BANK LENDING CHANNEL AND MONETARY TRANSMISSION MECHANISM IN UKRAINE

by

Maxym Kryshko

A thesis submitted in partial fulfillment of
the requirements for the degree of

Master of Arts in Economics

Economics Education and Research
Consortium
at the National University "Kyiv-Mohyla
Academy"

2001

Approved by _____
Chairperson of Supervisory Committee

_____

_____

_____

Program Authorized
to Offer Degree _____

Date _____

Economics Education and Research

Consortium

at the National University "Kyiv-

Mohyla Academy"

Abstract

BANK LENDING CHANNEL AND MONETARY TRANSMISSION MECHANISM IN UKRAINE

by Maxym Kryshko

Chairperson of the Supervisory Committee: Professor Serhiy Korablin,
Institute of Economics Forecasting
at Academy of Sciences of Ukraine

The paper studies in detail specific channel of the monetary transmission mechanism in Ukraine – bank lending channel. First, the research addresses the theoretical framework of the bank lending channel, its role and place within the system of other monetary transmission channels, examines necessary conditions for its existence, and presents a simplified, but still explanatory theoretical macro-model. Second, attention is paid to the institutional features of Ukrainian economy that make the bank lending channel (apart from traditional interest rate channel) the most plausible candidate to explain the influence of the National Bank's monetary policy on Ukrainian real sector. Third, the paper conducts extensive econometric analysis of whether bank lending channel in fact operates in Ukraine. Here the emphasis has been put on testing the first chain of the channel that connects National Bank of Ukraine with the system of commercial

banks. Two types of tests are applied to study this link. A macro test uses aggregated banking system data, while a micro test tries to identify bank lending channel effects through heterogeneity of individual banks. The results suggest that there is some macro evidence supporting the operation of bank lending channel in Ukraine, while the micro evidence seems to be somehow inconclusive as to the specific direction of the studied effect according to the size of the banks.

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

Figures

Tables

ACKNOWLEDGMENTS

The author wishes to express his gratitude to Prof. Herken-Krauer for valuable and helpful conversations and advice. He is also indebted to Max Kazanowsky and Yuriy Gorodnichenko for their enormous help in obtaining data, as well as to Irina Loukyanenko and Jurek Konieczny for helpful comments and ideas. Finally, the author is thankful to all his colleagues for their support and assistance.

GLOSSARY

Monetary Transmission Mechanism – a mechanism that transforms monetary policy actions conducted by central bank into the real economic activity.

Channel of Monetary Transmission Mechanism – specific link of causation between several variables that starts from central bank's certain policy action and ends up at some real sector variable (e.g. output). A single monetary policy action may be transmitted simultaneously through different channels of MTM.

NBU – National Bank of Ukraine

UEPLAC – Ukrainian-European Policy and Legal Advice Center

UAH – abbreviation that denotes Ukrainian local currency – hryvnia

OVDPs – public debt securities (like T-Bills or T-Bonds in US) issued by Ukrainian Ministry of Finance

PFTS – First Stock Trading System, the most active Ukrainian stock trading site.

Chapter 1

INTRODUCTION

It is well known that the countries with economies in transition have experienced deep and profound transformations over the recent decade. New institutions and institutional arrangements have gradually replaced the old ones, shifting the emphasis from central planning and direct governance to a more decentralized market-oriented model of economies.

The monetary policy conducted by the central bank is known to be one of the cornerstones of the mechanism such models work through. In this respect, the central bank faces a fundamental problem: it should be able to control effectively the influence of its monetary policy actions on the macroeconomic situation and on real economic activity in particular so as to attain ultimate policy goals. To exercise effectively such control and also to forecast the consequences of its monetary policy actions, the central bank needs a coherent model that is consistent theoretically and performs well empirically. Modern economic literature offers a great variety of theories that explain how different channels of the monetary transmission mechanism (MTM) operate. That is why the question of applicability and relevancy of a particular theoretical channel that can be incorporated in the central bank's model of MTM for policymaking purposes seems extremely important.

If we narrow the question down to the case of Ukraine, it appears to be even more important, because ten years ago Ukraine didn't have any of the present institutional arrangements in monetary sphere and therefore the models that existed at that time cannot perform well now. Moreover, the economy of Ukraine

has already passed the stage of stabilization after the breakup of Soviet Union and the issue of achieving positive economic growth has become crucial. With regard to this, policymakers at the government and in the central bank should be aware of monetary policy's effects on the real sector of Ukrainian economy. Features like weak capital markets, high dependence of agents on bank finance etc. may suggest that in Ukraine bank lending channel of MTM seem to augment most plausibly the traditional interest rate effects. Although this plausibility follows from very general institutional considerations, they are nevertheless important to be addressed. In addition, a closer look is needed to see whether required in theory assumptions of bank lending channel hold in Ukraine. This will help to justify the bank lending approach when constructing comprehensive and broad model of MTM in Ukrainian context, as well as to reveal the aspects of MTM specific to Ukraine that can then be incorporated into this model.

With all these thoughts in mind, the paper proceeds as follows. In the second chapter we address bank lending channel of MTM theoretically, emphasize its place and role within the system of other transmission channels, explore different views on its definition, necessary conditions and assumptions, and present a simple, but explanatory macro-model. In the third chapter, we turn to the institutional analysis of Ukrainian context and seek to establish that unlike the other channels of monetary transmission, the bank lending channel seems to augment conventional interest rate effects most plausibly. Chapter 4 is fully devoted to econometric testing of bank lending channel *at the level of National Bank – Ukrainian banking system link*, while making use of both macro- and micro-level data. A macro data test that primarily relies upon building and examining impulse response functions for bank deposits, loans and securities tends to support predictions implied by bank lending channel story. Yet, apart from many potential drawbacks in empirical results, the story admits alternative interpretations consistent with traditional interest rate channel. Therefore, the

second subsection of Chapter 4 employs micro-level data to identify bank lending channel through heterogeneity of individual banks. From the implications of bank lending channel, two effects – strength effect[1] and size effect – are hypothesized. However, existing micro data on Ukrainian banks allow confirmation, albeit with certain reservations, of only the strength effect and only for the group of small banks, while size effect turns out to be statistically insignificant. Finally, chapter 5 offers the summary of results and conclusions.

[1] Strength effect (if strength is proxied by liquidity) basically means that the sensitivity of lending to monetary policy is lower in absolute terms for banks with stronger (more liquid) balance sheets. See p.57 for details on the definition of strength and size effects.

Chapter 2

CHANNELS OF MONETARY POLICY TRANSMISSION AND BANK LENDING CHANNEL

General Theoretical Underpinnings

Monetary transmission mechanism is the mechanism identified in economic literature that transforms monetary policy actions conducted by central bank into real economic activity. Operating procedures, instruments and targets of monetary policy may essentially vary across countries. However, macroeconomic theory, as well as empirical studies, has developed a great many approaches that explain how such a link actually works.

Their common feature is that change in stance of monetary policy caused by central bank somehow translates into the growth of aggregate demand that lead to a rise in output. Yet, the internal microstructure of this transformation is not as straightforward.

Expansionary Monetary Policy => ["black box"] => Output ↑

In view of this, economists have worked out certain channels of MTM that specify exactly how this translation occurs and what eventually drives aggregate demand, and therefore real output, up or down.

The traditional explanation uses the basic Keynesian IS-LM framework and usually employs **interest rate channels**. According to this explanation (often referred to as "money view"), all agents in economy hold only two types of assets – money in the form of currency and bonds as a superficial collection of all other

financial assets. Expansionary monetary policy leads to a rise in the amount of bank reserves and therefore to the expansion of deposits. Because money and bonds are the only assets in the economy, economic agents tend to hold more money and fewer bonds. For the asset market to come to equilibrium, short-term interest rates should fall so that the agents accept additional money holdings. Fall in market real interest rates, which decreases the capital costs of financing investments, thereby causes a growth of investment spending. Increased investment drives aggregate demand and then output up. Schematically it can be depicted as follows:

Expansionary Monetary Policy => Real Interest Rate ↓ => Investment ↑ => Output ↑

Lack of empirical support for identifying significant effects of interest rates on investment spending stimulated researchers to find other channels of MTM. In order to classify them we turn to the approach of Mishkin (1996). In his survey article, he argues that besides interest rate channels there are two other groups of monetary transmission channels:

1. Other asset price channels
   - exchange rate channel;
   - equity price channels (Tobin's Q theory, wealth effects and similar housing and land price effects).
2. Credit channels
   - bank lending channel;
   - balance sheet channel;

- cash flow channel;
- unanticipated price level channel;
- household liquidity channel.

Other Asset Price Channels

While the traditional interest rate channel focuses on a single asset price (bond interest rate), there exist alternative theoretical channels of MTM that incorporate into analysis the prices on other assets, namely on foreign exchange and on equities.

Exchange Rate Effects on Net Exports

As argued by Mishkin (2001), essentially this channel relies upon interest rate effects too. When central bank loosens monetary policy and real interest rates fall, assets denominated in local currency become less attractive relative to foreign assets. The economy responds by depreciation of nominal exchange rate. This in turn raises the attractiveness of locally produced goods in export markets, thus stimulating net exports and output in the economy. Link of causation is as follows:

Expansionary monetary policy => Real interest rate ↓ => Exchange rate ↓ (depreciates) => Net Exports ↑ => Output ↑

Tobin's Q Theory

Another channel of MTM stems from famous Tobin's Q theory of investment. We are not going to describe the details of this theory here, but still we emphasize the essential conclusion relevant for out study. When monetary policy is getting easier, equity prices may (and often do) rise, thereby increasing the market value of firms relative to the cost of replacing their real capital. In terms of Tobin's Q

theory, this means that Q-ratio defined as firm's market value divided by replacement cost of firm's capital increases. As Q-ratio goes up, effective cost of real capital falls implying that the firm may issue new equity and purchase new equipment more cheaply than before. Hence, as Q-theory predicts, when stock prices surge, firms then tend to issue more equity and increase investment spending. Schematically, the channel works as presented below:

Expansionary monetary policy => Equity prices ↑ => Q-ratio ↑ => Investment ↑ => Output ↑

Wealth Effects on Consumption

The key notion for this channel is financial wealth of consumers. One of the most important components of financial wealth is common stocks held by consumers-households. As stock markets surge following the expansionary monetary policy, the market value of financial wealth rises, thus increasing the amount of resources available for consumption. Next, with more resources, consumption spending should definitely grow and stimulate aggregate output.

Expansionary monetary policy => Equity prices ↑ => Financial wealth ↑ => Consumption ↑ => Output ↑

It should be noted that the definition of "equity" here could be rather broad. We may replace equity prices with prices for housing or land, which are components of wealth too. Thus, similarly to the case above, a rise in these prices stimulates consumption due to increased wealth of households, and therefore promotes output growth.

Credit Channels

Bank lending channel of monetary transmission mechanism belongs to the broader group of so called *credit channels* that deal with information asymmetries in financial markets. This means that typically a borrower who gets the loan from bank is more certain and has more information about the risks and returns from the projects he is going to be engaged in with these funds than the lender does. Lack of proper information leads to information asymmetries in financial markets, both before and after financial transaction takes place. Lack of information before extending the loan leads to the adverse selection, whereas information deficiency after occurrence of transaction creates moral hazard problem.

The common feature of the credit channels is the assumption that banks play a distinct role in financial system due to the fact that they are more than anyone else suited to transact with significant class of borrowers, where the problems of asymmetric information can be very high.

The most general interpretation of how all credit channels transmit monetary policy is often referred to as *credit view* and can be depicted schematically:

Expansionary monetary policy => Loans ↑ => Investment ↑ => Output ↑

We will further address the bank lending view below in a separate subsection, while here we just briefly outline how the other credit channels work.

Balance Sheet Channel

This particular mechanism stems from the presence of moral hazard and adverse selection problems in financial markets. Usually, if firm's net worth declines, this implies that moral hazard and adverse selection in lending to this firm intensifies. In other words, ceteris paribus, lenders are now less willing to provide funds to

the low-net-worth firm, because of smaller collateral. In addition, lenders know that owners of the low-net-worth firm are more prone to engage in risky activities, which may imply that lenders will significantly cut back new loans. In sum, lower net worth of the firm might cause lower lending and thus fall in firm's investment spending.

Next, if we introduce monetary policy that triggers stock market movements, we are clearly led to the balance sheet channel of monetary transmission:

Expansionary monetary policy => Equity prices ↑ => Adverse selection ↓, Moral hazard ↓ => Loans ↑ => Investment ↑ => Output ↑

Cash Flow Channel

The same logic with asymmetric information applies to the cash flow channel. Here the changes in intensity of adverse selection and moral hazard are rooted in improvement/deterioration of the firm's cash flow. Suppose monetary expansion first lowers short-term nominal interest rates. Then the firm may find it much easier to serve its short-term debt because interest payments are now lower. This, of course, improves the firm's cash flow and adds certainty to the lender that the loan granted to this firm will be duly repaid. As a result, moral hazard and adverse selection problems diminish, which by itself promotes new lending and thus increases investment spending and output.

Expansionary monetary policy => Nominal interest rate ↓ => Cash flow ↑ => Adverse selection ↓, Moral hazard ↓ => Loans ↑ => Investment ↑ => Output ↑

Unanticipated Price Level Channel

As other credit channels, the unanticipated price level channel also relies on financial market imperfections. However, the source of movement in intensity of adverse selection and moral hazard problems now originates in changes of the

firm's net worth induced by unanticipated price level shock (positive or negative). Suppose the economy experiences an unanticipated rise in price level after the monetary expansion has occurred. Mishkin (2001) notes that in industrialized countries debt payments are essentially fixed in nominal terms in respective contracts. As long as this is true, the real value of the firm's liabilities decreases, thus increasing real net worth of the firm. The rest of the transmission proceeds as before:

Expansionary monetary policy => Unanticipated price level ↑ => Net worth ↑ => Adverse selection ↓, Moral hazard ↓ => Loans ↑ => Investment ↑ => Output ↑

Household Liquidity Channel

Apart from focusing on spending of businesses when examining channels of MTM, credit channel literature pays attention to spending of households too, specifically on residential housing and durable goods. However, there is one channel, meaningfully different from all considered above and connected with liquidity effect on households. If households have relatively large amount of their wealth invested in financial assets compared to the debts they owe, then their expected probability of financial distress is low. This implies that the households are relatively more willing to buy housing and durable goods.

These considerations lead us to the following link of causation. Expansionary monetary policy boosts stock prices together with the value of financial assets. As households perceive the probability of getting in financial trouble to be low, consumer durable and housing spending will rise stimulating aggregate demand and output. Schematically, the mechanism works as follows:

Expansionary monetary policy => Equity prices ↑ => Value of financial assets ↑ => Likelihood of financial distress ↓ => Consumer spending on housing and durables ↑ => Output ↑

Bank Lending Channel: Theoretical Discussion

In contemporary economic literature there is still a discussion as to the definition of specific bank lending channel, its microfoundations and prerequisites and its features that distinguish this sub-channel from the other credit view sub-channels.

Mishkin (1996) in his survey article about different groups of MTM channels distinguishes within credit channels two ones: *bank lending channel* and *balance-sheet channel* in wide sense. In previous section, we have already touched upon the most representative sub-channels of the latter. As to the former, in Mishkin's view, because of

(i) banks' special role in dealing with certain types of borrowers (bank-dependent business firms and households) that will not be able to access loan markets without intermediation of banks and

(ii) imperfect substitutability between bank deposits and other sources of financing for banks

the bank lending channel operates as follows. Expansionary monetary policy boosts the reserves of banks, as well as the deposit base of banking system, thereby allowing for the amount of loans to increase. Growth of loans causes the investment of bank-dependent firms and to a less extent consumer spending to rise, pushing up aggregate demand and output.

Expansionary monetary policy => Bank deposits ↑ => Bank loans ↑ => Investment, consumer spending ↑ => Output ↑

Additionally, Mishkin doesn't state explicitly whether the bank lending channel is an independent one or acts as an amplifying mechanism for traditional interest rate channel. Moreover, he points out that recently there have emerged reasons to suspect that the bank lending channel is losing importance, at least in the United States.

Bernanke and Gertler (1995), however, argue that the credit channel, along with bank lending component, is not actually an alternative view to the traditional MTM. It is just a set of features that intensify and extend traditional interest rate effects and is not a truly independent mechanism.

They introduce the concept of *external finance premium*, which is the difference in cost between funds raised externally by issuing stocks and bonds and funds generated internally through earnings retention. The size of this premium reflects the degree of imperfections in credit markets that determines the discrepancy between the expected return received by lenders and the costs faced by potential borrowers. According to their formulation of credit view, "a change in monetary policy that raises or lowers open-market interest rates tends to change the external finance premium in the same direction". Therefore, this complementary effect of monetary policy on the borrowing cost and on real activity is amplified. Thus, in the view of Bernanke and Gertler (1995), the bank lending channel is the linkage that explains impact of actions taken by central bank on external finance premium by focusing on relationship between these actions and the supply of loans by depository institutions. It basically operates in two stages:

(i) open market operations shrink banks' core deposit base and force banks to raise other liabilities (for instance, in the form of CDs) thereby

increasing banks' relative costs of funds and making banks reduce the supply of loans;

(ii) after banks have reduced the supply of loans, bank-dependent borrowers have to bear additional costs to find a new lender and establish credit relationship, which is likely to increase the external finance premium and hence drive real economic activity down.

