INVENTORY INVESTMENT AND LOAN SUPPLY SHOCKS. EVIDENCE FROM UKRAINE

by

Dzhumyga Maryna

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Thesis Supervisor: Professor Lukyanenko Iryna

Approved by _____
Head of the KSE Defense Committee, Professor Roy Gardner

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Date _____

Kyiv School of Economics

Abstract

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This study analyses the sensitivity of the inventory investment to loan supply shocks. The research uses the annual data for big manufacturing firms in Ukraine over the period 2000-2008. The estimated model is based on the production-smoothing model augmented by proxy for loan supply shocks. Results suggest that finished goods inventories are sensitive to loan supply shocks, while material inventories are not. The impact of loan supply shocks on finished goods inventories is shown to be positive. Therefore, monetary policy may influence the level of country's inventories. Finished goods inventory investment may be treated as a part of monetary transmission mechanism in Ukraine.

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GLOSSARY

FE. Fixed effect

GMM. Generalized Methods of Moments

IMF. International Monetary Fund

Chapter 1

INTRODUCTION

Overall, in the presence of demand and supply shocks determining the optimal level of inventories is very hard and not always successful task for management. While holding inventories firm has to think about the cost of carrying inventories and cost of not carrying inventories. The increase in the cost of keeping inventories may lead to the reduction in their level. There are at least three ways of financing: use available funds, borrow from bank or issue securities. Loan supply shocks could influence the real economy if relationships between the bank and the firm are important. Namely, loan supply shocks lead to changes in the spendings of bank-dependent firms, which may cause change in inventories. If a firm is bank dependent, fluctuations of the loan supply affect all components of the investment. The inventory investment has special sensitivities to different shocks, since it has lower adjustment cost compared to other investments (R&D, for instance). As a result, the share of inventories decline in the total investment is generally higher and they should be more sensitive to loan supply shocks than other types of firm's investments. Therefore, finance-constrained firms may use inventory investment to respond to shocks. Therefore, one may expect that shocks in the loan supply make an impact on bank dependent firms' inventory investment.

Change in inventories makes a significant impact on the real-economy variables (Wilkinson 1987). Ukraine has a high level of inventories (6 % of GDP[1]).

[1] This is the ratio of total inventories of manufacturing firms to GDP. For more details, please, see chapter Data Description.

Shortage of inventory investment leads to lack in the output (Carpenter et al 1994). Cunningham (2004) and Dobronogov (2007) demonstrate that this is also true for Canada and Iran respectively. Due to this evidence, the inventory behavior may make a relevant contribution to the economic instability in Ukraine.

If the banking sector plays an important role in Ukraine, inventory investment may respond to credit conditions and plays the role of the monetary transmission mechanism. In Ukraine the demand for financial services grew rapidly since 2003 year[2]. The increase in the personal and corporate income, the shadow economy led to this growth. Moreover, in 2006 the National Bank of Ukraine abated the reserve requirement for banks. This also reinforced the growth in loans and reduced their price. Banks' loan portfolio has grown from 67.8 to734 billions of 2007 UAH over the period from 2003 to 2008[3]. Since 2008 Ukraine has been facing financial the crisis, namely, banking and currency crisis. The Ukrainian banking sector is one of the weakest banking sectors in the world[4]. Also, it is worth mentioning, that credit availability became worse in 2008[5] (see Figure 1).

Furthermore, the crisis leads to fluctuations of the internal finance. As a consequence, investments of bank dependent firms may suffer from this. The inventory investment has lower adjustment cost compared to other types of investment. As a result, it has special sensitivity to shocks. So, the question about the extent to which the loan supply affects inventory investment arises.

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[2] Source:Institute for economic Research and Policy Consulting in Ukraine. 2005. Market structure, minimum capital requirements and the stability of the banking sector in Ukraine

[3] Source: www.bank.gov.ua

[4] Source: Standard & Poor's 2008 Review of banking sector in Ukraine http://www2.standardandpoors.com

[5] Source: http://www.bank.gov.ua/Publication/research/Pub0408.pdf

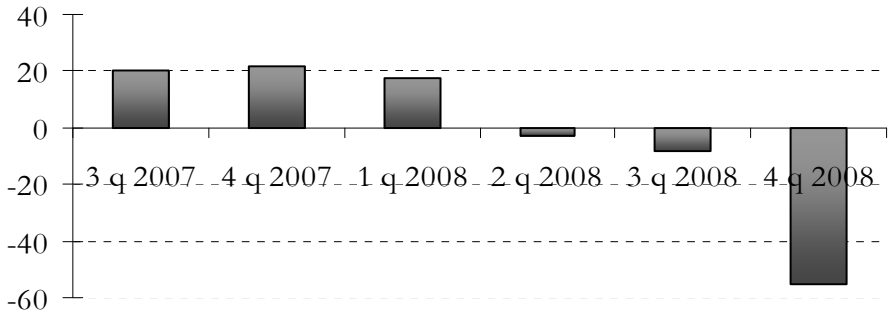

Figure 1. Dynamic of Qualitative Estimation of the Credit Availability to Industry
Notes: "credit availability become worse"(-), "credit availability become better"(+)

On the other hand, according to Blinder and Maccini (1991) different types of inventories investment[6] have different levels of the volatility, since they play different roles in the production process. Also, they have different adjustment costs. Hence, different types of inventories have different sensitivity to loan supply shocks. Having materials inventories is more important for a firm compared to finished goods inventories. Therefore, one might expect that materials inventories are less sensitive to loan supply shocks. Understanding the extent to which different kinds of manufactures' inventory investments reflect the problems in the banking sector may help to explain monetary transmission mechanism. Also, if finished goods inventories are sensitive to loan supply shocks, than there is an evidence to think that loan supply shocks may make ability to smooth the production worse.

This paper tests the hypothesis that loan supply shocks have significant impact on change in inventories in Ukraine. Another goal is to shed more light on the sensitivity of materials and finished goods inventories to loan supply shocks. Production-smoothing model (Blinder and Maccini, 1991) is used in order to

[6] There are three kinds of inventory investment: material, semifinished and finished good inventories

investigate this. The model is estimated based on the assumption of the acceleration principle. Namely, current inventory investment is a part of required value to adjust equilibrium level. Constructed panel covers the period 2000-2008 and is based on data from annual statistical forms for manufacturing enterprises. Data was taken from database of Kyiv School of Economics.

For the most part, obtained results are consistent with findings in the literature. Also, the main empirical finding confirms the hypothesis that finished goods inventories are more sensitive to loan supply shocks compared to material inventories. The results are robust to the inclusion of different financial variables.

The paper consists of the following parts: chapter 2 is focused on the literature review of the theoretical and empirical approaches used to investigate inventory behavior, chapters 3 and 4 are based on the methodology and data description, chapter 5 provides empirical models, regression results, their discussion and the last chapter contains conclusions.

Chapter 2

LITERATURE REVIEW

This section is organized as follows. The first part is concentrated on the theoretical approaches used in the literature to model the inventory behavior. The second part is focused on empirical approaches, with the emphasis on developing and transition countries.

2.1 Theoretical evidence

Two major approaches are used in the inventory behavior research: (i) production smoothing-buffer stock model (e.g. Ramey 1989, Peters 1997), and (ii) (S, s) model (Blinder et al. 1981, Fisher and Hornstein 2000). These approaches are based on different assumptions about inventories. The production-smoothing model considers inventories as a buffer stock with the goal to minimize costs associated with inventories (Peters 1997). It assumes that expected sales and existing investment determine the inventory behavior. As a result, this approach is widely used to model finished goods inventories. The (S, s) model assumes that the delivery cost is constant. This model is appropriate to characterize the behavior of raw materials inventories, since it determines the optimal inventories size by the "marginal benefits of holding inventories" (S) and "marginal cost of holding inventories"(s) (Small 2000). Blinder et al. (1981) argue that this model explains the inventory behavior better compared to the production-smoothing model. But, they also shows that the data should not be aggregated, since different economy sectors have different sensitivity to shocks.

Almost all studies are concentrated on total inventories or just on finished goods inventories (e.g. Carpenter and Levy 1998, Cunningham 2004). As a consequence, they are based on the production-smoothing model. Also, it should be noticed that a large share of papers focused on the materials inventories uses production-smoothing model (e.g. Small 2000).

