MONETARY TRANSMISSION IN UKRAINE: IS THERE A BROAD CREDIT CHANNEL?

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Abstract

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This thesis investigates the mechanism by which monetary policy affects the real sector in Ukraine. Theoretical underpinnings of monetary transmission mechanism are provided to justify the plausibility of the broad credit channel as the one augmenting the traditional liquidity effect. Then, the results and methodologies of previous empirical studies of the broad credit channel for developed and transition countries are analyzed. Analysis of monetary environment and financial intermediation development finds some prerequisites for the broad credit channel operation in Ukraine. This conclusion is at least partly supported by empirical investigation of monetary policy impact on firms' balance sheets. The application of two-step nonlinear estimation allowed to find positive albeit weak link between monetary shocks and financial constraints of firms with high agency costs, which means that even if broad credit channel is operative in Ukraine, it is rather weak.

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GLOSSARY

Monetary Transmission Mechanism - mechanism by which the money supply affects real economic activity.

Broad Credit (Balance Sheet) Channel – adverse selection related change in credit conditions for the firms caused by monetary shocks, affecting firms balance sheets via liquidity effect.

Financial Accelerator – magnification of monetary shocks by firms' balance sheets conditions.

Two-step nonlinear estimation – estimation procedure, implying separate estimation of cross-sectional and time-series dimensions for panel data, thereby allowing different shocks on dependent variable in each time period.

Chapter 1

INTRODUCTION

Undoubtedly, an awareness of the mechanism by which the money supply affects real economic activity (conventionally referred to as the monetary transmission mechanism) is crucial to successful policy-making. And huge amount of empirical research devoted to investigating monetary transmission mechanism (MTM) significantly testifies to this. Yet, the issue of plausibility of various MTM channels has remained the subject of hot debate over the last two decades. Nevertheless, the point most researchers agree on[1] is the failure of conventional interest rate story to explain fully the timing and magnitude of the economy's response to monetary shocks. In this connection, introducing credit market frictions, which propagate and amplify initial shocks (so called financial accelerator), is believed to fill the gap between real life and theoretical MTM model predictions. *The Balance sheet* or *broad credit channel* is consistent with financial accelerator view and is one of the channels that has received a wide empirical support.

In transition economies, where unexpected and unwarranted effects of monetary policy are especially costly, investigating the MTM acquires particular importance. Of note is the fact that, one of the recent programs of the Ukrainian central bank is to lower the cost of credit resources to stimulate investment activity. In this context, identifying the credit channel in Ukraine has serious policy implications. From theoretical point of view, the presence of credit market frictions in the form of asymmetric information and costly contract enforcement as a prerequisite of the operation of the credit channel is fully satisfied in Ukraine. Since what mostly matters for contemporary Ukraine

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[1] Discussed in Bernanke, Gertler (1995)

is investment activity of business units, the impact of monetary policy is worth be studied in a broader sense, i.e. via balance sheets of the firms.

Hence, the aim of this paper is to contribute to the empirical literature by testing the importance of broad credit channel in Ukraine. The paper proceeds as follows. In Chapter 2, theoretical basis of MTM and particularly the broad credit channel is uncovered with stress on importance and plausibility of broad credit substantiation. Chapter 3 examines plausibility of various transmission channels within Ukrainian economic and monetary environment and analyzes institutional preconditions of the broad credit channel operation. Chapter 4 deals with the review and analysis of existing empirical evidence for the credit channel in the developed and transition countries. Chapter 5 describes the methodology for testing the broad credit channel hypothesis in Ukraine. The hypothesis tested implies that firms with limited access to credit market face increased dependence of investment on cash flow after monetary tightening. Data necessary to test given hypothesis is presented in Chapter 6. Chapter 7 is devoted to econometric aspects of the broad credit channel hypothesis testing and results interpretation. Finally, the main conclusions of research are presented in Chapter 8.

Chapter 2

THEORETICAL FRAMEWORK

Monetary transmission mechanism encompasses a set of channels through which money supply affects the real economy. Transmission channels operating through the rate of return on assets are generally referred to as 'money view' and channels operating through credit market frictions constitute so called 'credit view'.

Money view relies on conventional IS-LM story that reduction in quantity of outside money results in rise of real rate of return. The transmission channels supported by money view (as described in Mishkin (1995)) are as follows.

Interest rate channel

$$M \downarrow \Rightarrow i \uparrow \Rightarrow I \downarrow \Rightarrow Y \downarrow$$

$M \downarrow$ denotes monetary contraction resulting in rise of real interest rate ($i \uparrow$), which in turn raises cost of capital. The later implies a decline in investment spending ($I \downarrow$) followed by decline in aggregate demand and output ($Y \downarrow$). According to the model, contractionary monetary policy causes a rise in the short-term nominal interest rate. Thereafter, sticky prices and rational expectations lead to a rise in the long-term real interest rate, which in turn affects investment.

Although originally this channel was assumed to operate through business investment decisions, later research recognized its relevance to residential investment and consumer durable expenditures.

The exchange rate channel

$$M \downarrow \Rightarrow i \uparrow \Rightarrow E \uparrow \Rightarrow NX \downarrow \Rightarrow Y \downarrow$$

This channel deserves particular attention for small open economy with flexible exchange rate. According to this channel, a rise in the domestic interest rate raises the value of deposits denominated in domestic currency relative to other currency deposits, thus leading to a domestic currency appreciation ($E \uparrow$). A higher value of domestic currency makes domestic goods less competitive, thereby decreasing net exports ($NX \downarrow$) and casing a fall in output.

Tobin's q channel

$$M \downarrow \Rightarrow P_e \downarrow \Rightarrow q \downarrow I \downarrow \Rightarrow Y \downarrow$$

Where P_e denotes equity prices, and Tobin's q is a ratio of firm's market value to replacement cost of capital. The magnitude of q determines investment possibilities, which are high if new equipment is cheap relative to the firm market price. Contractionary monetary policy lowers the prices of equities ($P_e \downarrow$), which in turn decreases q, thus leading to lower investment spending.

Wealth channel

$$M \downarrow \Rightarrow P_e \downarrow \Rightarrow wealth \Rightarrow consumption \Rightarrow Y \downarrow$$

The rationale behind this channel is based on permanent income hypothesis, i.e. the consumers' willingness to smooth consumption over time. The fact that consumer spending depends on lifetime resources rather than today's income, implies importance of equity prices.

Hence, monetary contraction leading to fall in stock prices, cases a reduction in consumers' wealth and, thus, their spending.

The Credit view relaxes the assumption of smooth financial markets functioning and builds in information asymmetry, which allows incorporating distributional consequences of monetary policy. It is worth noting that the credit view is often thought of as an enhancement mechanism rather than an independent channel.[2] Broadly defined, the credit channel stems from movements in the external finance premium, which is the difference between cost of external and internal funds. Thus, direct effects of monetary policy on interest rates are amplified by effects on borrowers' balance sheets and income statements. In terms of traditional analysis, policy shifts both LM and IS schedules. In general, the transmission mechanism implies policy induced swings in liquidity of banks, firms or households followed by a decline in creditworthiness and solvency. In accordance with primary focus credit channel is split into three sub-channels: bank-lending, firm balance sheet and household liquidity, which are schematically described in Mishkin (1995) in the following way.

Bank lending channel

$$M \downarrow \Rightarrow bank\ deposits \downarrow \Rightarrow bank\ loans \downarrow \Rightarrow I \downarrow \Rightarrow Y \downarrow$$

Banks play important role in providing credit to borrowers with information asymmetry problems (e.g. small firms with limited access to credit markets). If monetary contraction squeezes banks reserves and deposits, the quantity of bank loans available goes down. This curtails investment opportunities of bank-dependent borrowers and leads to a fall in output.

Balance sheet channel

$$M \downarrow \Rightarrow P_e \downarrow \Rightarrow Net\ Worth \downarrow \Rightarrow Collateral \downarrow \Rightarrow Loans \downarrow \Rightarrow I \downarrow \Rightarrow Y \downarrow$$

Monetary contraction pulls down equity prices, which lowers firm's net worth. This in turn implies that firms have less collateral for their loans and lenders face higher potential losses from adverse selection. Thus, the external finance financial premium rises and fewer loans remain affordable for business units.

Household liquidity channel

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2 See Bernanke, Gertler (1995)

$$M \downarrow \Rightarrow P_e \downarrow \Rightarrow \text{ financial assets} \downarrow \Rightarrow \text{likelihood of financial distress} \uparrow$$
$$\Rightarrow \text{consumer durable and residential expenditures} \downarrow \Rightarrow Y \downarrow$$

This channel operates in a similar fashion as the previous one but through the 'balance sheets' of households. When consumers have a large amount of financial assets relative to their debt, they estimate the probability of financial distress as low and are willing to spend more on consumer durables and housing.

Another interpretation of the credit channel deals with price effects.

Unanticipated price level channel

$$M \downarrow \Rightarrow \text{unanticipated } P \downarrow \Rightarrow \text{adverse selection} \uparrow \Rightarrow \text{moral hazard} \uparrow \Rightarrow \text{loans} \downarrow$$
$$\Rightarrow I \downarrow \Rightarrow Y \downarrow$$

This channel operates through the monetary policy effects on the general price level. If debt payments are contractually fixed in nominal terms, an unanticipated decline in price level results in decline of real value of firm's assets relative to its debt. This raises adverse selection and moral hazard, thereby causing a decline in lending and investment.

In general, there is no agreement concerning the relative importance and empirical support for the channels described above. Due to widespread controversy about how exactly monetary policy exerts its influence on the economy, the monetary transmission mechanism was often labeled as a "black box". Some points summarizing numerous studies of various countries are worth noting.

1) A solid empirical support for liquidity effect, i.e. policy induced changes in interest rate (see Bilan (2002) for a detailed discussion). The presence of empirical findings suggesting that the behavior of economies is consistent with traditional money view. Thus, Bernanke and Gertler (1995) VAR analysis, Romer and Romer (1993) narrative approach,

Ramey (1993) VEC models testify to the relevance of interest rate channel.

2) A failure of mere changes in cost of capital (interest rate channel) to explain the scope of fluctuations in real activity. As Bernanke and Gertler state: "…*it is difficult to explain the magnitude, timing and composition of economy's response to monetary policy shocks solely in terms of conventional interest rate effects. The mechanisms collectively known as credit channel help to fill in the gaps in the traditional story.* "
3) A diminishing importance of narrow bank lending channel in developed economies due to deregulation and institutional changes. Increasing relevance of balance sheet channel with respect to banks (elaborated in seminal paper by Kashyap and Stein (2000)).
4) A minor role of wealth channel in monetary transmission is admitted on the basis of VAR analysis conducted by Ludvigson et al (2002).
5) Prevailing evidence in favor of monetary policy effects working through borrowers' and lenders' balance sheets. (The detailed review of empirical literature will be the subject of next chapter). In the light of the preceding discussion, this makes the broad credit channel reasonable candidate to augment money view in uncovering the "black box".

With this in mind, let's proceed with delving into theoretical underpinnings of the broad credit channel.

