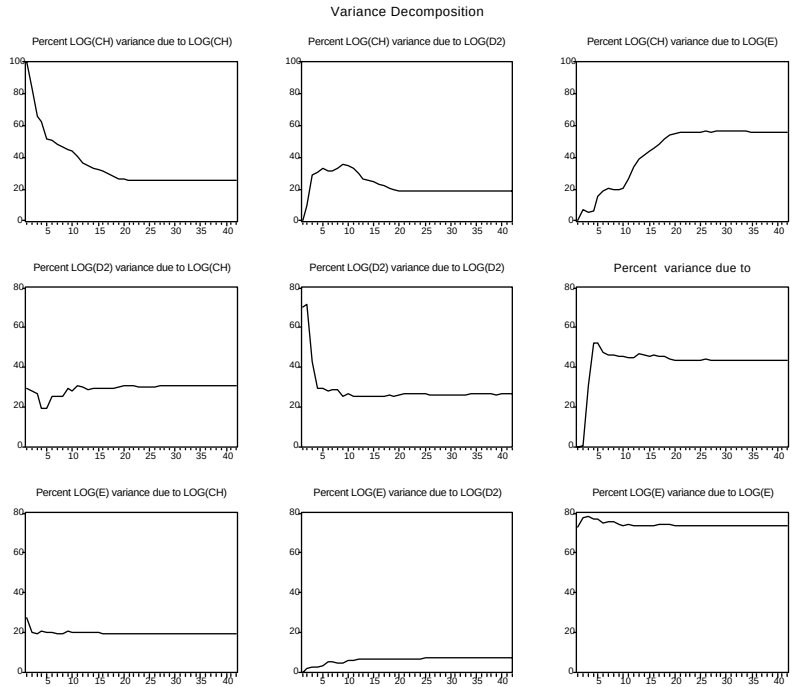

Variance Decomposition
Percent LOG(CFG) variance due to LOG(CFG)
Percent LOG(CFG) variance due to LOG(D2)
Percent LOG(D2) variance due to LOG(CFG)
Percent LOG(D2) variance due to LOG(D2)

Testing the relation between credit to public sector firms and inter est differential **d2** *does not confirm* the thesis for commercial bank credit rationing to these firms. This is explained, to a great extent, by the fact that banks extend credits primarily to big state owned firms as they possess more information about them, consistent with established long term relationships. On the other hand, it is a well known fact that big firms are less sensitive to changes in interest rates than small ones.

The results from model 2 show that changes in the interest rate spread initially lead to a temporary reduction of credit to state owned firms. However, the effects of this shock subside fast afterward. Con currently, variance of credit to state owned firms is mainly accounted for by changes in credit to these firms over past periods (95% of vari ance), while changes in interest rate spread account for just 5% of vari ance.

Model 3



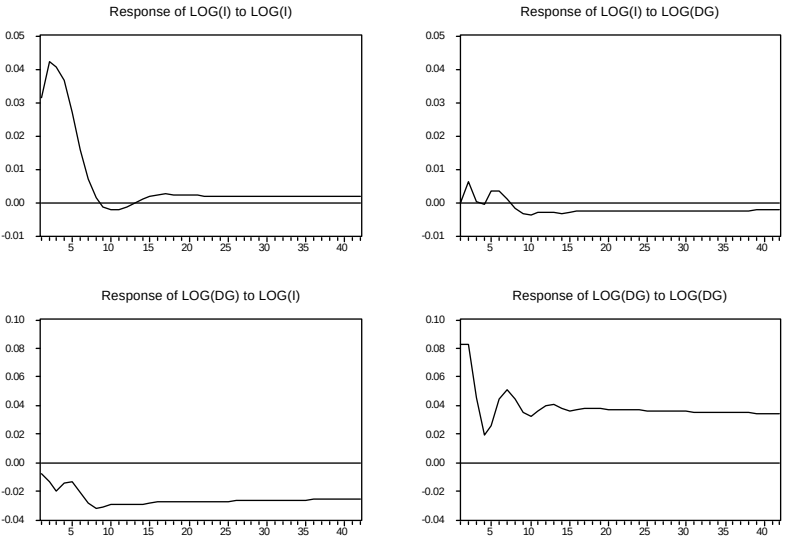


The results from model 3 show that widening of interest rate spread results in reduced credit to households. The effect of this shock is tem porary and subsides in four months. The BGL/USD exchange rate also affects credit to households and the initial impulse from an appreciat ing exchange rate results in credit reduction. This trend is quickly neu tralized and in two weeks the relation is already positive.

