Financial Constraints and Investment: The Case of Ukraine

by

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Abstract

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The paper examines the issue of financial constraint in a large sample of Ukrainian joint-stock companies in the framework of flexible accelerator investment model. Despite underdeveloped local capital market, Ukrainian firms are found to be unconstrained on average. Moreover, the relationship between cash flow and investment is found to be negative in most size and ownership categories. The result is consistent with previous researches which found joint stock companies to be financially unconstrained as they have better access to capital market. The result is also influenced by large share of state owned companies which are likely to operate under soft budget constraint, and foreign owned companies which invest heavily after recent privatization.

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Chapter 1

INTRODUCTION

Investment is one of the most interesting and important areas especially in transition countries. However, in my research I am not going to find out how firms attract investment – that has been already done many times. What I am interested in is how firms make decisions about their own investments and how financial structure affects those decisions.

Since Modigliani and Miller, whose paper *The Cost of Capital, Corporate Finance and the Theory of Investment* (1958) became the corner stone of modern corporate finance, it was assumed that the structure of corporate capital does not influence investment decisions of the firm as long as both external and internal finance have equal price. That is the essence of Modigliani-Miller theorem which is based on assumption that perfect capital markets exist.

However, in the recent few decades this theory was carefully examined using empirical evidence and it was found that financial structure of the firm does influence its investment decisions. The most important works in this field are Fazzari, Hubbard, and Petersen (hereinafter FHP, 1988) and Kaplan and Zingales (1997) in developed countries, while in transition the best paper in this area is, probably, Lizal and Svejnar (2002). The reason for rejecting Modigliani-Miller

assumptions is that external financing may be more costly than internal funds, although debate on this question is not finished. The most popular explanation why costs differ across different sources is asymmetric information. Financial constraints are important even in countries with developed capital market, such as the US, Germany, or Japan (see for example Hoshi, Kashyap, and Scharfstein (1991) for Japan, or Chirinko and von Kalckreuth (2002) for Germany). Hence, there is almost no doubts that it will be also the case in countries with underdeveloped capital market, which, unfortunately, includes Ukraine. Thus, the purpose of my research is to investigate the influence of financial constraints in Ukrainian companies on their investment decisions. The most important question I want to answer is how much Ukrainian firms depend on their own financial sources and how that differs across different categories of firms. In view of Ukraine being a transition economy with strong need for investment that must be very useful information. Moreover, this knowledge is necessary to understand how monetary and tax policy influence investment. FHP (1988), for example, argue that it works not only through changing interest rates and investment opportunities but also by influencing internal funds which may be essential for investment decisions. The impact of taxes on investment also changes substantially if investment-cash flow sensitivity is taken into account. Another example: Zaderiy (2003) used investment-cash flow sensitivity in analyzing monetary transmission mechanism in Ukraine.

The common approach to estimate empirically the financial constraints suggests using traditional investment equation $\frac{I_t}{K_{t-1}} = a + b\frac{Q_t}{K_{t-1}} + c\frac{CF_t}{K_{t-1}} + v$ (where I is investment, K - capital, Q – proxy for investment opportunities, v - error term) normalized by capital and extended with cash flow variable *CF* which is assumed to be a proxy for internal funds. The idea behind is that for financially unconstrained firms the coefficient *c* must be insignificant, while for constrained firms it takes a positive value. If firm cannot afford external financing its investment decisions are expected to depend on available internal funds proxied by *CF*.

Investment opportunities in developed countries are usually proxied by market-to-book value ratio. However, this indicator is usually unavailable or highly unreliable in transition due to underdeveloped capital markets. What is used instead is sales or sales change, which is theoretically justified by neoclassical and accelerator investment models. Furthermore, estimation is usually done not only for the whole sample of firms, but also for subsamples differentiated a priori by the degree of financial constraint based on dividend payouts (as FHP, 1988), creditworthiness indicators (as Chirinko and von Kalckreuth, 2002), bond ratings (as Whited, 1992) etc.

In transition most of those indicators are simply unavailable and hence can hardly be used. Data is not easy to obtain even in the case it exists. What is usually used to distinguish firm is ownership (Lizal and Svejnar, 2002), or

belonging to financial-industrial groups (Perotti and Gelfer, 2001), or simply size of the firm.