2.2 Empirical evidence

Empirical specification of the production-smoothing model used in the literature considers inventory investment as a function of expected inventories and sales levels. Expected sales and inventories can be presented in different functional forms and include different variables. Due to this, arises some ambiguity in the production-smoothing model. Wrong functional form or omitted variable bias may be a source of such kind of a problem (Carpenter et al. 1994). As a result, many studies make an effort to investigate the inventory behavior by using additional information. Moreover, Blinder and Maccini (1991) show that the share of investment in the finished goods inventories and the volatility of this kind of inventories is the smallest among other types of inventories. Nevertheless papers are usually concentrated just on the finished goods inventories.

Empirical papers concentrated on the behavior of inventories may be divided according to their focus on groups of countries into two subsets: (i) developed countries (e.g. Kashyap et al 1993, Guariglia 1999, Small 2000, Guariglia and Mateut 2009), (ii) developing and transition countries (Dobronogov 2007, Crum and Golberg 1998). Moreover, researchers show that the ratio of inventories to GDP has a tendency to go down with time in developed countries. Chikan et al. (2005, p. 70) presents some evidence that "no general regression model can be found to explain inventory behavior in different countries". At first, the review is

focused on developed countries. Afterwards, it will be concentrated on developing and transition countries.

Almost all papers focused on the developed countries try to investigate the sensitivity of inventory investment to different variables. A number of recent papers study the connection of the inventory investment with growth of GDP (Chikan and Tatrai 2003, Chikan et al. 2005, Irvine and Schuh 2005, Chikan and Kovacs 2009, Carpenter et al 1994). An interesting result of these papers is that the higher is the GDP growth during a period, the higher is the growth in inventories.

A large share of research looks for the way of the connection of the interest rate and inventories. As it was reviewed by Maccini et al. (2004), Ramey (1989) argues that 60 percent of changes in inventories are due to shocks, while 40 are due to changes in the output. Maccini et al. (2004) find the cointegration between inventory investments and the real interest rate. Furthermore, they show that firms respond only to the long-run variations in the real interest rate. Because of this fact, the inventory could be considered as a monetary transmission mechanism. Carpenter and Levy (1998, p.344) state that "approximately 90 percent of the total variance of inventory investment is short run" and this variation is not caused by business cycle. Due to this, the question about the reason of short-run variance of inventory investment arises.

Several ways are used in the literature in order to investigate unexplained movements of the inventory investment. If firms can not borrow or lend at the market interest rate, their ability to invest depends on financial constraints. Some researches argue that financial variables influences inventory investment. Researchers investigate the inventory investment behavior and their findings support the hypothesis of the inventories sensitivity to financial constraints

(Cunningham 2004, Small 2000, Gertler and Gilchrist 1994, Carpenter et al. 1998). Carpenter et al. (1998) employ different financial variables and find that the inventory investment is more sensitive to the cash flow compared to the cash stocks and coverage. Some authors try to explore the sensitivity of small versus large firms' inventories (e.g. Gertler and Gilchrist 1994, Carpenter et al. 1994, Cunningham 2004) to the monetary policy. Their results strongly support the hypothesis that "bank lending channel" may be a source of inventory movements. Carpenter et al. (1994) argue that this impact of internal finance might be different across different types of firms and find that small firms are more sensitive to internal finance compared to large, because small firms have fewer possibilities to borrow from banks. Gertler and Gilchrist (1994) use USA quarterly panel data in order to shed more light on the influence of firms' financial position on small and large firms' inventory. Their empirical paper shows that small firms' inventories are more sensitive to movements in coverage ratio compared to large firms. Later, Guariglia (1999) investigates the impact of financial constraints on inventory investment for UK manufacturing firms. He finds materials inventories are more affected by coverage ratio compared to finished goods inventories. Also, he shows that financially constrained firms are more sensitive to financial variables, specifically during the period of crisis. Small (2000) using UK panel data investigates whether financially constrained firms are more affected by the cash flow. He finds that there is no adequate measure of firm's financial constraint. Cunningham (2004) deduces that Canadian manufacturing firms' inventories are not sensitive to internal funds.

Another part of the literature tries to study links between the loan supply and the inventory investment. Kashyap et al. (1993) investigate the impact of loan supply shocks on commercial paper yields. They use a "mix" variable defined as a ratio of corporate bank borrowing to commercial paper borrowing. As a result, they indicate the significance of parallel movements in the monetary policy and the

"mix" variable. Namely, the increase in the "mix" variable is a result of upward shift in the loan supply. Therefore, authors argue that this variable can be used as a proxy for loan supply movements. Unfortunately, they use aggregated data and this does not allow them to examine the cross-sectional sensitivity. Later Guariglia and Mateut (2009) explore the sensitivity of UK manufacturing firms to the proxy variable. Their results suggest that inventories sensitivity to the proxy depends on the firm's global engagement. They find that it does not make an impact on inventory behavior of UK big firms.

Peek et al. (2003) use other confidential variable CAMEL as an approximation of loan supply shocks. This variable is composed on the basis of 5 bank's characteristics: Capital, Asset, Management, Earnings and Liquidity. In order to control demand shocks researchers use the forecast of the economic activity. Based on the aggregate data they find a significant impact of the loan supply on real economy variables. Furthermore, the volume of this impact is stronger for bank dependent components of GDP (inventories, residential investment). Also, one of the recent papers by Nippani et al. (2009) investigates the impact of non-financial paper yields on the inventory behavior. They use a spread, the difference between the commercial paper rate and the Treasury bill and show the positive correlation between commercial paper yields and the total inventory investment.

Now review turns to studies concentrated on developing and transition countries. Understanding the reason of inventories movements are most important for transition and developing countries, since they have high level of inventories (Dobronogov 2007). Researcher states that the inflation and the large state sector may be a reason of this. Crum and Golberg (1998) support the previous view and state that firms in Hungary, Poland and Czechoslovakia have the high borrowing price and the difficult access to credit. Due to this transition countries have high and nonoptimal level of inventories. Also researches try to make some

suggestions to managers in transition countries. However, they use just the cost minimization approach and do not investigate to which extent other variable influence the inventory investment. Black and Tarassova (2003) argue that Russia makes arduous conditions for small firms. As a consequence, small firms can not be competitive and it is very difficult to model their behavior.

As the main conclusion, there are many thoughts about the reason for movements in the inventory investment. All of them are to a certain extent complementing each other. This paper aims to contribute to the existing literature in several ways. It brings new evidence to the movements in the inventory investment and sheds more light upon the bank influence on the inventory investment through a credit channel in Ukraine. Investigation of the inventory behavior is substantial for countries with high level of inventories like Ukraine. Due to this, paper complement existing literature by examination sensitivity of inventories to loan supply shocks. Also, paper sheds more lights on difference of behavior of materials and finished goods inventories. Namely, it will test hypothesis whether finished goods inventories are more sensitive to loan supply shocks compared to materials inventories.

Chapter 3

METHODOLOGY

The background model used to test empirically the sensitivity of materials and finished goods inventories to loan supply shocks is model that has become the basis for modeling of the inventory behavior (Lovell 1961). This approach is generally applied in the literature to materials and finished goods inventories (e.g. Guarigilia 1999, Blinder and Maccini 1991)

Production-smoothing model (Blinder and Maccini 1991) used in this paper is based on the Lovell's adjustment model:

$$\Delta I_{i,t+1} = I_{i,t+1} - I_{i,t} = \alpha(I^*_{i,t} - I_{i,t}) - \beta(S_{i,t} - S^*_{i,t}) + \xi_{i,t}\,, \qquad (1)$$

Let S and I be the logarithms of sales and inventories respectively. Terms $S^*_{i,t}, I^*_{i,t}$ represent expected or desired sales volume and stock of inventories at period t of firm i. Variable $\Delta I_{i,t+1}$ represents the growth rate in inventories. Let $\xi_{i,t}$ be a stochastic term, which include both aggregate and random disturbances. Model (1) is based on the assumption, that a firm takes into account the expected volume of sales in order to determine the necessary level of inventories. If desired volume of sales goes up, a firm should produce more. As a result, the demand for materials inventories rises. On the other hand, if a firm expects sales to increase, this may cause finished goods inventories to go up, since "the probability of a costly stockout increases" (Carpenter et al 1994). As a result equation (1) is suitable for both finished goods inventories and materials

inventories. If expected and actual levels of sales are different, the change in inventories may partially capture this difference. Coefficient β expresses this reaction of the inventory investment to forecast error in sales. The bigger the forecast error, the higher is change in inventories. This gives the reason of a negative sign before β in (1). Coefficient α shows the speed of adjustment of the change in inventories level to the gap between desired and actual level of inventories.