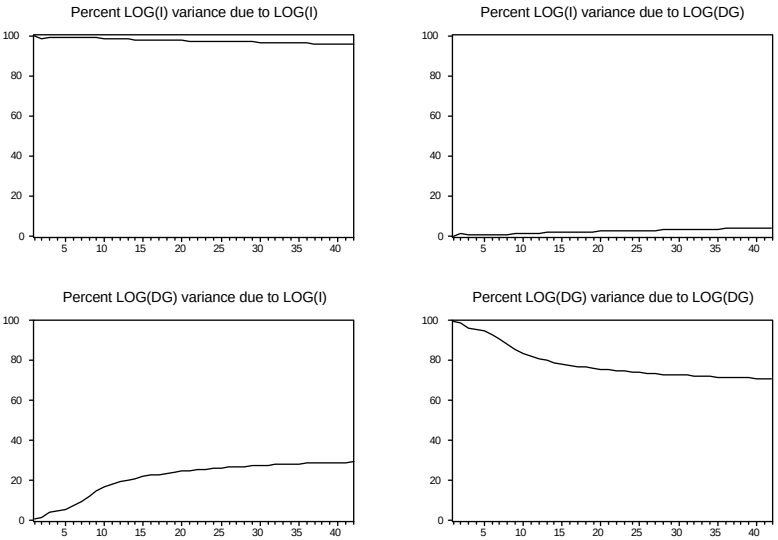
Variance of credit to households is primarily accounted for by the exchange rate (60%), which explains its decisive influence on house holds' expectations. The interest rate spread accounts for just 20% of the variance of credit to households. The strong impact of the BGL/USD exchange rate can be explained by the low interest rate spread between lev interest and interest on dollar denominated depos its, and reflects still unabated fear that the fixed rate might be aban doned. Moreover, with the bulk of trade flows being effected in US dollars the significance of currency risk is preserved.