Schematically, the above-mentioned procedure can be described as follows:

Tight monetary policy (reserves ↓) => Bank deposits ↓, other liabilities ↑ => Cost of funds for banks ↑ => Bank loans ↓ => External finance premium ↑ => Investment ↓ => Output ↓

Two key assumptions underlie the proposed mechanism:

(i) banks cannot costlessly switch from drained core deposits to other liabilities, such as CDs or new equities

(ii) many borrowers are significantly bank-dependent.

Interestingly, a more elaborate look into the bank lending view is presented by Kashyap and Stein (1993). They generally follow an earlier formulation in a model by Bernanke and Blinder (1988), however, additionally, they essentially strengthen theoretical postulates and assumptions by outlining microeconomic foundations needed to generate bank lending channel.

First, they define the bank lending channel of monetary transmission by contrasting it with the traditional interest rate (or money) view. While the major feature of the money view is that there are only two assets in the economy – money and bonds, the lending view emphasizes that there are three assets –

money, publicly issued bonds and intermediated loans – and that they differ in meaningful ways. In this framework, banks are special in two respects: they can create money and also make loans to firms and households.

Kashyap and Stein (1993), unlike Bernanke and Gertler (1995), treat the bank lending channel as an independent one operating through the impact of monetary policy actions on the supply of intermediated loans. They argue that the decrease in bank reserves can considerably affect real activity if it makes banks reduce the supply of loans. More precisely, the cost of loans relative to bonds will increase, and bank-dependent firms will be forced to shrink investment.

They stipulate necessary conditions that must hold for bank lending channel to be operative:

(i) bonds and intermediated loans must not be perfect substitutes for certain borrowers;

(ii) central bank must be able to influence the supply of intermediated loans by altering the amount of reserves available to the banks;

(iii) the economy must have imperfect price adjustment mechanism so as to generate non-neutrality of monetary shock.

With respect to the first condition, Kashyap and Stein refer to other researchers (e.g. Diamond (1984)) and state that financial intermediaries including banks can be efficient in terms of reducing the costs of monitoring certain types of borrowers. Hence, some firms will be intermediary-dependent because of likely high own costs of monitoring. For these firms bonds and loans won't be perfect substitutes.

The second condition requires careful examination, because one may well think of many factors that could potentially undermine the ability of the central bank to affect the supply of loans. Among such factors can be availability of non-bank finance, the existence of regulations that provide for exemptions of certain types of bank liabilities from reserve requirements etc. In other words, when central bank tightens monetary policy, the borrowers from real sector are able to find with little costs alternative financing or banks can substitute away from transaction deposits to other non-reservable liabilities so that ceteris paribus the effect of tightening will be very limited.

As to the third necessary condition, Kashyap and Stein just note that imperfect price adjustment is not unique to the lending view and is present in any theory where monetary policy is non-neutral. The same assumption is implicitly present in the formulations of bank lending channel by Mishkin (1996), Bernanke and Blinder (1988, 1992) and Bernanke and Gertler (1995).

Bank Lending Channel: Integrated Approach

As we can see, the approaches to the theory of bank lending channel differ in details somewhat. However, we may certainly identify a set of common assumptions that each of the approaches possesses.

First, each of the theorists recognizes that the financial structure that transmits monetary policy actions of central bank is important, and financial intermediaries are considered, unlike in the traditional money view, to matter for MTM. Second, bank intermediated loans are seen as imperfect substitutes for other assets in the economy such as money and bonds. Moreover, all agree that such imperfect substitutability should be pronounced for spending decisions of a sizable share of borrowers (largely small bank-dependent firms and households). Third, on liability side of banks, transaction deposits cannot be costlessly substituted for

other forms of financing. This provision, in other words, means that the monetary and regulatory policy of central bank can ultimately affect supply of bank loans. And finally, all perspectives on the bank lending view presume that the economy must have nominal rigidities that allow for a monetary policy shock to be non-neutral. By the way, this assumption is needed not only by lending view, but also by the conventional money view[2].

The differences come from the exact forces that influence spending decisions. In Bernanke and Gertler's view, firms choose to invest more or less due to movements in external finance premium, i.e. decrease in supply of bank loans is transmitted to real economy through demand side. At the same time, Kashyap and Stein (1993), Cecchetti (1995), Bernanke and Blinder (1988) argue that changes in investments are caused by shrinking supply of bank loans, with demand schedule for loans relatively unchanged[3].

As can be seen, our common assumptions correspond most closely with the approach of Kashyap and Stein (1993). Therefore, for the purposes of this paper we will basically stick to this approach and will further consider bank lending channel in line with its assumptions, necessary conditions and way of operation.

Schematically, we perceive the bank lending channel to operate as follows:

Expansionary monetary policy => Bank deposits ↑ => Supply of bank loans ↑ => Investment ↑ => Output ↑

[2] However, the sources of imperfect price adjustment may well vary from wage stickiness to limited participation of certain groups of agents (e.g. households) in financial markets.

[3] Empirical confirmation for this statement comes from the work by Kashyap, Stein and Wilcox (1993).

In this chain a rise in bank deposits and corresponding shift of loan supply schedule occur at the level of banking system, while investment decisions and increases in aggregate demand and output take place in the real sector.

For further reference, we denote necessary conditions of bank lending channel in the following manner:

(A1) Bank loans and bonds are imperfect substitutes on the liability side of certain borrowers;

(A2) central bank must be able to influence the supply of intermediated loans by altering the amount of reserves available to the banks;

(A3) The economy must have nominal rigidities to allow for imperfect price adjustment.

These are the conditions required by theory so that a distinct bank lending channel be operative.

Representative Model

In our opinion, the most powerful but still simple explanatory tool that incorporates the assumptions of bank lending channel is a theoretical macro-model by Bernanke and Blinder (1988). Essentially, it modifies traditional IS-LM framework and introduces imperfect substitutability between loans and bonds, both for banks and for other agents (firms/households). This is done by assuming an additional (meaningfully different from money and bonds) asset in the economy – loans – and by explicitly considering market for this asset, in which banks play a major role. Constant prices are inherited from IS-LM model and thus monetary shock's non-neutrality is guaranteed.

First, the model starts by stipulating accounting identity of aggregate banking system (under assumption of zero net worth):

$B^b + E + L^s = D \cdot (1 - \tau)$

where

B^b – quantity of bonds held by banks

E – amount of excess reserves

L^s – amount of loans

D – total deposits (assume only transactional)

τ – reserve requirement ratio

Then, Bernanke and Blinder (1988) assume that the amount of loans supplied L^s represents a share of total bank assets which positively depends on loan interest rate and negatively – on bond interest rate[4].

$L^s = \lambda(\rho, i) \cdot D \cdot (1 - \tau)$

where

$\lambda(\rho, i)$ – share of assets invested in loans to firms such that $\lambda_\rho > 0,\ \lambda_i < 0$

ρ – loan interest rate

i – bond interest rate

This is the supply of loans, while the demand L^d is determined by borrowers – firms and households in the following way:

$L^d = L(\rho, i, y)$

such that $L_\rho < 0,\ L_i > 0$ and $L_y > 0$

where y – borrowers' income (GNP)

Equating supply of and demand for loans, we obtain:

[4] Similar shares are assumed for bonds and excess reserves of banks. In the same fashion, they are determined by respective rates of return.

$$L(r, i, y) = l(r, i) \cdot D \cdot (1 - t) \qquad (1)$$

Let us now turn to the money market. For simplicity Bernanke and Blinder ignore cash and consider only deposits. Analogously, equating demand D(i,y) and supply of deposits that is determined by bank reserves R and by money multiplier m(i) yields the equilibrium amount of deposits in the economy:

$$D(i, y) = m(i) \cdot R \qquad (2)$$
where $D_i < 0$ and $D_y > 0$, while $m_i > 0$

The equilibrium in deposit market also implies equilibrium in money market. From (2) we can then derive conventional upward sloping LM locus.

As far as bond market in concerned, we note the following. Since there are only three assets in the model (money, bonds and loans), demands for deposits and for loans implicitly define the non-public's demand for bonds[5]. Thus, if the loan and money markets clear, then the bond market clears too.

What remains is the goods market, which is traditionally represented by IS curve:

$$y = Y(r, i) \qquad (3)$$
where $Y_r < 0$ and $Y_i < 0$

Next, Bernanke and Blinder substitute deposits determined by (2) into expression (1) and solve for the equilibrium loan interest rate ρ as a function of bond interest rate i, income y and bank reserves R[6].

$$r = f(i, y, R) \qquad (4)$$

---

[5] Because the sum of all demands must equal total financial wealth.

[6] This is possible if all unknown functions involved are "well-behaved".

Here the loan interest rate ρ is increasing function with respect to both i and y, and decreasing with respect to R[7].

Finally, loan market interest rate is substituted into the equation describing goods market, which produces so called *CC curve* ("commodities-credit" curve).

$$y = Y(f(i, y, R), i) \qquad (5)$$

Like the IS curve, the CC curve is negatively sloped (decreasing in i). But unlike the IS curve, it is shifted by monetary policy (changes in R), as well as by loan market shocks that influence loan demand L(ρ, i, y) or loan supply (through λ(ρ, i) function).

In this setting, the impact of, say, expansionary monetary policy goes beyond the conventional interest rate channel's predictions. Figure 1 below neatly exemplifies the additional effect on the economy that stems from the shift of CC curve after expansion of bank reserves induced by central bank.

[7] Obviously, more bank reserves lead to lower interest rate on loans, while greater demand (higher y) pushes loan interest rate up. More subtly, greater bond interest rate increases ρ as long as interest elasticity of money multiplier m(i) is relatively small.

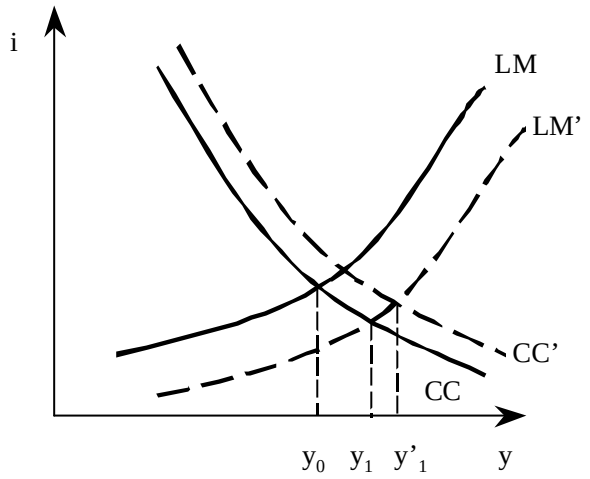

Figure 1. The Effect of Expansionary Monetary Policy (CC-LM Framework)

Here we can clearly see that the additional impact of expansionary monetary policy on output is equal to the difference y'_1-y_1.

The derived CC curve reduces to the conventional IS curve if any of the following holds:

(i) loans and bonds are perfect substitutes for borrowers ($L_r \to -\infty$);

(ii) loans and bonds are perfect substitutes for banks ($l_r \to \infty$);

(iii) interest rate on loans doesn't influence goods market ($Y_r = 0$).

This completes the exposition of the Bernanke-Blinder's model, as well as theoretical background of bank lending channel. We would just like to note that unsurprisingly, the conditions above are strictly in contrast to the contents of bank lending channel's assumptions worked out by us so far. In the next chapter we turn to the institutional analysis of Ukrainian context and study the plausibility of the bank lending channel, as well as that of other MTM channels.

Chapter 3

WHY BANK LENDING CHANNEL BEST AUGMENTS TRADITIONAL INTEREST RATE EFFECTS IN UKRAINE

In this chapter we try to explain, generally on institutional grounds, why the bank lending channel may well function in Ukraine, while others, except for traditional interest rate channel, definitely have some problems. To begin with, we look at some stylized facts about Ukrainian economy relevant for monetary transmission mechanism in recent years (1998-2000). Then, by comparing them with the assumptions of different theoretical concepts of MTM channels, we determine which ones may have difficulties or even cannot operate in Ukraine. Next, we consider the question of bank lending channel plausibility in Ukrainian context, discussing the factors that might weaken its potency.

Stylized Facts about Ukraine

First, let's look at some particularities of the Ukrainian context in which we study the plausibility of bank lending channel during 1998-2000:

(i) The existence of severe capital controls in foreign exchange market and overwhelming importance of exchange rate targeting to defend price stability led to the situation when monetary policy actions that altered real interest rates and caused to some extent capital inflows/outflows didn't end up with immediate exchange rate appreciation/depreciation. Rather, because National Bank tried to preserve the exchange rate within the announced band (in 1998 – first half 1999) or to prevent the exchange rate from appreciation (in 2000), its influence on real economic activity

showed up only as a result of devaluation under the pressure of August 1998 financial crisis.

(ii) The capital market remains largely weak in Ukraine. The volume of equity market capitalization is very low as a percentage of GDP, while corporate bond market is almost non-existent. In total, market capitalization of traded Ukrainian securities as of Jan-2001 stands at only 9% of GDP, while even 1998 figures for other transition countries are much higher (Russia – 29%, Czech Republic – 25%, Hungary – 33%)[8]. The number of publicly traded firms is very limited and the respective market is very thin. For example, according to UkrInform Information Agency (2001), in 2000 the total volume of trade in stock market amounted to 5% of GDP, while trades in organized market accounted for only 2% of GDP. The respective numbers of developed countries considerably exceed these levels marking greater development of capital markets.

(iii) In 1998, the Ukrainian stock market was definitely dominated by public debt (OVDPs). However, after the collapse of the OVDP market shortly in August-September 1998, stock market as a whole dropped substantially and remained depressed. For example, the most active Ukrainian stock trade system – PFTS (see Figure 2 below) – began to rebound slightly only since January 2000, with market capitalization $3bn as of June 2000 compared to $1.2bn as of September 1998. Note that at the beginning of 1998 stock market capitalization of PFTS-traded firms stood at $8bn[9]. Moreover, since May 2000 the market stagnated, while monetary policy was rather loose. Therefore, in 1999-2000 the stance of monetary policy seemed to be uncorrelated with stock market movements.

---

[8] Source of data for Ukraine – UkrInform Information Agency (2001), for other countries – Eremenko (2000).

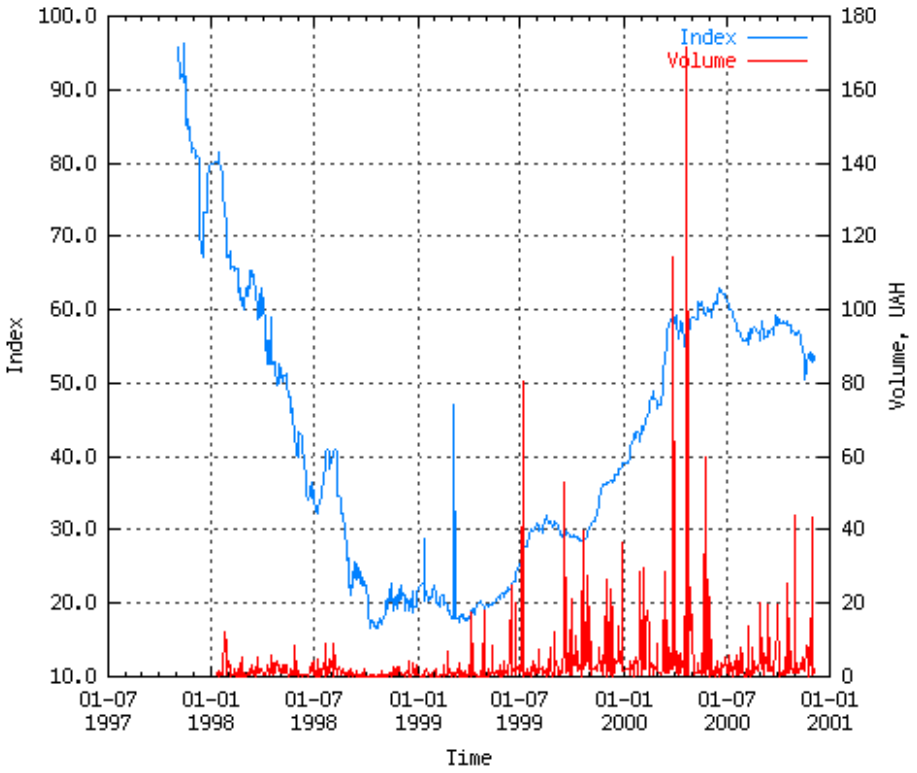

Figure 2. PFTS - Index and Volume of Trade

(iv) Ukrainian households hold their wealth primarily in three forms: savings accounts at banks or cash denominated in foreign exchange (mostly, US dollars); real estate; and other real assets (cars, etc).

(v) A very tiny share of consumer durables is purchased using loans of commercial banks or under the installment agreements with sellers. Therefore, the willingness of consumers to spend funds on durable goods doesn't depend on market interest rates. The same is true for the expenditures on residential housing.