As I estimate financial constraints for Ukraine, which is a transition economy, all abovementioned problems apply. Hence, I use a flexible accelerator model with sales differences being a proxy for investment opportunities and differentiate firms by ownership. I use a large sample of Ukrainian joint-stock companies for estimation, including about 1300 firms and covering the period of 1999-2002.

As a result of my research I provide estimates of financial constraints faced by Ukrainian companies across various kinds of firms differentiated by ownership. Such information has an important policy application: financial constraints influence effect of monetary and tax policy. This influence varies with the magnitude of the constraint and differs across different groups of firms thus making the impact of monetary and tax policy uneven.

The rest of the paper proceeds as following: Chapter 2 covers the related literature on financial constraints, Chapter 3 sets the basic model for estimation, Chapter 4 contains data description, Chapter 5 summarizes empirical findings of the paper, and then conclusion follows. In appendices one can find detailed data description as well as regression outputs and related tests.

Chapter 2

LITERATURE REVIEW

The story of financial constraints and their influence on firm's decisions starts with Modigliani and Miller (hereinafter MM) who put the corner stone of modern financial theory. In "The Cost of Capital, Corporation Finance and the Theory of Investment" (1958) they proved that under a set of assumptions the market value of a firm does not depend on its capital structure. In equivalent way, this statement can be reformulated as follows: "The average cost of capital to any firm is completely independent of its capital structure" (MM, 1958). However, the assumptions they made are crucial for this conclusion. The main assumtion is that any firm acts in a perfect capital market. It is due to this assumption that arbitrage can take place and equate the cost of capital for the firms with different leverage. This, in turn, implies that investment decisions must be independent of financial variables as long as managers maximize firm's market value, which is independent of financial structure according to MM's finding.

This conclusion provided a foundation for neoclassical investment theory. In this theory a firm solves an intertemporal optimization problem independently of financial factors (see, for example, Hall and Jorgenson, 1967). Investment here

is only a function of investment opportunities (usually expressed as Tobin's Q), which is consistent with profit maximization, and there is no reason why investment should be influenced by financial variables.

Jorgenson and Siebert (1968) empirically showed this model to be superior to liquidity model but their result was reversed by Elliot (1973) on a wider sample.

Moreover, a number of works emerged showing that capital markets are far not perfect and providing explanations to those imperfections. The major reasons are asymmetric information and incentive problems. The former lies in different information distribution between managers and potential investors and generates the so called "lemons" problem (Akerlof, 1970): investors cannot distinguish reliable and bad firms and therefore require an additional premium to compensate the risk of bad investment. Such models were developed by Myers and Majluf (1984) and Greenwald, Stiglitz, and Weiss (1984) concerning equity markets.

The latter problem of incentives concerns the difference between managers' and owners' goals, which introduce the necessity to monitor managers and generates costs for owners. This makes an outside investor to require a higher return to cover monitoring costs and compensate moral hazard risk. An example of such an approach can be found in Jensen and Meckling (1976).

The general conclusion which can be drawn from all above mentioned is that: "(1) imperfect information generates costs for outside investors, making external finance more expensive than internal finance, and (2) internal resources are not only relatively cheaper than external sources of finance but also reduce the cost of internal financing" (Saltari, 2001). With these findings capital markets can no more be assumed to be perfect and consequently the results of Modigliani-Miller theorem might be expected to fail in case of imperfect capital markets. In other words, one could expect financial variables to be important for investment decisions of a firm acting in environment with asymmetric information.

This proposition was nicely supported by the work of Fazzari, Hubbard, and Peterson (hereinafter FHP)(1988). They showed on a sample of 422 US manufacturing firms that internal finance (proxied by cash-flows) does influence firms' investment, although the magnitude of that influence varies across firms. According to FHP any firm has three possible sources of financing its investment needs: internal finance (retained profits), financing by debt, and financing by issuing new equity. This distinction is important because there is a certain hierarchy of these sources based on their costs. In a perfect capital market environment it does not matter for a firm how to finance its investment. With perfect information external finance can be easily obtained and serves to smooth fluctuations of internal funds. Internal finance is not a limiting factor of

investment and hence there is no reason to expect any significant relationship between them. These considerations can be applied to large mature companies with long investment history. Outsiders can easily predict the results of investment projects of these firms and thus asymmetric information problem is of minor importance.