Broad Credit Channel: The Underlying Theory

As noted earlier, credit market frictions in the form of asymmetric information and costly contract enforcement combined with smooth functioning constitute a basic prerequisite for the credit view. Another point of departure extends the logic of the money view: if in the money view there is money and all other assets, credit view presumes imperfect substitutability between all other assets. Under these conditions, a wedge between cost of funds raised externally and the opportunity cost of internal funds appears. This wedge, referred to as *the external finance premium* reflects the deadweight loss associated with the information asymmetry between borrowers and lenders, and includes costs of collection and evaluation of information on project creditworthiness.

The balance sheet channel is based on assumption that external finance premium facing particular borrower depends on borrowers net worth, which is defined as the sum of liquid assets and marketable collateral. Intuitively, higher net worth implies more collateral thus reducing lender's risk not to get the loan repayed, and, therefore, is associated with lower external finance premium. In such a way, a borrowers' financial position affects the terms of credit they face and, as a result, their investment opportunities. This idea underlies the argument that endogenous movements in balance sheet variables amplify and propagate monetary shocks, which describes the mechanism known as the *financial accelerator*.

According to Bernanke and Gertler (1995) the balance sheet channel is operative since monetary policy directly and indirectly affects borrowers' balance sheets via its effect on interest rate.

A schematic representation of direct effects is as follows.

Weakening borrowers financial position via debt servicing payments increase

$$M \downarrow \Rightarrow i \uparrow \Rightarrow debt\ servicing\ \exp enses \uparrow \Rightarrow net\ cash\ flows \downarrow \Rightarrow net\ worth \downarrow$$

Weakening borrowers financial position via collateral shrinking.

$$M \downarrow \Rightarrow i \uparrow \Rightarrow asset\ prices \downarrow \Rightarrow collateral \downarrow \Rightarrow net\ worth \downarrow$$

The indirect effect implies that decline in revenue due to a worsening of customers financial position is not matched by a corresponding decline in costs, which squeezes net worth and creditworthiness.

Besides impairing balance sheets of non-financial firms, contractionary monetary policy has important cross–sectional implications for banks as well. Bernanke and Gertler (1995) acknowledge the relevance of the balance sheet model in identifying the bank-lending channel. They point out that rising interest rate lower the value of securities, thus hurting bank's liquidity and loan capacity. These theoretical premises are embodied in Kashyap and Stein (2000) empirical analysis of banks' balance sheets, which concluded sharper impact of monetary policy on lending capacity of less liquid banks.

So far, monetary policy impact on firm investment was the focus of discussion. Nevertheless, as it was already mentioned, credit market frictions also affect households borrowing and spending decisions. Thus, the broad credit channel model may be used to explain high sensitivity of residential investment and consumer durable expenditures to monetary policy shocks (Ludvigson (1998), Boldin (1994)).

Having outlined basic intuition behind broad credit channel, let's consider its formal representation. Graphically, the workings of the broad credit channel are presented in Figure1.

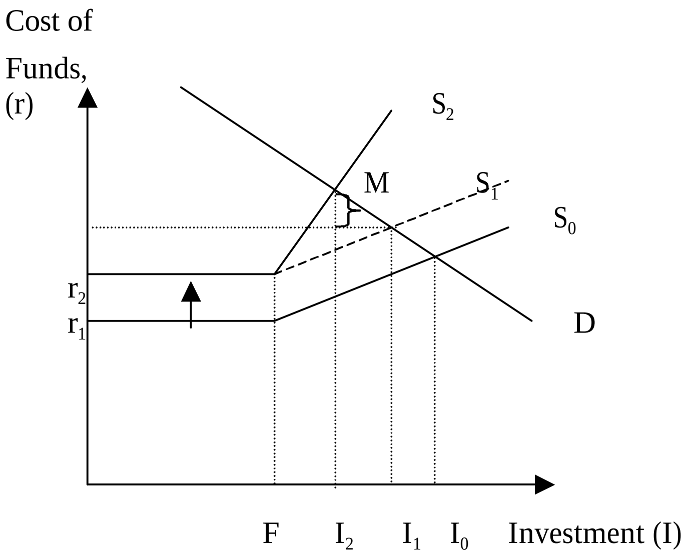

FIGURE1. BROAD CREDIT CHANNEL: MAGNIFICATION OF AN INTEREST RATE INCREASE

Source: Oliner and Rudebusch (1996)

Let F denote the amount of internal funds available and r_1 - the cost of these internal funds. Let's assume r_1 comprises the risk free interest rate r_f and firm appropriate risk adjustment q. Let r_f represent monetary policy stance. B=I-F stands for the amount of debt. Information asymmetry imposes external finance premium Ω on cost of capital for investment exceeding F. Since higher debt requires a higher premium, loan supply schedule is upward sloping for I > F. Suppose, there is a monetary policy shock, raising cost of internal funds from r_1 to r_2. According to preceding extensive discussion this would also raise external finance premium. Thus, the dependence of Ω on the risk free rate acts to magnify the initial monetary shock. In terms of figure one, the loan supply schedule shifts to S_2 rather than to S_1 and M represents magnification effect. The argument could be formalized in a following way.

Cost of internal funds: $\bar{r} = r_f + q$

External finance premium: $\Omega = \Omega(B, r_f)$

Overall cost of funds: $r = \bar{r} + \Omega$ is affected by monetary policy in a following way:

$\frac{\partial r}{\partial r_f} = \frac{\partial \bar{r}}{\partial r_f} + \frac{\partial \Omega}{\partial r_f}$, where the second term reflects the essence of broad credit channel, the so-called magnification effect.

Demand and supply schedules in Figure1 are defined by following equations:

(demand) $r = -kI + v$

(supply) $r = \bar{r} + \Omega(B, r_f) = r_f + q + l \cdot r_f \left(I - F\right)$, with k, l and $v \succ 0$

Equating supply and demand yields the formula for equilibrium investment:

$$I_e = \frac{r_f + q + l r_f F}{k + l r_f}$$

Equilibrium investment sensitivity to changes in internal funds is determined as:

$$\Phi = \frac{\partial I_e}{\partial F} = \frac{l r_f}{k + l r_f}$$

The crucial point is the sensitivity of Φ to monetary policy stance:

$$\frac{\partial \Phi}{\partial r_f} = \frac{lk}{(k + l r_f)^2} \succ 0$$

Intuitively this implies that dependence on cash flow should be higher after monetary contraction that at other times. This straightforward regularity is a point of departure for the empirical analysis of the broad credit channel.

Chapter 3

MONETARY ENVIRONMENT AND INSTITUTIONAL PRECONDITIONS

Having outlined the general theoretical underpinnings of MTM, lets proceed with analysing the plausibility of the broad credit channel and other channels within Ukrainian economic environment.

Monetary Policy Framework in Ukraine

The policy of National Bank of Ukraine (NBU) is based on exchange rate targeting, which legislatively is proclaimed as a long-run policy objective. The intermediate targets of NBU are money supply and monetary base level and growth rate and amount of loans to real sector. To achieve these targets NBU uses reserve requirements, open-market operations, certificates of deposits and discount rate as a policy instruments. In practice, only required reserves and certificates of deposit are viable and efficient instruments. Open market operations are in the process of very slow recovery after the market of government bonds (OVDP's) collapse in 1998 and discount window still remains a purely declarative instrument.

Stylized Facts about Financial Intermediation in Ukraine

Two links of monetary transmission chain determine the character and strength of monetary policy impact on real sector. The first link constitutes the transmission from monetary conditions to financial variables and is determined by structure of the financial system. The second is the link between financial conditions and spending decisions of firms and households. Let's consider these two points in Ukrainian context:

1. From monetary conditions to financial prices.

(i) Though the depth of financial intermediation remains too low relative to developed economies, there is gradual progress over the last two years. Corporate bond market, which was hardly existent prior to 2001year boom (growth of corporate bond issues with respect to previous year constituted 160%[3] in 2001), is developing rapidly with Ukrainian leading companies issuing bonds instead of taking bank loans. Though stock market still remains highly underdeveloped, gradual growth of stock trade (as depicted at Figure2) and recovery of government bonds market are definitely good tendencies.

Dynamics of stock trade

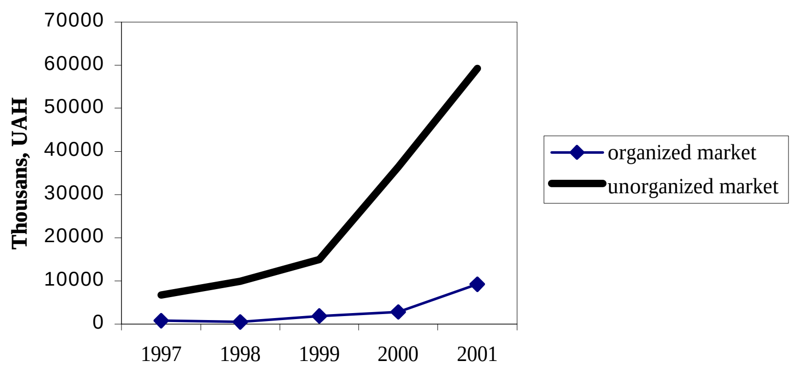

FIGURE2. DYNAMICS OF STOCK TRADE

Source: www.ssmsc.gov.ua

Another indicator of depth of financial intermediation, the ratio of broad money to GDP is growing steadily, as depicted in the Figure3, though being still far below its level in developed countries (60%-100%).

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[3] Source – Bulletin of NBU Council, 2002

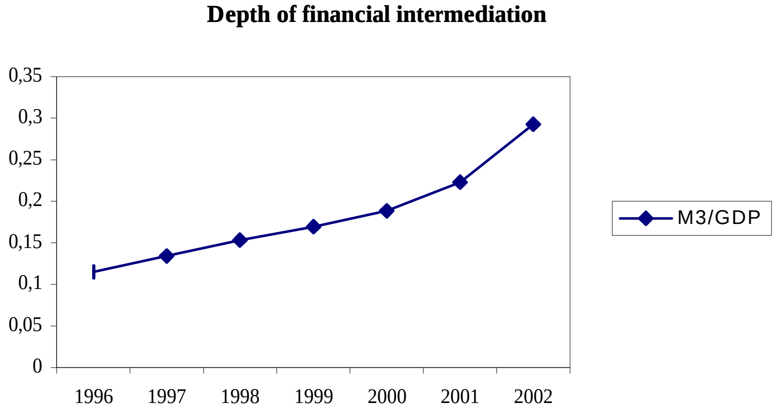

FIGURE3. DYNAMICS OF DEPTH OF FINANCIAL INTERMEDIATION

Source: NBU

(ii) Restricted openness of domestic financial markets to foreigners. (For example, banks with 100% foreign capital constitute only 3.8%[4] of total number of banks) This implies no pressure from foreign competitors, resulting in poorer corporate governance in banking sector and no possibility to attract funds from abroad when domestic liquidity conditions are severe.

(iii) High degree of dollarization of Ukrainian economy. Substantial share of barter and cash payments, stipulated by huge scope of shadow economy. All these facts imply large share of money circulating outside the banking system, and thus out of direct control of monetary authorities.