Now we turn to the question of plausibility of specific transmission channels of monetary policy. For the time being, we set aside traditional interest rate channel,

[9] PFTS related figures are the estimates of Dragon Capital company (www.dragon-capital.com)

as well as the bank lending channel. The former may obviously work in Ukraine, if we assume that under "interest rate" we mean not only T-bills (T-bonds) yields, but also prices of business loans – interest rates in credit market. As for the latter, we will explore its plausibility below in a separate section.

Why Other Channels Are Not Good Candidates

To begin with, note that Tobin's Q theory is probably not working in Ukraine due to its reliance on stock prices that seem to be weakly correlated with stance of monetary policy. Then, the wealth effect on consumption, operating through the prices of stocks held by households, doesn't seem to work either, just because households in Ukraine hold almost no stocks (but rather foreign exchange). Within the group of credit channels, the balance sheet channel, which is supposed to transmit monetary policy through firms' improved/deteriorated net worth following changes in their stock prices, is also likely to be inoperative. Another credit channel associated with liquidity effects on households' durable and residential housing spending also crucially depends on movements in stock prices that determine financial wealth, the perceived probability of financial distress and therefore willingness to spend. If stock prices are uncorrelated with monetary policy and households don't own stocks, then this channel is totally impotent[10].

At first sight, exchange rate effect on net exports seems very plausible MTM channel in Ukraine where the exports/GDP ratio has always been relatively high and presently exceeds 40%. Yet, we shortly show that recent developments in Ukrainian economy do not allow identifying exchange rate effects on net exports as a channel of monetary policy transmission. Why is it so? Basically, the

[10] As an example we may take the crash, slight rebound and subsequent stagnation of Ukrainian stock market after the August 1998. This crash and stagnation didn't influence in any systematic way residential housing market, as well as purchases of consumer durables.

exchange rate channel presumes that (i) domestic currency exchange rate is floating or bounded by relatively wide band to allow certain movements; (ii) institutional arrangements in foreign exchange market are stable; (iii) domestic economic agents can choose which assets and denominated in which currency (domestic or foreign) to hold so that expansionary monetary policy actions, reflected in interest rates, may cause shifts in these holdings and therefore in demand and supply of foreign exchange, thereby pushing up exchange rate and stimulating net exports.

Obviously, this was not the case in Ukraine in 1998-2000. Before August 1998 National Bank was primarily concerned with keeping the exchange rate within announced band to secure price stability. Furthermore, because of capital controls, lower interest rates induced later by expansionary monetary policy were not a driving force of changes in exchange rate and thus in net exports.

Why Bank Lending Channel May Be Plausible

The bank lending channel theory adopted in this paper stipulates three crucial assumptions for its proper functioning. However, only two of them – the imperfect substitutability between loans and bonds for certain borrowers (A1) and the power of central bank to affect supply of bank loans through changes in available reserves (A2) – seem to require substantiation. Assumption (A3) concerning price stickiness in the economy we just presume to hold.

In line with **assumption (A1)**, empirical evidence[11] points towards the observation that monetary policy actions influence the expenditures of smaller and thus more bank-dependent firms to a much greater extent, than the expenditures of large corporations, which can obtain non-bank financing in

[11] Gertler and Gilchrist (1994), Kashyap, Stein and Wilcox (1993), Kashyap, Stein and Lamont (1994), Carpenter, Fazzari, and Petersen (1994)

capital markets. Therefore, the proposition that bank loans and other means of external finance shouldn't be perfect substitutes for a certain sizable group of borrowers boils down to the importance of two sub-issues: (i) importance of small (or generally, bank-dependent) firms-borrowers and (ii) availability of alternative sources of external finance to these borrowers. If the class of the firms that depend on bank loans is very narrow or capital markets offer plenty of alternative solutions (bonds, equity, etc), then we may well expect that assumption (A1) may fail to be satisfied and the importance of bank lending channel will be considerably limited.

In the context of Ukrainian economy, almost any economic agent either small or large is very likely to be bank-dependent. This is because financial intermediaries other than banks generally are very weak, restricted in activities or at least have proved to be very dangerous and extremely risky (for instance, those notorious trusts and investment funds in hyperinflation times). The degree of dependence will then vary with the ability of the firms themselves to provide internal finance and satisfy their needs.

Alternative sources of external finance to the firms in Ukraine could be:

(i) Corporate bonds;

(ii) Equities (offered publicly);

(iii) Government subsidies;

(iv) Off-shore borrowing;

(v) Barter settlements;

(vi) Trade credit and subsequent non-payments and accumulation of arrears;

It should be noted that non-payments together with barter have become very popular sources of financing. Strictly speaking, these are not sources, but the ways of solving the problem when no such financing in monetary form can be attracted. Hence, the last two items are only quasi-alternatives to bank loans, and the real alternatives reside in rest of the list.

According to Eremenko (2000), offshore borrowing in Ukraine in 1998 amounted to 0.88% of GDP, while domestic credit/GDP ratio appeared to be 17.2%. This implies that offshore borrowing is a relatively unimportant source. Moreover, it is subject to huge variety of NBU's regulations and foreign exchange controls. For example, all credits from non-residents including those from offshore are to be registered in National Bank of Ukraine, the interest rate cannot exceed the rate on external public debt denominated in hard currencies (say, interest rate on Ukrainian eurobonds) etc.

Government subsidies in Ukraine are available only to state-owned or state-dominated enterprises and the amounts usually are very limited. Small and medium firms don't possess enough political influence to lobby the transfers from central government. In 1998, the magnitude of subsidies is roughly estimated at 4.6% of GDP[12], thus being more important than offshore borrowing, but still far from the contribution of domestic loans. Besides, we have to be aware of the two facts that (i) not all subsidies are spent to finance real activity; (ii) often government subsidies are provided through offsetting of mutual claims. These considerations mean that this source of financing might be very costly for relatively non-influential small and medium firms and even for large private agents.

[12] In 1998 the share of subsidies in total government expenditures was at 11% (Eremenko, 2000), while total government expenditures/GDP ratio equaled 41.9% (UEPLAC, 2001). Hence, the share of government subsidies in GDP is appr. 0.419*0.11=4.6%.

As far as corporate bonds and equities are concerned, in Ukraine they are only theoretical alternatives to bank loans. The explanation comes from very weak capital market. General weakness of stock market has already been established above as a stylized fact. Besides, one should be aware that, for example, in 2000 about ½ of stock market trade is accounted for by bills of exchange, promissory notes and similar instruments, and only 26% - by equity[13] (UkrInform Information Agency, 2001). The situation in corporate bond sector is even more disappointing. According to the data of State Securities and Stock Market Commission, in year 2000 only 17 companies issued corporate bonds amounting to 69.9m UAH, whereas since 1996 the volume of all corporate bond issues totaled 340m UAH. This is extremely low if we contrast these figures with Ukraine's 2000 GDP of 175bn UAH.

Summing up, we just note that the range of firms dependent on banks seems to be rather broad and includes small and big agents, while the alternative sources of finance are either under-developed and hard to find, or overregulated and costly. We therefore conclude that assumption (A1) is likely to hold in Ukraine.

Let us now turn to **assumption (A2)** that refers to the ability of National Bank of Ukraine to shift the supply schedule of bank loans by changing the amount of reserves available to commercial banking system.

Broadly speaking, literature on lending view offers many potential explanations of why this assumption may fail. For example, Cecchetti (1999), as well as Kashyap and Stein (1997b) concentrate on identifying indicators that can help measure the likely strength of the bank lending channel. In doing so, they primarily rely on quantifying factors that could conceivably undermine assumptions of bank lending channel. With respect to assumption (A2), they consider figures that

[13] In turn, large portion (unfortunately, exact figure is unavailable) of these 26% represents secondary market sales of corporatized state enterprises' equity by State Property Fund to private investors.

characterize the *importance of small banks* (presuming that supply of loans of this category is the most vulnerable to monetary policy), as well as *bank health* (arguing that the higher the bank health, the weaker the impact of monetary policy on bank lending). In other words, if small banks are rare and/or the banking system is rather healthy, then central bank's monetary policy may have problems influencing lending behavior of such banking system.

Another approach is suggested in Kashyap and Stein (1993). It has nothing to do with quantifying the strength of bank lending channel, but rather proposes a set of microfoundations that might potentially compromise the potency of monetary policy in the bank lending channel context. This way of looking at the problem seems quite reasonable and suitable for our purposes of examining assumption (A2)'s institutional plausibility and we readily adopt it below.

According to Kashyap and Stein (1993), four factors could weaken the connection between reserves and supply of loans and thus disrupt bank lending channel plausibility[14]:

(i) financial intermediaries other than banks;

(ii) ability of banks to adjust other assets, not loans, after shocks to reserves (or ability to exercise portfolio preferences);

(iii) ability to raise non-reservable funds;

(iv) existence of regulatory standards and constraints (e.g. capital adequacy).

Although theoretically these factors are shown to affect negatively the potency of bank lending channel, each item still deserves careful consideration in specific institutional context of Ukrainian economy.

It is quite clear that if non-bank financial intermediaries occupy substantial market share along with banks, then the efforts of central bank to influence the supply of all loans (not just only those from banks) might not be successful. However, it is unlikely to be an obstacle for the National Bank of Ukraine. The reasons are (i) legislation prohibiting any entities other than licensed banks to perform lending operations and (ii) general underdevelopment of non-bank intermediaries. Generally speaking, these in theory could be:

- insurance companies;
- pension funds;
- mutual funds;
- finance companies.

Yet, in Ukraine non-bank intermediary sector is very weak. Ideally, we would like to have the aggregate balance-sheet information on all participants and then we can compare it with figures for banks. Unfortunately, at this stage this information is not available to us. Therefore, we will confine ourselves to qualitative judgement.

Ukrainian legislation on insurance requires that *insurance companies* are prohibited to extend short- and medium-term loans and to make risky investments. It is only long-term residential investment loans that insurance companies can grant, and only from life insurance reserves. They normally hold their funds in banks at demand or savings accounts and rarely purchase public debt or invest in real estate.

---

[14] See Kashyap and Stein (1993) for detailed theoretical justification.

The system of *pension funds* remains at embryonic level of development. In Ukraine, there is single public pension fund – State Pension Fund – that usually either suffers from funds' shortage, or invests its surpluses (if any) in public debt (OVDPs) or just holds the funds in authorized bank. Private pension funds exist, but their assets are negligible, if compared to the assets of banking system.

Mutual funds (in Ukraine – trusts, investment funds, etc) in fact managed to function somehow, notwithstanding their tremendous collapse in early 1994 and subsequent population's loss of confidence. But again, the assets of survivors are so small that they can help very little in solving the problem of external finance to the majority of firms. *Finance companies* cannot operate in Ukraine because of legislation: according to Law "On Banks and Banking Activity", lending, factoring and other similar operations are licensed by NBU and are primarily the prerogative of commercial banks.

Another possibility of weak reserves-loan supply link may arise when banks are able to adjust the assets other than loans quickly and almost at no cost (e.g. securities, interbank loans) following the changes in reserves. If this is so, then banks might wish to hold buffer stock of securities and in essence insulate their credit portfolio from, say, tight monetary policy by selling this buffer (alternatively, by adjusting interbank lending), thus making up for drained reserves.

Nevertheless, as we have already established, the stock market in Ukraine is not as liquid as, for instance, interbank market and is rather illiquid. Moreover, the most should-be-thick segment – market for public debt – recently seemed to be very unattractive to banks (low yields combined with high risk of default, in light of still coming to mind Sep-1998 "voluntary" OVDP conversion). That is why, although aggregate securities portfolio of banks of various sizes exhibits predictable (from rational buffering point of view) pattern and smaller banks tend

to have higher share of securities in total assets, the share of OVDPs in total assets doesn't mimic the whole portfolio (see Table 1 below). This suggests that Ukrainian banks are not trading liquidity for greater rate of return in this sector.

Table 1. Ukrainian Banking System: Share of Securities and OVDPs in Total Assets, by Bank Size

Bank Category, by assets	Securities/TA	OVDPs/TA
Largest banks (>1bn UAH)	5.18%	2.63%
Large banks (>100m UAH)	4.70%	0.44%
Medium banks (>50m UAH)	6.30%	0.80%
Small banks (<50m UAH)	7.60%	0.37%

Source: NBU (2001), author's calculations; all data as of Jan-2001

The explanation for this phenomenon could be that Ukrainian banks mostly concentrate on interbank market, rather than on securities, when it comes to alternatives for lending to real sector. Therefore, in Ukraine banks cannot adjust quickly securities' holdings due to relative illiquidity of stock market, while in fact can do fast adjustment of interbank lending[15].

It should be noted that it is the ability to raise non-reservable funds and the existence of regulatory standards that we believe may mostly undermine the efforts of National Bank to affect the supply of bank loans when it tightens or loosens monetary policy.

Banks in Ukraine can raise non-reservable finance in three forms:

(i) Subordinated debt;

[15] For example, just by refraining from current lending and waiting 1-30 days for already granted credits to get paid off.

(ii) Equity[16];

(iii) Offshore borrowing[17].

The importance of new equity and subordinated debt may support the following facts. Over the year 2001, the total amount of statutory capital of all Ukrainian banks rose from 2.9bn UAH to 3.67bn UAH, or by 25.8% (NBU, 2001). At the same time, normative capital of Ukrainian banking system increased by 14.8% from 4.3bn UAH to 4.9bn UAH. After statutory capital, subordinated debt is cited to be the second major source of normative capital's growth.

As far as regulatory standards and constraints are concerned, we would like to note the following.

First, we illustrate how they can, in some circumstances, make the assumption (A2) fail. As an example, let's take the capital adequacy requirement. In line with Basle Accord[18], this requirement stipulates that the bank's equity divided by risk-weighted assets must not be lower than certain level. Essentially, we say that:

$$\frac{Bank's\ Equity}{Risk-Weighted\ Assets} \geq R_{CA}$$

where R_{CA} – capital adequacy requirement

Since the bank cannot adjust its equity on short notice, it may well happen that the inequality above will transform into equality. In other words, even if bank can extend the loan to its customer without any fear to get illiquid, it in fact cannot do

---

16 This shows up as an increase in statutory capital of a bank. By the way, the pressure for higher capital comes from the requirements of international financial organizations (say, World Bank) and from NBU. The latter imposes minimum levels of normative capital and terms by which banks will have to comply with these levels.

17 It is implemented technically by borrowing funds from abroad through interbank market and then lending out the money here in Ukraine: interbank loro-deposits are not subject to reserve requirements.

18 Bank for International Settlements (1997), *Core Principles for Effective Banking Supervision*, Basle: Basle Committee on Banking Supervision

this due to *binding* capital adequacy restriction. Thus, such bank may end up purchasing T-Bills or going to the interbank market[19]. In these circumstances, marginal adjustments of asset portfolio will then be reflected in changes of securities holdings or interbank lending, not in changes of loan portfolio. Thus, the impact of the central bank's monetary policy on the loan supply by such constrained bank is likely to be limited.

In Ukraine, capital adequacy requirement is set by National Bank at 4%. Interestingly, the actual Normative Capital/Risk-weighted Assets ratio for the whole commercial banking industry is much higher – 13.8% as of Jan-2001 (NBU, 2001). However, it may well turn out that at the level of individual banks capital adequacy requirement is binding for many of them.

Furthermore, NBU's Instruction "On Analysis and Regulation of Commercial Banks' Activity" establishes a number of additional regulatory standards with which the banks must comply. Some of them may directly tie up the amount of loans:

- Momentary and general liquidity;
- Solvency;
- Assets quality requirements;
- Requirements on lending to insiders and affiliated persons;
- Maximum indebtedness of single borrower;
- Others;

[19] It can do so simply because risk weight attached to T-Bills (T-Bonds) is 0 and attached to interbank lending

All of these standards may also appear to be binding, thus impairing the ability of National Bank to shift the supply of loans by monetary policy.

Summarizing our findings up to this point regarding assumption (A2), we would like to emphasize that two factors – non-reservable funds and regulatory standards – seem to mostly undermine the validity of assumption (A2) in Ukraine. The ability of Ukrainian banks to adjust other assets, not loans, in response to the monetary policy is likely to matter, but is less important. Lastly, non-bank financial intermediaries don't seem to pose any threat at all.

Thus, we overall conclude this chapter by saying that there are good institutional reasons to believe that National Bank of Ukraine might fail to exert the influence on supply of loans by conducting monetary policy (assumption A2), which makes bank lending channel less plausible. Consequently, in the next chapter we closely address the issue of testing (A2) using econometric techniques.

is normally between 0 and 0.2, while for loans it is at least 0.5.

Chapter 4

EMPIRICAL EVIDENCE FROM UKRAINIAN BANKING SYSTEM

From the theoretical background presented above we know that three assumptions are necessary for bank lending channel to be operative. We have tried to substantiate on institutional grounds assumption (A1) as to the "banks-firms" link in the previous chapter. As far as assumption (A3) is concerned, we would like to note the following. Any monetary theory that pretends to explain the effects of monetary policy actions should provide for some imperfect price adjustment mechanism, be it wage stickiness or limited participation of some agents in financial system. Thus, in the view of a great variety of mechanisms that contemporary economic literature offers, it seems to be a formidable task to substantiate some in case of Ukraine.