On the contrary, small or young firms' activities are difficult to predict and investors require a premium for their risks. It is here where the hierarchy of financial sources is in effect because of substantial difference in the cost of internal and external funds. While making a decision about its investment a company relies, first of all, on its internal sources as they are cheapest and easiest to use. When internal funds are exhausted, the firm can resort to borrowing from banks. However, such a financing is more costly and thus can be used only for projects with higher expected q (market to book value ratio). It must be pointed out that the marginal cost of financing by debt increases with leverage as long as banks find it riskier to deal with higher-leverage firms. Still, the cost of debt is lower than that of issuing new equity because lenders usually have more expertise in monitoring their clients and thus can better identify risky projects, while potential shareholders will require a "lemons" premium to compensate for monitoring and higher risk.

It is clear from the previous discussion that the impact of internal funds on investment must differ across firms, depending on their financial status. FHP

deviate from the widespread assumption of "a representative firm" and divide their sample into three groups based on dividend payouts. The underlying assumption here is that financially unconstrained firms can afford to use their internal funds to pay dividends (indeed MM theorem applies to those firms, saying that market value of the firm does not depend on dividend payouts), while financially constrained firms choose to retain their profits and reinvest them. It must be admitted that this discriminative approach became traditional in financial constraints literature.

The major finding of FHP's work was that all firms' investments are sensitive to availability of internal finance, but this sensitivity increases with degree of financial constraint (as defined in FHP based on dividend payouts). Those firms which retain almost all their income are most sensible to cash flow and liquidity. The authors come with conclusion that "financial constraints in capital markets can magnify the macroeconomic effect of shocks to cash flow or liquidity that reduces some firms' access to low cost finance". They also point out the implications for tax policy: financially constrained firms take into account not only marginal tax on their new investments, but also average tax rate as it influences their investments through internal finance. However, it must be borne in mind that this applies only to some firms and thus the effect of the same tax can differ across firms depending on their financial status. The importance of FHP conclusions becomes even stronger if we take into account the

representativeness of the sample they used. The sample they analyzed contains only 49 of 422 firms that were classified as financially constrained. However, those all firms were the companies which are of particular interest for investors as long as data was taken from Value Line – a company providing investment research covering only selected firms. It is obvious, that the share of financially constrained firms in the population must be higher, thus enhancing FHP's conclusion about importance of the internal finance.

In their work, FHP provide a detailed explanation of why and how financial constraints influence investment. However, several works followed FHP, reconsidering their conclusions. Kaplan and Zingales (1997) analyzed thoroughly a subsample of financially constrained firms from FHP and came to the conclusion exactly opposite to that of FHP. They revised the degree of financial constraint of each firm in each year based on annual reports, financial statements etc. to discover that there are "85.3 percent of firm-years in which [there is] no evidence of financing constraints that restrict investment". Moreover, estimation results showed that investment is more sensitive to cash flow in least constraint firms which contradicts to initial FHP findings. To explain it Kaplan and Zingales showed mathematically that relationship between financial constraints and investment-cash flow sensitivity depends on the particular form of production function and hence cannot be taken as given.

The results of Kaplan and Zingales, which weakest point was a small sample, are further supported by Cleary (1999). On a large diversified sample of 1317 US firms he managed to obtain similar results. Cleary based his sorting on changes in dividend payout supported with a number of financial variables (assets-to-liabilities ratio, debt ratio, sales growth etc.). He demonstrated that "the investment decisions of firms with high creditworthiness are significantly more sensitive to the availability of internal funds than are firms that are less creditworthy". His explanatory arguments come to the fact that any firm relies firstly on its internal finance. However, this can be applied in any direction and thus is not very convincing.

Nevertheless, the method employed by Cleary does not necessarily lead to the conclusion he made. Chirinko and von Kalckreuth (2002) analyzed a large sample of German firms discriminating them by creditworthiness ratio determined by Bundesbank. This approach is close to that of Cleary, but the result is different. Chirinko and von Kalckreuth found that investment-cash flow sensitivity is significantly higher for constrained firms which support the original conclusion of FHP.

Thus, the fact that financial constraints play important role in investment decision became commonly accepted. However, the nature of this influence and its direction remain questionable and seems to be dependent on the specific approach utilized in this or that research, especially in determining the degree of

financial constraint. From this point of view Ploetscher and Rottmann (2002) research is interesting. Their sample comes from the results of two surveys conducted among German manufacturing firms. They used ordered probit to estimate the influence of financial constraints on changes in investment. In this case financial constraint dummy were determined based on the use of trade credit, which is a very expensive source of external finance; thus only financially constrained firm will resort to it. The results of the estimation prove that investment growth is significantly lower for constrained firms and is positively related to the sales growth which is considered to be an indicator of liquidity growth. This research once more provides a support to the traditional approach to the relationship between investment and financial constraints.