Moreover, expected level of inventories is assumed to be dependent on the level of the existing sales volume:

$$I_{it}^{*} = \delta_i + \delta_1 S_{i,t} + w_{i,t}\,, \tag{2}$$

where $w_{i,t}$ expresses a random error. If a firm expects sales to rises, then the expected level of inventories will also go up. This is represented by a marginal coefficient δ_1. After Blinder and Maccini (1991) this approach is widely used in the literature, since it allows controlling for the firm effect by adding δ_i to the equation.

Also, desired volume of sales S_t^{*} from (1) can be expressed as a function of previous time period sales volume S_{t-1} including the firm effect γ_i and random term $\varepsilon_{j,t}$ for industry j:

$$S_{it}^{*} = \gamma S_{it-1} + \gamma_i + \varepsilon_{j,t} \tag{3}$$

After some simplification equation (1) produces the following:

$$\Delta I_{i,t+1} = -aI_{i,t} + (-\beta + \alpha\delta_1)S_{it} + \gamma\beta S_{it-1} + \eta_i + \eta_{j,t} + u_{i,t} \tag{4}$$

where $\eta_i, \eta_{j,t}$ $u_{i,t}$ are firm a effect, a time effect for a particular industry and an idiosyncratic component of the error term respectively.

It is crucial to mention, that expected level of sales can be considered not only in the form presented by equation (3). The literature suggests (e.g. Gertler and Gilchrist 1994) that firm's financial variables include some information about the expected level of sales. In this case, financial variables will make influence on inventories. Taking into account the fact that financial variables may have significant influence on the desired level of sales equation (4) can be presented in the following way:

$$\Delta I_{i,t+1} = -aI_{i,t} + (-\beta + \alpha\delta_1)S_{it} + \gamma\beta S_{it-1} + \sum_i c_i X_{it} + +\eta_i + \eta_{j,t} + u_{i,t} \qquad (5)$$

First three terms in (5) are controls. They allow testing the importance of the set of variables $\{i, IF, CR, R\}$. The coefficient near control variables will be compared with findings in the literature in the next chapter.

Let X denote the set of variables $\{i, IF, CR, R\}$. These variables capture the influence of internal and external finance. Let i, IF and CR denote the logarithm of interest rate, internal fund and coverage ratio, respectively. Carpenter et al. (1998) state that decline in internal finance may lead to the reduction in "accumulation of all assets", particularly, inventories. If firm does not have a possibility to use external finance, its investment will be sensitive to internal finance. Also, internal and external funds are not equivalent in cost for a firm (Cunningham 2004). Therefore, firms which have an access to both internal and external finance are expected to be not sensitive to internal finance. Following Gertler and Gilchrist (1994) the proxy for coverage ratio is calculated as a ratio of cash-flow to the product of interest rate and short term debt. Short-term debt is

defined by commercial papers and short-term bank borrowing. Researchers argue that this ratio could be used as a proxy for "movements in small firm's financial positions" and does not influence inventory investment behavior of big firms. However, the sample used in these paper covers only big companies. Due to this the coverage ratio is expected to be insignificant.

As in Kashyap et al. (1993) and Guariglia and Mateut (2009) this study uses $R_{i,t}$ variable, as a proxy of loan supply shocks. $R_{i,t}$ is the ratio of the bank borrowing to the total borrowing, while the total borrowing is defined as a sum of commercial paper borrowing and bank borrowing. $R_{i,t}$ is measured at the firm level. Kashyap et al. (1993) show that ratio $R_{i,t}$ is a good indicator of movements in loan supply shocks and of access to external finance. Authors investigated the sensitivity of ratio to the loan supply shocks empirically and find that decline in the loan supply leads to decrease of the ratio of corporate bank borrowing to commercial paper borrowing.

Ramey (1989) argues that materials inventories are more volatile than finished-goods inventories. In order to explore whether the sensitivity of inventories to credit conditions varies with different kinds of inventories, one can compare this coefficient across materials and finished goods inventories. If having materials inventories is more important for a firm, one can expect that materials inventories are less sensitive to loan supply shocks than finished-goods inventories.

In order to evaluate whether the sensitivity of the inventory investment differs for materials and finished goods inventories, equation (5) will be estimated for materials and finished goods inventories separately. Under the maintained hypothesis that loan supply shocks make a smaller impact on materials

inventories compared to finished goods inventories, coefficient near $R_{i,t}$ is expected to be smaller in magnitude or even insignificant for materials inventories.

Error term in (5) is presented as a sum of three: (i) η_i, linear combination of firm fixed effect and random error; (ii) $\eta_{j,t}$, time specific term for an industry j; (iii) $u_{i,t}$, random error term. Term $\eta_{j,t}$ captures a time effect for a particular industry. This dummy controls for products price effect, cost effect, changes in technology for a particular industry.

The model presented by equation (5) includes the lagged dependant variable as one of the regressors. Namely, $I_{i,t}$ is used to explain $\Delta I_{i,t+1}$. However, the lagged dependant variable is necessarily correlated with a firm effect: $corr(I_{i,t}, \eta_i) \neq 0$. As a result, OLS gives biased estimate. The FE procedure eliminates the firm fixed effect, but it produces simultaneity bias in AR models. Although, if OLS estimate is biased upward, the estimation obtained after FE will be biased downward. To avoid this bias, one may use Generalized Method of Moments (GMM procedure proposed by Arellano and Bond, 1991). It suppresses firm effect using first differences of equation (5). Second and further lags of the dependant variable are used as instruments for the lagged dependant variable. Even though, short time dimension of panel ($T = 9$) and large number of firms ($N = 3027$) also suggest to use Arellano-Bond procedure. The robust estimation of covariance matrix might be used to meet heteroscedasticity problem.

Described above procedure allows to obtain consistent and asymptotically efficient estimators. To check whether first- differenced GMM gives a consistent estimator, one might compare GMM, OLS and FE procedure's estimates on the lagged dependant variable. OLS procedure gives biased estimators since it does

not capture the fixed firm effect. FE procedure is also biased, but the sign of bias after FE is opposite to bias after OLS. First-difference GMM estimates are consistent if coefficient on the lagged dependent variable obtained after GMM lies within coefficients obtained after OLS and FE.

The validity of the model might be checked by two criteria: Sargan/Hansen test and test for second-order serial correlation of the residuals. Sargan test is a test for over-identifying restrictions. This test has a null hypothesis of overidentification problem's absence. If standard errors are robust, one can use Hansen test with the same null as in Sargan test. Also, to get consistent result Arellano-Bond procedure requires the presence of the first-order serial correlation in the residuals and the absence of the second-order serial correlation. Arellano-Bond AR1 and AR2 tests have the null of no first-order and second-order serial correlation of the differenced residuals respectively.

Chapter 4

DATA DESCRIPTION

This section is organized as follows. First part is concentrated on the dataset used in the paper. The second part is focused on the summary statistics, with the emphasis on general tendencies in variables behavior.

4.1 The dataset

All necessary data are taken from the database of Kyiv School of Economics and IMF statistics. Namely, the study uses the data for enterprise statistics from balance sheet statements Form1 and Form2. The attention is restricted to a sample of manufacturing firms[7] covering the period 2000-2008.

The main variables used in the paper are sales, finished goods inventories, materials inventories, commercial papers, internal funds, interest rate and bank loans[8].

The sales variable is used as a proxy of the output. Data for sales are taken from the balance sheet statement Form 2.

Data for inventories, internal funds and bank loans are taken from the balance sheet Form 1. Data for banks' lending interest rate is taken from IMF statistics[9]

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[7] The process of determining the sample is described below.