Therefore, as follows from the chapter's title, we devote all attention to focusing on "National Bank – commercial banks" link in our study of bank lending channel. In other words, in this chapter we test empirically the assumption (A2) that basically says that National Bank should be able to influence the supply of loans of commercial banks by changing the amount of available reserves.

Assumption (A2) can in fact be tested in many ways. Though, two qualitatively different approaches are used in the literature:

(i) tests rely on time series aggregate macro data;

(ii) hypotheses and tests exploit microeconomic cross-sectional (often panel) data.

In this paper we are going to employ both approaches so as to stay in tradition of the already established literature.

Macroeconomic Evidence

In order to support or reject the existence/importance of bank lending channel using aggregated time series macro data, economists have formulated various criteria and tested different hypotheses:

(i) So called "narrative approach" of Romer and Romer (1990) where a sequence of focal episodes associated on reasonable grounds with tight money is used to identify monetary shocks. These shocks then are used to test the hypothesis that the impact of bank lending on output has to be greater than that of money in such focal episodes.

(ii) Miron, Romer and Weil (1993) study the relevance of bank lending channel by assessing:

- Spread between loan and bond rates (e.g. should widen in tight money episodes);
- Movements in "mix" variable (ratio of loans to loans + commercial paper) under the influence of monetary policy;
- Correlation between loans and real output (criterion – predictive power of loans versus money in respective equations that include real output);

(iii) Stephen King (1986) uses Granger causality test and compares the performance of demand deposits versus loans in predicting real GNP in US. In addition, he employs vector autoregressions (VARs) that include

aggregate loans and demand deposits, as well as GNP, loan, and T-bill rates. Then he makes an inference about the importance of bank asset composition in monetary transmission process on the basis of GNP variance decomposition.

(iv) With respect to emerging markets, Kim (1999), Carrasquilla (1998), and Sirivedhin (1998) have applied VAR technique to investigate the response of aggregate banks' asset portfolio to monetary policy shocks and/or to unfold monetary transmission process.

Similar to the last contributors, in this section we take up their approach. However, it is elaborated in more refined and developed fashion in Bernanke and Blinder (1992) and Bagliano and Favero (1998). Therefore, we mainly draw on these two works, with certain modifications aiming at adjusting econometric specification to Ukrainian data and peculiarities. This approach is based on estimating appropriate VAR models to study the aggregate banks' asset portfolio adjustment following from the changes in the stance of monetary policy.

The motivation for choosing mentioned methodology comes from three observations:

(i) considerable critique in literature of many abovementioned approaches (e.g. "narrative approach" seems to suffer from endogeneity problem, predictive power is not a good criterion for tests[20]);

(ii) impossibility to perform some sorts of tests on Ukrainian data (e.g. in Ukraine there is no commercial paper or close substitutes, T-bills/T-bond rates were not meaningful for a long period of time);

[20] See Bernanke and Gertler (1995, pp.23-24)

(iii) relative popularity of VAR estimation techniques to study interaction of macro variables.

Methodology and Testable Hypothesis

In this subsection we follow the approach of Bernanke and Blinder (1992) to testing monetary transmission mechanism. The methodology can briefly be described as a set of consecutive steps and assumptions that lead us to actual econometric model we estimate below.

Suppose we have managed to isolate a measure of the monetary policy stance. Its innovations can readily be interpreted as monetary policy shocks, while non-random portion of changes – as monetary policy actions induced by processes in the economy. Additionally, assume that these shocks can be treated as random and completely not connected to current economic disturbances. Then, Bernanke and Blinder (1992) conclude, "the reduced form responses of the economy to observed policy shocks would correctly measure the dynamic structural effects of a monetary policy change".

Without going into too much detail and using the same notation as in Barnanke and Blinder (1992), the economy can be represented in the following model:

$$\begin{aligned} Y_t &= B_0 Y_t + B_1 Y_{t-1} + C_0 P_t + C_1 P_{t-1} + u_t \\ P_t &= D_0 Y_t + D_1 Y_{t-1} + G P_{t-1} + v_t \end{aligned} \qquad (1)$$

where Y is a vector of general economic indicators (such as GDP, prices, output), P is a vector of policy variables, and u and v are uncorrelated disturbances.

As the model consisting of two sets of equations is not identified, we must impose some identifying restrictions on coefficients. The first one (that $D_0 = 0$) corresponds to what we have already said above about no connection between

contemporaneous policy actions and processes in economy. The second identifying restriction is that $C_0=0$ which means that policy variables influence general economy not contemporaneously, but only after a lag.

In either case, we are able to rewrite the model as a standard VAR and estimate it. And then we can study the impact of policy variable's shocks on general economy variables by exploring impulse response function of general economy variables to the previous changes in policy disturbances (v in our notation). What distinguishes impulse responses from VARs with different identifying restrictions is that when $D_0=0$, policy variables P should be placed first in ordering, while in case of $C_0=0$ policy variables P go last in ordering.

For the purposes of our analysis, we assume that monetary policy stance in Ukraine can reasonably be measured by nominal interest rate on interbank credit[21], output – by index of real industrial production and prices – by Consumer Price Index. Furthermore, we add aggregate bank balance-sheet variables such as deposits, loans to real sector and securities to the class of non-policy variables so as to study their response to the changes in the stance of monetary policy in Ukraine.

Finally, let us formulate the hypothesis consistent with predictions of bank lending channel.

If bank lending channel is operative and specifically National Bank of Ukraine can affect supply of loans by changing the amount of reserves available to banks, then following a contractionary shock to a monetary policy indicator, the

[21] Open market interest rates are not meaningful, because after 1998 they have lost the connection with actual situation in money market. Monetary base can be an alternative measure. However, research conducted by Bernanke and Blinder (1992), Bernanke and Gertler (1995), Kim (1999), Bagliano and Favero (1998), Bernanke and Mihov (1995) has shown the fruitfulness of this measure in empirical applications.

aggregate balance sheet of commercial banks and economy should respond in such a way:

(i) deposits, as well as loans and securities decline;

(ii) deposits decline sharply and relatively faster than loans;

(iii) loans and securities adjust more smoothly than deposits and differently, with securities falling faster and bottoming earlier than loans;

(iv) fall in output should roughly correspond in timing to the fall in loans.

In the subsequent subsections, we describe the data we utilize in testing hypothesis and the exact econometric specification.

Data Description and Econometric Specification

In passing, we would like to note that in the rest of this section we treat the words "loans" and "credits" interchangeably implying the loans (credits) granted to real sector by Ukrainian commercial banks.

The variables that we are going to employ in our hypothesis testing include:

Table 2. Variables That Enter Empirical Model

Variable	**Description**	**Sample Coverage**	**Source**
FUNDSRATE	Nominal interbank interest rate on credits, % per annum	1996:09-2000:09	NBU, UEPLAC
INDSA	Index of real industrial production, 1990 = 100, seasonally adjusted	1996:09-2000:09	UEPLAC
CPI	Consumer price index	1996:09-2000:09	UEPLAC
DEPOSITS	Total demand and term deposits at commercial banks including deposits in foreign currency,	1996:12-2000:09	NBU

	m UAH		
CRED	Total amount of credits granted to real sector by commercial banks, m UAH	1996:09-2000:09	NBU
SECURITIES	Securities portfolio of commercial banks, including OVDPs, stocks, municipal bonds, bills of exchange (held for sale), m UAH	1997:12-2000:08	NBU
EXRATE	US dollar official exchange rate, average per month, UAH/USD	1996:09-2000:09	NBU

All data presented in the table are monthly. Generally speaking, there are two dimensions along which the model specification varies:

(i) Nominal versus real terms[22] of financial variables;

(ii) Specific financial variable (deposits, credits, securities).

Therefore, for each financial variable - deposits, credits, securities - we have estimated separate Vector Error Correction (VEC) model[23], and each model has also been tried with financial variable put in real terms.

All series appear in the model in first differences of log levels, except for interbank credit interest rate that enters the model just in first differences. For the further notation, D(<Variable Name>) means first difference, DLOG(<Variable Name>) means first difference of log level of respective variable.

General structure and assumptions of a baseline VEC model are as follows:

[22] Deflated by CPI

[23] All the series involved have turned to be I(1) – integrated of degree 1 – and have to be differenced, while cointegration analysis has proved strong presence of long-term relationships in levels. Therefore, unrestricted VAR that we planned to estimate at the beginning turned into VEC. See details below.

(i) Variables (in such ordering):
FUNDSRATE, <Financial Variable>, INDSA, CPI

(ii) Lags included: 1 lag

(iii) Linear trend in variables is assumed

(iv) 1 cointegrating equation (intercept and no trend)

(v) Exogenous variables: DLOG(EXRATE)

$$D(FUNDSRATE) = \alpha_0 + \alpha_1 D(FUNDSRATE(-1)) + \alpha_2 DLOG(< FinVar > (-1)) + \\ + \alpha_3 DLOG(INDSA(-1)) + \alpha_4 DLOG(CPI(-1)) + \alpha_5 u + \alpha_6 DLOG(EXRATE) + \varepsilon_1$$

$$DLOG(< FinVar >) = \beta_0 + \beta_1 D(FUNDSRATE(-1)) + \beta_2 DLOG(< FinVar > (-1)) + \\ + \beta_3 DLOG(INDSA(-1)) + \beta_4 DLOG(CPI(-1)) + \beta_5 u + \beta_6 DLOG(EXRATE) + \varepsilon_2$$

$$DLOG(INDSA) = \gamma_0 + \gamma_1 D(FUNDSRATE(-1)) + \gamma_2 DLOG(< FinVar > (-1)) + \\ + \gamma_3 DLOG(INDSA(-1)) + \gamma_4 DLOG(CPI(-1)) + \gamma_5 u + \gamma_6 DLOG(EXRATE) + \varepsilon_3$$

$$DLOG(CPI) = \delta_0 + \delta_1 D(FUNDSRATE(-1)) + \delta_2 DLOG(< FinVar > (-1)) + \\ + \delta_3 DLOG(INDSA(-1)) + \delta_4 DLOG(CPI(-1)) + \delta_5 u + \delta_6 DLOG(EXRATE) + \varepsilon_4$$

where

(i) <FinVar> stands for either DEPOSITS, or CRED, or SECURITIES;

(ii) u denotes cointegrating relationship between all variables that enter the model:

$$u = \mu_0 + FUNDSRATE(-1) + \mu_1 LOG(< FinVar > (-1)) + \mu_2 LOG(INDSA(-1)) + \\ + \mu_3 LOG(CPI(-1)) + \nu, \qquad \nu - \text{disturbance term}$$

(iii) ε_i are disturbance terms.

Several points are worth mentioning here:

1. Results of Augmented Dickey-Fuller test have shown that all series entering the model have unit root and are all integrated of degree 1 (that is they are I(1))[24]. That is why we have formulated the model in terms of first differences, not in levels.

2. First identifying restriction (namely, that $D_0 = 0$ in our general model (1) which means that current policy decisions of National Bank are not affected by contemporaneous processes in the economy, but rather are predetermined by past values of economic variables) seems preferable in the circumstances of Ukraine. Therefore, monetary policy indicator (FUNDSRATE) is placed first in the ordering.

3. Inclusion of cointegrating equation(s) into the model and turning it from unrestricted VAR into VEC has been motivated by Johansen cointegration test.

4. Exchange rate is included as an exogenous variable, because over the sample period institutional analysis of the policy conducted by National Bank allows to stress that it has been rather predetermined and targeted.

5. The choice of number of lags is based on Akaike information criterion, Schwarz information criterion, as well as on general rationale such as stability of impulse responses and meaningfulness of variables' behavior and coefficients.

Below, the particular lag structure is chosen and analysis of cointegration is performed with respect to each model.

[24] See Appendix 1 for details.

DEPOSIT VEC

Here we have general model with <FinVar> equal to DEPOSITS. Under the assumption of intercept and no trend in cointegrating equation, Johansen cointegration test together with VEC estimation for different lags structure allow to produce the following results.

Table 3. Deposit VEC: Lag Structure and Cointegration Analysis

No of lags	**1**	2	3	4
No of cointegrating equations (Johansen test)	**1**	1	2	2
Akaike	**-17.60**	-17.54	-18.08	-18.44
Shwarz	**-16.3**	-15.57	-15.1	-14.7
Sign of DLOG(EXRATE) in DEPOSIT equation	**+**	+	-	-
Influence of FUNDSRATE shock on LOG(DEPOSITS)	**Negative**	Negative, unstable	Positive, unstable	Positive, very unstable

On the basis of Schwarz information criterion, we may prefer to estimate the model with 1 lag and 1 cointegrating equation, because test statistic has the lowest value. On the contrary, Akaike information criterion gives us 4 lags and 2 cointegrating equations. In the latter case, however, we observe huge fluctuations of DEPOSITS induced by changes in FUNDSRATE and sign of DLOG(EXRATE) in DEPOSIT equation is negative, while it has to be positive (deposits should rise following devaluation, but not fall).

Thus, if we exclude possibilities with 3 and 4 lags, on the basis of both Akaike and Schwarz criteria, we have to choose 1 lag and 1 cointegrating equation.

CREDIT VEC

Let's look at the rationale for lag structure and number of cointegrating equations, when we turn to VEC model with credits as key financial variable. The same assumption of intercept and no trend in cointegrating equations applies as before.

Table 4. Credit VEC: Lag Structure and Cointegration Analysis

No of lags	**1**	2	3	4
No of cointegrating equations (Johansen test)	**0 (1)**	1	1	1
Akaike	**-17.59 (-17.87)**	-17.57	-17.86	-18.74
Shwarz	**-16.54 (-16.61)**	-15.67	-15.27	-15.5
Sign of DLOG(EXRATE) in CRED equation	**- (-)**	-	-	-
Influence of FUNDSRATE shock on LOG(CRED)	**Negative - Positive**	Positive	Positive, very unstable	Positive, very unstable

Under the column that denotes estimation with 1 lag, in parentheses are given the results for VEC with 1 cointegrating equation, whereas Johansen test indicated there is no such equation at all. Here we face a controversy, because Akaike criterion prescribes to choose 4 lags, while Schwarz criterion demands that we use 1 lag. Contrary to theory, it turns out that the sign of change in exchange rate in credits equation appears to be negative, although respective coefficient is insignificant at all lag structures.

In such circumstances, taking into account very short-run character of all processes that occur in Ukraine, we have chosen, maybe a bit arbitrarily, the structure of the model with 1 lag. We have also included 1 cointegrating equation

because Akaike and Schwarz statistics are superior to the case when no such equation is introduced.

SECURITIES VEC

Vector Error Correction model for securities' portfolio suffers from two drawbacks in data:

(i) sample period is much shorter than for deposits and credits;

(ii) several types of securities are bundled in one aggregate, while some (like discounted bills of exchange) may appear as part of credits or just accounts payable to banks.

Cointegration and lag structure analysis of VEC with securities gives us the following picture.

Table 5. Securities VEC: Lag Structure and Cointegration Analysis

No of lags	**1**	2	3	4
No of cointegrating equations indicated by Johansen test	**1**	3	2	4
No of cointegrating equations actually used in estimation	**1**	1	1,2	1,2
Akaike	**-15.04**	-14.52	-15.47, -15.87	-16.64, -17.13
Shwarz	**-13.56**	-12.28	-12.45, -12.48	-12.83, -12.94
Influence of FUNDSRATE shock on LOG(SECURITIES)	**Negative**	Negative	Diverging path	Negative, very unstable and non-stationary

It should be noted that the sign of exchange rate in this model plays much less and rather indicative role, because almost all securities held by commercial banks in Ukraine are denominated in UAH.

As can be seen, Johansen cointegration test shows abnormal number of cointegrating equations at lags 2 and 4. Thus, as one can hardly find motivation for more than one cointegrating equation with securities, we have decided to estimate VEC model with fewer ones. However, in models with 3 or 4 lags the path of securities has nonetheless demonstrated either divergent or unstable and non-stationary character of reaction on shock to FUNDSRATE. Amid remaining possibilities, on the basis of both Akaike and Schwarz criteria, 1 cointegrating equation and 1 lag seem to be preferred.

At the very end, it appears that the final version of the econometric specification is essentially as we have outlined in baseline case. In the next subsection, we interpret the results of estimation.

Interpreting Results

The results of estimating deposit, credit and securities VEC models according to the specification described above are presented in Appendices 2, 3 and 4 respectively.

From every estimated VEC model, we are able to compute impulse response functions for deposits, credits and securities, as well as for output and prices, that follow from the shocks to monetary policy indicator.

As we have already mentioned, assuming these shocks reflect policy intentions, the impulse responses allow us to trace the impact of monetary policy on general economy and on aggregate balance sheet of Ukrainian commercial banks.