Some of the above mentioned approaches, as well as a number of others have been analyzed in Saltari's (2001) survey on financial structure and investment. He discusses the most popular models used to explain investment, such as q-theory, Euler's equation, and VAR-approach (used to estimate marginal q). All of them initially do not contain any financial variables. The latter are included in attempt to estimate empirically the importance of financial constraints. The author concludes that

(1) by now theoretical models fail to include financial variables and thus cannot provide a solid background for empirics; hence a lot of work must be done to integrate theory and empirics;

(2) the nature of the financial constraint is important for the relationship between financial variables and investment (the way constrained and unconstrained firms are distinguished can influence the results).

The situation becomes even worse when it comes to transition countries. Besides problems with theoretical background for financial constraints the data questions become of the primary importance. In transition one cannot expect stock market to be very developed and thus market values of the companies (if available) hardly reflect their real values and hence cannot be used as a proxy for investment opportunities. In such a situation an accelerator model is more applicable. The flexible accelerator model assumes that an optimal level of capital K_t^* exists and each period a firm closes a gap between K_t and K_t^*. Furthermore, the output is proportional to K_t^*. With this setting investment depends on output as $\frac{I_t}{K_{t-1}} = a + \sum_{i=1}^{m} b_i \frac{Y_{t-i}}{K_{t-1}} + e_t$, where all variables are normalized on capital. Here output controls for investment opportunities.

This type of model was employed by Lizal and Svejnar (2002) in their analysis of a large sample of Czech firms. In their work another important question was touched: How to distinguish constrained and unconstrained firms? The most obvious way is simply differentiate them by size or, as it was actually done, by ownership. They divided all firms into twelve groups: state-owned,

foreign joint-stock companies, private joint-stock companies, private limited liability companies, foreign limited liability companies etc. The general result confirms the existence of financial constraints in five out of twelve categories. The unconstrained firms include foreign owned (which can obtain financing from abroad) and state owned firms. The latter can be explained by existence of soft budget constraint. Another important result emerges from separate regressions for each year. As time passes the financial variables become of less importance as a result of developing market structures.

An example of another approach to discriminating firms can be found in Perotti and Gelfer (2001). They studied Russian firm and divided them into three groups: independent firms, those belonging to horizontal financial-industrial groups (FIG), and hierarchical FIGs. As an investment opportunity indicator, a proxy for Tobin's q was constructed based on market-to-book value ratio together with profitability and leverage indicators. The authors found that investment of individual firms and industrial alliances (horizontal FIGs) is lead mostly by internal funds and don't account for profitability (q coefficients are insignificant). But the result for bank-led (vertical) FIGs is striking: the relationship between cash flows and investment appeared to be negative. Two explanations are possible for this fact: either controlling banks reallocate investment for more effective investment or simply the profits are appropriated.

Since investment in this group of firms does account for profitability measured by the proxy for Tobin's q, the authors incline to the former hypothesis.

A comparative analysis of financial constraints in transition countries is done by Konings, Rizov, and Vandenbussche (2002). On the data for Poland, Czech Republic, Romania, and Bulgaria they found the presence of financial constraints in the former two countries, while in the latter two cash flow is an insignificant determinant of investment. However, this is concluded to be not a result of perfect capital markets, but rather a signal for soft budget constraints in slowly reforming economies.

From those researches it can be concluded that the organizational structure and ownership are the most usable factors to discriminate firms. Any indications of financial constraints must be interpreted cautiously. It is difficult to find a good control variable for investment opportunities: poor choice can result in overestimated importance of financial constraints because financial variables are usually correlated with investment opportunities. The absence of financial constraints also must be taken carefully as it is often due to soft budget constraint.

Chapter 3

METHODOLOGY[1]

As I want to estimate the relationship between investment, output, and financial variables, it is necessary to specify first the form of that relationship. Investment demand can be derived twofold: either from accelerator model, or from neoclassical investment demand model. Although those two models use different approaches, they lead to similar results in terms of the form of resulting investment demand equation.