[4] -source NBU

(iv) Substantial growth in bank loans (illustrated at Figure 4) and bank deposits, which indicates on the greater confidence in financial system and increased interaction between the real and financial sectors.

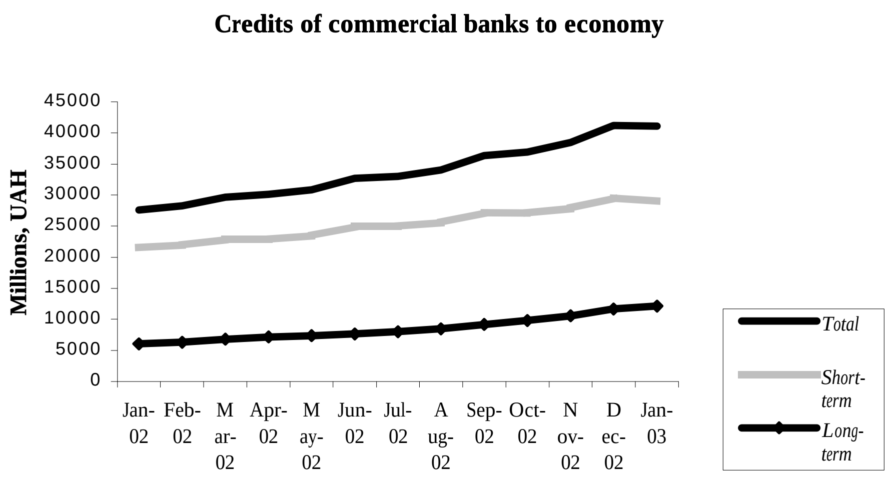

FIGURE4. DYNAMICS OF BANK CREDITS

Source: NBU

(v) Dominance of own capital as an investment source. Despite positive tendencies in volumes of lending, credits still remain unaffordable for many (in particular, small) firms.

The discussed above features of Ukrainian financial structure imply that the mentioned links between monetary, financial and real conditions in Ukraine are not that determined and strong as in developed countries. This fact doesn't rule out the financial accelerator effect in Ukraine, but substantially weakens the power of the balance sheet transmission channel.

With this in mind let's proceed to analyse all the possible transmission channels from the point of view of their relevance to Ukraine.

The Plausibility of Different Transmission Channels in Ukraine

Interest rate channel - the issue whether all the links of traditional Keynesian mechanism hold in Ukraine remains undecided. For example, Snizhko (2002) first, points on low interest elasticity of money demand due to widespread usage of money substitutes: mutual arrears, barter, etc and second, doubts the importance of long-term real interest rates in the investment decision making. On the other hand, Bilan (2002) finds the empirical evidence of strong negative response of interbank interest rate to a monetary easing. Though the latter study sheds light only on the first link in the channel of interest, it represents a good starting point for further analysis.

The exchange rate channel – as noted by Kryshko (2001) the effectiveness of this channel is undermined by existing capital controls and exchange rate targeting to maintain the price stability and, therefore, the exchange rate channel "showed up only as a result of a devaluation under the pressure of August 1998 financial crisis".

Tobin's q channel, Wealth channel and Household liquidity channel - - depend crucially on the stock market development. The stock market in Ukraine is not developed sufficiently for the impact of interest rates on stock prices to be sound. Besides, keeping the wealth in the form of stocks is very atypical for Ukrainian households. These facts make given channels inoperative in Ukraine.

Bank lending channel – the importance of this channel is undermined by small share of bank credits as an investment sources. Besides, in practice the operativeness of this channel depends on the ability of National Bank to affect the supply of loans by altering reserve requirements. As is extensively discussed in Kryshko (2001), the ability of banks to raise non-reservable funds largely invalidates the crucial assumption of bank lending channel. The empirical evidence from Ukrainian banking system obtained by Kryshko is somewhat inconclusive and neither provides overwhelming support nor rejects the bank-lending channel in Ukraine.

Balance sheet channel – as discussed in previous chapters there are several scenarios how this channel can influence firms net worth and hence investment decisions. In fact, each of these scenarios has a different degree of plausibility in Ukraine. Thus, the effect on net worth working via stock prices is unlikely to be important due to already mention reasons. However, the effect of interest expenditures on the net worth is quite plausible for Ukraine. Indirect effect, working through the decline in revenue due to a worsening of customers' financial position may also be operative in Ukraine. There is another peculiarity of Ukrainian economy which makes broad credit channel rather than bank-lending channel more reasonable candidate to augment the interest rate story. As was mentioned, despite high rates of growth, banking sector is still small relative to the economy size (the ratio of bank credits to GDP amounted to18%, which is two times smaller than in developed countries). Besides, the practice of commercial credits between firms reduces the dependence from banks, but still leaves room for balance sheet effects.

Chapter 4

PREVIOUS EMPIRICAL EVIDENCE

Conventionally empirical literature devoted to MTM splits into two broad categories: studies using aggregate data and studies focusing on cross-sectional implications. In terms of credit channel testing the later category considers credit opportunities for different classes of borrowers, while the former observes the mix of financial instruments via which the credit is extended. Henceforth, I will concentrate on cross-sectional models, which are believed to be superior because they allow testing asymmetric responses across firms, which is crucial for credit channel assumptions. However a fruitful aggregate-data study is worth mentioning in opening the discussion.

In an important paper, Kashyap, Stein and Wilcox (1993) examine the behaviour of aggregate volumes of commercial paper and bank loans following monetary tightening. They use the VAR approach to identify how credit portfolio changes following Romer dates[5]. The basic finding is that monetary tightening results in sharp increase of commercial paper issuance and decline in the ratio of loans relative to commercial paper. The authors use this finding to justify the bank lending channel. An alternative story suggested by Gertler and Gilchrist (1993) and Oliner and Rudebusch (1996) begins with idea of countercyclical demand for short-term credit resulting from drops in cash flow. High-grade borrowers easily solve this problem by issuing commercial paper, while borrowers with lower quality balance-sheets experience financing difficulties. Thus, movements in credit mix reflect changes in relative peril of different types

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5 Romer dates are seven monetary contraction episodes, identified by Romer and Romer (1989, 1992)

of borrowers rather than in the relative ability of different types of lenders to obtain funds. Note that, this interpretation of results is consistent with broad credit channel hypothesis.

Armed with the idea of borrowers heterogeneity, another group of researchers uses the cross-sectional dimension to identify the transmission mechanism. Several crucial assumptions are common for all papers that are analysed below.

1) Firm size is used to proxy the access to capital markets. As Gertler and Gilchrist indicate, agency costs apply mainly to younger firms, firms with a higher degree of idiosyncratic risk and firms that are not well collateralized, which are on average smaller firms.

2) Either cash flow or coverage ratio (defined as $CR = \frac{Cash\ \ flow}{Interest\ \ payments}$) is used to measure internal financial strength of the firm.

3) Earlier derived formula $\frac{\partial \Phi}{\partial r_f} = \frac{lk}{(k + lr_f)^2} \succ 0$ is a framework for testing the hypothesis. Positive significant coefficient tying investment to financial measure during monetary contractions is expected for small firms as a support for a broad credit channel.

An important contribution to the issue is Gertler's and Gilchrist's (1994) investigation of manufacturing firms. They use quarterly data on sales, inventories and short-term debt for pool of manufacturing firms disaggregated by size. The authors find that larger firms typically respond to an unanticipated decline in cash flows by increasing their short-term borrowing, whereas smaller firms decumulate inventories and cut production. To justify their finding authors use the following pieces of evidence.

1) Informal descriptive analysis

2) VAR approach to estimate the response of mentioned series to Romer dates and Federal funds rate. It suggests that Romer episodes have substantially larger effect on small firms. Funds rate also has larger impact on small firms, but differences are not so striking as for Romer episodes.

3) Estimation of inventories equations. The following structure is presumed to underlie the demand for inventories.

$$\Delta I_t = a_1(E_{t-1}S_t - I_{t-1}) + a_2 i_{t-1} + a_3 CR_{t-1} +$$
$$+ \sum_{s=1}^{2} a_{4s}\Delta I_{t-s} + \sum_{s=1}^{2} a_{4s}\Delta I_{t-s} + \sum_{s=1}^{2} a_{5s}\Delta S_{t-s} + \sum_{s=1}^{2} a_{6s}\Delta CR_{t-s} + u_t$$

Where *I, S*, *CR* stand for logarithms of inventories, sales and the coverage ratio respectively, and *i* – denotes the log of short-term interest rate. E*S denotes expected sales, which are proxied by actual sales in estimation. Estimation results suggest that coverage ratio is a significant predictor for small firms inventory behavior but not for large ones. Further, authors determine that coefficient on coverage ratio for small firms doubles when economy switches from high to low growth state.

The weakness of the outlined research is failure to trace the impact of monetary policy on the coverage ratio. This shortcoming is surmounted in Oliner and Rudebusch (1996) related work.

Oliner and Rudebusch test the broad credit channel hypothesis by estimating demand for fixed investment in a similar fashion to Gertler and Gilchrist estimate inventories demand. The extension is introduction of dummy for the tight money period.

The paper uses the following specification:

$$IK_t = \sum_{s=1}^{8} a_{1s} YK_{t-s} + \sum_{s=1}^{8} a_{2s} IK_{t-s} + \sum_{s=1}^{8} a_{3s} COC_{t-s} + d\left(DMT_t * CFK_{t-1}\right) + u_t$$

Where YK and CFK stand for output and cash flow, scaled by capital stock, COC denotes cost of capital. Conforming to expectations, the authors find d to be positive and significant for small firms and generally insignificant for large firms. Although the model looks elegantly straightforward and reasonable, the unavailability of uncontroversial measures for tight money and cost of capital significantly reduce the power of the test.

The outlined studies were criticized on the ground that differences in technologies and other nonfinancial aspects between large and small firms can explain the results. A study by Bernanke, Gertler and Gilchrist (1996) is a significant step forward in this debate. Using firm level data, authors show that previous results survive when industry dummies are included and when the sample is divided by financial criteria rather than by firm size.

A non-linear approach to testing monetary policy impact on banks' balance sheets was offered by Kashyap and Stein (2000). Though the aim of this paper was to find evidence for bank lending channel, its general framework seems to be highly relevant for identifying broader credit channel (Wesche (1999) relies upon this model in testing broad credit channel in Austria). Kashyap and Stein examine the effect of balance sheet strength (proxied by liquidity) on lending under tough policy. The following hypotheses are tested within a two-step procedure:

$$\frac{\partial^2 Loans_{it}}{\partial B_{it} \partial M_t} \succ 0 \quad \frac{\partial^3 Loans_{it}}{\partial B_{it} \partial M_t \partial size_{it}} \prec 0,$$

where B and M stand for balance sheet and monetary policy indicators respectively.