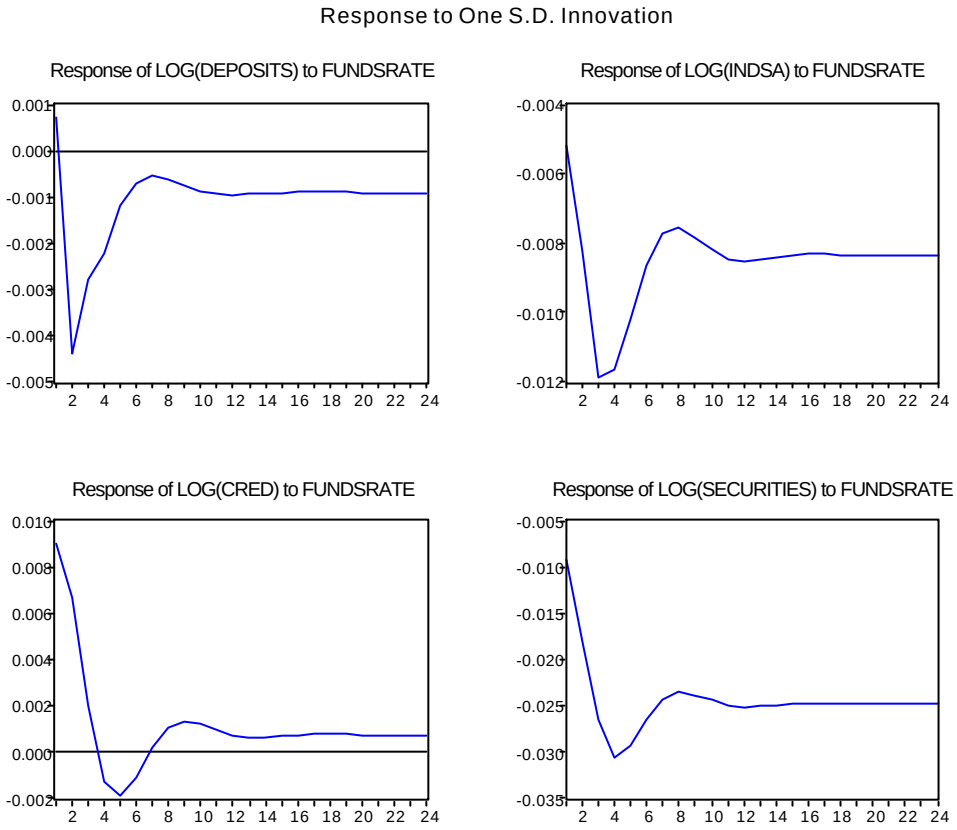

Figure 3. Impulse Response Functions Implied by 1 S.D. Shock to the Monetary Policy Indicator

Figure 3 depicts the response of financial variables and industrial output to the innovation in FUNDSRATE over 24-months horizon. Careful examination of the graphs allows us to establish the following facts.

As suggested by theory, deposits at commercial banks fall immediately in 2nd month after the contractionary shock to the FUNDSRATE has occurred. Then they begin to restore slowly, but from 10th month level off and remain at the reduced level (i.e. negative permanent shock is observed);

No doubt, that credits and securities strictly tied up with bank liabilities by accounting identities decline too. However, as predicted by bank lending view, they fall differently. Initially, in the first month credits go up by about 0.9%, possibly displaying their countercyclical nature. Afterwards, during next 4 months we observe them decreasing below the initial level and reaching the bottom in 5th month, with 90% of the drop having occurred up to 4th month. Finally, credits begin to grow, reach the local peak in 9th month and stabilize around the level 0.07% higher than the amount before shock has occurred.

At the same time, securities' behavior differs from that of the credits. Essentially, we observe securities falling immediately in the first month (by appr. 0.9%), then decreasing more sluggishly over the next 3 months, attaining the trough in 4th month (more than 3% drop), growing by 0.5% over successive 5 months and finally stabilizing at the level 2.5% below initial one.

Such behavior is exactly what we would expect, if our original hypothesis were true. Credits cannot be adjusted at once, because they represent largely long-term[25] relationships between banks and their clients. Therefore, at the first stage, contractionary shock to monetary policy indicator and immediate loss of deposits leads to the securities' sell-off (or just to waiting for redemption and not purchasing again). At the same time, due to demand inertia, credits may even rise, but shortly afterwards (in our case, in the second month) also start to decline. It also appears that compared to securities, credits decrease more sluggishly and bottom 1 month later.

What is hard to explain is that on a longer horizon credits face tiny but still positive permanent increase, rather than fall, as we have originally expected. However, securities, in line with our predictions, are affected negatively.

[25] At least, longer on average than the average term of securities held by Ukrainian banks.

One more fact, concerning the relation of the observed portfolio adjustment with movement in real output, deserves attention. Figure 3 also depicts the impulse response of industrial production[26]. The point is that the output shrinks and bottoms roughly over the same period as credits begin to drop and bottom. 90% of the fall in credits occurs in the fourth month, while bottom is reached in the 5th. Similarly, output declines over the first three months, attains minimum in third, grows very little in the 4th month and finally gradually rebuilds along with credits. Such relatively fair correspondence in movement of credits and output confirms the prediction of bank lending channel.

Now, if we relate all these observations with statements of our original hypothesis, we obtain the following outline:

(i) deposits, as well as securities, have permanently declined, as predicted. Credits have initially declined too, *but on a longer horizon they have demonstrated tiny, but still positive permanent increase*;

(ii) along with bank lending view predictions, deposits have dropped sharply and relatively faster than credits;

(iii) credits and securities have adjusted more sluggishly than deposits as well as differently: securities have dropped faster and bottomed earlier than credits and the magnitude of fall has been more pronounced for securities;

(iv) movements in industrial production and in volume of credits have fairly corresponded in timing.

[26] Specifically, it is taken from credit VEC model, but the pattern of output adjustment is almost identical in other two VECs.

Thus, on basis of the tests performed and with some reservation about the response of credits, we may generally accept our original hypothesis and stress that in Ukraine empirical evidence from banking system witnesses in favor of the bank lending channel of monetary transmission.

Robustness of the Model

The robustness of the model has been checked in two directions:

(i) VEC models have been re-estimated with bank aggregates turned into real terms by CPI deflating. The results as to the path flow and peaks and troughs have qualitatively remained the same for securities and deposit VECs, just with a more pronounced drop of key variables. Interestingly, that puzzling positive permanent shock to the level of credits that we documented has disappeared in the new real terms formulation of credit VEC model and we have obtained *negative* permanent shock to credits, entirely as expected.

(ii) We have also tried to employ alternative monetary policy indicator – monetary base – and verify the results accordingly. In this respect, although we do not provide details in this paper, results appear to have been very controversial and inconclusive. This could be the case because monetary base might not be a good indicator of monetary policy.

Possible Drawbacks

However, notwithstanding these promising findings, we have to allow for the certain drawbacks that may weaken our preliminary conclusion about acceptance of the hypothesis. Among them could be:

- Ordering of variables when building impulse response functions;

- Inadequate statistical significance of dynamic terms in deposit and securities equations (see Appendix 2 and 4);

- Vulnerability to Lucas (1976) critique;

Institutional framework in Ukraine has definitely altered over the sample period. Moreover, even if not, econometrically estimated relationship that link policy and target variables in our model might not be stable, in the view of frequently changing National Bank's policy. This implies that the results of our econometric model might not be reliable.

- Credit equation residuals are not normal in credit VEC;

Possible explanation of non-normality might come from the results of Ariccia and Garibaldi (1998) for United States and Mexico. They suggest that the response of bank credit to short-term interest rate shocks seems to be asymmetric. In other words, when the key interest rate (like our FUNDSRATE) rises, the negative effect on aggregate credit is found strong. At the same time, the influence of negative interest-rate shocks on bank credit appears to be quite weak.

- Rather short sample in securities VEC model;

Obsolete accounting standards used by Ukrainian banks prior to 1998 have imposed sort of data constraint on the present work. This is so because only since Jan-1998 Ukrainian banks have started to report their securities portfolios according to international accounting principles. Therefore, the number of observations included when estimating securities VEC model is only 31.

- Alternative interpretations.

For example, Allan Meltzer (1995) argues that the proposition of bank lending view that central bank is capable of shifting supply of bank loans by means of monetary policy seems very doubtful. He suggests that alternatively, "changes in requests to borrow, induced by monetary (and other) impulses, best explain cyclical changes in lending". In other words, monetary policy operates exclusively through money demand mechanism, and cyclical changes in total credit are largely determined by rising or falling credit demand that responds to conventional monetary impulses.

Concluding Remarks

Taking into account substantial amount of possible drawbacks, it seems reasonable to demand more evidence, preferably arising from microeconomic data on Ukrainian banking system that would further confirm or reject bank lending channel predictions.

Microeconomic Evidence from Banks' Balance Sheets

As we have established in previous section, identification of bank lending channel with macro data is a hard problem. First, there are plenty of limitations such as vulnerability to Lucas critique, model specification problems, and second, alternative interpretations of the previous section's story consistent with traditional interest rate effects are possible.

Therefore, as suggested in relevant literature on empirical testing of bank lending channel[27], we now try to check the validity of implications that theory produces for the response of individual banks' lending to monetary policy. Specifically, we seek to establish whether cross-sectional differences in such a response significantly depend upon individual banks' characteristics. Then, as long as

[27] For example, see Ferri and Kang (1999), Peek and Rosengren (1995), Kashyap and Stein (1997a), Favero, Giavazzi and Flabbi (1999)

assumptions (A1) and (A3) are assumed to hold, the evidence concerning the response of lending to monetary policy may serve as a test of whether assumption (A2) is in fact applicable in Ukraine.

Methodology and Testable Hypotheses

The empirical approach adopted in this section is closely related to the one taken up in Kashyap and Stein (1997a) and in Favero, Giavazzi and Flabbi (1999). The former work deals with US banking system and uses both cross-sectional and time dimensions of individual banks data, while the latter considers European banks and focuses on their behavior in a single tight money year 1992. To be precise, we primarily stick to the testing procedure and hypotheses formulated in Kashyap and Stein (1997a), while borrowing some terms and simplifications from Favero, Giavazzi and Flabbi (1999). Of course, concrete variables and econometric specification have been properly adjusted to account for Ukrainian context.

Now let us unfold the empirical framework that will allow us to test the validity of assumption (A2). As shown above, assumption (A2) in the context of Ukraine refers to the ability of National Bank to shift the supply schedule of loans of commercial banks by performing open market operations or by other means that alter the amount of reserves available to banks. In terms of contractionary monetary policy shock, this assumption implies that the loan supply schedule moves inward and commercial banks cannot costlessly offset the drain of demand deposits by attracting the other forms of financing. However, if the latter proposition is true, then the influence of monetary policy on lending behavior of individual banks should vary for different banks, i.e. significant cross-sectional differences must be observed.

We may readily presume that a stronger and more liquid bank with a higher share of liquid assets in total assets is able to withstand the contractionary monetary

shock relatively easier, than a less liquid bank, simply by using its large stock of cash and funds at correspondent accounts and thus leaving its credit portfolio intact. On the other hand, a weaker and less liquid bank will have to allow its total assets to shrink partly due to outflow of liquid assets and partly due to cutting its loans.

Let's denote the measure of lending activity of bank i at time t as TL_{it}, its ratio of liquid to total assets as LR_{it}, and its size in terms of net assets as SIZE, as well as adopt the nominal interbank interest rate on credits ($FUNDS_t$) as monetary policy indicator. Then two testable hypotheses that draw on bank lending channel immediately ensue from the argument made above:

(H1) **Strength effect** (where strength of a bank is proxied by liquidity)

The banks that cannot perfectly make up the fall in demand deposits are to exhibit the strength effect: $\frac{d^2 TL_{it}}{dLR_{it} dFUNDS_t} > 0$. If the first derivative $\frac{dTL_{it}}{dLR_{it}}$ here is thought of as the extent of liquidity constraints on bank's lending activity, then the strength effect states that during contractionary monetary policy periods (higher values of $FUNDS_t$) liquidity constraints become more severe. In contrast, if we first look at the derivative with respect to $FUNDS_t$, the sensitivity of lending to monetary policy appears to be lower in absolute terms for banks with stronger balance sheets. The positive sign arises because the first derivative with respect to $FUNDS_t$ is negative, and stronger banks tend to have greater (less negative) values of this derivative, which means lower sensitivity of lending to monetary policy in absolute terms.

(H2) **Size effect**

The second hypothesis is that $\frac{d^3 TL_{it}}{dLR_{it} dFUNDS_t dSIZE} < 0$, which means that the strength effect should be the most pronounced for small banks that theoretically are to experience the highest difficulties in finding alternative forms of financing after contractionary shock. The largest banks, according to bank lending channel predictions, have much easier time attracting lost funds, thereby demonstrating much weaker or even opposite strength effect. These considerations justify negative sign in size effect.

Data Description

Our source for all individual bank variables is Association of Ukrainian Banks, to which most of Ukrainian banks report their balance sheets and income statements. The data we employ in this section is monthly and covers the period from Jan-1998 to Aug-2000. The cross-sectional dimension of the panel includes 169 banks, however, for each period there are approximately 30-40 missing values meaning that some banks haven't reported in certain periods due to various reasons. Thus in total our panel consists of 32x169=5408 bank-months, while the number of observations excluding missing values is 3982 bank-months.

In the econometric specification that succeeds this subsection, we choose the following macro and bank-level micro **variables** that correspond to the objects in strength and size effect formulations.

(i) TL_{it} – the stock of total loans and financial leasing granted to non-financial entities of bank i in time period t, not adjusted for accumulated loan loss reserves;

(ii) LR_{it} - strength of balance sheet of bank i in time period t, proxied by liquidity ratio that is calculated as follows:

$$LR = \frac{Cash + Funds\,at\,CorrAccounts + Interbank\,Sold + Securities}{Net\,Assets}$$

Cash here means cash in vaults; funds at correspondent accounts include funds placed with National Bank of Ukraine, as well as placed with other resident and non-resident banks; interbank sold represents credits granted to and deposits placed with other banks in UAH and in foreign currencies; securities are total amount of securities held by bank valued at purchasing price and not adjusted for value loss reserves.

(iii) To test our hypotheses, we also need size variable. In essence, we don't have a separate one, but instead we assign banks to three size groups: *small, medium and big banks* – and then estimate regressions introducing appropriate dummies. In order to determine to which size group the bank belongs, for each time period t we sort all banks with respect to *net assets* (NA_{it}) in ascending order and then apply such assignment rule:
small banks – net assets below 80^{th} percentile;
medium banks – net assets between 80^{th} and 95^{th} percentile;
big banks – net assets above 95^{th} percentile.

(iv) As a measure of the stance of monetary policy, in line with the macro approach that we undertake in previous section, we have again chosen $FUNDS_t$ - the nominal interbank interest rate on credits.

(v) Another macro variable that is needed to test our hypotheses is some proxy for the real economic activity. Again, to stay consistent with macro test section, we choose seasonally adjusted index of real industrial production (1990=100) – $INDSA_t$.

The last two series cover the same period as in Ukrainian commercial banks' panel (Jan-1998 – Aug-2000) and are obtained from NBU and from UEPLAC respectively.

Empirical Model: Specification and Estimation Procedure

Ultimately, we aim at measuring the effect of monetary policy conducted by National Bank of Ukraine on liquidity constraints of banks of three size groups – small, medium and big. Strength effect predicts that it should be positive at least for small banks, while size effect essentially states that strength effect should dampen with bank size.

For this purpose, following the methodology of Kashyap and Stein (1997a), we employ **two-step regression procedure**.

Step 1. At first, we estimate cross-sectional regressions for each time period t and for each size group:

$$DLOG(TL_{it}) = \beta_{t0} + \sum_{j=1}^{3} \beta_{tj} \cdot DLOG(TL_{i,t-j}) + \gamma_t \cdot LR_{i,t-1} + \varepsilon_{it}$$

where $DLOG(TL_{it})$ – the log change in total loans of bank i at time t

$LR_{i,t-1}$ – liquidity ratio

ε_{it} – disturbance term

As argued earlier, the coefficient γ_t shows the severity of liquidity constraints that banks of certain size group face at time t.

Step 2. Then we run, for each size group, the time-series regression of γ_t's estimated at the first step on three lagged values of γ, on the time trend, on the change in monetary policy stance, and on the change in real economic activity:

$$g_t = \alpha_0 + \sum_{j=1}^{3} \alpha_j \cdot g_{t-j} + \alpha_4 \cdot t + \sum_{j=0}^{3} \beta_j \cdot D(FUNDS_{t-j}) + \sum_{j=0}^{2} \delta_j \cdot DLOG(INDSA_{t-j}) + \varepsilon_t$$

where $DLOG(INDSA_t)$ – the log change in real industrial production at time t

$D(FUNDS_t)$ – the change in monetary policy indicator

ε_t – disturbance term

We are essentially interested in the signs and magnitude of the β_j coefficients from the second-step regression for small, medium and big banks. Our hypotheses in principle imply that contractionary monetary policy impulse should intensify liquidity constraints, at least for the small banks. This means that the upward changes in FUNDS lead to the higher values of g_t's and the sum of β_j should be positive. For medium and big banks, this sum may also be positive, but it should decline with size, being the highest for small banks, lower for medium and the lowest for big banks.