The capital accumulation constraint is traditionally presented as

$$K_t = (1-\delta)K_{t-1} + I_t$$

with K_t being current capital stock, I_t - gross investment, and δ - depreciation. Gross investment can be divided into two parts: replacement investment and net investment, such that

$$I_t = I_t^{net} + I_t^{replacement}$$

$$I_t^{replacement} = \delta K_t$$

$$I_t^{net} = I_t - \delta K_t$$

[1] Following Lizal and Svejnar (2002).

Let's denote output as Y_t and assume that there exists some optimal level of capital K_t^*. According to flexible accelerator model developed by Koyck (1954), a firm will reduce the gap between actual and optimal level of capital by some proportion λ, so that $I_t^{net} = \lambda(K_t^* - K_{t-1})$. Furthermore, output is assumed to be proportional to optimal capital level: $Y_t = \mu K_t^*$, which make it possible to express net investment as

$$I_t^{net} = \lambda(K_t^* - K_{t-1}) = \frac{\lambda}{\mu} Y_t - \lambda K_{t-1}.$$

Hence, the level of capital at present time is

$$K_t = K_{t-1} + I_t^{net} = K_{t-1} + \frac{\lambda}{\mu} Y_t - \lambda K_{t-1} = \frac{\lambda}{\mu} Y_t + (1-\lambda) K_{t-1}$$

We can derive then the same expressions for all $K_{t-1}, K_{t-2,} K_{t-3}$ etc. and substitute them one into another to obtain

$$K_t = \frac{1}{\mu}(\lambda Y_t + \lambda(1-\lambda) Y_{t-1} + \lambda(1-\lambda)^2 Y_{t-2} + ...)$$

Substituting it into expression for gross investment we will obtain

$$I_t = \frac{1}{\mu} \sum_{i=0}^{\infty} \lambda(1-\lambda)^i Y_{t-i} - (1-\delta) K_{t-1} \qquad (1)$$

This specification is a distributed lag model requiring coefficients to decline in geometric order. In related literature it accustomed to relax this requirement by setting some number of lags experimentally without imposing any restrictions on

coefficients (see for example Lizal and Svejnar, 2002). Thus, the final equation with this specification becomes

$$I_t = a + \sum_{i=0}^{m} b_i Y_{t-i} + cK_{t-1} + e_t$$

As one can see this is the equation for gross investment. However, it is also possible to derive a similar expression for net investment. Take our expression for K_t as well as for K_{t-1}: their difference will be the net investment:

$$I_t^{net} = K_t - K_{t-1} = \frac{1}{\mu}\left(\lambda \Delta Y_t + \lambda(1-\lambda)\Delta Y_{t-1} + \lambda(1-\lambda)^2 \Delta Y_{t-2} ...\right) \qquad (1a)$$

Again, instead of infinite number of lags, some finite number is determined experimentally.

Investment equations of the same form can be also obtained from neoclassical model based on profit maximization:

$$\max \pi_t = p_t Y_t - w_t L_t - r_t K_t$$
$$s.t. Y_t = f(K, L)$$

If we consider Cobb-Douglas production function $Y = K^a L^{1-a}$ and assume one-period investment ordering (investment is fully installed in one period) we will obtain from FOC that $K_t^* = a\frac{p_t}{r_t} Y_t$ which yields net investment

$$I_t^{net} = \Delta K_t^* = a\frac{p_t}{r_t}\left(\Delta Y_t\right) \qquad (1a')$$

and gross investment is defined by equation

$$I_t = \sum_i b_i a \frac{p_{t-i}}{r_{t-i}} Y_{t-i} + \delta K_{t-1} + e_t, \quad i = \overline{1,m} \qquad (1')$$

As one can see those expressions are similar to equations (1a) and (1) respectively, which have been derived in the flexible accelerator model. Note also, that net investment equation in this case has no lags.

These equations are usually further normalized by the level of capital stock:

$$\frac{I_t}{K_{t-1}} = a + \sum_i b_i \frac{Y_{t-i}}{K_{t-1}} + \varepsilon_t . \qquad (2)$$

$$\text{and} \quad \frac{I_t^{net}}{K_{t-1}} = a + \sum_i b_i \frac{\Delta Y_{t-i}}{K_{t-1}} + \varepsilon_t \qquad (2a)$$

The number of items under the sum can be infinite and, as it was mentioned, is usually chosen experimentally. As my dataset is limited to only four years this is the most I can use in my research. Lizal and Svejnar (2002) in their estimation used four lags having quarterly data. They argued that using more lags yields similar results. That may be the consequence of some annual pattern in firms' behavior, and thus must be captured with one or two lags. Moreover, Ukrainian firms still rarely consider long term prospects and are more oriented at short-term benchmarks, which justifies usage of few lags.