Model 4

Response to One S.D. Innovations



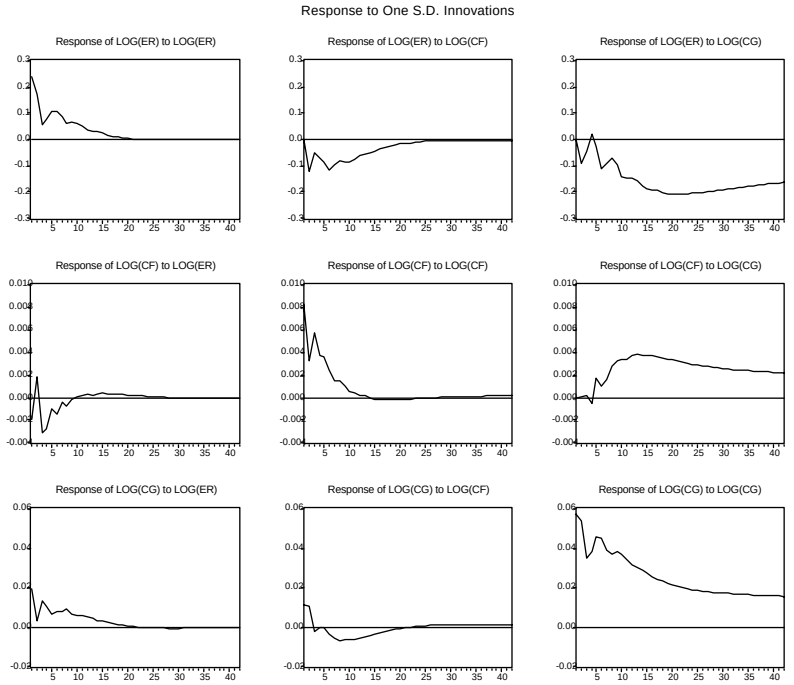
Variance Decomposition

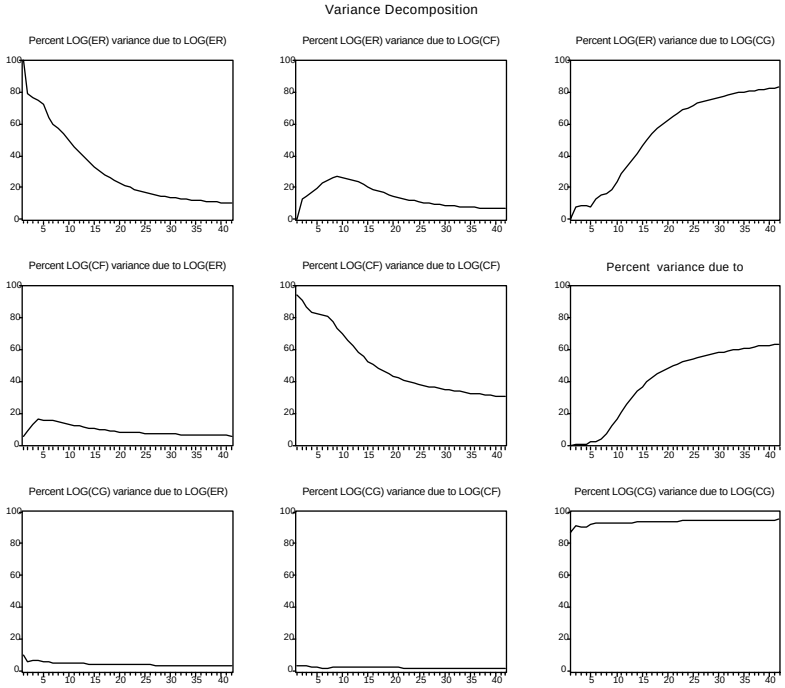


Model 4 examines the relationship between the interest rate and the government deposit at the Issue Department balance sheet. The results show that the initial impulse from increasing the government deposit leads to higher interest rate. This shock is rapidly offset, however; in practice the government deposit does not have a long term effect on the interest rate (the effect of monetary policy through the budget is insignificant). On the other hand, interest rate variance is accounted for only by changes in the interest rate in previous periods.

Actually, there exists a price mechanism whereby the government impacts reserve money. Maintaining an artificially low interest rate leads to reduced interest expenses on debt service and by increasing the government deposit at the Issue Department monetary constraints are further tightened.

Model 5

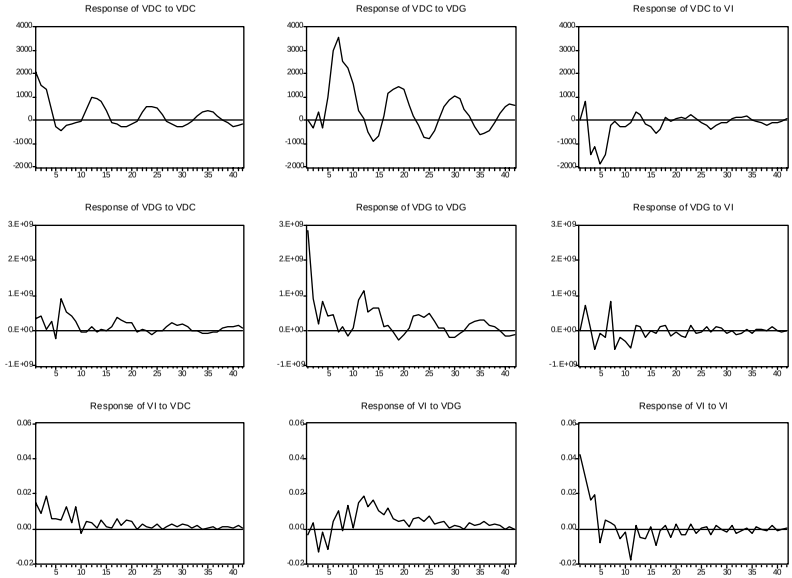




Model 5 examines the relationship between commercial bank ex cess reserves, credit to the government and credit to firms in the economy. The results confirm the thesis that an increase in excess re serves is accompanied by reduced credit to the government and firms. A difference appears in the effect of the impulse from increasing excess reserves. In terms of credit to firms it is only temporary, while in terms of credit to the government its effect is permanent. Excess reserve vari ance accounts for 80% of changes in credit to the government.