As argued by Kashyap and Stein (1997a), the advantage of the two-step approach is that it imposes no a priori structure on the time-series properties of lending volume. Implicitly, it allows a unique macro shock for each time period t, which we think is important in overwhelmingly volatile Ukrainian institutional context. Alternatively, we may well follow the one-step regression procedure by performing panel estimation that uses cross-sectional and time dimensions simultaneously. In the latter case, there would be no efficiency loss in terms of parameters' covariance, which we otherwise would have to bear in two-step approach. However, for the purposes of the present paper we would rather be more conservative and allow for greater flexibility of specification by choosing two-step procedure.

Let us now turn to the issue of **estimation techniques**. It is natural to expect heterogeneity across different banks in our first-step regressions, which means

that it is likely that error terms are not homoskedastic[28]. That is why the first-step cross-sectional regressions we estimate both by OLS and by GLS with cross-sectional weighting applied to account for cross-sectional heteroskedasticity. The second-step regressions are estimated by OLS and then are adjusted for autocorrelation when necessary. In order to obtain efficient estimates of the parameters we use Newey-West Heteroskedasticity and Autocorrelation Consistent (HAC) standard errors and covariance to calculate respective p-values.

The results of exemplary first-step regression estimated both by OLS and by GLS with cross-sectional weighting for the December 1998 are presented in Appendix 5 and 6. It should be noted that we introduce auxiliary dummy variables DECILE2 and DECILE3 (equal to 1 for medium and big banks and 0 otherwise) so as to capture the intensity of liquidity constraints in a single estimated equation. As is clearly seen from these Appendices, the lagged changes in lending volume for small banks are all statistically significant in OLS version (with White covariance) of the regression. Moreover, when cross-sectional weighting is applied to account for heterogeneity, the lagged terms of all bank categories in GLS version of the first-step regression have high t-statistics. While the latter estimation may have generated suspiciously significant point estimates, this shouldn't be a problem, because point estimates of parameters in OLS and GLS versions are very close. For example, the measure of liquidity constraints for small banks is 0.278 and 0.273 respectively, while for the big banks it stands at –0.414 and –0.452. However, if the difference is not tiny, we may well interpret these two estimates as lower and upper bound for the true g_t (further referred to as GAMMA) - intensity of liquidity constraints at time t.

[28] The tests for heteroskedasticity in fact have supported this conclusion indicating the rejection of the null of no heteroskedasticity, although here we do not provide further details.

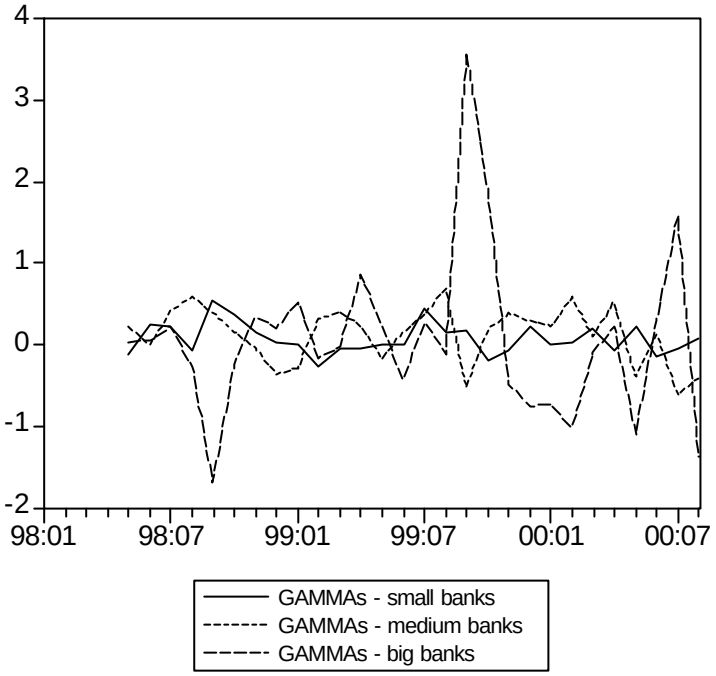

Figure 4. Intensity of Liquidity Constraints (GAMMAs), by Bank Size Group
In the figure above, we can see the complete picture of liquidity constraints' behavior, as estimated from the set of the first-step regressions (GLS version).

Before we present the results of the second-step time series regressions, it seems relevant to discuss some **problems with** outlined so far **two-step procedure**. As emphasized by Kashyap and Stein (1997a), biases in the level of GAMMAs are not an issue for our hypotheses, while biases in correlation between GAMMAs and monetary policy may essentially influence the validity of our results.

- One aspect of concern is endogeneity of liquidity ratio. The bias in estimated coefficient near the stance of monetary policy in the second-step regression may arise due to mutual interdependence of LR and loan demand cyclicality. Kashyap and Stein (1997a) offer two kinds of stories that could potentially explain such a bias: heterogeneous risk aversion and

rational buffer stocking. Without going into too much detail, we may think about the endogeneity bias a bit simpler. If some banks (namely small ones) really have a problem of withstanding tight money periods, they will rationally opt for greater holdings of liquid assets precisely to protect their loan portfolios. In other words, not only does liquidity affect lending, but also reverse causation is plausible.

Therefore, to tackle the endogeneity problem we need an instrument for the liquidity ratio. Below in subsection we make a step in this direction by constructing a suitable instrument for LR and then re-estimating our empirical model appropriately.

- Another problem emphasized by Kashyap and Stein (1997a) is that we may well capture indirect capital shock effect instead of direct influence of monetary policy[29]. This observation justifies the inclusion of trend variable in second-step time series regression to control, although a bit crudely, for these capital induced effects. It should also be noted that in the context of Ukraine the rationale for trend could additionally stem from the fact that since March 1999 onwards the overall economic climate is improving thereby making liquidity constraints for banks less severe.

Instrumenting Liquidity Ratio

We would basically like to find a variable that is highly correlated with liquidity ratio and is not correlated with loan demand cyclicality. The idea for the procedure of constructing a suitable instrument for liquidity ratio originates from the work of Kashyap and Stein (1997a). They suggest regressing liquidity ratio

[29] The mechanism is the following. Tight monetary policy, in line with traditional interest rate channel, raises short-term interest rates, which in turn depresses economic activity. Some of the bank loans may become bad, thus causing capital of banks to decline. In these circumstances, as long as capital requirements imposed by central bank (or NBU in case of Ukraine) are binding, banks may decide to stop or significantly limit the amounts of new lending in order to comply with capital regulations.

"against any plausible observable measures of loan cyclicality, and using the residuals from this regression as our instruments".

The readily observed measure of loan demand cyclicality, taking account of our data limitations, could only be *the ratio of total loans to net assets*. Unfortunately, the composition of total loans is unavailable. Thus, we choose to regress liquidity ratio against contemporaneous value and one lag of total loans/net assets ratio and against time trend. Prior to running first-step regressions, we estimate by pooled least squares the following equation:

$$LR_{i,t} = a_0 + a_1 \cdot t + \sum_{j=0}^{1} b_j \cdot \frac{TL_{i,t-j}}{NA_{i,t-j}} + e_{it}$$

where $TL_{i,t}$ and $NA_{i,t}$ – total loans and net assets of bank i at time t

$LR_{i,t}$ – liquidity ratio

e_{it} – disturbanc e terms

Then for each bank-month combination we generate residuals that would serve as instruments for liquidity ratio in our first-step regressions. The Appendix 7 provides the detailed view on the results of this preparatory estimation. Here we just emphasize some points for the case of small banks: (i) the contemporaneous value of loans/assets ratio has theoretically predictable sign (negative), as well as high t-statistic, (ii) while lagged ratio is statistically insignificant. The results tell us that when a small bank decides to increase its share of credit portfolio by 1%, then its liquidity ratio is expected to decline by roughly 0.76%. The predictive power of the equation is rather moderate (R^2=57.2%), meaning that if loans/assets ratio is a good measure of loan demand cyclicality, then the informal degree of endogeneity between lending and liquidity positions of Ukrainian banks seems to be relatively high.

Next, everything is done according to the two-step procedure described above. The only difference is that in the first-step regressions we use residuals from our preparatory regression instead of actual liquidity ratios. The second step is unchanged. Finally, as Kashyap and Stein (1997a) note, we may think of the above procedure for solving endogeneity problem in our two-step approach as being "quasi" instrumental variables.

Interpreting Results

At last, we have arrived at the point when we are ready to present the results of the second step of our two-step procedure, namely showing the impact of monetary policy on intensity of liquidity constraints (GAMMA).

The results of the second-step regressions (in each size group) are presented for three variants of the first-step estimation:

- OLS with White heteroskedasticity consistent covariance;
- GLS with cross-sectional weighting;
- GLS with cross-sectional weighting, liquidity ratio instrumented according to the procedure of the above subsection.

For the further simple reference we denote these variants in tables below as OLS, GLS (CS) and GLS (CS)-IV respectively. The results of the second-step estimation are shown below in Table 6 that provides us with compact overview of the aggregate figures in which we are interested. Additional details are contained in Appendix 8.

Table 6. Compact Overview of the Second-Step Regressions

Size Group	Aggregate Impact of Monetary Policy on GAMMA (Sums of Coefficients on Monetary Policy Indicator)					
	GLS (CS)		OLS		GLS(CS)-IV	
	Coef	Prob	Coef	Prob	Coef	Prob
Small banks	0.004645	0.278773	0.006801	0.142501	0.016742	0.000315
Medium banks	0.000259	0.969670	0.004188	0.58231	-0.009942	0.259680
Big Banks	0.010036	0.403852	0.001925	0.869920	0.014599	0.428294
Differential (small-big)	-0.005392		0.004875		0.002143	

As is clearly seen, each coefficient representing the total impact of monetary policy on GAMMA for each size group is accompanied by respective p-value. In calculating p-values, we are using Newey-West heteroskedasticity and autocorrelation consistent (HAC) standard errors & covariance.

First, let's look at the magnitudes and signs of the coefficients. In line with **strength effect**, the impact of monetary policy on small banks' intensity of liquidity constraints is positive in all variants, as expected. However, it is statistically significant at conventional level (here, at 1%) only for the GLS (CS)-IV variant of the first-step regressions. The magnitudes of the impact in OLS and GLS (CS) versions are rather comparable ranging from 0.0046 to 0.0068; in quasi-IV case, the coefficient is approximately 2-3 times greater. The picture for medium banks is rather controversial: neither signs of coefficients are consistently positive (or negative), nor the point estimates are statistically significant. The difference in magnitudes is more than 16-fold (compare 0.00026 with 0.00419). Results for big banks are supportive of the strength effect producing positive point estimates for the effect of monetary policy on liquidity constraints in all versions. At the same time, p-values are quite high meaning statistical insignificance of the results for big banks. As to the magnitudes, coefficients

exhibit less dispersion than those of medium banks, but still vary from appr. 0.002 to 0.0146, or more than 7-fold.

Let's now turn to small-big banks' differentials and see whether the **size effect** holds. As long as the results for medium banks are contradictory, we only look at the small banks versus big banks differential. Our hypothesis predicts that this differential should be significantly positive presuming that liquidity constraints intensify much harder for small banks than for big banks in tight money periods. What we actually observe is that in GLS (CS) version the small-big differential is in fact negative, contrary to the predictions of bank lending channel, while for OLS and GLS (CS)-IV versions it is hopefully positive and comparable across (0.0049 and 0.00214). However, since the coefficients for big banks have rather high p-values, we cannot state that even for GLS (CS)-IV case this monetary policy differential is significant[30]. Therefore, overall size effect is unlikely to hold.

Apart from statistical significance, we are also interested in the **economic meaning of results**. Roughly speaking, we ask and try to answer the question of how differently in terms of lending do banks perform while adjusting to monetary policy shock.

As long as we observe significant strength effect, strictly speaking, only for small banks, we will address this question in application to this size group.

Suppose, we have two small banks – strong and weak in terms of liquidity and the same in all other respects (including the size of credit portfolio). Let LR(strong)=0.5 and LR(weak)=0.1 implying that the shares of cash, funds at correspondent accounts, interbank funds sold and securities in total assets of these banks stand at 50% and 10% respectively. As seen from Table 6, the most

[30] Unless the covariance between small and big banks' coefficients is positive and very high, which seems not to be the case.

conservative measure of the impact of monetary policy on small banks' liquidity constraints is approximately 0.0046. Then, simply on the basis of a stronger balance sheet in terms of liquidity, 1% increase in FUNDS rate (contractionary impulse of monetary policy) will lead, after 3 months, to a differential contraction of both banks' lending with gap amounting to appr. 0.19%=(0.5-0.1)*0.0046[31]. In other words, the credit portfolio of strong small bank will shrink less than that of the weak small bank and the difference will amount to 0.19% of initial volume of loans.

Remaining Problems and Alternative Measure of Balance Sheet Strength

Notwithstanding the fact that we have found the strength effect for small banks, some limitations evident from a closer look at Appendix 8 may undermine our conclusions:

(i) Autocorrelation problem

The results of second-step regressions for small and big banks in OLS and GLS (CS) versions and for small banks in GLS (CS)-IV version suffer from the presence of autocorrelation that is indicated by Breusch-Godfrey Serial Correlation Lagrange Multiplier test. Although we have adjusted standard errors and covariance appropriately (Newey-West approach), the presence of lagged dependent variable terms may lead to the biased and inconsistent point estimates.

(ii) Huge differences in monetary policy impact coefficients across alternative estimation techniques of the first-step regressions (even for small banks the magnitudes vary by 2-3 times)

[31] Of course, this is a rough estimate because we usually have autocorrelation in lending so that ultimate effect may somewhat differ.

(iii) Non-normality of residuals in regressions for small banks

One more problem that seems to be connected with specific conditions of Ukraine is also worth mentioning. Securities in Ukraine are not as liquid as they are in US or in Europe, stock market is rather weak and thin, with trade volumes well below the turnover on foreign exchange or loan markets. Therefore, the bank in Ukraine may in fact have high share of securities in its assets, at the same time experiencing liquidity strains and borrowing heavily in interbank market.

In a move to account for this specific concern, as well as to alleviate (or even get rid of) the influence of the above-mentioned limitations and to ensure the robustness of our results, we employ an **alternative measure of balance sheet strength** – namely, liquidity ratio of the previous definition that excludes SECURITIES. With this alternative liquidity ratio denoted as LRNS we then estimate first-step regressions in two versions: GSL (CS) and GLS (CS)-IV. The procedure for the second-step regressions in each size group remains unchanged.

The Table 7 below summarizes the results of second step with alternative liquidity ratio. Appendix 9 contains specific details of estimation.

Table 7. Compact Overview of the Second-Step Regressions: Alternative Liquidity Ratio

Size Group	**Aggregate Impact of Monetary Policy on GAMMA (Sums of Coefficients on Monetary Policy Indicator)**			
	GLS (CS)		**GLS (CS)-IV**	
	Coef	Prob	Coef	Prob
Small banks	0.004887	0.52899	0.019963	0.206026
Medium banks	-0.004015	0.49613	-0.019849	0.217016
Big Banks	0.005937	0.568495	0.002148	0.892122
Differential (small-big)	-0.001050		0.017815	

Above all, take note of the fact that we have managed to purge autocorrelation throughout the second-step regressions (see Appendix 9).

First, let's bring our attention to each size group's coefficients and compare them to those from previous estimation with traditional liquidity ratio. As far as small banks are concerned, the magnitudes and signs of coefficients are essentially the same and comparable. The bad news is that statistical significance of the coefficient in GLS (CS)-IV version is poorer (p-value is about 20% versus 0.03% previously). However, the reverse side of the coin is that here (see Appendix 9) we don't have autocorrelation problem and residuals are normal. Thus, we may state that estimation procedure with alternative liquidity ratio basically confirms the strength effect that we have found for small banks so far.

The picture of medium banks' liquidity constraints response to monetary policy changes a bit in that now we have consistently negative and still insignificant coefficients. P-values are lower than those in Table 6, implying better precision of estimation, but still not low enough. The conclusion is that alternative estimation has improved precision, but added economic controversy: out of five estimates, three are negative and two are positive.

Results for big banks show that the precision of coefficients has deteriorated, while magnitude of the response to monetary policy in GLS (CS) version has decreased by about 40% (from 0.01 to 0.0059) and in GLS (CS)-IV version – 7-fold. Moreover, we no more observe autocorrelation, which adds credibility to our present point estimates. That the magnitudes are positive and lower may be the case under the predictions of bank lending channel, but statistical significance is disappointing. Therefore, strength effect for big banks is rather weak.

Second, the small-big differentials remain as controversial and insignificant as before with opposite signs in GLS (CS) and GLS (CS)-IV versions and poor precision exemplified by high p-values. Thus, size effect is unlikely to have shown up because of employing alternative liquidity ratio.

Concluding Remarks

So far, we seem to establish the two crucial points regarding the validity of assumption (A2):

(i) **Strength effect** hypothesized above seems to hold only for small banks group, while being rather weak for big banks and very controversial for medium ones.

The latter controversy is quite understandable meaning that medium banks possess the features of both small and big financial institutions and may produce contradictory results when aggregated in a single equation. At the same time, the weakness of the positive (or negative) strength effect for big banks might be the result of inappropriate assignment to size groups or efficiency loss caused by our two-step estimation procedure adopted instead of more efficient one-step panel regression.