The first step implies estimating cross-sectional regressions for each size group for each time period t.

$$DLog(Loans_{it}) = b_{0t} + \sum_{j=1}^{4} b_{tj} DLog(Loans_{i,t-j}) + g_t B_{i,t-1} + e_i$$

At the second step time-series regressions of $g's$ estimated at first step are run on the following.

$$g_t = a_0 + \sum_{j=1}^{4} a_j g_{t-j} + a_5 t + \sum_{j=1}^{4} d_j DM_{t-j} + \ldots$$, where d is of interest

Since it originates from the broad credit channel hypothesis, this framework may be easily applied to firms. The application of two-step procedure is advantageous for several reasons.

1) As Kashyap and Stein (2000) argue, the two-step procedure doesn't impose any a priori structure on the time series properties of dependent variable, implicitly allowing different macro-shock in each time period. If we use panel data model, all macro-effects would work linearly through the monetary measure.

2) It is parameterized more parsimoniously, as only the coefficient on liquidity constraint is of interest. There is no need to include control variables like cost of capital into the equation.

3) It involves testing of the size effect $\frac{\partial^3 Investment_{it}}{\partial B_{it} \partial M_t \partial size_{it}} \prec 0$, thereby providing additional evidence for existence of the credit channel.

Empirical Investigation of MTM in Transition Countries

If the plenty of recent research has shed some light on the monetary transmission in developed countries, the issue still remains mainly a “black box” for transition economies. Though the studies of MTM in transition countries have gained an increased attention recently, there is still a lack of sound empirical evidences. Baltic countries are in the forefront to fill this gap. As noted in the World Bank Transition Newsletter (2001), the credit channel was found to be important in Estonia and Latvia, but not in Lithuania. One of the papers providing such a conclusion is that of Pikkani (2000). In the study of monetary sector of Estonia, the author uses VAR and Error Correction Models to estimate bank loan demand and bank loan supply equations and money demand equation. The results support the existence of credit channel, though the workings of broad and narrow credit channels are not disentangled.

Some succesful studies of MTM were also conducted for CEE countries. However, Ganev et al (2002), investigating MTM in CEE countries and Kuijs(2002) studying MTM in Slovakia restrict their attention to interest rate and exchange rate channels, due to the fact that these channels are more easily identifiable.

An interesting study, devoted to credit channel of monetary transmission in Russia is that of Denisova (2000). In this study author sets up a hypothesis that monetary contraction in the form of credit rationing was one of the reasons of sharp output decline in Russia in 1992-1996. Due to the specifics of transitional economy, the credit channel is examined via interenterprise arrears rather than via bank loans. The hypothesis is tested within two-sector (energy vs. manufacturing) non-Walrasian general equilibrium model with price regulation and credit rationing. The results suggest that : “…monetary policy along with other factors has added to the depth of observed output decline in Russia in 1992-96. The sectoral pattern of the recession seems to have being influenced by monetary impulse as well. “

For Ukrainian data investigation of narrow credit channel and application of two-step approach was pioneered by Kryshko (2001). Though being somewhat inconclusive, his results represent good starting point for further investigation of MTM channels in Ukraine. To my knowledge, no studies in Ukraine were focused on broad credit channel yet. Thus, the aim of this paper is to fill the gap by elaborating on above described econometric techniques.

Chapter 5

METHODOLOGY AND TESTED HYPOTHESIS

Evidently, the starting point of MTM investigation is identification of monetary shocks. Fortunately this task is facilitated by Bilan (2002) results. In her paper she used Granger causality test and test for responsiveness to monetary policy actions to check the information content of various interest rates. The result suggests that *interbank interest rate* contains more information about monetary policy than any other interest rate and should be used in econometric modelling as a monetary policy stance.

In accordance with previous chapters discussions the broad credit channel hypothesis may be formalised as:

$$\frac{\partial^2 Investment_{it}}{\partial IF_{it} \partial M_t} > 0, \text{ for small firms}$$

Where IF and M denote internal funds and monetary policy stance respectively. Intuitively this means that contractionary monetary policy impairs credit conditions for firms with worse access to financial markets, thereby increasing their dependence on internal funds in investment spending. Due to the reasons stated in previous chapter, the hypothesis will be tested within the framework suggested by Kashyap and Stein (2000) with some adjustments to Ukrainian data.

The coefficient of interest $\frac{\partial^2 Investment_{it}}{\partial IF_{it} \partial M_t}$ may be estimated either by usage of two-step non-linear approach or by one-step panel estimation. The former is performed according to the following scheme (following Kashyap and Stein (2000)).

1) Cross-sectional regressions for each time t and each size group are estimated

$$DLog(INV_{it}) = b_{0t} + \sum_{j=1}^{k} b_{tj} DLog(INV_{i,t-j}) + g_t IF_{i,t-1} + e_i$$

2) Time series regressions for g_t's estimated at first step are run for each size group

$$g_t = a_0 + \sum_{j=1}^{k} a_j g_{t-j} + \sum_{j=1}^{k} d_j DM_{t-j} + \sum_{j=0}^{m} f_j \cdot DLog(INDSA_{t-j}) + e_t$$

Where $DLog(INV_{it})$ denotes the log change in total gross investment for firm i at time t, $IF_{i,}$ - internal funds for firm *i*, DM_t - interbank interest rate, $DLog(INDSA_t)$ - the log change in real index of industrial production, seasonally adjusted at time t. This variable is included to model the impact of aggregate real activity on financial constraints.

The parameter of interest is d . The sum of d 's is expected to be positive for small firms as a support for the broad credit channel operation.

The alternative is application of one-step panel estimation, which simultaneously employs both cross-sectional and time dimensions. In this case the model may be specified the following way.

$$DLog(INV_{it}) = b_{0t} + \sum_{j=1}^{k} b_{tj} DLog(INV_{i,t-j}) + \sum_{j=1}^{n} d_{j} IF_{i,t-1} DM_{t-j} +$$

$$+ \sum_{j=0}^{m} f_{j} \cdot DLog(INDSA_{t-j}) + e_{i}$$

As was already argued in the preceding chapters, the two-step procedure has some advantages for this particular model, despite the inevitable efficiency loss. As noted by Kashyap and Stein (2000) and Kryshko (2001): “the two-step approach imposes no a priori structure on a time series properties of dependent variable”. In other words, two-step approach allows a unique macro shock in each time period, which is important for Ukrainian context. For these reasons two-step rather than one step estimation will be applied.

Chapter 6

DATA DESCRIPTION

To proceed with model estimation and testing, the following data are necessitated.

Table1. Data and Sources Description

Varia-ble	Description	Units	Sample coverage	Source
K	Firm's capital assets	Thousands, UAH	1996-2001	"Phoenix" database, www.smida.gov.ua, www.corporation.com.ua
IF	Internal funds (proxied by sales)	Thousands, UAH	1996-2001	"Phoenix" database, www.smida.gov.ua, www.corporation.com.ua
INV	Firm's gross investment	Thousands, UAH	1997-2001	Imputed from the data on capital
AGII	Aggregate gross investment in industry	Millions, UAH	1996:I-2002:III	State Committee of Statistics
RINDP	Real industrial production, net of taxes	Millions, UAH	1996:I-2001:IV	UEPLAC quarterly issues of monthly update "Ukrainian Economic Trends"
IIR	Interbank interest rate	%, annual rate	1996:I-2001:IV	UEPLAC quarterly issues of monthly update "Ukrainian Economic Trends"
INDSA	Seasonally adjusted index of real industrial production	(1990=100)	1996:I-2001:IV	UEPLAC quarterly issues of monthly update "Ukrainian Economic Trends"

The sources of primary micro-data (K, IF, INV) are "Phoenix" database and government agency of stock market development. The databases comprise yearly balance sheets and income statements of a large sample of Ukrainian firms. For the purpose of model testing the sample of 150 manufacturing firms for the years 1996 – 2001 was created. The particular enterprise was included in a sample in case of its presence in several databases, i.e. the selection criterion was availability of data for all needed years. On one hand such a selection resulted in bias toward relatively large and solvent corporations, on the other hand this made the sample more reliable from the point of view of balance sheets credibility.

The following variables are of interest.

INV_{it} – gross investment of firm i at time t. This variable is imputed from balance sheets in the following way: $INV_{it} = K_t - K_{t-1} + dK_{t-1}$, where K stands for capital, d - for depreciation rate.

IF_{it} – internal funds of firm *i* at time *t.* Since the data for profit are missing for some years, cash flow cannot be calculated directly. Assuming strong positive correlation between the sales and the funds at firms' disposal, internal funds are proxied by sales for which the money was paid.

Once needed variables are calculated, the sample is adjusted to drop the observations with missing values or negative investment. Thus, we end up with 103 firms, or a panel of 515 firm-years.

To test the hypothesis the sample has to be split into two size groups: small and large firms. The firms are assigned to group of small if their sales are below 75% percentile and to group of large if their sales are above 75 %

The problem with these micro data is low frequency of time series, which doesn't allow to trace properly the reaction of the economy to monetary shocks. This problem can be circumvented by distribution of low frequency series by the related series. For this purpose the following series, which constitute the aggregate counterparts of the needed micro-variables, are incorporated:

AGII – aggregate gross investment in industry, used for interpolation of the quarterly values for individual firm investment.
RINDP – real industrial production, net of taxes, used for interpolation of the quarterly values for individual firm sales. High correlation between the sample totals and these aggregate variables, makes it possible to rely on the latter in determining the quarterly pattern of micro-variables.

Given high frequency additional variables, the annual micro data are distributed into quarterly using the following framework referred to as Denton approach.

Application of Denton procedure for time series distribution is motivated by a thorough digging in the corresponding literature. Though offered quite long ago (1971), this method is justified in more recent papers (e.g. Fernandez, 1987) and is described in IMF Benchmarking (2001)[6] as "relatively simple, robust and well-suited for large applications".

Consider INV and AGII, the time series available on the annual and the quarterly basis respectively. In case the series show similar pattern over time, the problem is to construct a new quarterly variable INVQ that makes use of the information available in AGII and satisfies the condition that four values of the new variable within each year sum up to the observed annual totals for INV. Denton (1971) specified this as a constrained minimization problem:

$$INVQ = AGII\mathbf{b} + u$$

---

[6] see www.imf.org/external/pubs/ftqna/2000/Textbook/index.html

$\min_b (INVQ - AGIIb)' A(INVQ - AGIIb)$ subject to $INV = B'INVQ$, where

$B = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ \end{bmatrix}$, $A = D'D$, and D serves to convert the values of INVQ and AGII to first differences.

Algebraic manipulations yield the following solution:

$$IN\hat{VQ} = AGII\hat{b} + A^{-1}B(B'A^{-1}B)^{-1}\left[INV - B'AGII\hat{b}\right]$$

By using outlined procedure (automated by Stata), 20 quarterly observations were obtained for INV and IF for each firm. Therefore the final sample comprises 20x103 = 2060 firm-quarters.

However helpful in case of low frequency of time series, data interpolation inherently leads to some inaccuracy and information loss. Since distributing the annual firm data, we rely on aggregate quarterly trends the specifics of separate firms are artificially smoothed. However, even though the usage of interpolation to some extent weakens the power of econometric test, theoretically it should not revert the relation between variables of interest and therefore should not distort the inference.