Note also, that net investment equation in neoclassical investment model has no lagged variables at all which is quite convenient in view of limited data.

It is necessary to point out that equations (2) and (2a) shows only demand for investment, implicitly assuming investment supply to be perfectly elastic.

However, assuming possibility of existing financial constraint we cannot rely on elastic supply any more. To incorporate this possibility into investment equation such as (2) it is usually augmented by some cash flow variables, following FHP (1988) approach:

$$\frac{I_t}{K_{t-1}} = a + \sum b_i \frac{Y_{t-i}}{K_{t-1}} + \frac{CF_t}{K_{t-1}} + \varepsilon_t \qquad (3)$$

Financial variables available usually include profit, retained earnings, cash flow generated etc. In my research I use profit as it is directly available from financial statements.

Under hypothesis of perfect capital market, coefficient of a financial variable must be zero as company's investment is not restricted by own funds and it can easily resort to external financing. Hence, in financial constraints literature significant positive coefficient of a cash flow variable is interpreted as an indication of limited access to external resources. However, in transition this coefficient has one more important meaning. As Lizal and Svejnar (2002) note, "in transition context, the inclusion of the profit variable as a regressor allows one also to test the soft budget constraint hypothesis". Indeed, as a firm operating under SBC has free access to external financing regardless of profitability, its own resources can be expected to be of minor importance for its investment, and hence the coefficient of a financial variable would be zero. Negative coefficient of profit variable in this context would be even stronger sign of soft budget

constraint, as it would show that losses-making firms have better access to banking credit than profitable ones.

Chapter 4

DATA DESCRIPTION

For my research I use data from financial statements (balance sheets and income statements) of Ukrainian enterprises. This data is freely available at www.istock.com.ua and is published to fulfill the requirement about public disclosure of financial information of joint-stock companies.

The full dataset I am using contains statements of over 10 000 firms since 1999 till 2002. However, I had to reduce the number of firms chosen due to two reasons. First, there are numerous irregularities in the dataset, while I need full information on all four subsequent years, as I use differences in my estimations. Second, the data contains information on joint-stock companies from all sectors of economy, while the flexible accelerator model I estimate is appropriate only for manufacturing firms. Remember, when deriving the investment equations we assumed that output and capital stock are linearly related. This might be true for industrial firms, but it hardly holds for the companies providing services and using small capital stock. Of course, transportation services or hotel business require substantial investment into fixed assets. However, that cannot be said about all the firms in those sectors and those businesses quite often use rented equipment which does not appear in their accounting books. Hence, I dropped

services, trade, financial sector etc. As a result, my final sample has only 1324 manufacturing companies having complete information on all variables I need for all four years.

One can doubt the reliability of these data and that will be right to some extent as most Ukrainian firms use double bookkeeping and don't present all real figures. However it concerns mostly their costs and thus influences mostly profits, which might be understated, while figures on capital and sales are rather close to reality. Anyway, this data is the best that can be obtained and it doesn't differ much even from audited statements in most relevant aspects (as my own experience of analyzing financial statements shows).

Although, as it was mentioned, the dataset contains all financial information about those companies, I actually need only three variables: capital stock (comes from balance sheet), sales (found in income statement), and cash flow. Sales are a proxy for output. Investment is defined as change in gross capital stock (net investment). Cash flow was calculated based on balance sheet and income statement as

Cash Flow = Profit before interest and taxes + Depreciation – Taxes –

–– Capital expenditures – Change in net working capital

Table 1

	Number	Capital	Sales	Net Investment
Corporate	40%	38%	51%	6%
Private	42%	6%	8%	0%
State	13%	43%	29%	70%
Foreign	6%	13%	13%	24%
All	100%	100%	100%	100%

All firms were divided into four groups according to the type of majority shareholders: owned by individuals (550 firms), state-owned (171 firms), foreign-owned (75 firms), and owned by other corporations (528 firms)[2].