[8] Detailed description of variables is presented in the Appendix, Table A1

[9] Source :http://www.imf.org/external/index.htm

Inventories show the value of inventories held by a particular firm at a particular moment of time. There are two sources for getting the inventories data: Form 1 and Form 1m. The former is used for large enterprises, while the last one for small firms. It is worth to notice that the balance sheet statement Form 1m does not include disaggregated information for inventories, it just shows the total number of inventories. The reason of this is that small firms do not have significant amount of finished goods inventories, since their production process does not allow them to do this. Due to this, the attention will be restricted to big companies and to Form 1. Also, it is crucial to mention that during different periods of time some firms can belong either to small or to big firms. As a result their data may be in Form 1 or in Form 1m. Using the companies that report the data using Form1 during the whole period gives confidence that the sample will be homogeneous and have data for finished goods and materials inventories. Due to this, the attention is restricted to those firms, which during the whole period from 2000 till 2008 were big. Also, some branches which do not have finished goods inventories[10] are also eliminated from the sample. Namely, estimation will be made on the base of 3027 companies (detailed data are presented in Table 1). Table 2 expresses representetiveness of the sample. Namely, it shows the number and the percentage of particular industry's firms in the sample and in population.

Table 1. Number of observations and firms included to the sample

Type of firms	Number of observations	Number of firms
Firms that have data for 9 years	50130	5570
Firms that have data for 9 years and were big	30672	3408
Firms that have data for 9 years, were big and are not likely to have 0 inventories	27243	3027

[10] Publishing of newspapers and other publishing industries, production of bread, processing of scrap metal

Table 2. Percentage of firm from a particular industry in the sample and in population

Industry	Sample		Population	
	Number of firms	Weights, %	Number of firms	Weights, %
Engineering industry	1041	34.6%	23857	28.7%
Food	773	25.7%	15614	18.8%
Glass making	324	10.8%	6765	8.1%
Chemical industry	237	7.9%	6820	8.2%
Textile	230	7.6%	6480	7.8%
Woodworking industry	99	3.3%	3009	3.6%
Metal industry	90	3.0%	993	1.2%
Woodworking industry	62	2.1%	6945	8.4%
Papermaking	50	1.7%	951	1.1%
Publishing activities	42	1.4%	9909	11.9%
Leather manufacture	35	1.2%	1142	1.4%
Coke industry	26	0.9%	533	0.6%
Total	3027		83018	

Basically, one should understand by population the sample based on the total available data for manufacturing firms from the balance sheet statements Form 1 and Form 2. It is worth to mention that the sample represents industries well except the publishing industry and the woodworking industry. However, the publishing industry was excluded from the sample since it does not have finished goods inventories.

4.2 Summary statistics

Dobronogov (2007) states that transition countries have high level of inventories, while in developed countries the level of inventories is less than 2% of GDP. Figure 2 demonstrates that a percentage of inventories of GDP in Ukraine goes

down with time, but still it is far from 2% level. Figure 3 shows that the growth of inventories[11] was positive during 2005-2007 and it declines substantially in 2008.

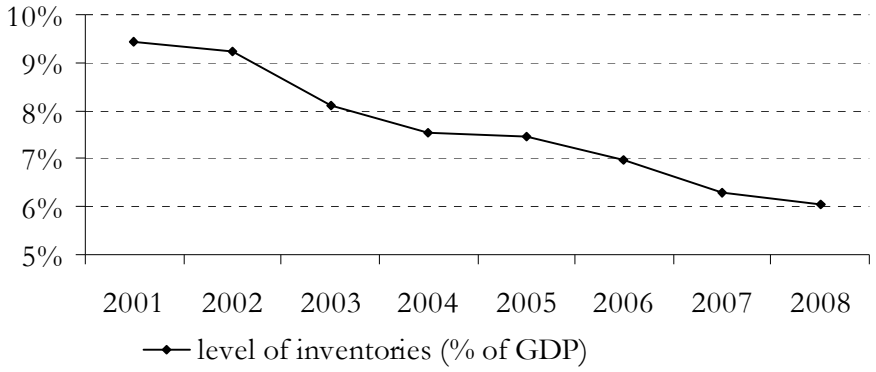

Figure 2. Dynamic of the inventory level of manufacture firms as a percent of GDP. 2001-2008.

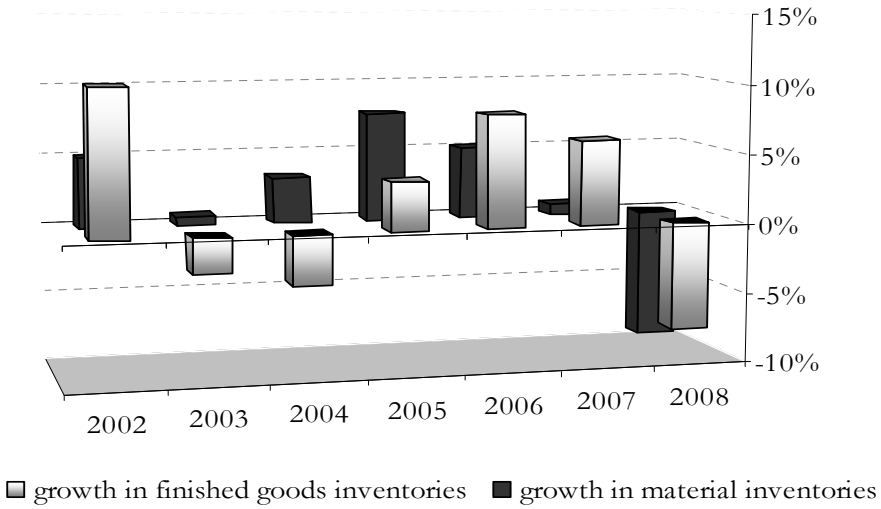

Figure 3. Dynamic of the growth of materials inventories and finished goods inventories of manufactures firms. 2001-2008. Millions of 2007[12] UAH.

[11] Dynamics of materials and finished goods inventories are presented in Appendix, Figure A1.

Loan portfolio has been growing substantially over the period 2003-2008 (see Figure 4). This growth might be explained by positive shocks in the loan supply. Also, it is visible that the growth of loan portfolio decreased in 2008 and became negative in 2009 (see Figure 5).

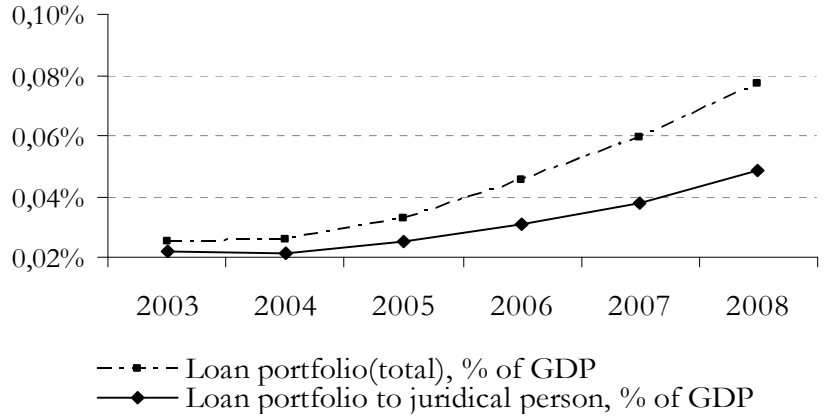

Figure 4. Dynamic of the loan portfolio in Ukraine.2003-2008

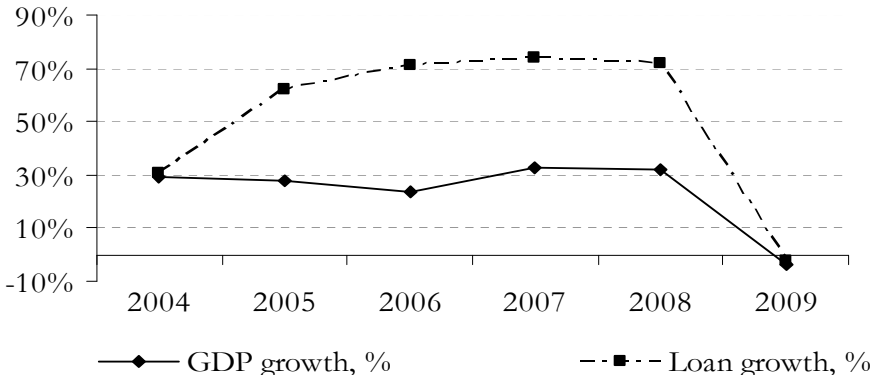

Figure 5. Dynamic of the loan portfolio and GDP growth in Ukraine. 2004-2008

[12] Producer price index[12] is used to present all variables in real terms. Source: State Statistics Committee of Ukraine: http://www.ukrstat.gov.ua/

Table 3 represents some basic statistics of the data. One can see that on average big firms hold more materials inventories than finished goods inventories.