To ensure estimation accuracy, the sample is tested for outliers. Plotting investment against sales in each period allows detecting several outliers, which are dropped from sample afterwards.

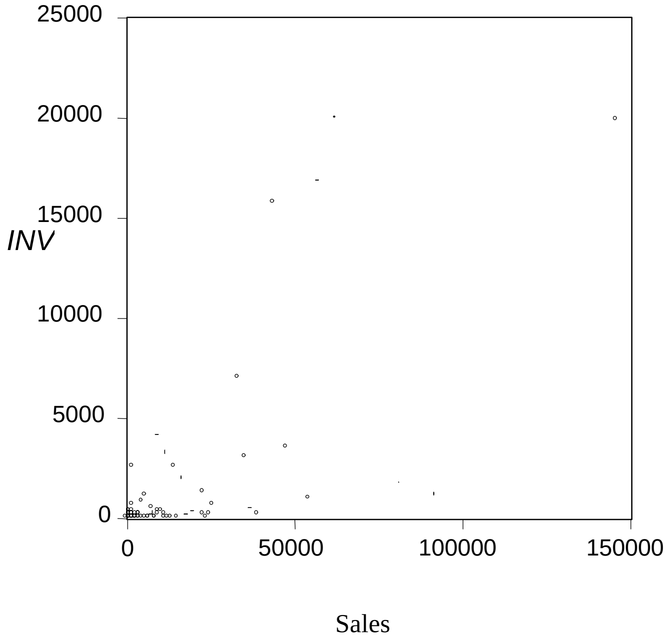

FIGURE5. CHECKING FOR OUTLIERS

Figure 5 gives a clearer idea how exactly the sample should be adjusted.

Chapter 7

RESULTS AND INTERPRETATION

Estimation Techniques and Results

1) First Step.

$$DLog(INV_{it}) = b_{0t} + \sum_{j=1}^{3} b_{tj} DLog(INV_{i,t-j}) + g_t IF_{i,t-1} + e_i$$

To control for possible heterogeneity across different firms (heteroscedastic disturbances) the first-step regressions are estimated using both OLS with White Heteroscedasticity Consistent Covariance and GLS with cross sectional weighting. To find formal evidence of disturbances behaviour, the White heteroscedacticity test with no cross terms is carried out for a single time period. The calculated c^2 statistics 12,166 exceeds the 5% critical value 9,49 therefore the homoscedasticity is rejected. The examples of both versions of first-step regressions are presented in Appendix A, whereas the details of heteroscedasticity test are given in Appendix B. It should be noted, that in GLS version, unlike OLS, g's tend to be statistically significant, yet, in both versions g's are of comparable magnitude and are negligibly small. The dynamics of financial constraints for GLS version are presented on Figure 6.

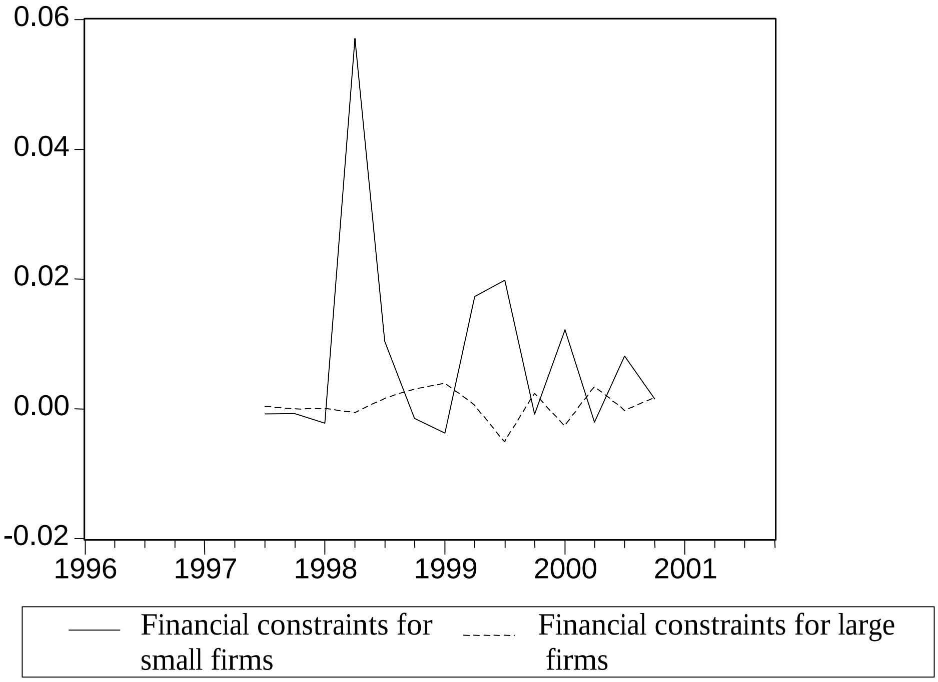

FIGURE6. FINANCIAL CONSTRAINTS BY FIRM SIZE GROUP

What can be noted from the Figure6 is high volatility and sometimes - negative magnitudes of financial constraints for small firms. In Wesche (2000) analogous studies for Austria, the financial constraints evolve to approximately –0.01, which is explained by increased capital market integration in Europe. However, it is difficult to interpret the behaviour of financial constraints in case of Ukraine. The only reasonable explanation is presence of intermediate size group, for which there are no regularities in financial constraints.

2) Second Step

$$g_t = a_0 + \sum_{j=1}^{k} a_j g_{t-j} + \sum_{j=1}^{3} d_j IIR_{t-j} + \sum_{j=0}^{3} f_j \cdot DLog(INDSA_{t-j}) + e_t$$

Second step regressions are estimated by OLS with the inclusion of AR terms to adjust for autocorrelation where necessary (see the estimation output in Appendix C). The problem arising at this step is low size of sample, i.e. – number of gammas estimated. Note that p-values for the sum of the ***d*** coefficients are calculated using Wald coefficient restrictions test.

Table2. Overview of Second Step Results

Size group	**Aggregate Impact of Monetary Policy on Gammas (sum of the coefficients)**			
	OLS		GLS	
	Estimate	Probability	Estimate	Probability
Small	0.00085	0.4455	0.007	0.0342
Large	0.00008	0.959	-0.00004	0.4185

Results Interpretation. In line with theory, the effect of monetary policy tightening on small firms' financial constraints is positive and statistically significant for GLS version. For large firms, $\frac{\partial^2 Investment_{it}}{\partial IF_{it} \partial M_t}$ is insignificant, which is also consistent with theoretical predictions. However, the negligibly small magnitude of the coefficients that represent aggregate impact of monetary policy on firms' financial constraints stands against the importance of the broad credit channel. It should be noted that analogous estimates for the developed countries are at least hundred times higher (Oliner and Rudebusch (1996), Wesche(2000)). Therefore, the conclusion to be drawn from these results is that even if the broad credit channel is operative in Ukraine, it is relatively weak. This result is consistent with the conclusions of preceding chapter, which stated that at current stage of financial intermediation development the potential power of the balance sheet channel is limited.

To check the sensitivity of results to the criteria of firms' division into small and large, the regressions are reestimated using the assets as the sample splitting criteria. Table3 provides the ultimate results.

Table3. Overview of Second Step Results

Size group	**Aggregate Impact of Monetary Policy on Gammas (sum of the coefficients)**			
	OLS		GLS	
	Estimate	Probability	Estimate	Probability
Small	0.0009	0.2618	0.0012	0.0812
Large	0.00005	0.5223	0.000002	0.7958

Again, for GLS version, in compliance with theory $\frac{\partial^2 Investment_{it}}{\partial IF_{it} \partial M_t}$ appears to be significantly positive for small firms and insignificant for large firms, which means different sample splitting criteria yield qualitatively identical results.

Despite, the fact that obtained estimates confirm to our expectations concerning the credit channel hypothesis in Ukraine, there are some econometric problems, which are worth mentioning.

1) Low number of degrees of freedom at a second stage of estimation.
2) Counterintuitive behaviour of financial constraints, which may be attributed to specification problems at first stage.

3) Relatively small time span of the sample, which seems problematic in distinguishing regularities in investment behaviour from pure statistical noise.
4) Preponderance of relatively large and solvent corporations in the sample, which may distort the inference for the whole economy.

Economic Meaning of Results

Dependence of small firm investment on internal funds is intensified following contractionary impulse of monetary policy, whereas this pattern doesn't hold for large firms. For example, if we have two small firms, one with a cash flow =50, and the other with a cash flow = 100 in previous period. Then, in three quarters following the 1% increase in interbank interest rate, given the highest significant estimate of monetary policy impact on financial constraint =0.007, the differential contraction of investment spending for these two firms will amount to approximately (100-50)*0.007=0.35 %. Obviously this figure is too small to assert on the importance of balance sheet effects and may merely constitute random deviation from zero. Moreover, on the basis of institutional analysis in Chapter 3, we may presume changes in financial conditions do not affect large part of small firms that use only own capital as a source of investment. The fact that empirically we obtain the evidence that they do affect may be explained by bias toward larger firms in the sample. Anyway, we arrive at a conclusion that in Ukraine there exists a layer of firms, whose investment decisions are influenced by monetary policy induced changes in financial prices. The "balance sheet story" may look as follows. There is a group of smallest size firms, whose extremely high agency costs make any sources of credit unaffordable for them. There is also a group of large corporations, whose high net worth makes them eligible to credits under any financial conditions. And, finally, there is intermediate group, subject to credit conditions fluctuations depending on situation on financial markets. Hence, the investment spending of such enterprises may be affected by monetary shocks. Whether the share of such firms is meaningful enough to be consistent with the financial accelerator effect still remains an open question and represents an area for further research.

Chapter 8

CONCLUSIONS AND SUMMARY

This paper represents an attempt to uncover the "black box" of monetary transmission mechanism in Ukraine. In particular, on the basis of theoretical literature studying the emphasis is put on the balance sheet channel, which gained increased academic interest and solid empirical support in many developed countries. The analysis of institutional preconditions suggests that most of transmission channel models are hardly as relevant for Ukraine, as they are for the developed countries. At the present stage of financial structure development, the broad credit channel importance is quite questionable for Ukraine, though not rejected at all. The key hypothesis of this paper is as follows. Liquidity effect induced by monetary contraction leads to increase of interest expenditures and decline of equity prices, which in turn reduces net cash flows and net worth of borrowers. The lower the net worth of borrowers, the higher the external finance premium they face and the less credits they can get. Finally, the availability of credits affects the investment decisions of the borrowers. In other words for the firms with limited access to capital market the dependence of investment on internal funds becomes more severe during tight money period. Given balance sheet data for sample of industrial firms this hypothesis is tested econometrically within the two-step non-linear procedure. According to the estimates, the impact of monetary policy on financial constraints of firms with high agency costs appears to be positive and statistically but not economically significant. Thus, despite the qualitative consistence with the broad credit channel hypothesis, quantitatively the strength of that impact is too small to overwhelmingly support that hypothesis.