Model 6

Response to One S.D. Innovations



Variance Decomposition

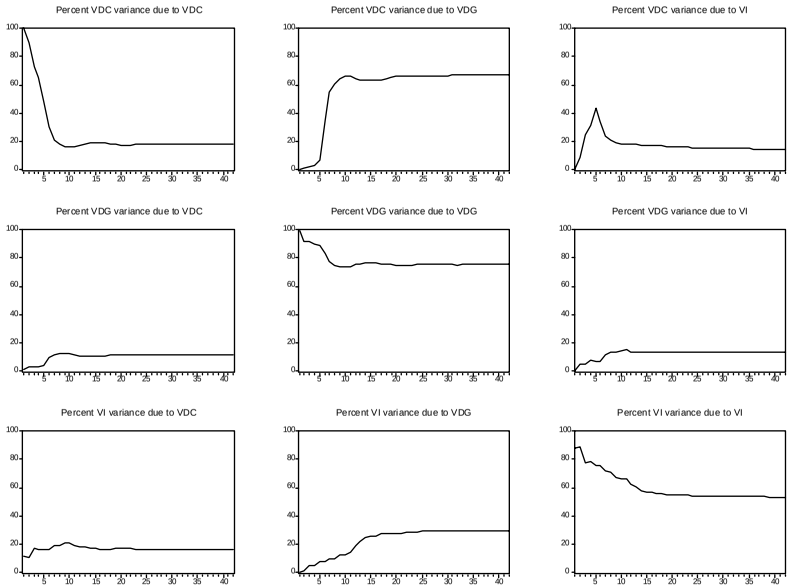
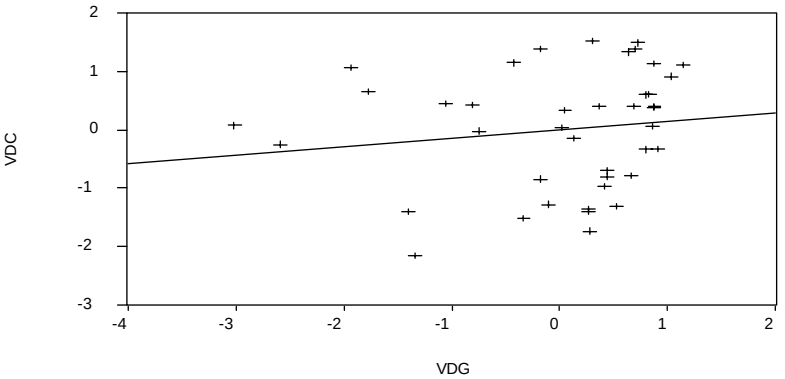
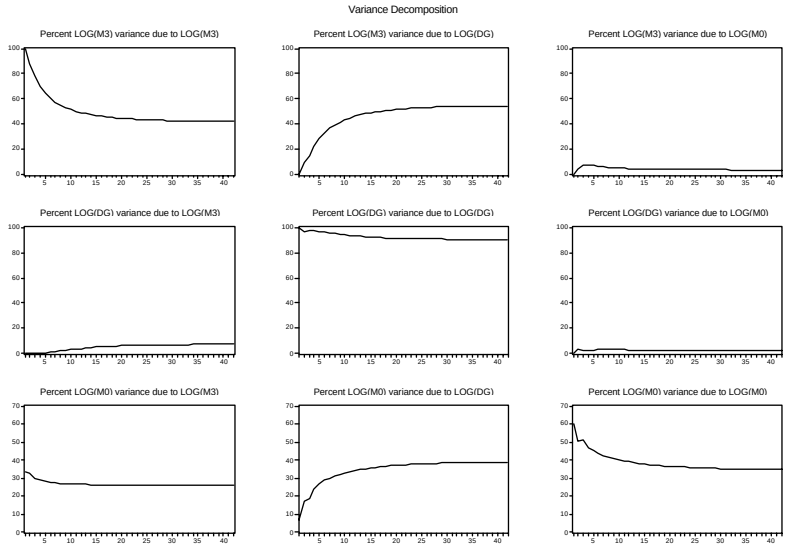