Table 3. Descriptive statistics of variables

Variables	(1) Observations	(2) Mean	(3) Std.Dev	(4) Maximum	(5) Minimum
Materials inventories	27243	5178,29	175,63	1437935	0
Finished goods inventories	27243	2097,66	68,55	805373	0
Internal funds (in UAH)	27243	910,74	88,54	1191283	0
Internal funds (in USA dollars)	27243	827,89	105,04	1382621	0
Short-run credits	27243	3088,34	128,52	773300	0
Long-term credits (current backlog)	27243	390,53	38,62	376255	0
Long-term credits	27243	2669,53	190,46	2672488	0
Commercial papers	27243	1366,43	87,74	673736	0
R	27243	0.39	0.4696	1	0
Sales	27243	84496,8	3764,92	28710628	0
CR	27243	1,11	92,09	14511	0
i	9	19,61	5,83	32	14

Focusing on loan supply variable, one can see that the average value of R, ratio of credits from a bank to the total short term debt is 0.39. However, approximately

55% of firms do not use short term loans from banks[13]. As a consequence, the average of the ratio is higher if one takes into account only firms for which loans from banks are not 0. Dynamics of the total loans from banks to short term debt is presented in the Figure 6. One can see that this ratio had tendency to go up with time over the period 2000-2008. The growth presented in Figure 7 has several peaks, which support the fact that National Bank of Ukraine reduced reserve requirements for banks, i.e. bank credits become more available

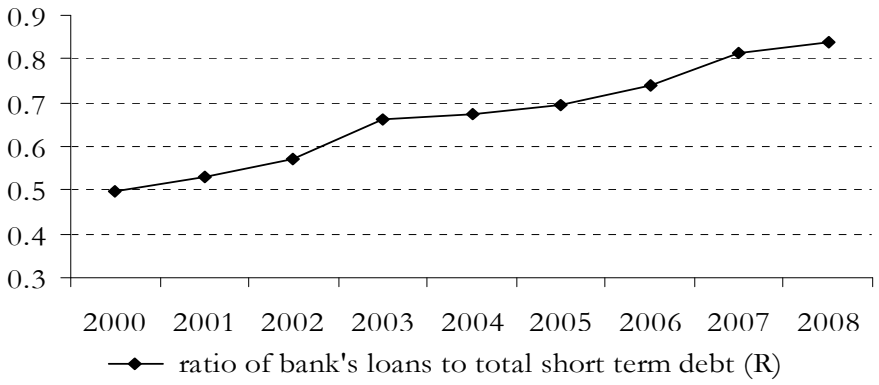

Figure 6. Dynamic of ratio of bank's loans to the total short term debt in Ukraine. 2000-2008

For the specification (5) the set of dummies $\eta_{j,t}$ (j and t denote an industry and a time respectively) are separate dummies for each period of the time and for each industry.

[13] See Appendix, Table A2 for more detailed information on the number of firms, which do not use loans from banks and commercial papers

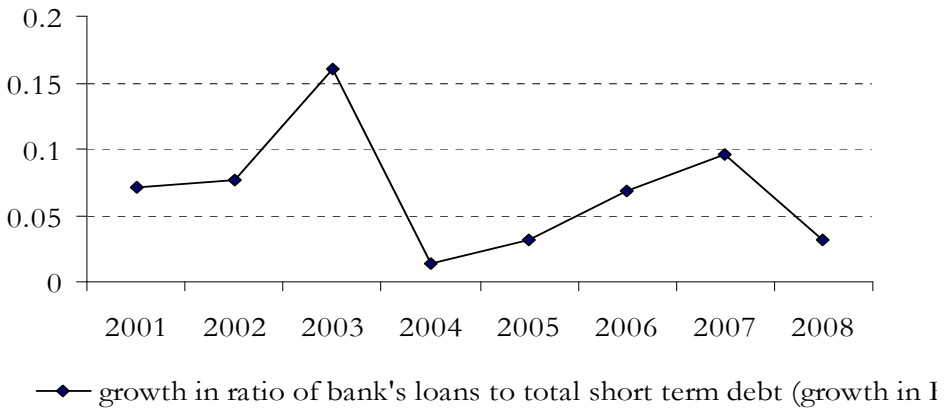

Figure 7. Dynamic of the growth in ratio of bank's loans to total short term debt in Ukraine. 2000-2008

Chapter 5

EMPIRICAL ESTIMATION

This chapter reports the results from estimating equation (5) using: (i) OLS procedure; (ii) OLS procedure including industry-time effect; (iii) Arellano Bond. Obtained results are discussed and compared with findings in the literature.

5.1 Estimation results

To investigate the behavior of finished goods and materials inventories, equation (5) is estimated for materials and finished goods inventories separately. Moreover, investigation is divided to into several parts subject to variables used to investigate an impact of internal finance and loan supply shocks on inventory investment. First, the attention is focused on the results obtained after including the proxy for loan supply shocks to the equation. The results obtained after estimation using OLS, FE and Arrellano- Bond procedures are presented in Table 4 and Table 5.

Second columns of Table 4 and Table 5 represent main results of the estimation using OLS procedure for materials and finished goods inventories respectively[15]. Coefficients before the lagged inventories are statistically significant and, as expected, have negative signs. This fact is consistent with findings in the literature. The change in sales makes a positive significant effect on the inventories investment.

[15] Detailed results obtained after OLS procedure are presented in Appendix B, Table B1 and TableB4

Table 4. Estimation results. OLS, OLS+industry time effect, FE, Arellano-Bond (GMM) procedure. Materials inventories

Variables	OLS	OLS+industry-time effect	FE	GMM
$I^m_{i,t}$	-0.137***	-0.137***	-0.598***	-0.559***
	(-40.90)	(-40.83)	(58.77)	(9.58)
$\Delta S_{i,t}$	0.227***	0.225***	0.255***	0.340***
	(30.24)	(29.67)	(31.67)	(3.88)
$S_{i,t-1}$	0.118***	0.119***	0.280***	0.113*
	(32.17)	(32.14)	(37.35)	(2.50)
$R_{i,t}$	0.078***	0.077***	0.021	-0.432
	(5.54)	(5.49)	(1.18)	(-1.75)
Industry-time dummies	no	yes	no	yes
N	21189	21189	21189	15135
adj.	0.100	0.100	0.219	-
AR1 test (p-value)	-	-	-	0.0000
AR2 test (p-value)	-	-	-	0.057
Hansen test (p-value)	-	-	-	0.418

t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5. Estimation results. OLS, OLS+industry time effect, FE, Arellano-Bond(GMM) procedure. Finished goods inventories

Variables	OLS	OLS+industry-time effet	FE	GMM
$I^f_{i,t}$	-0.121***	-0.121***	-0.656***	-0.502***
	(-35.89)	(-35.77)	(49.03)	(4.10)
$\Delta S_{i,t}$	0.179***	0.177***	0.222***	0.400***
	(12.57)	(12.33)	(14.93)	(4.28)
$S_{i,t-1}$	0.113***	0.113***	0.280***	0.419***
	(20.75)	(20.62)	(21.88)	(4.21)
$R_{i,t}$	0.070**	0.066*	0.003	3.760***
	(2.66)	(2.49)	(0.10)	(3.92)
Industry-time dummies	no	yes	no	yes
N	21189	21189	21189	18162
adj.	0.100	0.100	0.219	-
AR1 test (p-value)	-	-	-	0.000
AR2 test (p-value)	-	-	-	0.166
Hansen test (p-value)	-	-	-	0.201

t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The results presented in the third columns of Table 4 and Table 5 treat the industry-time effect[16]. This effect is captured by adding a set of separate for each period of time and for each industry dummies $\eta_{j,t}$ to the estimated model. Obtained results do not differ significantly from OLS coefficients. However, this does not mean that the omitting industry effect does not make an impact on obtained results. OLS regressions include the interest rate, which is fixed over the particular year for all firms. Hence, this interest rate captures also time effect.