Thus, the contribution of this paper consists in quantifying the link between monetary policy and firms' investment decisions. Though not providing overwhelming evidence, the results make the “black box” more explicable and represent good starting point for the investigation of the importance of financial accelerator effect in Ukraine.

BIBLIOGRAPHY

Bean, Ch., J. Larsen, and K. Nikolov (2002) *Financial Frictions and the Monetary Transmission Mechanism: Theory, Evidence and Policy Implications*, ECB Working Paper # 113

Bernarke, B. S., and M. Gertler. *Inside the Black Box: The Credit Channel of Monetary Transmission.* Journal of Economic Perspectives, 9(4),1996.

Bernanke, B. S., Gertler, M. and S. Gilchrist, *The Financial Accelerator and the Flight to Quality*, The Review of Economics and Statistics, vol. 78, 1996

Bilan Olena (2002), *Investigating the Liquidity Effect on Ukrainian Interbank Market*, EERC MA Thesis

Checcetti, S. G. (1995), *Distinguishing Theories of the Monetary Transmission Mechanism*, Federal Reserve Bank of Saint Louise Review,77(3)

Denisova, I. A. (2000): *Credit Channel of Monetary Transmission. The role of Interenterprise Arrears*, EERC Working Paper #99/12

Denton, F.T., *Adjustment of Monthly or Quarterly Series to Annual Totals: An Approach based on Quadratic Minimization*, Journal of the American Statistical Association, 66 (1971)

Favero, C.A., Giavazzi, F. and L. Flabbi (1999), *The Transmission mechanism of Monetary Policy: Evidence From Banks' Balance Sheets*, NBER Working Paper # 7231

Fernandez R. B., *A Methodological Note on Estimation of Time Series*, The Review of Economics and Statistics, 63(3), 1981

Ganev, G. et al (2002), *Transmission Mechanisms of Monetary Policy in Central and Eastern Europe*, Case report, CERGE

Gertler, M. and S. Gilchrist (1994), *Monetary policy, Business Cycles and the Behavior of Small Manufacturing Firms*, Quarterly Journal of Economics, 109 (May)

Kashyap, A.K., J.C. Stein and D. W. Wilcox (1993), *Monetary Policy and Credit Conditions: Evidence from Composition of External Finance*, American Economic Review, 83(1)

Kashyap, A.K. and J.C. Stein (2000), *What Do a Million Observations on Banks Say About the Transmission of Monetary Policy?* American Economic Review, 90(3)

Kryshko Maksym(2001), *Bank Lending in the Transmission of Monetary Policy in Ukraine*, EERC MA Thesis

Kuijs, L. (2002) *Monetary Policy Transmission Mechanisms and Inflation in the Slovak Republic*, IMF Working Paper

Lattemae, R. (2001), *Monetary Transmission Mechanism in Estonia – Some Theoretical Considerations and Stylized Facts*, Eesti Pank Working Paper

Ludvigson, S. Steindel, Ch. And M. Lettau (2002), *Monetary Policy Transmission Through Consumption – Wealth Channel*, FBRNY Economic Policy Review, May

Lyziak, T. (2001) *Monetary Transmission Mechanism in Poland. Theoretical Concepts vs. Evidence*, CCBS Working Paper

Mishkin, F. S.(1995), *Symposium on the Monetary Transmission Mechanism*, Journal of Economic Perspectives, 9(4)

Oliner S. D and G. D. Rudebuch (1996), *Is There A Broad Credit Channel for Monetary Policy?* Board of Governors of Federal Reserve System

Pikkani, R. (2000), *Monetary Sector Under A Currency Board Arrangement: Specification and Estimation of a Model with Estonian Data*, BOFIT Working Paper

Snizhko O.V. (2002) in Materials of scientific conference "*Strategy of Monetary Policy: Problems of Choice and Application*", National Bank of Ukraine, p. 166-171

Wesche, K. (1999), *Is There a Credit Channel in Austria? The Impact of Monetary Policy on Firms' Investment Decisions*, Oesterreichische Nationalbank Working Paper, #41

APPENDIX A

First- Step Estimation

<u>OLS version</u>: Exemplary regression for II quarter of 1998

Dependent Variable: DLOG(INV?)
Method: Pooled Least Squares
Sample: 1998:2 1998:2
Included observations: 1
Total panel observations 103
White Heteroskedasticity-Consistent Standard Errors & Covariance
Cross sections without valid observations dropped

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.446861	0.347064	-1.287546	0.2011
DUMCF?	-0.694716	0.551308	-1.260124	0.2108
DLOG(INV?(-1))	-0.285412	0.829296	-0.344161	0.7315
DLOG(INV?(-1))*DUMCF?	2.960906	1.085745	2.727072	0.0076
DLOG(INV?(-2))	0.643003	0.733091	0.877111	0.3827
DLOG(INV?(-2))*DUMCF?	-4.181084	1.431189	-2.921405	0.0044
DLOG(INV?(-3))	0.062720	0.371383	0.168882	0.8663
DLOG(INV?(-3))*DUMCF?	1.383142	0.705356	1.960912	0.0529
CF?(-1)	0.000171	0.000122	1.405445	0.1632
DUMCF?*CF?(-1)	-0.000172	0.000122	-1.409329	0.1621

R-squared	0.259984	Mean dependent var	0.020520
Adjusted R-squared	0.188369	S.D. dependent var	1.139134
S.E. of regression	1.026252	Sum squared resid	97.94697
F-statistic	3.630320	Prob(F-statistic)	0.000644

Note: DBIG is dummy variable that takes the value of 1 for large firms and 0 for small firms

<u>GLS version</u>: full set of regressions

1997: 3

Dependent Variable: DLOG(INV?)
Method: GLS (Cross Section Weights)
Sample: 1997:3 1997:3

Included observations: 1
Total panel observations 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.439806	0.016144	27.24330	0.0000
DUMCF?	-0.067771	0.016875	-4.015921	0.0001
DLOG(INV?(-1))	0.665662	0.203124	3.277123	0.0015
DLOG(INV?(-1))*DUMCF?	0.494272	0.216148	2.286732	0.0245
CF?(-1)	-0.00079	4.94E-07	-1.603377	0.1122
CF?(-1)*DUMCF?	1.12E-06	4.98E-07	2.238874	0.0275

Weighted Statistics			
R-squared	0.927537	Mean dependent var	3.991546
Adjusted R-squared	0.914237	S.D. dependent var	8.410195
S.E. of regression	0.232318	Sum squared resid	5.073333
F-statistic	25929.67	Prob(F-statistic)	0.000000

Unweighted Statistics			
R-squared	-0.162992	Mean dependent var	0.517373
Adjusted R-squared	-0.224853	S.D. dependent var	0.334903
S.E. of regression	0.370647	Sum squared resid	12.91366

1997:4

Dependent Variable: DLOG(INV?)
Method: GLS (Cross Section Weights)
Sample: 1997:4 1997:4
Included observations: 1
Total panel observations 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.486898	0.031746	-15.33730	0.0001
DUMCF?	-0.346121	0.036583	-9.461237	0.0000
DLOG(INV?(-1))	0.836102	0.081890	10.21005	0.0000
DLOG(INV?(-1))*DUMCF?	0.937899	0.096439	9.725353	0.0000
DLOG(INV?(-2))	0.647841	0.170327	3.803523	0.0003
DLOG(INV?(-2))*DUMCF?	-1.387259	0.186734	-7.429075	0.0000
CF?(-1)	-0.00075	9.02E-08	-8.316075	0.0055
CF?(-1)*DUMCF?	6.81E-05	9.31E-08	7.317300	0.0000

Weighted Statistics			
R-squared	0.984108	Mean dependent var	-1.437136
Adjusted R-squared	0.982945	S.D. dependent var	7.791181
S.E. of regression	0.101920	Sum squared resid	0.955674
F-statistic	82632.84	Prob(F-statistic)	0.000000

Unweighted Statistics			
R-squared	0.752485	Mean dependent var	-0.031818

Adjusted R-squared	0.733653	S.D. dependent var	0.281129
S.E. of regression	0.145087	Sum squared resid	1.936634

1998:1

Dependent Variable: DLOG(INV?)
Method: GLS (Cross Section Weights)
Sample: 1998:1 1998:1
Included observations: 1
Total panel observations 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.846826	0.071827	11.78972	0.0000
DUMCF?	0.625958	0.135532	4.618530	0.0000
DLOG(INV?(-1))	2.427360	0.088201	27.52067	0.0000
DLOG(INV?(-1))*DUMCF?	0.396706	0.155511	2.550986	0.0124
DLOG(INV?(-2))	-1.175220	0.154399	-7.611581	0.1000
DLOG(INV?(-2))*DUMCF?	-1.516630	0.298223	-5.085552	0.0000
DLOG(INV?(-3))	-0.708487	0.226488	-3.128142	0.0024
DLOG(INV?(-3))*DUMCF?	1.457918	0.257483	5.662184	0.0000
CF?(-1)	-0.00221	4.14E-07	-5.334539	0.0034
CF?(-1)*DUMCF?	2.22E-06	4.19E-07	5.290355	0.0000

Weighted Statistics			
R-squared	0.949107	Mean dependent var	1.351013
Adjusted R-squared	0.949018	S.D. dependent var	5.128956
S.E. of regression	0.160713	Sum squared resid	2.324580
F-statistic	11193.37	Prob(F-statistic)	0.000000

Unweighted Statistics			
R-squared	0.679212	Mean dependent var	0.098796
Adjusted R-squared	0.647134	S.D. dependent var	0.380545
S.E. of regression	0.226054	Sum squared resid	4.599025

1998:2

Dependent Variable: DLOG(INV?)
Method: GLS (Cross Section Weights)
Sample: 1998:2 1998:2
Included observations: 1
Total panel observations 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.369779	0.046190	-8.005689	0.0000
DUMCF?	-0.663961	0.076299	-8.702120	0.0000
DLOG(INV?(-1))	0.785734	0.141163	5.566132	0.0000
DLOG(INV?(-1))*DUMCF?	1.705524	0.169986	10.03329	0.0000

DLOG(INV?(-2))	-0.270626	0.192463	-1.406118	0.1631
DLOG(INV?(-2))*DUMCF?	-2.964639	0.254955	-11.62808	0.0000
DLOG(INV?(-3))	0.137585	0.054833	2.509152	0.0139
DLOG(INV?(-3))*DUMCF?	1.171845	0.100964	11.60652	0.0000
CF?(-1)	0.0571	0.000 137	4.159090	0.0001
CF?(-1)*DUMCF?	-0.000577	0.000137	-4.205145	0.0001

Weighted Statistics

R-squared	0.919757	Mean dependent var	6.020372
Adjusted R-squared	0.919733	S.D. dependent var	45.02434
S.E. of regression	0.736073	Sum squared resid	48.76231
F-statistic	41147.18	Prob(F-statistic)	0.000000

Unweighted Statistics

R-squared	0.089281	Mean dependent var	0.028346
Adjusted R-squared	-0.001791	S.D. dependent var	1.155249
S.E. of regression	1.156283	Sum squared resid	120.3291