Chart 15



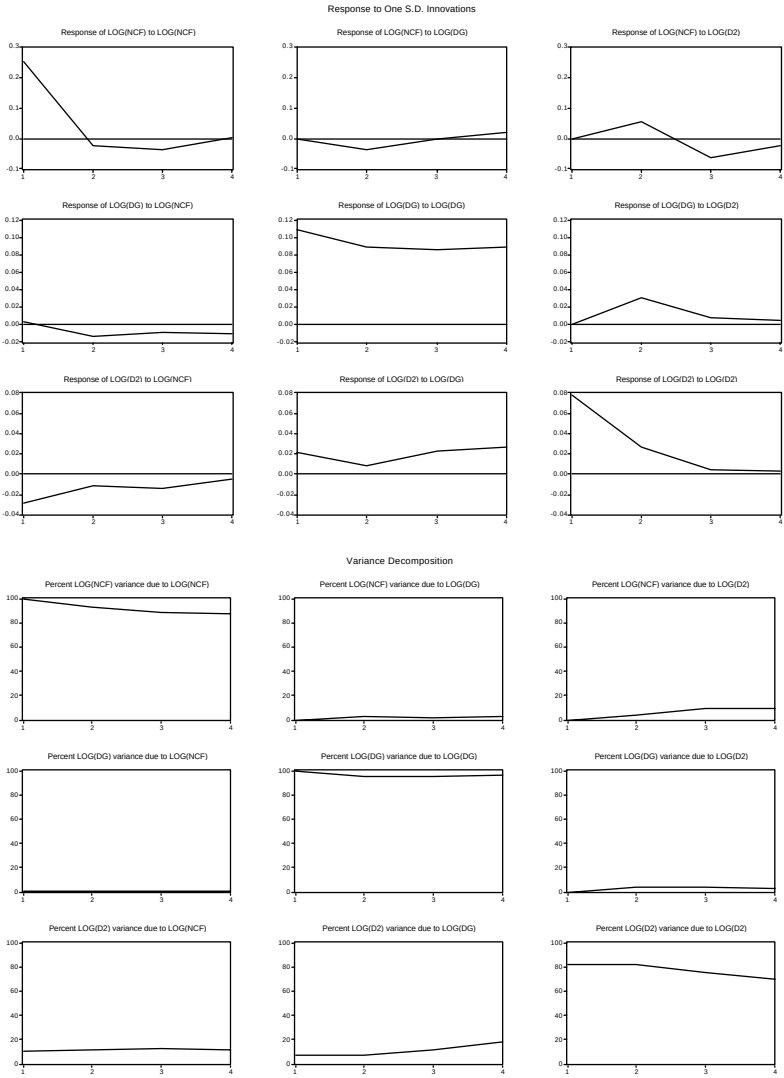
Model 6 examines the relationship between domestic credit vari ance, government deposit variance and interest rate variance. The re sults show that 60% of domestic credit variance is accounted for by government deposit variance. We discover a positive relationship be tween domestic credit variance and government deposit variance. Ac tually the government affects domestic credit through changes in its deposit at the Issue Department balance sheet, i.e. monetary policy is being conducted through this instrument.

Model 7



From model 7 it becomes clear that about 50% of broad money and monetary base variance is due to fluctuations in government deposit. Again this model confirms the thesis for the government's monetary policy (conscious or unconscious) being conducted through changes in its deposit at the Issue Department balance sheet.