Also, lagged dependant variable is one of the repressors and it is correlated with firm specific term. As a consequence, OLS estimates are subject to an omitted bias.

As it was discussed in the methodology chapter, FE procedure also gives biased estimators. At the same time, the signs of the bias for the lagged depended variable are opposite. Comparing the results presented in first rows of Table 4 and Table 5 allows to see that estimates of lagged dependent variable ($I_{i,t}$) obtained after Arellano-Bond lie within estimates from OLS and FE regressions. This gives an evidence to think that estimates obtained after Arellano-Bond procedure have at least lower bias compared to estimates of FE and OLS procedures.

Arellano-Bond AR1, AR2 tests and Hansen test (modification of Sargan test used in case of robust standard errors) give an evidence to think that model is correctly specified. In other words, according to the Arellano-Bond AR1 and Arellano-Bond AR2 tests one can reject the null of the absence of the first order correlation and can not reject the null of absence of the second order correlation.

[16] Detailed results obtained after OLS procedure+industry-time effect are presented in Appendix B, Table B2 and TableB5

Also, the Hansen statistics is not significant. As a result, the null of instruments validity is not rejected.

Results obtained after Arellano-Bond procedure suggest that materials inventory investment is not sensitive to proxy variable R. In other words, increase in the ratio of bank borrowing to the total short term borrowing does not make an impact on materials inventory investment. On the other hand, finished goods inventories' equation has positive coefficient on the proxy variable. This fact suggests a presence of sensitivity of finished goods inventory investment to availability to external finance and to loan supply shocks.

Following Kashyap et al. (1993), Guariglia (1999), Guariglia and Mateut (2009) the influence of loan supply is investigated with the help of a proxy variable R. However, one might think that this variable captures both the loan supply and the loan demand. The lagged proxy is less sensitive to loan demand of current period, because it can capture only expectations about future demand. Due to this, including the proxy lag ($R_{i,t-1}$) to the model and compare results with results for obtained for $R_{i,t}$ might be helpful in interpreting the influence of proxy. Therefore, described above estimation procedure is also implemented to the model with proxy lag. Results are presented in Table 6 and Table 7.

Obtained results suggest that the coefficient on lagged proxy, similarly to the coefficient on proxy, is significant for finished goods inventories and insignificant for materials inventories. Furthermore, the coefficient on proxy lag is also positive (1.56) but less in magnitude compared to coefficient on proxy variable (3.76[17]).

[17] Value is taken from Table 5, GMM (Arellano-Bond) specification

Table 6. Estimation results. OLS, OLS+industry time effect, FE, Arellano-Bond (GMM) procedure. Materials inventories

Variables	OLS	OLS+industry-time effect	FE	GMM
$I^m_{i,t}$	-0.136***	-0.137***	-0.598***	-0.554***
	(-40.73)	(-40.66)	(58.75)	(6.57)
$\Delta S_{i,t}$	0.228***	0.225***	0.255***	0.353***
	(30.26)	(29.69)	(31.66)	(9.67)
$S_{i,t-1}$	0.118***	0.119***	0.279***	0.370***
	(32.15)	(32.12)	(37.33)	(8.37)
$R_{i,t-1}$	0.062***	0.060***	0.015	0.060
	(4.49)	(4.36)	(0.85)	(0.74)
Industry-time dummies	no	yes	no	yes
N	21189	21189	21189	15135
adj.	0.100	0.100	0.218	
AR1 test (p-value)	-	-	-	0.000
AR2 test (p-value)	-	-	-	0.199
Hansen test (p-value)	-	-	-	0.305

t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7. Estimation results. OLS, OLS+industry time effect, FE, Arellano-Bond(GMM) procedure. Finished goods inventories

Variables	OLS	OLS+industry-time effect	FE	GMM
$I_{i,t}^{f}$	-0.121***	-0.121***	-0.656***	-0.646***
	(-35.91)	(-35.80)	(49.00)	(4.89)
$\Delta S_{i,t}$	0.179***	0.177***	0.223***	0.353***
	(12.58)	(12.34)	(14.96)	(5.49)
$S_{i,t-1}$	0.112***	0.113***	0.280***	0.388***
	(20.65)	(20.48)	(21.92)	(5.95)
$R_{i,t-1}$	0.073**	0.073**	0.042	1.516**
	(2.83)	(2.82)	(1.30)	(3.07)
Industry-time dummies	no	yes	no	yes
N	21189	21189	21189	15135
adj. R2	0.062	0.062	0.031	-
AR1 test (p-value)	-	-	-	0.000
AR2 test (p-value)	-	-	-	0.176
Hansen test(p-value)	-	-	-	0.212

t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Hence, there is an evidence to think that proxy variable defined as a ratio of bank borrowing to total short term debt may also capture shifts in loan demand, but this ratio still may be used as a proxy for loan supply shocks.

The main focus of the study is the influence of loan supply shocks on materials and finished goods inventories. However, to determine whether shocks in the loan supply make an impact on the inventories behavior, the magnitude of influence of other financial variables (interest rate, coverage ratio and internal funds) should be investigated. To explore the possibility of multicollinearity between financial variables, model (5) is also estimated with each variable separately. Table 8 and Table 9 represent all results obtained after using Arellano-Bond procedure. Tables do not compare results obtained after OLS, FE and Arellano-Bond procedures, but one can easily do this using results presented in

Appendix B. It is worth to note, that all coefficient on lagged dependent variable lies within OLS and FE coefficients. Hence, finite-sample bias is unlikely to appear under this specification. Arellano-Bond and Hansen tests do not indicate any problem with model specification.

However, for some specifications the null of Arellano-Bond AR2 test is not rejected for 5 percent significant level, but it could be rejected for higher p-value. So, one should take this into account during interpretation of result. Results suggest that both internal fund and coverage ratio do not influence inventory investment's behavior.

Table 8. Estimation results. Arellano-Bond procedure. Materials inventories

Variables	(1)	(2)	(3)	(4)
$I^m_{i,t}$	-0.496***	-0.539***	-0.461***	-0.547***
	(6.58)	(2.00)	(4.00)	(2.07)
$\Delta S_{i,t}$	0.285**	0.907**	0.671**	0.880**
	(2.73)	(3.21)	(2.99)	(3.14)
$S_{i,t-1}$	0.221**	0.443*	0.294*	0.442*
	(2.94)	(2.37)	(2.15)	(2.55)
$R_{i,t}$	-0.266	0.287		
	(-1.01)	(0.48)		
$IF_{i,t}$	0.044		0.011	
	(1.21)		(0.17)	
$CR_{i,t}$	0.000			-0.001
	(0.71)			(-0.68)
N	15135	12108	12108	12108
AR1 test (p-value)	0.000	0.000	0.000	0.000
AR2 test (p-value)	0.108	0.057	0.053	0.067
Hansen test (p-value)	0.362	0.418	0.089	0.455

t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: industry-time dummies were included to the estimation using Arellano-Bond procedure

Table 9. Estimation results. Arellano-Bond procedure. Finished goods inventories

Variables	(1)	(2)	(3)	(4)
$I^{f}_{i,t}$	-0.639**	-0.502***	-0.520***	-0.523***
	(2.97)	(4.10)	(6.51)	(6.66)
$\Delta S_{i,t}$	0.406***	0.400***	0.223**	0.221***
	(4.61)	(4.28)	(2.97)	(5.17)
$S_{i,t-1}$	0.464***	0.419***	0.250**	0.248***
	(4.12)	(4.21)	(2.61)	(5.95)
$R_{i,t}$	2.096***	3.760***		
	(4.51)	(3.92)		
$IF_{i,t}$	-0.043		-0.003	
	(-0.70)		(-0.06)	
$CR_{i,t}$	-0.000			-0.000
	(-0.53)			(-0.51)
N	15135	18162	15135	15135
AR1 test (p-value)	0.000	0.000	0.000	0.000
AR2 test (p-value)	0.216	0.166	0.056	0.058
Hansen test (p-value)	0.563	0.201	0.128	0.127

t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Notes: industry-time dummies were included to the estimation using Arellano-Bond procedure

Also, one can see that proxy for loan supply shocks make a significant and positive effect on inventories investment. This output confirms the influence of loan supply shocks across firm and time. All estimation procedures give the same result: finished goods inventory investment is more sensitive to loan supply shocks compared to materials inventory investment. This finding is consistent with argument of presence of the link between inventory investment and loan supply shocks. Furthermore, this influence is more important for finished goods inventories.