In Table 1 weights of each group in terms of their number, capital stock, sales, and investment are compared. As one can easily see, private owned firms, although the most numerous, are mostly small companies that have miserable share in total capital stock and sales. Their cumulative net investment is close to zero (in fact, slightly negative). On the other hand, weight of state owned and foreign owned companies in sales, capital, and especially investment is disproportionately large. I would also like to point at comparatively small number of firms in the latter category which might lead to a small sample bias. Finally,

[2] Descriptive statistics for each group can be found in the appendix.

only corporate owned firms have comparable shares of number, sales, and capital. However, the volume of investment in this category is still very small.

The firms were also differentiated by size of sales. They were divided into three groups: small, with sales less then 1 mln. hryvnas; medium, with sales between 1 mln. and 10 mln. hryvnas; and big with sales more than 10 mln. hryvnas.

Chapter 5

ESTIMATION RESULTS

As two specifications for investment equation were derived, one for net investment and another for gross investment, both were estimated yielding results which are close quantitatively and similar qualitatively. I used no lags in my estimations, as they appeared to be insignificant. However, I will present only estimates for net investment, since results are similar, while using no lagged variables is more theoretically justified for this specification, at least in neoclassical model.

Although many researchys estimate the investment equation for different firms' categories separately in order to determine the financial constraint for each of them, I estimate only one equation with dummies for each category. I also included interaction terms for size and ownership dummies and cash flow and sales growth variables. In such a way I was able to determine the effect of cash flow and sales growth on investment for the firms of each size in each category.

The reported results come from pooled OLS regression with robust standard errors. The choice of that particular method is explained by quite small number of time periods (only three years) which makes fixed effects estimation

very inefficient and a lot of cross-sectional information is lost. Moreover, F-test strongly suggests that pooled OLS is more appropriate in this case.

I also checked my variables for endogeneity, as it could be suggested that sales and investment might be determined simultaneously (see for instance Konings et al (2002)) especially when aggregated data or differences are used. In the specification I use this is not the case and it is unlikely that investment of a particular year could influence sales or profit of the same year. Still, I check endogeneity problem with Durbin-Wu-Hausman test using lagged values of sales and profits as instruments. The residuals from the regression of sales growth on profit and their lagged values are found to be insignificant when plugged into the basic model, which allows concluding that endogeneity problem is not present here.

Full regression output can be found in appendix. However, it does not show clearly the estimates for each group. Thus for the convenience of presentation the estimates of sales growth variable coefficients for all categories are summarized in Table 2, while Table 3 presents similar estimates for cash flow.

Table 2 Estimated sales growth coefficients (p-values in brackets)

	Owned by other	Private	State	Foreign
Big	0.00321 (0.719)	0.02846 (0.000)	0.19288 (0.161)	0.43477 (0.019)
Medium	0.00764 (0.198)	0.03289 (0.000)	0.19731 (0.163)	0.43920 (0.023)
Small	-0.05830 (0.202)	-0.03305 (0.443)	0.13137 (0.332)	0.37326 (0.027)

From the very first sight at those tables it becomes clear that results are somewhat surprising. First of all, many Ukrainian firms seem to invest regardless of available investment opportunities: in 7 out of 12 categories sales growth variable is insignificant, which in a flexible accelerator model framework can be interpreted as lack of profit maximizing behavior. Note, that only foreign owned companies of all sizes are profit-maximizers in this context. It can also be said about big and medium private owned companies, but not about small ones. In all size groups state owned companies and companies owned by other firms also have insignificant relationship between sales growth and investment.

Table 3 Estimated cash flow coefficients (p-values in brackets)

	Owned by other firms	Private	State	Foreign
Big	-0.47907 (0.090)	-0.47299 (0.094)	-0.46869 (0.097)	-0.47282 (0.093)
Medium	-0.01678 (0.000)	-0.0107 (0.003)	-0.0064 (0.182)	-0.01053 (0.009)
Small	-0.00529 (0.026)	0.0002 (0.167)	0.0045 (0.192)	0.00037 (0.452)

Although conclusions about influence of sales growth on investment are not very optimistic, the relationship between cash flow and investment seems to be even stranger. Only 4 out of 12 categories are found unconstrained if consider the insignificance of coefficients. However, the other 8 categories have significant but negative coefficients. In the financial constraints literature such a result is usually also interpreted as absence of constraints, and can be due either to large start-up investment or extreme case of soft budget constraint. In the present

research the former explanation can be applied to foreign owned firms, as most of them have been recently acquired after full scale privatization started in Ukraine in late 90th. The latter explanation is quite appropriate for state owned firms, as many of them benefit from tax privileges and state subsidies. However, there is more general factor that could explain negative relationship between investment and cash flow in all kinds of firms. Although the companies in the sample were differentiated by the ownership, it is worth to remember that they all are joint-stock companies, which are usually expected to have better access to capital market. Hence, even small firms with low cash flow might have relatively easy access to external financing.