1998:3

Dependent Variable: DLOG(INV?)
Method: GLS (Cross Section Weights)
Sample: 1998:3 1998:3
Included observations: 1
Total panel observations 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.638812	0.019449	-32.84562	0.0000
DUMCF?	0.332939	0.042274	7.875802	0.0000
DLOG(INV?(-1))	-0.866441	0.037670	-23.00066	0.0000
DLOG(INV?(-1))*DUMCF?	2.772535	0.107865	25.70385	0.0000
DLOG(INV?(-2))	1.060448	0.115036	9.218422	0.0000
DLOG(INV?(-2))*DUMCF?	-2.089580	0.236861	-8.821968	0.0000
DLOG(INV?(-3))	0.232619	0.094686	2.456748	0.0159
DLOG(INV?(-3))*DUMCF?	0.061679	0.180848	0.341054	0.7339
CF?(-1)	0.0104	6.07E-06	1.708454	0.0910
CF?(-1)*DUMCF?	-8.82E-06	6.09E-06	-1.447902	0.1511

Weighted Statistics

R-squared	0.909904	Mean dependent var	-8.519445
Adjusted R-squared	0.909894	S.D. dependent var	36.99724
S.E. of regression	0.380707	Sum squared resid	13.04442
F-statistic	103874.1	Prob(F-statistic)	0.000000

Unweighted Statistics

R-squared	0.876209	Mean dependent var	-0.549860
Adjusted R-squared	0.863830	S.D. dependent var	1.163634
S.E. of regression	0.429395	Sum squared resid	16.59422

1998:4

Dependent Variable: DLOG(INV?)
Method: GLS (Cross Section Weights)
Sample: 1998:4 1998:4
Included observations: 1
Total panel observations 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.569691	0.016783	-33.94477	0.0400
DUMCF?	0.309675	0.022809	13.57665	0.0000
DLOG(INV?(-1))	0.293391	0.035737	8.209633	0.0000
DLOG(INV?(-1))*DUMCF?	1.366915	0.049341	27.70368	0.0000
DLOG(INV?(-2))	0.239438	0.034008	7.040559	0.0000
DLOG(INV?(-2))*DUMCF?	-1.067993	0.048058	-22.22278	0.0000
DLOG(INV?(-3))	-0.202692	0.051638	-3.925234	0.0002
DLOG(INV?(-3))*DUMCF?	0.337707	0.052885	6.385743	0.0000
CF?(-1)	-0.00152	1.20E-05	-3.751111	0.0003
CF?(-1)*DUMCF?	4.82E-05	1.21E-05	3.999435	0.0001

Weighted Statistics

R-squared	0.929662	Mean dependent var	-28.92930
Adjusted R-squared	0.929628	S.D. dependent var	60.28486
S.E. of regression	1.162181	Sum squared resid	121.5599
F-statistic	29587.94	Prob(F-statistic)	0.000000

Unweighted Statistics

R-squared	0.058261	Mean dependent var	-0.794432
Adjusted R-squared	-0.035912	S.D. dependent var	1.316129
S.E. of regression	1.339554	Sum squared resid	161.4963

1999:1

Dependent Variable: DLOG(INV?)
Method: GLS (Cross Section Weights)
Date: 05/23/03 Time: 22:36
Sample: 1999:1 1999:1
Included observations: 1
Total panel observations 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	-0.056050	0.109606	-0.511378	0.6103
DUMCF?	0.070256	0.355110	0.197842	0.8436
DLOG(INV?(-1))	-0.472114	0.122241	-3.862157	0.0002
DLOG(INV?(-1))*DUMCF?	-0.674854	0.588746	-1.146256	0.2547
DLOG(INV?(-2))	-0.811951	0.044883	-18.09048	0.0000
DLOG(INV?(-2))*DUMCF?	1.902964	0.561140	3.391246	0.0010
DLOG(INV?(-3))	0.009318	0.035753	0.260606	0.7950
DLOG(INV?(-3))*DUMCF?	-0.630961	0.314470	-2.006425	0.0478
CF?(-1)	-0.0038	4.82E-06	-7.002118	0.0017
CF?(-1)*DUMCF?	3.77E-05	5.11E-06	7.372595	0.0000

Weighted Statistics			
R-squared	0.933169	Mean dependent var	3.658475
Adjusted R-squared	0.932486	S.D. dependent var	6.917948
S.E. of regression	0.599672	Sum squared resid	32.36460
F-statistic	1453.928	Prob(F-statistic)	0.000000

Unweighted Statistics			
R-squared	0.741554	Mean dependent var	0.708257
Adjusted R-squared	0.715710	S.D. dependent var	1.624443
S.E. of regression	0.866135	Sum squared resid	67.51710

1999:2

Dependent Variable: DLOG(INV?)
Method: GLS (Cross Section Weights)
Sample: 1999:2 1999:2
Included observations: 1
Total panel observations 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.990260	0.016486	60.06796	0.0000
DUMCF?	0.120768	0.023427	5.155073	0.0000
DLOG(INV?(-1))	0.104452	0.032647	3.199443	0.0019
DLOG(INV?(-1))*DUMCF?	0.457462	0.033895	13.49628	0.0000
DLOG(INV?(-2))	0.110346	0.032209	3.426001	0.0009
DLOG(INV?(-2))*DUMCF?	0.991656	0.056203	17.64406	0.0000
DLOG(INV?(-3))	0.660382	0.071254	9.268030	0.0000
DLOG(INV?(-3))*DUMCF?	-1.174057	0.097750	-12.01080	0.0000
CF?(-1)	0.0173	8.86E-06	1.947586	0.0546
CF?(-1)*DUMCF?	-1.68E-05	8.88E-06	-1.895420	0.0612

Weighted Statistics			
R-squared	0.979540	Mean dependent var	9.577073
Adjusted R-squared	0.969494	S.D. dependent var	22.05055
S.E. of regression	0.495987	Sum squared resid	22.14028
F-statistic	21731.57	Prob(F-statistic)	0.000000
Unweighted Statistics			
R-squared	0.689612	Mean dependent var	0.587457
Adjusted R-squared	0.658573	S.D. dependent var	1.149148
S.E. of regression	0.671467	Sum squared resid	40.57810

1999:3

Dependent Variable: DLOG(INV?)
Method: GLS (Cross Section Weights)
Sample: 1999:3 1999:3
Included observations: 1
Total panel observations 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.198078	0.029137	-6.798091	0.0356
DUMCF?	-2.103730	0.123017	-17.10109	0.0000
DLOG(INV?(-1))	0.315350	0.020761	15.18988	0.0000
DLOG(INV?(-1))*DUMCF?	2.722759	0.115211	23.63284	0.0000
DLOG(INV?(-2))	0.293565	0.014619	20.08062	0.0122
DLOG(INV?(-2))*DUMCF?	-1.277255	0.074121	-17.23195	0.0000
DLOG(INV?(-3))	0.254393	0.021310	11.93774	0.0000
DLOG(INV?(-3))*DUMCF?	-1.239918	0.101813	-12.17834	0.0000
CF?(-1)	0.0198	2.70E-06	7.351198	0.0000
CF?(-1)*DUMCF?	-2.49E-05	3.07E-06	-8.113505	0.2170

Weighted Statistics			
R-squared	0.941034	Mean dependent var	0.560521
Adjusted R-squared	0.940137	S.D. dependent var	3.745275
S.E. of regression	0.371947	Sum squared resid	12.45100
F-statistic	1105.317	Prob(F-statistic)	0.000000
Unweighted Statistics			
R-squared	0.527635	Mean dependent var	-0.004787
Adjusted R-squared	0.480398	S.D. dependent var	0.533154
S.E. of regression	0.384315	Sum squared resid	13.29284

1999:4

Dependent Variable: DLOG(INV?)
Method: GLS (Cross Section Weights)

Sample: 1999:4 1999:4
Included observations: 1
Total panel observations 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.308542	0.022275	13.85133	0.0000
DUMCF?	-1.439925	0.208837	-6.894984	0.0000
DLOG(INV?(-1))	0.293049	0.093445	3.136048	0.0023
DLOG(INV?(-1))*DUMCF?	-1.084834	0.176637	-6.141595	0.0000
DLOG(INV?(-2))	-0.112060	0.022723	-4.931493	0.0000
DLOG(INV?(-2))*DUMCF?	2.158894	0.325634	6.629816	0.0000
DLOG(INV?(-3))	-0.000654	0.020024	-0.032663	0.9740
DLOG(INV?(-3))*DUMCF?	-0.192582	0.047392	-4.063575	0.0001
CF?(-1)	-0.00082	1.55E-06	-3.114785	0.0025
CF?(-1)*DUMCF?	7.16E-06	1.97E-06	3.639277	0.0005

Weighted Statistics

R-squared	0.893761	Mean dependent var	2.874157
Adjusted R-squared	0.893137	S.D. dependent var	5.657615
S.E. of regression	0.468689	Sum squared resid	19.77025
F-statistic	1592.839	Prob(F-statistic)	0.000000

Unweighted Statistics

R-squared	0.034580	Mean dependent var	0.261582
Adjusted R-squared	-0.061962	S.D. dependent var	0.686406
S.E. of regression	0.707352	Sum squared resid	45.03117

2000:1

Dependent Variable: DLOG(INV?)
Method: GLS (Cross Section Weights)
Sample: 2000:1 2000:1
Included observations: 1
Total panel observations 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.925273	0.028041	-68.65860	0.0000
DUMCF?	0.895692	0.245463	3.648993	0.0004
DLOG(INV?(-1))	1.666516	0.025157	66.24404	0.0000
DLOG(INV?(-1))*DUMCF?	-2.364032	0.131604	-17.96317	0.0000
DLOG(INV?(-2))	-2.356283	0.053982	-43.64921	0.0000
DLOG(INV?(-2))*DUMCF?	2.263982	0.607766	3.725086	0.0003
DLOG(INV?(-3))	0.305101	0.038620	7.900090	0.0000
DLOG(INV?(-	-0.638713	0.419289	-1.523325	0.1312

3))*DUMCF?				
CF?(-1)	0.0122	2.06E-06	5.914603	0.0000
CF?(-1)*DUMCF?	-1.48E-05	2.79E-06	-5.312541	0.0000
Weighted Statistics				
R-squared	0.889967	Mean dependent var	-63.90544	
Adjusted R-squared	0.879963	S.D. dependent var	180.9195	
S.E. of regression	1.093191	Sum squared resid	107.5559	
F-statistic	301271.0	Prob(F-statistic)	0.000000	
Unweighted Statistics				
R-squared	0.568507	Mean dependent var	-1.207688	
Adjusted R-squared	0.525357	S.D. dependent var	1.810395	
S.E. of regression	1.247260	Sum squared resid	140.0091	