(ii) Our two-step estimation procedure provides little evidence that **size effect** holds for Ukrainian banks.

This may be explained again by efficiency loss already mentioned or by institutionally volatile Ukrainian banking system. It might be that in some periods liquidity constraints for big banks after contractionary monetary policy shock may intensify (not relieve) as well as for small banks, notwithstanding their higher ability to attract alternative forms of financing. It might also be that National Bank of Ukraine could exercise some sort of informal control over big banks and, say, force them to buy

heavily T-bills, thus intentionally intensifying their liquidity constraints irrespective of their current liquidity positions.

Therefore, our micro evidence concerning the ability of National Bank to affect loan supply schedule by changing the amount of available reserves is rather vague and indecisive: strength effect holds for small banks only, while size effect doesn't show up at all. The conclusion could be that our techniques and data have failed to prove the validity of the assumption (A2) and probably this assumption requires more careful and detailed decomposition and examination in further research.

Chapter 5

CONCLUSIONS AND SUMMARY

Summarizing the findings of the present work, we clearly understand that our efforts aimed at studying bank lending channel of monetary transmission mechanism in Ukraine represent a rather small, but still meaningful step towards examining such challenging and fascinating monetary phenomenon.

In this paper we seem to have established that, purely on theoretical grounds, the bank lending channel may operate in Ukraine. The institutional analysis of Ukrainian context strongly suggests that unlike many other channels of monetary transmission, bank lending channel is likely to be the best candidate to augment conventional interest rate effects.

Nevertheless, the institutional arguments regarding the assumption, crucial for bank lending channel to exist, about the National Bank's ability to affect the supply of bank loans by monetary policy turn out not to be completely persuasive. Therefore, we then employ econometric analysis to test the validity of this potentially doubtful assumption using both macro and micro data on Ukrainian banking system. Our macro evidence appears to be consistent, although with some minor reservations, with the implications of bank lending channel. At the same time, micro evidence seems to be somehow inconclusive with regard to the specific direction of the hypothesized bank size effect. The explanation for such results may well stem, on the one hand, from volatile institutional structure of Ukrainian economy and from limitations of our econometric techniques, on the other hand. In addition, the relative inconclusiveness of the micro evidence might have something to do with the

potential unreliability of the data contained in the balance sheets of the Ukrainian banks.

Overall, we can argue that the empirical evidence in fact provides some, albeit not overwhelming, support to the hypothesis that the bank lending channel operates in Ukraine. Moreover, we think this area remains fruitful for further research, especially with respect to quantifying the second link of monetary transmission – from banks to firms. Using these results, the policymakers at the National Bank will be able to assess the impact of their policy not only on individual banks or aggregate policy variables, but also on real sector agents.

WORKS CITED

Ariccia, Giovanni Della and Garibaldi, Pietro (1998), "Bank Lending and Interest Rate Changes in a Dynamic Matching Model", *IMF Working Paper*, #WP/98/93, June

Bagliano, Fabio C. and Favero, Carlo A. (1998), "Information from Financial Markets and VAR measures of Monetary Policy", *Annual Meeting of the European Economic Association Paper*, Berlin, September

Bernanke, Ben S. and Blinder, Alan S. (1988), "Credit, Money and Aggregate Demand", *The American Economic Review*, Paper and Proceedings 78, pp.435-39

Bernanke, Ben S. and Blinder, Alan S. (1992), "The Federal Funds Rate and the Channels of Monetary Policy", *The American Economic Review*, Vol. 82, Issue 4, September, pp.901-921

Bernanke, Ben S. and Gertler, Mark (1995), "Inside the Black Box: The Credit Channel of Monetary Policy Transmission", *NBER Working Paper*, #5146, June

Bernanke, Ben S. and Mihov, Ilian (1995), "Measuring Monetary Policy", *NBER Working Paper*, #5145, June

Carpenter, Robert, Fazzari, Steven and Petersen, Bruce (1994), "Inventory Investment, Internal Finance Fluctuations, and the Business Cycle", *Brookings Papers on Economic Activity*, pp.75-138

Carrasquilla, Alberto (1998), "Monetary Policy Transmission: the Colombian Case". In "The Transmission of Monetary Policy in Emerging Markets", *BIS Policy Paper*, #3

Cecchetti, Stephen G. (1995), "Distinguishing Theories of the Monetary Transmission Mechanism", *Federal Reserve Bank of St. Louis Economic Review*, May-June, pp.83-97

Cecchetti, Stephen G. (1999), "Legal Structure, Financial Structure, and the Monetary Policy Transmission Mechanism", *Federal Reserve Bank of New York Economic Policy Review*, July, pp.9-28

Diamond, Douglas W. (1984), "Financial Intermediation and Delegated Monitoring", *The Review of Economic Studies*, Vol. 51, Issue 3, July, pp.393-414

Eremenko, Ihor (2000), "An Alternative View on Central Bank Targeting in Transition Economies: the Role of the Financial Sector", *EERC MA Thesis Paper*, Kyiv: NaUKMA, May

Favero, Carlo A., Giavazzi, Francesco, and Flabbi, Luca (1999), "The Transmission Mechanism of

Monetary Policy in Europe: Evidence from Banks' Balance Sheets", *NBER Working Paper*, #7231, July

Ferri, Giovanni and Kang, Tae Soo (1999), "The Credit Channel at Work: Lessons from the Republic of Korea's Financial Crisis", *World Bank Policy Research Working Paper*, #2190

Gertler, Mark and Gilchrist, Simon (1994), "Monetary Policy, Business Cycles, and the Behavior of Small Manufacturing Firms", *Quarterly Journal of Economics*, Vol. 109, May, pp.309-340

Kashyap, Anil K. and Stein, Jeremy C. (1993), "Monetary Policy and Bank Lending", *NBER Working Paper*, #4317, April

Kashyap, Anil K. and Stein, Jeremy C. (1997a), "What do a Million Banks Have To Say about the Transmission of Monetary Policy?" *NBER Working Paper*, #6056, June

Kashyap, Anil K. and Stein, Jeremy C. (1997b), "The Role of Banks in Monetary Policy: A Survey with Implications for the European Union", *Federal Reserve Bank of Chicago Economic Perspectives*, July, pp.2-18

Kashyap, Anil K., Stein, Jeremy C. and Lamont, Owen (1994), "Credit Conditions and the Cyclical Behavior of Inventories", *Quarterly Journal of Economics*, Vol. 109, August, pp.565-592

Kashyap, Anil K., Stein, Jeremy C. and Wilcox, David W. (1993), "Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance", *The American Economic Review*, Vol. 83, Issue 1, March, pp.78-98

Kim, Hyun E. (1999), "Was Credit Channel a Key Monetary Transmission Mechanism Following the Recent Financial Crisis in the Republic of Korea", *World Bank Policy Research Working Paper*, #3003, April

King, Stephen R. (1986), "Monetary Transmission: Through Bank Loans or Bank Liabilities", *Journal of Money, Credit and Banking*, Vol. 18, Issue 3, August, pp. 290-303

Lucas, Robert (1976), "Econometric Policy Evaluation: A Critique", *Carnegie Rochester Conference Series on Public Policy*, #1

Meltzer, Allan H. (1995), "Monetary, Credit and (Other) Transmission Processes: A Monetarist Perspective", *The Journal of Economic Perspectives*, Vol. 9, Issue 4, Autumn, pp.49-72

Miron, Jeffrey A., Romer, Christina D., and Weil, David N. (1993), "Historical Perspectives on the Monetary Transmission Mechanism", *NBER Working Paper*, #4326, April

Mishkin, Frederic S. (1996), "The Channels of Monetary Transmission: Lessons for Monetary Policy", *NBER Working Paper*, #5464, February

Mishkin, Frederic S. (2001), *The Economics of Money, Banking, and Financial Markets*. Boston, Toronto: Little, Brown and Co.

Peek, Joe and Rosengren, Eric S. (1995) "Bank Lending and the Transmission of Monetary Policy" in *Is Bank Lending Important for the Transmission of Monetary Policy?* Edited by J. Peek and E. Rosengren, *Federal Reserve Bank of Boston: Conference Series #39*, June

Romer, Christina D. and Romer, David H. (1990), "New Evidence on the Monetary Transmission Mechanism", *Brookings Papers on Economic Activity*, #1, pp.149-214

Sirivedhin, Tanya (1998), "Financial Reform and the Monetary Transmission Mechanism: the Case of Thailand". In "The Transmission of Monetary Policy in Emerging Markets", *BIS Policy Paper*, #3

UEPLAC (2001), *Ukrainian Economic Trends*, January

UkrInform Information Agency (2001), *Information Digest: Banks and Finance*, #1(53), January

NBU (2001), "Pidsumky diyal'nosti komertsiynykh bankiv za 2000 rik", *Visnyk NBU*, #3, March

APPENDICES

Appendix 1.

Augmented Dickey-Fuller Unit Root Hypothesis Test

Variable	**ADF Test Statistic**	**MacKinnon Critical Values**
FUNDSRATE	-2.369736	-3.1828 (10% critical value)
LOG(CPI)	-2.874370	-3.1629 (10% critical value)
LOG(INDSA)	-0.625638	-3.1711 (10% critical value)
LOG(DEPOSITS)	-1.627235	-3.1868 (10% critical value)
LOG(CRED)	-3.476506	-3.4801 (5% critical value)
LOG(SECURITIES)	-1.407009	-3.2203 (10% critical value)
LOG(EXRATE)	-1.515660	-3.1635 (10% critical value)
D(FUNDSRATE)	-5.832909 ***	-4.1678 (1% critical value)
DLOG(CPI)	-5.376410 ***	-4.0890 (1% critical value)
DLOG(INDSA)	-5.504980 ***	-4.1219 (1% critical value)
DLOG(DEPOSITS)	-3.215159 *	-3.1882 (10% critical value)
DLOG(CRED)	-4.709632 ***	-4.1083 (1% critical value)
DLOG(SECURITIES)	-3.564328 *	-3.2367 (10% critical value)
DLOG(EXRATE)	-7.362660 ***	-4.0909 (1% critical value)

Notes:

1) ADF tests for credits and securities included 6 lags, while for the rest of the series 3 lags turned to be enough.
2) ***, **, and * indicate rejection of the Unit Root hypothesis at 1%, 5% and 10% significance level respectively.

Appendix 2.

Deposit VEC: Estimation Output

Date: 02/24/01 Time: 17:26
Sample(adjusted): 1997:02 2000:09
Included observations: 44 after adjusting endpoints
Standard errors & t-statistics in parentheses

Cointegrating Eq:	CointEq1
FUNDSRATE(-1)	1.000000
LOG(DEPOSITS(-1))	-47.07739 (66.0988) (-0.71223)
LOG(INDSA(-1))	274.0340 (112.382) (2.43842)
LOG(CPI(-1))	9.701698 (116.899) (0.08299)
C	-753.9696

Error Correction:	D(FUNDSRATE)	D(LOG(DEPOSITS))	D(LOG(INDSA))	D(LOG(CPI))
CointEq1	-0.381866 (0.11534) (-3.31087)	-0.000237 (0.00033) (-0.71883)	-0.000717 (0.00022) (-3.25729)	0.000141 (0.00011) (1.34340)
D(FUNDSRATE(-1))	0.152229 (0.15190) (1.00218)	-0.000275 (0.00043) (-0.63333)	0.000217 (0.00029) (0.74945)	-7.35E-05 (0.00014) (-0.52954)
D(LOG(DEPOSITS(-1)))	-105.0798 (58.5218) (-1.79557)	-0.297394 (0.16708) (-1.77991)	0.017651 (0.11176) (0.15794)	0.066989 (0.05344) (1.25354)
D(LOG(INDSA(-1)))	85.99840 (77.1679) (1.11443)	-0.011076 (0.22032) (-0.05027)	-0.325912 (0.14737) (-2.21158)	-0.061773 (0.07047) (-0.87663)
D(LOG(CPI(-1)))	-581.2014	0.183618	0.328137	0.454165

	(140.440)	(0.40097)	(0.26820)	(0.12825)
	(-4.13842)	(0.45794)	(1.22349)	(3.54138)
C	8.390048	0.029959	-0.001733	0.004624
	(2.87477)	(0.00821)	(0.00549)	(0.00263)
	(2.91851)	(3.65010)	(-0.31571)	(1.76154)
DLOG(EXRATE)	99.95346	0.042272	0.043112	0.069698
	(33.4536)	(0.09551)	(0.06389)	(0.03055)
	(2.98783)	(0.44258)	(0.67484)	(2.28154)
R-squared	0.543310	0.124621	0.331776	0.522290
Adj. R-squared	0.469253	-0.017332	0.223415	0.444823
Sum sq. resids	5594.211	0.045601	0.020402	0.004665
S.E. equation	12.29613	0.035106	0.023482	0.011228
Log likelihood	-169.0298	88.75111	106.4461	138.9083
Akaike AIC	5.163480	-6.553837	-7.358152	-8.833711
Schwarz SC	5.447328	-6.269988	-7.074304	-8.549863
Mean dependent	0.070682	0.026018	0.003206	0.014284
S.D. dependent	16.87814	0.034806	0.026646	0.015070
Determinant Residual Covariance		5.33E-09		
Log Likelihood		169.3830		
Akaike Information Criteria		-17.59619		
Schwarz Criteria		-16.29860		

Appendix 3.

Credit VEC: Estimation Output

Date: 02/24/01 Time: 17:47
Sample(adjusted): 1996:11 2000:09
Included observations: 47 after adjusting endpoints
Standard errors & t-statistics in parentheses

Cointegrating Eq:	CointEq1
FUNDSRATE(-1)	1.000000
LOG(CRED(-1))	74.56474 (43.6499) (1.70825)
LOG(INDSA(-1))	244.7766 (115.626) (2.11696)
LOG(CPI(-1))	-163.8362 (79.0442) (-2.07272)
C	375.4391

Error Correction:	D(FUNDSRATE)	D(LOG(CRED))	D(LOG(INDSA))	D(LOG(CPI))
CointEq1	-0.281355 (0.11109) (-2.53263)	-0.000319 (0.00030) (-1.06014)	-0.000685 (0.00021) (-3.29737)	0.000226 (9.1E-05) (2.47903)
D(FUNDSRATE(-1))	0.117054 (0.15843) (0.73883)	0.000441 (0.00043) (1.02863)	0.000200 (0.00030) (0.67447)	-0.000168 (0.00013) (-1.29578)
D(LOG(CRED(-1)))	11.48030 (62.5545) (0.18352)	-0.191945 (0.16930) (-1.13372)	0.011097 (0.11703) (0.09482)	0.069343 (0.05129) (1.35208)
D(LOG(INDSA(-1)))	52.92741	0.314703	-0.244279	-0.052020

	(73.0547)	(0.19772)	(0.13667)	(0.05990)
	(0.72449)	(1.59163)	(-1.78733)	(-0.86851)
D(LOG(CPI(-1)))	-590.7045	-0.361243	0.345765	0.427739
	(146.355)	(0.39611)	(0.27381)	(0.11999)
	(-4.03610)	(-0.91197)	(1.26281)	(3.56473)
C	5.673667	0.035889	-0.002944	0.005311
	(3.08758)	(0.00836)	(0.00578)	(0.00253)
	(1.83757)	(4.29472)	(-0.50961)	(2.09804)
DLOG(EXRATE)	90.04839	-0.016489	0.087996	0.053492
	(36.5877)	(0.09903)	(0.06845)	(0.03000)
	(2.46116)	(-0.16651)	(1.28557)	(1.78324)
R-squared	0.475620	0.184724	0.302457	0.559791
Adj. R-squared	0.396964	0.062432	0.197825	0.493760
Sum sq. resids	6453.851	0.047276	0.022588	0.004338
S.E. equation	12.70222	0.034379	0.023764	0.010414
Log likelihood	-182.3638	95.50458	112.8608	151.6355
Akaike AIC	5.220157	-6.604029	-7.342594	-8.992579
Schwarz SC	5.495711	-6.328475	-7.067040	-8.717025
Mean dependent	-0.005745	0.026527	0.003117	0.014280
S.D. dependent	16.35715	0.035505	0.026533	0.014637
Determinant Residual Covariance		4.46E-09		
Log Likelihood		185.1129		
Akaike Information Criteria		-17.86695		
Schwarz Criteria		-16.60728		

Appendix 4.