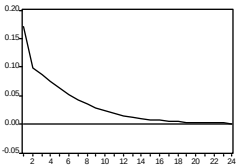
Model 8



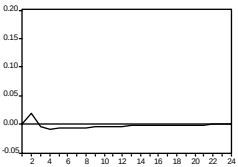
Model 9

Response to One S.D. Innovations

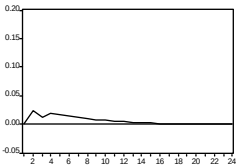
Response of LOG(NCH) to LOG(NCH)



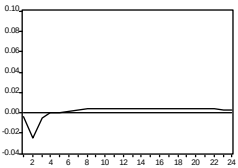
Response of LOG(NCH) to LOG(D2)



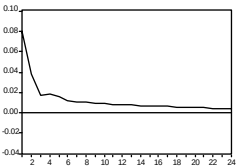
Response of LOG(NCH) to LOG(DG)



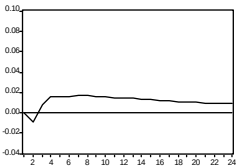
Response of LOG(D2) to LOG(NCH)



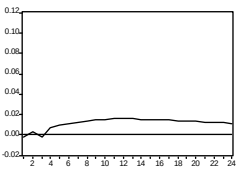
Response of LOG(D2) to LOG(D2)



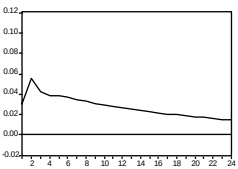
Response of LOG(D2) to LOG(DG)



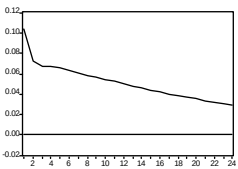
Response of LOG(DG) to LOG(NCH)



Response of LOG(DG) to LOG(D2)

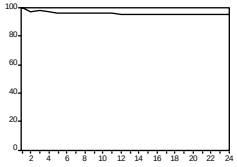


Response of LOG(DG) to LOG(DG)

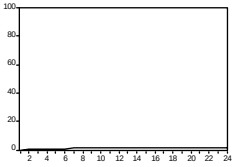


Variance Decomposition

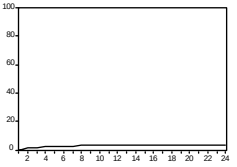
Percent LOG(NCH) variance due to LOG(NCH)



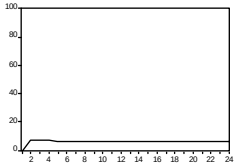
Percent LOG(NCH) variance due to LOG(D2)



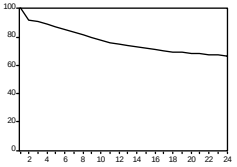
Percent LOG(NCH) variance due to LOG(DG)



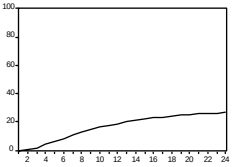
Percent LOG(D2) variance due to LOG(NCH)



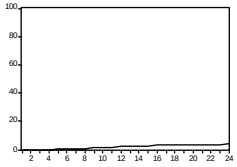
Percent LOG(D2) variance due to LOG(D2)



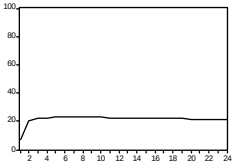
Percent LOG(D2) variance due to LOG(DG)



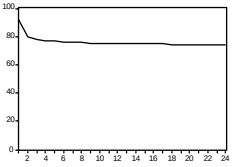
Percent LOG(DG) variance due to LOG(NCH)



Percent LOG(DG) variance due to LOG(D2)



Percent LOG(DG) variance due to LOG(DG)



Models 8 and 9 test the relationship between *newly extended* credits to private firms and households, the government deposit (as an ap proximation of monetary restriction) and the interest rate differential (as an approximation of credit rationing).

By using newly extended credits repayment of credits to commer cial banks is not taken into account. It is assumed that this model can also incorporate well the effects of the interest rate and the government deposit. The results show that increasing the government deposit ini tially causes a reduction of newly extended credits to private firms but this impulse rapidly subsides and its trend changes over three periods' time.

On the other hand, the government deposit has no effect on credit to households. Measuring the response of newly extended credits to in terest rate differential **d2** does not confirm the thesis for credit ration ing to firms and households. This is explained by the fact that commer cial banks can gather better information about households, on the one hand, and in case of default on the credit the procedure for collateral realization is fast. The variance of newly extended credits to private firms and households is entirely accounted for by the past values of these variables, indicating the model's *restrictive* character by using only newly extended credits (because it does not incorporate the effect of repaid old credits).