5.2. Discussion of the results

This section provides analysis and limitations of the result obtained after estimation discussed in previous chapter's section.

Taken together, the results of estimation show that all control variables (lagged inventories, change in sales and lagged sales) are significant over different models. Furthermore, speed of adjustment (coefficient on lagged inventory level) is always negative. This confirms robustness of obtained results and goes in line with literature (e.g. Guariglia 1999).

Also, obtained results suggest that coverage ratio and internal funds do not make a significant impact on both materials and finished goods inventories for big manufacturing firms. This is consistent with findings in the literature (e.g. Gertler and Gilchrist 1994) and confirms hypothesis that big firms are expected to be less sensitive to internal funds compared to small firms, because they are less financially restricted.

The fact that finished goods inventories are sensitive to proxy variable can be interpreted as sensitivity to availability of external finance, because proxy is defined as a ratio of bank borrowing to short term borrowing might be also an indicator of access to external finance. This finding differs from results obtained by Guariglia and Mateut (2009). Authors find that proxy variable make an impact only for purely domestic constraint UK firms, while financially unconstraint firms are insensible to movements in proxy variable. Different sensitivities of UK and Ukrainian firms to ratio of bank borrowing to short term borrowing might be explained by their different global engagement.

Positive impact of proxy for loan supply on finished goods inventories suggests that finished goods inventory investment play the role of monetary transmission mechanism. However, insensibility of materials inventory investment to proxy for loan supply shocks suggest that materials inventories are not sensitive to external finance and, as a result, to changes in monetary policy.

CONCLUSIONS AND IMPLICATIONS

This study analyses the sensitivity of the inventory investment to loan supply shocks. Employing balanced panel data of 3027 Ukrainian big manufacturing firms over the period 2000-2008 and using the augmented production-smoothing model paper investigates the inventory investment behavior.

The evidence is provided to coverage ratio and internal funds to have a significant impact on both materials and finished goods inventories. This finding is in line with previous studies and confirms the hypothesis of big firms being sensitive to internal finance.

Estimates, however, contradict to those obtained by Guariglia and Mateut (2009). The results suggest that inventory investment of big manufacturing firms in Ukraine is sensitive to the ratio of bank borrowing to total short-term borrowing. Meanwhile, Guariglia and Mateut (2009) argue that big firms in UK do not face financial constraint due to high level of global engagement. The ambiguity might be explained by the fact that big firms in Ukraine are subject to larger financial constraint due to their poor globally engagement.

The paper also shows significant link between the loan supply and inventory investment. Furthermore, the research suggests that finished goods inventories are sensitive to loan supply shocks, while material inventories are not. This provide some evidence that finished goods inventories are more financially constrained compared to materials inventories; access to external finance does not influence material inventories, but has an impact on finished goods inventories.

The impact of loan supply shocks on finished goods inventories is shown to be positive. Therefore, monetary policy may influence the level of country's inventories. Finished goods inventory investment may be treated as a part of monetary transmission mechanism in Ukraine. Hence, monetary policy may influence economy through this transmission channel.

This paper uses ratio of bank borrowing of Ukrainian firms to the total short-term borrowing as a proxy for loan supply. However, proxy used may capture both loan demand and loan supply sides. Therefore, finding a better proxy, which capture only supply side, is a subject for future research.

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APPENDIX A. DATA

Table A1. Variables notation

Variable	Notation
$I^{m}_{i,t}$	Natural logarithm of materials inventories for firm *i* at time *t*
$I^{f}_{i,t}$	Natural logarithm of finished goods inventories for firm *i* at time *t*
R	Ratio of bank borrowing to short term debt. Bank borrowing is defined as a sum of short-run credits and long-run credits with current backlog; Short-term debt is defined as a sum of bank borrowing and commercial paper borrowing.
$S_{i,t}$	Natural logarithms of sales for firm *i* at time *t*
i	Lending rate: weighted average rate charged by commercial banks on loans in national currency. The rate is weighted by loans amounts
IF	Natural logarithm of internal funds. Internal funds is defined as a sum of available money and equivalents in national currency and available money and equivalents in foreign currency
CR	Ratio of cash-flow to the product of interest rate and short term debt. Short-term debt is defined by commercial papers and short-term bank borrowing.

Table A2. Distribution of firms by using from bank's loans and commercial papers

Type of firms		Number of firms
firms which do not use commercial papers	firms which do not use loans from banks	12644
	firms which use loans from banks	8188
Total		20832
firms which use commercial papers	firms which do not use loans from banks	2492
	firms which use loans from banks	3919
Total		6411

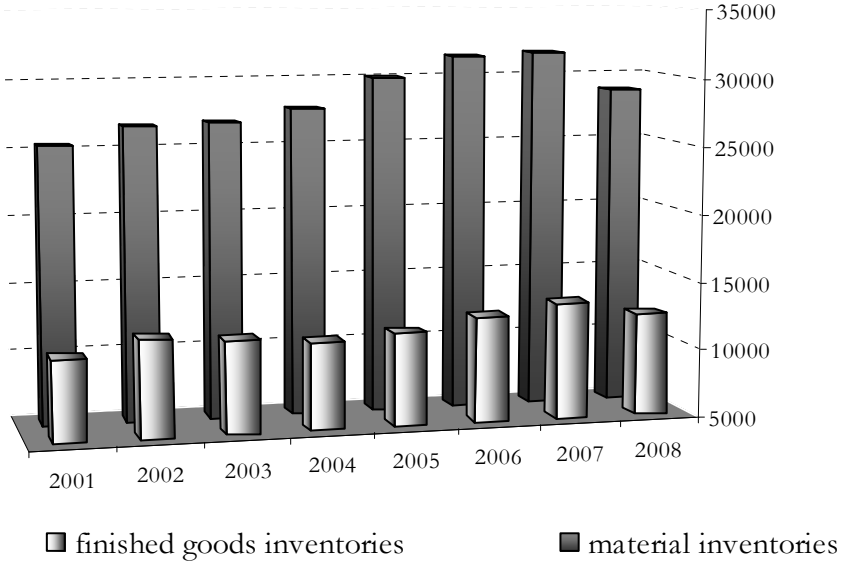

Figure A1. Dynamic of materials inventories and finished goods inventories of manufactures firms. 2001-2008. Millions of 2007[18] UAH.

[18] Producer price index is used to convert all variables in real terms. Source: State Statistics Committee of Ukraine: http://www.ukrstat.gov.ua/

APPENDIX B. ESTIMATION RESULTS

Table B1. Estimation results. OLS procedure. Materials inventories

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$I^{m}_{i,t}$	-0.138***	-0.138**	-0.137**	-0.136**	-0.134***	-0.135**	-0.134**
	(-40.99)	(-40.85)	(-40.9)	(-40.73)	(-40.49)	(-40.48)	(-40.4)
$\Delta S_{i,t}$	0.225***	0.226***	0.227***	0.228***	0.227***	0.227***	0.227***
	(29.88)	(29.96)	(30.24)	(30.26)	(30.22)	(30.04)	(30.22)
$S_{i,t-1}$	0.112***	0.113***	0.118***	0.118***	0.119***	0.116***	0.119***
	(27.17)	(27.38)	(32.17)	(32.15)	(32.31)	(29.09)	(32.30)
$R_{i,t}$	0.093***		0.078***				
	(6.23)		(5.54)				
$R_{i,t-1}$		0.078***		0.062***			
		(5.34)		(4.49)			
i_t	0.030	0.035*	0.024	0.026	0.032*	0.035*	0.032*
	(1.83)	(2.17)	(1.51)	(1.64)	(2.01)	(2.16)	(2.01)
$IF_{i,t}$	0.006*	0.005*				0.004	
	(2.52)	(2.42)				(1.65)	
$CR_{i,t}$	0.000	0.000					0.000
	(0.30)	(0.31)					(0.31)
_cons	-0.177**	-0.193**	-0.190***	-0.196***	-0.223***	-0.217**	-0.223***
	(-3.10)	(-3.40)	(-3.34)	(-3.45)	(-3.95)	(-3.84)	(-3.95)
adj. R2	0.100	0.100	0.100	0.100	0.099	0.099	0.099
N	21189	21189	21189	21189	21189	21189	21189