Securities VEC: Estimation Output

Date: 02/24/01 Time: 17:54
Sample(adjusted): 1998:02 2000:08
Included observations: 31 after adjusting endpoints
Standard errors & t-statistics in parentheses

Cointegrating Eq:	CointEq1
FUNDSRATE(-1)	1.000000
LOG(SECURITIES(-1))	56.17630
	(15.0084)
	(3.74299)
LOG(INDSA(-1))	-199.8649
	(108.711)
	(-1.83849)
LOG(CPI(-1))	90.92865
	(25.9794)
	(3.50003)
C	-830.4160

Error Correction:	D(FUNDSRATE)	D(LOG(SECURITIES))	D(LOG(INDSA))	D(LOG(CPI))
CointEq1	-0.537134	-0.000537	-0.000535	0.000458
	(0.20227)	(0.00108)	(0.00039)	(0.00014)
	(-2.65558)	(-0.49821)	(-1.36119)	(3.16326)
D(FUNDSRATE(-1))	0.214459	5.40E-05	2.97E-05	-0.000216
	(0.20593)	(0.00110)	(0.00040)	(0.00015)
	(1.04143)	(0.04914)	(0.07427)	(-1.46128)
D(LOG(SECURITIES(-1)))	-4.071289	-0.102767	0.038010	-0.038323
	(36.8840)	(0.19665)	(0.07164)	(0.02642)
	(-0.11038)	(-0.52260)	(0.53059)	(-1.45054)
D(LOG(INDSA(-1)))	-102.7069	0.700687	-0.293761	-0.002452
	(129.495)	(0.69040)	(0.25151)	(0.09276)
	(-0.79314)	(1.01490)	(-1.16800)	(-0.02644)

D(LOG(CPI(-1)))	-232.7831	-0.233522	0.598151	0.077774
	(269.448)	(1.43656)	(0.52333)	(0.19300)
	(-0.86392)	(-0.16256)	(1.14297)	(0.40297)
C	1.027061	-0.000490	-0.005788	0.013209
	(5.06004)	(0.02698)	(0.00983)	(0.00362)
	(0.20298)	(-0.01816)	(-0.58891)	(3.64429)
DLOG(EXRATE)	82.99983	0.061582	0.062500	0.062123
	(41.3139)	(0.22026)	(0.08024)	(0.02959)
	(2.00901)	(0.27958)	(0.77891)	(2.09926)
R-squared	0.544835	0.132758	0.157575	0.684370
Adj. R-squared	0.431044	-0.084052	-0.053032	0.605462
Sum sq. resids	5279.917	0.150080	0.019917	0.002709
S.E. equation	14.83228	0.079078	0.028808	0.010624
Log likelihood	-123.6211	38.63679	69.94045	100.8632
Akaike AIC	5.589291	-4.878960	-6.898551	-8.893568
Schwarz SC	5.913095	-4.555157	-6.574747	-8.569764
Mean dependent	-0.694194	0.000252	0.005366	0.016623
S.D. dependent	19.66385	0.075951	0.028073	0.016914
Determinant Residual Covariance		3.75E-08		
Log Likelihood		89.09936		
Akaike Information Criteria		-15.03534		
Schwarz Criteria		-13.55509		

Appendix 5.

OLS Estimation Output: Example of First-Step Regression for Dec-1998

Dependent Variable: DLOG(TL?)
Method: Pooled Least Squares
Date: 04/14/01 Time: 17:50
Sample: 1998:12 1998:12
Included observations: 1
Total panel observations 96
White Heteroskedasticity-Consistent Standard Errors & Covariance
Cross sections without valid observations dropped

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.036533	0.067797	-0.538855	0.5915
DECILE2?	0.150299	0.178861	0.840312	0.4032
DECILE3?	0.237094	0.104411	2.270774	0.0258
DLOG(TL?(-1))	-0.294749	0.149915	-1.966115	0.0527
DECILE2?*DLOG(TL?(-1))	1.075423	0.208035	5.169441	0.0000
DECILE3?*DLOG(TL?(-1))	0.677145	0.249184	2.717445	0.0080
DLOG(TL?(-2))	-0.410204	0.111495	-3.679136	0.0004
DECILE2?*DLOG(TL?(-2))	0.768199	0.434722	1.767104	0.0810
DECILE3?*DLOG(TL?(-2))	-0.358731	0.237576	-1.509966	0.1349
DLOG(TL?(-3))	-0.346648	0.189424	-1.830011	0.0709
DECILE2?*DLOG(TL?(-3))	0.339670	0.313207	1.084493	0.2814
DECILE3?*DLOG(TL?(-3))	0.003635	0.266722	0.013629	0.9892
LR?(-1)	0.278252	0.163824	1.698487	0.0933
DECILE2?*LR?(-1)	-0.427238	0.332403	-1.285304	0.2023
DECILE3?*LR?(-1)	-0.691889	0.189132	-3.658236	0.0005

R-squared	0.351027	Mean dependent var	0.067864
Adjusted R-squared	0.238859	S.D. dependent var	0.250050
S.E. of regression	0.218152	Sum squared resid	3.854813
F-statistic	3.129468	Prob(F-statistic)	0.000623

Notes:

DECILE2 and DECILE3 are dummy variables that take the value of 1 if individual bank belongs to the medium and big size group respectively and 0 otherwise.

Appendix 6.

GLS Estimation Output: Example of First-Step Regression for Dec-1998

Dependent Variable: DLOG(TL?)
Method: GLS (Cross Section Weights)
Date: 04/14/01 Time: 18:06
Sample: 1998:12 1998:12
Included observations: 1
Total panel observations 96
White Heteroskedasticity-Consistent Standard Errors & Covariance
Cross sections without valid observations dropped

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.038542	0.000297	-129.7803	0.0000
DECILE2?	0.200529	0.014771	13.57545	0.0000
DECILE3?	0.233443	0.012354	18.89576	0.0000
DLOG(TL?(-1))	-0.258076	0.021588	-11.95443	0.0000
DECILE2?*DLOG(TL?(-1))	1.041134	0.027851	37.38260	0.0000
DECILE3?*DLOG(TL?(-1))	0.749149	0.024195	30.96255	0.0000
DLOG(TL?(-2))	-0.372495	0.005492	-67.82324	0.0000
DECILE2?*DLOG(TL?(-2))	0.897076	0.033568	26.72426	0.0000
DECILE3?*DLOG(TL?(-2))	-0.479972	0.033067	-14.51509	0.0000
DLOG(TL?(-3))	-0.329416	0.011272	-29.22480	0.0000
DECILE2?*DLOG(TL?(-3))	0.341155	0.028895	11.80685	0.0000
DECILE3?*DLOG(TL?(-3))	0.022676	0.031775	0.713640	0.4775
LR?(-1)	0.273291	0.006413	42.61423	0.0000
DECILE2?*LR?(-1)	-0.535566	0.026370	-20.30970	0.0000
DECILE3?*LR?(-1)	-0.725353	0.011380	-63.74063	0.0000

Weighted Statistics			
R-squared	0.984735	Mean dependent var	0.377603
Adjusted R-squared	0.982097	S.D. dependent var	1.490580
S.E. of regression	0.199443	Sum squared resid	3.221987
F-statistic	373.2391	Prob(F-statistic)	0.000000

Unweighted Statistics			
R-squared	0.347109	Mean dependent var	0.067864
Adjusted R-squared	0.234264	S.D. dependent var	0.250050
S.E. of regression	0.218809	Sum squared resid	3.878084

Notes:

DECILE2 and DECILE3 are dummy variables that take the value of 1 if individual bank belongs to the medium and big size group respectively and 0 otherwise.

Appendix 7.

Extracting Instrument for Liquidity Ratio: Preparatory Regression

Dependent Variable: LR?
Method: Pooled Least Squares
Date: 04/17/01 Time: 12:59
Sample: 1998:02 2000:08
Included observations: 31
Total panel observations 3618
Cross sections without valid observatio ns dropped

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.705776	0.007418	95.13864	0.0000
DECILE2?	0.080906	0.016965	4.768987	0.0000
DECILE3?	-0.084722	0.034492	-2.456317	0.0141
@TREND	0.001725	0.000267	6.463162	0.0000
DECILE2?*@TREND	0.001391	0.000668	2.081992	0.0374
DECILE3?*@TREND	0.001012	0.001042	0.971493	0.3314
TL?/NA?	-0.758575	0.033081	-22.93112	0.0000
DECILE2?*TL?/NA?	-0.136241	0.103342	-1.318352	0.1875
DECILE3?*TL?/NA?	0.151159	0.268682	0.562593	0.5737
TL?(-1)/NA?(-1)	0.005623	0.033077	0.169996	0.8650
DECILE2?*TL?(-1)/NA?(-1)	-0.015939	0.103413	-0.154130	0.8775
DECILE3?*TL?(-1)/NA?(-1)	-0.011641	0.268102	-0.043421	0.9654

R-squared	0.572093	Mean dependent var	0.421329
Adjusted R-squared	0.570788	S.D. dependent var	0.193472
S.E. of regression	0.126752	Sum squared resid	57.93395
F-statistic	438.2785	Durbin-Watson stat	0.205999
Prob(F-statistic)	0.000000		

Notes:

DECILE2 and DECILE3 are dummy variables that take the value of 1 if individual bank belongs to the medium and big size group respectively and 0 otherwise.

Appendix 8.

Second-Step Regressions Details: Impact of Monetary Policy on GAMMA

First-Step Strength Measure: LR = [Cash (in vaults and at c/a[1]) + Interbank Sold + Securities] / Net Assets

Dependent Variable: GAMMA – intensity of liquidity constraints

	GLS (CS)		OLS		GLS (CS)-IV	
	Coef	**Prob**	**Coef**	**Prob**	**Coef**	**Prob**
Small Banks						
TREND	0.000459	0.891628	0.000379	0.917221	0.005753	0.007871
Funds 0 lag	0.002457	0.089782	0.002840	0.083343	0.007417	0.000025
Funds 1 lag	0.000931	0.458183	0.001342	0.291503	0.005893	0.000467
Funds 2 lag	-0.001627	0.272874	-0.000567	0.706528	-0.001440	0.197885
Funds 3 lag	0.002884	0.140237	0.003186	0.150352	0.004872	0.000686
Funds: sum	**0.004645**	**0.278773**	**0.006801**	**0.142501**	**0.016742**	**0.000315**
INDSA 0 lag	1.269874	0.091590	0.939978	0.250936	2.607408	0.006697
INDSA 1 lag	-2.127529	0.006024	-2.025479	0.021154	-3.004740	0.000855
INDSA 2 lag	-2.487087	0.002434	-2.730407	0.004683	-2.430354	0.000755
AR(4)	-0.785159	0.000481	-0.809968	0.000324	-0.900975	0.000000
R2	0.859530		0.849470		0.887184	
Adj R2	0.598659		0.569915		0.717960	
Prob(F-stat)	0.060173		0.073149		0.012772	
BG LM test	Auto at 5%		Auto at 5%		Auto at 1%	
Medium Banks						
TREND	-0.009873	0.322206	-0.010088	0.259334	-0.004162	0.703416
Funds 0 lag	0.003969	0.421426	0.004300	0.399449	0.000390	0.927209
Funds 1 lag	-0.001277	0.733558	-0.000850	0.793307	-0.001741	0.565804
Funds 2 lag	-0.000505	0.900125	0.000645	0.881520	-0.004652	0.165456
Funds 3 lag	-0.001929	0.553567	0.000094	0.977941	-0.003939	0.376414
Funds: sum	**0.000259**	**0.969670**	**0.004188**	**0.58231**	**-0.009942**	**0.259680**
INDSA 0 lag	-2.977807	0.270532	-2.509597	0.323544	-5.637235	0.080909
INDSA 1 lag	-0.891681	0.613621	-0.044202	0.981086	-6.320656	0.047414
INDSA 2 lag	0.450845	0.807276	0.621710	0.712728	2.237226	0.201003
R2	0.443431		0.395902		0.561657	

First-Step Strength Measure:
LR = [Cash (in vaults and at c/a[1]) + Interbank Sold + Securities] / Net Assets

Dependent Variable: GAMMA – intensity of liquidity constraints

	GLS (CS)		**OLS**		**GLS (CS)-IV**	
	Coef	**Prob**	**Coef**	**Prob**	**Coef**	**Prob**
Adj R2	-0.027512		-0.115259		0.190752	
Prob(F-stat)	0.534024		0.660407		0.235997	
BG LM test	No Auto		No Auto		No Auto	
Big Banks						
TREND	-0.052239	0.003015	-0.057234	0.003122	-0.019239	0.435565
Funds 0 lag	-0.010770	0.234232	-0.012413	0.107584	-0.003752	0.756005
Funds 1 lag	0.012642	0.177342	0.008101	0.486708	0.005652	0.572727
Funds 2 lag	0.006170	0.670163	0.006873	0.643983	0.001450	0.893439
Funds 3 lag	0.001994	0.819375	-0.000635	0.950440	0.011249	0.207827
Funds: sum	**0.010036**	**0.403852**	**0.001925**	**0.869920**	**0.014599**	**0.428294**
INDSA 0 lag	8.168263	0.260309	5.551106	0.482540	2.228075	0.782786
INDSA 1 lag	14.694566	0.007202	12.969917	0.018451	12.843427	0.080434
INDSA 2 lag	28.853930	0.002182	31.264246	0.000501	16.349952	0.031617
AR(1)	-0.465189	0.270784	-0.529319	0.213648		
R2	0.889215		0.889747		0.718205	
Adj R2	0.745195		0.746417		0.436410	
Prob(F-stat)	0.003387		0.003315		0.059369	
BG LM test	Auto at 10%		Auto at 10%		No Auto	

Notes:
1) "c/a" means funds placed at correspondent accounts with other banks, including NBU.
2) The regression for every size group includes 3 lags of dependent variable.
3) All p-values are calculated using Newey-West Heteroskedasticity and Autocorrelation Consistent Standard Errors & Covariance (lag truncation=2).
4) BG LM means Breusch-Godfrey Serial Correlation Lagrange Multiplier test.

Differential small-big	**-0.005392**	**0.004875**	**0.002143**

Appendix 9.

Second-Step Regressions Details: Impact of Monetary Policy on GAMMA, Alternative Liquidity Ratio

First-Step Strength Measure: LRNS = [Cash (in vaults and at c/a[1]) + Interbank Sold] / Net Assets

Dependent Variable: GAMMA – intensity of liquidity constraints

	GLS (CS)		GLS (CS)-IV	
	Coef	**Prob**	**Coef**	**Prob**
Small Banks				
TREND	-0.001295	0.833781	-0.004338	0.439525
Funds 0 lag	0.003094	0.213078	0.007280	0.084027
Funds 1 lag	0.001566	0.556698	0.007178	0.008896
Funds 2 lag	-0.001305	0.330379	0.000711	0.824876
Funds 3 lag	0.001532	0.662270	0.004794	0.529334
Funds: sum	**0.004887**	**0.52899**	**0.019963**	**0.206026**
INDSA 0 lag	2.378837	0.094323	4.607954	0.020394
INDSA 1 lag	-1.181137	0.250117	1.918337	0.184307
INDSA 2 lag	-2.698462	0.134991	-0.561369	0.760888
AR(4)	-0.605285	0.060834	-0.811300	0.015508
R2	0.755390		0.683531	
Adj R2	0.301113		0.208828	
Prob(F-stat)	0.255055		0.308832	
BG LM test	No Auto		No Auto	
Medium Banks				
TREND	-0.011248	0.132984	0.001022	0.923359
Funds 0 lag	0.000124	0.968892	-0.009699	0.233239
Funds 1 lag	-0.001430	0.606267	-0.000289	0.958459
Funds 2 lag	-0.001583	0.584680	-0.008266	0.111809
Funds 3 lag	-0.001125	0.636735	-0.001595	0.796546
Funds: sum	**-0.004015**	**0.49613**	**-0.019849**	**0.217016**
INDSA 0 lag	-2.171673	0.151182	-8.384828	0.088493
INDSA 1 lag	-0.324522	0.851152	-5.315081	0.074552
INDSA 2 lag	1.486291	0.296885	0.600597	0.788135

First-Step Strength Measure:
LRNS = [Cash (in vaults and at c/a[1]) + Interbank Sold] / Net Assets

Dependent Variable: GAMMA – intensity of liquidity constraints

	GLS (CS)		**GLS (CS)-IV**	
	Coef	**Prob**	**Coef**	**Prob**
R2	0.474781		0.487019	
Adj R2	0.030364		0.052957	
Prob(F-stat)	0.449041		0.416396	
BG LM test	No Auto		No Auto	
Big Banks				
TREND	-0.026841	0.002633	-0.015063	0.177417
Funds 0 lag	-0.006827	0.239990	-0.002792	0.667528
Funds 1 lag	0.018553	0.004822	0.009449	0.189366
Funds 2 lag	-0.012397	0.027042	-0.003033	0.474692
Funds 3 lag	0.006608	0.095939	-0.001474	0.779486
Funds: sum	**0.005937**	**0.568495**	**0.002148**	**0.892122**
INDSA 0 lag	3.128615	0.123242	1.241400	0.668579
INDSA 1 lag	10.410466	0.002323	7.179175	0.096375
INDSA 2 lag	11.786861	0.000314	7.496638	0.107597
R2	0.904563		0.680960	
Adj R2	0.809126		0.361920	
Prob(F-stat)	0.000228		0.101763	
BG LM test	No Auto		No Auto	

Notes:
1) "c/a" means funds placed at correspondent accounts with other banks, including NBU.
2) The regression for every size group includes 3 lags of dependent variable.
3) All p-values are calculated using Newey-West Heteroskedasticity and Autocorrelation Consistent Standard Errors & Covariance (lag truncation=2).
4) BG LM means Breusch-Godfrey Serial Correlation Lagrange Multiplier test.

Differential small-big	**-0.001050**	**0.017815**