IV. Theoretical Conclusions and Practical Recommendations

The results from the study lead to a number of theoretical conclu sions and practical recommendations designed *to improve* the opera tion of the Bulgarian currency board, making its modus operandi more transparent and based on simplified rules.

Within the Bulgarian model of currency board, there exists a *spe cific form of financial repression*. Major instruments of this repression are the government deposit within the Issue Department liabilities, commercial bank minimum reserve requirements and the existence of base interest rate.

Changes in government deposit affect money supply through re serve money. These changes can be interpreted as an indicator of quasi monetary policy under currency board arrangement. An increase in this deposit causes contraction of the monetary base and is con ceived as a specific form of monetary restriction.

Fluctuations in government deposit also influence commercial bank lending behavior through traditional channels of asymmetric informa

tion and credit rationing. Private firms are most seriously affected by credit rationing. This confirms the existence of a credit channel within the monetary transmission mechanism.

Retention of *the base interest rate*[12] (Article 35 of the Law on the BNB) and the way of its setting violate the principal requirement of the currency board for market flexibility of interest rates. With interest rates below natural levels (induced by preference to saving and invest ment), the traditional mechanism of financial repression in the mean ing of McKinnon Shaw is derived. Availability of a base interest rate under a fixed exchange rate constitutes a *de facto* second nominal an chor which makes the economic structure *over identified* without equi librium solution.

Minimum reserve requirements, whose setting is left within BNB powers, are the *third* major instrument inducing distortions in the money market and the banking system.

Possibilities exist for the currency board operation to be improved.

With regard to *government deposit*, two alternative solutions are possible. The first is for the government to abandon money supply regulation[13] by withdrawing its deposit from the liabilities of the Issue Department, to be deposited with commercial banks. The second is for the government deposit to be separated in an independent institution. This way the currency board will be released from atypical functions and money supply will become transparent and automatic. The assets of the Issue Department will include net foreign assets, and within the liabilities will remain only currency in circulation (consistent with cur rency board underlying principles).

The switch of government deposit to *commercial banks* would shift the effects of government deposit on money supply from reserve money to money multiplier. The impact through the multiplier will de pend on commercial bank behavior (particularly on assets in which government funds will be invested), as well as on the public propensity to hold banknotes. Anyway, the deposit's influence will be based on market principles, will reflect commercial bank behavioral preferences

[12] See footnote 10.

[13] In actual fact monetary policy will always exist in one form or another, while the cur rency issuer is a monopolist. Monetary policy may be based on discretion or rules, con sciously constructed or being partially spontaneous but it will never be able to solve the problem of the optimal quantity of money meeting the spontaneously arising demand for money.

and will depend on the state of the credit and interbank money mar kets[14].

If government fund management is framed into a *separate institu tion*, to be governed by general rules applicable to commercial banks, the government would be facilitated in managing its own funds. Thus the government will be put on an equal footing with other financial in stitutions and will have to follow more closely market behavior.

The second principal recommendation that should be discussed is the *elimination* of commercial bank reserve requirements with the BNB. This way the *banks themselves* will determine the level of re serves with the central bank necessary for settlement. This would be in line with modern trends of liberalizing financial relations and banking. It is possible to switch to liquidity requirements as in Argentina, or at worst, reserves may accrue interest equal to the interest accrued on funds attracted in the interbank market.

The third suggestion concerns the abolition of the *base interest rate*. This issue has been discussed from the outset of currency board opera tion. Despite some technical arguments for the retention of the base interest rate voiced by the BNB, the effects of its elimination would be much more beneficial for the economy. Some countries with currency boards (Estonia, Argentina) do not announce base interest rates.

Finally, above three improvements would make the banking system more efficient and stable, contributing to greater transparency and au tomation in currency board operation. This would facilitate money sup ply adaptation to money demand and would help 'touch' the optimum quantity of money needed for growth, opening room to reduce credit rationing and asymmetric information in the credit market. Relations between the central bank, commercial banks and the state budget will be put on a market basis and their efficiency will be judged by their fund management abilities.

[14] At this point one may formulate the argument that by going to commercial banks the government's funds will increase money supply and a portion of these funds will flow back to the balance sheet of the Issue Department in the form of larger reserve requirements. The second part of this argument would be irrelevant once reserve requirements are eliminated.

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