2000:2

Dependent Variable: DLOG(INV?)
Method: GLS (Cross Section Weights)
Sample: 2000:2 2000:2
Included observations: 1
Total panel observations 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.578148	0.106971	-5.404719	0.0000
DUMCF?	-0.612070	0.130263	-4.698725	0.0000
DLOG(INV?(-1))	-0.842204	0.078460	-10.73413	0.0000
DLOG(INV?(-1))*DUMCF?	-0.280327	0.092489	-3.030940	0.0032
DLOG(INV?(-2))	-0.788980	0.063727	-12.38054	0.0000
DLOG(INV?(-2))*DUMCF?	-0.255114	0.106874	-2.387068	0.0191
DLOG(INV?(-3))	-0.437168	0.044517	-9.820150	0.0000
DLOG(INV?(-3))*DUMCF?	0.324251	0.111531	2.907279	0.0046
CF?(-1)	-0.00206	7.07E-06	-2.918074	0.0044
CF?(-1)*DUMCF?	2.40E-05	7.09E-06	3.388948	0.0010
Weighted Statistics				
R-squared	0.909616	Mean dependent var	5.342892	
Adjusted R-squared	0.909578	S.D. dependent var	28.91455	
S.E. of regression	0.594161	Sum squared resid	31.77246	
F-statistic	26040.58	Prob(F-statistic)	0.000000	
Unweighted Statistics				
R-squared	0.893849	Mean dependent var	0.108858	
Adjusted R-squared	0.883234	S.D. dependent var	1.941903	
S.E. of regression	0.663568	Sum squared resid	39.62898	

2000:3

Dependent Variable: DLOG(INV?)
Method: GLS (Cross Section Weights)
Sample: 2000:3 2000:3
Included observations: 1
Total panel observations 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.335952	0.029383	11.43346	0.0000
DUMCF?	0.470983	0.041630	11.31366	0.0000
DLOG(INV?(-1))	0.475659	0.016283	29.21219	0.0000
DLOG(INV?(-1))*DUMCF?	0.016840	0.024887	0.676635	0.5004
DLOG(INV?(-2))	0.400653	0.018017	22.23746	0.0000
DLOG(INV?(-2))*DUMCF?	0.317484	0.028039	11.32307	0.0000
DLOG(INV?(-3))	0.131266	0.007450	17.62038	0.0000
DLOG(INV?(-3))*DUMCF?	0.444581	0.023665	18.78649	0.0000
CF?(-1)	0.00808	1.55E-06	5.225709	0.0332
CF?(-1)*DUMCF?	-8.35E-06	1.56E-06	-5.357974	0.2355

Weighted Statistics

R-squared	0.979525	Mean dependent var	0.006700
Adjusted R-squared	0.977478	S.D. dependent var	1.601548
S.E. of regression	0.240351	Sum squared resid	5.199183
F-statistic	478.4047	Prob(F-statistic)	0.000000

Unweighted Statistics

R-squared	0.670308	Mean dependent var	-0.011043
Adjusted R-squared	0.637339	S.D. dependent var	0.428881
S.E. of regression	0.258278	Sum squared resid	6.003668

2000:4

Dependent Variable: DLOG(INV?)
Method: GLS (Cross Section Weights)
Sample: 2000:4 2000:4
Included observations: 1
Total panel observations 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.000600	0.041082	24.35605	0.0000
DUMCF?	0.369295	0.043289	8.530913	0.0000
DLOG(INV?(-1))	2.625434	0.103908	25.26686	0.0000
DLOG(INV?(-1))*DUMCF?	-1.986251	0.104180	-19.06560	0.0000
DLOG(INV?(-2))	-0.670874	0.036523	-18.36857	0.0000

DLOG(INV?(-2))*DUMCF?	0.716464	0.037363	19.17565	0.0000
DLOG(INV?(-3))	-0.328628	0.030463	-10.78788	0.0000
DLOG(INV?(-3))*DUMCF?	0.355310	0.031604	11.24266	0.0000
CF?(-1)	0.00148	2.18E-06	0.679611	0.4985
CF?(-1)*DUMCF?	2.35E-07	2.20E-06	0.106616	0.9153

Weighted Statistics			
R-squared	0.919994	Mean dependent var	24.45666
Adjusted R-squared	0.919993	S.D. dependent var	157.0782
S.E. of regression	0.414821	Sum squared resid	15.48688
F-statistic	1577248.	Prob(F-statistic)	0.000000

Unweighted Statistics			
R-squared	0.662778	Mean dependent var	1.237996
Adjusted R-squared	0.629056	S.D. dependent var	0.816593
S.E. of regression	0.497347	Sum squared resid	22.26190

APPENDIX B

White heteroscedasticity test for III quarter of 1998

Dependent Variable: RES^2
Method: Least Squares
Date: 03/28/03 Time: 21:31
Sample: 1 103
Included observations: 103

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.169637	0.087992	1.927859	0.0568
CF28	-3.98E-06	4.53E-06	-0.880254	0.3809
DLN47	-0.618350	0.386324	-1.600601	0.1127
DLN18	0.430031	0.327481	1.313148	0.1922
DLN28	-0.456300	0.191301	-2.385250	0.0190

R-squared	0.118118	Mean dependent var	0.251784
Adjusted R-squared	0.082123	S.D. dependent var	0.706022
S.E. of regression	0.676410	Akaike info criterion	2.103292
Sum squared resid	44.83804	Schwarz criterion	2.231192
Log likelihood	-103.3195	F-statistic	3.281493
Durbin-Watson stat	1.565223	Prob(F-statistic)	0.014350

APPENDIX C

Second Step Regression (GLS version of first step)

For small firms

Dependent Variable: GSMALL
Method: Least Squares
Sample(adjusted): 1998:1 2001:4
Included observations: 16 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000192	1.06E-05	-18.18026	0.0350
IIR	0.00515	2.44E-06	21.09228	0.0302
IIR(-1)	0.00278	1.80E-06	15.41083	0.0413
IIR(-2)	-0.00246	1.17E-06	-20.99963	0.0303
IIR(-3)	0.00149	9.68E-07	15.36406	0.0414
GSMALL(-1)	-1.874813	0.115217	-16.27202	0.0391
GSMALL(-2)	0.339772	0.042396	8.014278	0.0790
DLOG(INDSA)	0.000569	6.20E-05	9.177851	0.0691
DLOG(INDSA(-1))	-0.001023	5.96E-05	-17.16046	0.0371
DLOG(INDSA(-2))	0.001851	5.20E-05	35.59593	0.0179
DLOG(INDSA(-3))	0.003385	0.000203	16.66531	0.0382

R-squared	0.94689		
Adjusted R-squared	0.936011	S.D. dependent var	2.68E-05
S.E. of regression	1.69E-06	Akaike info criterion	-24.39456
Sum squared resid	2.86E-12	Schwarz criterion	-23.95006
Log likelihood	157.3673	F-statistic	275.6673
Durbin-Watson stat	1.478583	Prob(F-statistic)	0.046840

For large firms:

Dependent Variable: GBIG
Method: Least Squares
Sample(adjusted): 1998:1 2001:4
Included observations: 16 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.33E-05	1.74E-05	0.765100	0.5842
IIR	-1.54E-06	2.51E-06	-0.614917	0.6490
IIR(-1)	-1.07E-06	2.14E-06	-0.501233	0.7042
IIR(-2)	-1.60E-07	9.42E-07	-0.169387	0.8932
IIR(-3)	-1.30E-06	1.57E-06	-0.824949	0.5609
GBIG(-1)	-0.327752	1.298672	-0.252375	0.8426

GBIG(-2)	-0.146003	0.890490	-0.163958	0.8965
DLOG(INDSA)	-8.27E-05	8.27E-05	-0.999455	0.5002
DLOG(INDSA(-1))	2.11E-05	8.79E-05	0.240346	0.8498
DLOG(INDSA(-2))	-0.000123	6.63E-05	-1.848618	0.3157
DLOG(INDSA(-3))	-8.22E-05	0.000226	-0.364421	0.7775

R-squared	0.935339	Mean dependent var	6.56E-07
Adjusted R-squared	0.288727	S.D. dependent var	2.61E-06
S.E. of regression	2.20E-06	Akaike info criterion	-23.86625
Sum squared resid	4.85E-12	Schwarz criterion	-23.42175
Log likelihood	154.1975	F-statistic	1.446522
Durbin-Watson stat	2.206420	Prob(F-statistic)	0.574874

Using assets as sample splitting criterion

For small firms

Dependent Variable: G_S
Method: Least Squares
Sample(adjusted): 1998:1 2001:4
Included observations: 12 after adjusting endpoints
Convergence achieved after 31 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.13E-05	1.87E-05	-1.670832	0.2367
IIR	0.00113	6.84E-06	1.659434	0.2389
IIR(-1)	0.000685	5.04E-06	1.359677	0.3069
IIR(-2)	-0.001050	8.22E-06	-1.272228	0.3312
IIR(-3)	0.000295	6.76E-06	0.436469	0.7051
DLOG(INDSA)	0.000436	0.000264	1.651522	0.2404
DLOG(INDSA(-1))	3.23E-06	0.000211	0.015319	0.9892
DLOG(INDSA(-2))	0.000190	0.000185	1.025306	0.4130
DLOG(INDSA(-3))	-4.54E-05	0.000229	-0.198265	0.8612
AR(2)	-1.146396	0.619811	-1.849589	0.2056

R-squared	0.928112	Mean dependent var	-9.54E-08
Adjusted R-squared	0.604615	S.D. dependent var	1.77E-05
S.E. of regression	1.11E-05	Akaike info criterion	-20.09649
Sum squared resid	2.48E-10	Schwarz criterion	-19.69240
Log likelihood	130.5789	F-statistic	2.868995
Durbin-Watson stat	2.363429	Prob(F-statistic)	0.285173

For large firms

Dependent Variable: G_B
Method: Least Squares
Sample(adjusted): 1998:1 2001:4
Included observations: 16 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.72E-06	1.98E-05	-0.289370	0.8207
IIR	6.10E-08	5.11E-06	0.011937	0.9924
IIR(-1)	8.72E-07	2.67E-06	0.326868	0.7989
IIR(-2)	6.32E-07	4.02E-06	0.157165	0.9008
IIR(-3)	5.78E-07	2.75E-06	0.209836	0.8683
G_B(-1)	-0.555914	2.203959	-0.252234	0.8427
G_B(-2)	-0.827769	1.180923	-0.700951	0.6108
DLOG(INDSA)	3.81E-05	0.000184	0.206503	0.8704
DLOG(INDSA(-1))	6.57E-05	0.000132	0.496941	0.7064
DLOG(INDSA(-2))	1.86E-06	0.000124	0.015037	0.9904
DLOG(INDSA(-3))	8.71E-05	0.000261	0.334141	0.7947

R-squared	0.893767	Mean dependent var	6.92E-07
Adjusted R-squared	-0.168564	S.D. dependent var	2.33E-06
S.E. of regression	2.52E-06	Akaike info criterion	-23.59416
Sum squared resid	6.36E-12	Schwarz criterion	-23.14966
Log likelihood	152.5650	F-statistic	0.841326
Durbin-Watson stat	1.398477	Prob(F-statistic)	0.698815

Note
1) The decision to include AR terms is based on the correlogram of the dependent variables.
2) For the presented regression diagnostic tests indicate that residuals satisfy the assumptions of no autocorrelation and normality.