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B2. Estimation results. OLS procedure including industry-time dummy. Materials inventories

Variables	(1)	(2)	(3)	(4)	(5)	(6)
$I^{m}_{i,t}$	-0.139***	-0.139***	-0.137***	-0.137***	-0.135***	-0.135***
	(-40.94)	(-40.78)	(-40.83)	(-40.66)	(-40.43)	(-40.43)
$\Delta S_{i,t}$	0.223***	0.224***	0.225***	0.225***	0.224***	0.225***
	(29.31)	(29.40)	(29.67)	(29.69)	(29.47)	(29.65)
$S_{i,t-1}$	0.113***	0.114***	0.119***	0.119***	0.117***	0.120***
	(27.12)	(27.37)	(32.14)	(32.12)	(29.09)	(32.28)

Table B2. Estimation results. OLS procedure including industry-time dummy. Materials inventories.- Continued

Variables	(1)	(2)	(3)	(4)	(5)	(6)
$R_{i,t}$	0.093***		0.077***			
	(6.21)		(5.49)			
$R_{i,t-1}$		0.076***		0.060***		
		(5.21)		(4.36)		
$IF_{i,t}$	0.006*	0.005*			0.004	
	(2.57)	(2.45)			(1.69)	
$CR_{i,t}$	0.000	0.000				0.000
	(0.11)	(0.11)				(0.12)
_cons	0.021	0.008	-0.123	-0.029	-0.007	-0.027
	(0.09)	(0.03)	(-0.54)	(-0.13)	(-0.03)	(-0.12)
Industry-time effect	yes	yes	yes	yes	yes	yes
adj. R2	0.101	0.100	0.100	0.100	0.099	0.099
N	21189	21189	21189	21189	21189	21189

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B3. Estimation results. FE procedure. Materials inventories

Variables	(1)	(2)	(3)	(4)	(5)	(6)
$I^m_{i,t}$	-0.600**	-0.600***	-0.598***	-0.598***	-0.599***	-0.598***
	(58.42)	(58.39)	(58.77)	(58.75)	(58.52)	(58.77)
$\Delta S_{i,t}$	0.251***	0.250***	0.255***	0.255***	0.251***	0.255***
	(30.91)	(30.91)	(31.67)	(31.66)	(31.04)	(31.65)
$S_{i,t-1}$	0.269***	0.269***	0.280***	0.279***	0.271***	0.279***
	(34.30)	(34.23)	(37.35)	(37.33)	(34.82)	(37.32)
$R_{i,t}$	0.037		0.021			
	(1.91)		(1.18)			
$R_{i,t-1}$		0.035		0.015		
		(1.94)		(0.85)		
$IF_{i,t}$	0.011***	0.011***			0.010***	
	(3.86)	(3.72)			(3.64)	
$CR_{i,t}$	0.000	0.000				0.000
	(0.37)	(0.38)				(0.42)
_cons	1.503***	1.511***	1.454***	1.456***	1.502***	1.460***
	(23.69)	(23.82)	(23.33)	(23.38)	(23.76)	(23.49)
adj. R2	0.219	0.219	0.218	0.218	0.219	0.218
N	21189	21189	21189	21189	21189	21189

t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B4. Estimation results. OLS procedure. Finished goods inventories

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$I_{i,t}^{f}$	-0.122**	-0.123**	-0.121**	-0.121**	-0.120**	-0.120**	-0.120**
	(-36.04)	(-36.10)	(-35.89)	(-35.91)	(-35.79)	(-35.77)	(-35.79)
$\Delta S_{i,t}$	0.177***	0.177***	0.179***	0.179***	0.179***	0.180***	0.179***
	(12.35)	(12.42)	(12.57)	(12.58)	(12.60)	(12.58)	(12.60)
$S_{i,t-1}$	0.105***	0.105***	0.113***	0.112***	0.115***	0.115***	0.115***
	(15.61)	(15.71)	(20.75)	(20.65)	(21.27)	(18.20)	(21.27)
$R_{i,t}$	0.105***		0.070**				
	(3.71)		(2.66)				
$R_{i,t-1}$		0.108***		0.073**			
		(3.94)		(2.83)			
i_t	0.165***	0.174***	0.159***	0.159***	0.166***	0.166***	0.166***
	(5.36)	(5.62)	(5.20)	(5.21)	(5.46)	(5.42)	(5.46)
$IF_{i,t}$	0.003	0.003				-0.001	
	(0.76)	(0.64)				(-0.18)	
$CR_{i,t}$	0.000	0.000					0.000
	(0.18)	(0.19)					(0.18)
_cons	-0.814**	-0.838**	-0.828**	-0.825**	-0.860**	-0.861**	-0.860**
	(-7.53)	(-7.74)	(-7.67)	(-7.65)	(-8.02)	(-8.01)	(-8.02)
adj. R2	0.065	0.065	0.064	0.064	0.064	0.064	0.064
N	21189	21189	21189	21189	21189	21189	21189

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B5. Estimation results. OLS procedure including industry-time effect. Finished goods inventories

Variables	(1)	(2)	(3)	(4)	(5)	(6)
$I_{i,t}^{f}$	-0.123***	-0.123***	-0.121***	-0.121***	-0.121***	-0.121***
	(-35.92)	(-35.98)	(-35.77)	(-35.80)	(-35.65)	(-35.68)
$\Delta S_{i,t}$	0.175***	0.176***	0.177***	0.177***	0.178***	0.177***
	(12.11)	(12.19)	(12.33)	(12.34)	(12.34)	(12.35)
$S_{i,t-1}$	0.106***	0.106***	0.113***	0.113***	0.116***	0.115***
	(15.57)	(15.66)	(20.62)	(20.48)	(18.15)	(21.11)
$R_{i,t}$	0.100***		0.066*			
	(3.55)		(2.49)			
$R_{i,t-1}$		0.107***		0.073**		
		(3.90)		(2.82)		

Table B5. Estimation results. OLS procedure including industry-time effect. Finished goods inventories.-Continued

Variables	(1)	(2)	(3)	(4)	(5)	(6)
$IF_{i,t}$	0.003	0.002			-0.001	
	(0.67)	(0.53)			(-0.28)	
$CR_{i,t}$	0.000	0.000				0.000
	(0.08)	(0.09)				(0.09)
_cons	0.277	0.255	-0.433	0.228	0.224	-0.636
	(0.64)	(0.59)	(-1.00)	(0.52)	(0.51)	(-1.46)
Industry-time dummies	yes	yes	yes	yes	yes	yes
adj. R2	0.066	0.066	0.065	0.066	0.065	0.065
N	21189	21189	21189	21189	21189	21189

t statistics in parentheses, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table B6. Estimation results. FE procedure. Finished goods inventories

Variables	(1)	(2)	(3)	(4)	(5)	(6)
$I^{f}_{i,t}$	-0.656***	-0.656***	-0.656***	-0.656***	-0.656***	-0.656***
	(48.95)	(48.95)	(49.03)	(49.00)	(49.02)	(49.03)
$\Delta S_{i,t}$	0.220***	0.220***	0.222***	0.223***	0.220***	0.222***
	(14.64)	(14.68)	(14.93)	(14.96)	(14.70)	(14.93)
$S_{i,t-1}$	0.274***	0.274***	0.280***	0.280***	0.276***	0.280***
	(20.10)	(20.11)	(21.88)	(21.92)	(20.41)	(21.89)
$R_{i,t}$	0.013		0.003			
	(0.37)		(0.10)			
$R_{i,t-1}$		0.053		0.042		
		(1.57)		(1.30)		
$IF_{i,t}$	0.005	0.005			0.005	
	(1.01)	(0.99)			(0.93)	
$CR_{i,t}$	-0.000	-0.000				-0.000
	(-0.14)	(-0.13)				(-0.13)
_cons	0.882***	0.876***	0.860***	0.850***	0.880***	0.860***
	(7.61)	(7.56)	(7.54)	(7.46)	(7.61)	(7.57)
adj. R2	0.030	0.031	0.031	0.031	0.031	0.031
N	21189	21189	21189	21189	21189	21189

t statistics in parentheses, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$