We can also draw some more conclusions from the estimation results. Although they do not concern financial constraints issue, they might be interesting for understanding investment patterns among Ukrainian firms. It can be concluded that in 2002 investment intensified on average. Bigger firms invest more even relative to their capital, while ownership has no significant influence on investment.

Chapter 6

CONCLUSIONS

In this research I made an attempt to check existence of financial constraint in a large sample of Ukrainian industrial companies and investigate the difference between different ownership categories in terms of their credit rationing. The main finding is that Ukrainian firms experience no credit rationing despite underdeveloped local financial market. The existence of this phenomenon might be explained first of all by the nature of the data: only joint-stock companies are considered, which are usually assumed and found to be unconstrained. It can be also due to soft budget constraint in state owned companies and start-up investment in recently acquired foreign owned companies that relationship between cash flow and investment is negative.

Sales growth variable is found to have no significant influence on investment in all state owned companies, companies owned by other firms, and small private owned companies. In the context of the flexible accelerator investment model it might be interpreted as lack of profit maximizing behavior, although it can be that the data fail to fit the model.

Further research in this area might be done as more data become available. With more complete information and having more time periods it would be possible to obtain more precise estimates. It would also make it possible to analyze financial constraints in different time periods and see how their significance evolved over time. Another important extension to my research is to analyze broader sample of companies. I used only joint stock companies, while limited liability and sole ownership firms remained out of the scope of my research due to very limited information for those categories. That broader analysis would make it possible to draw more comprehensive conclusions on the problem of financial constraints in Ukraine.

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APPENDIX A
Data Descriptive Statistics

Table 1. Companies owned by other firms.

Variable		Mean	Std. Dev.	Min	Max	Observations	
sale	overall	33235.48	268138	0	5667167	N =	2112
	between		263253.2	0	4702874	n =	528
	within		51906.06	-1514614	997528.7	T =	4
profit	overall	992.0076	21909.71	-119568.4	649294	N =	2112
	between		16212.25	-27468.3	256160.8	n =	528
	within		14750.31	-279946.7	394125.3	T =	4
netinv	overall	969.8365	16242.01	-83709	423949	N =	1584
	between		14584.09	-26348.67	263148.3	n =	528
	within		7167.706	-84689.5	161770.5	T =	3
capg	overall	46840.61	293843.8	4	5170994	N =	2112
	between		293582.1	122.8	4837887	n =	528
	within		16619.7	-409496.9	379948.1	T =	4
CF	overall	596.6265	24576.83	-598906	387527	N =	1584
	between		14460.6	-293499.3	76964.33	n =	528
	within		19879.02	-304810	361332	T =	3

Table 2. Private owned firms.

Variable		Mean	Std. Dev.	Min	Max	Observations	
sales	overall	4716.799	12598.59	0	225867.3	N =	2200
	between		10973.13	0	113981.4	n =	550
	within		6203.147	-89896.93	129958.9	T =	4
profit	overall	-38.11727	1383.878	-39725.8	25950.6	N =	2200
	between		771.6485	-6485.2	8254.325	n =	550
	within		1149.126	-33278.72	32397.68	T =	4
invest	overall	-23.40963	1992.795	-41680	22835	N =	1650
	between		1415.382	-14961	11277.57	n =	550
	within		1403.694	-26742.41	15046.59	T =	3
capital	overall	7587.116	11375.63	68.7	106547	N =	2200
	between		11253.63	110.15	99030.5	n =	550
	within		1712.76	-7426.884	40475.87	T =	4
CF	overall	1167.195	13943.51	-42824	76427.3	N =	1650
	between		4771.02	-13556.3	17498.37	n =	550
	within		13102.91	-49957.97	64944.09	T =	3

Table 3. State owned firms.

Variable		Mean	Std. Dev.	Min	Max	Observations
sales	overall	58409.41	262940.4	0	2928665	N = 684
	between		257722.1	0	2251613	n = 171
	within		54851.51	-771512.5	735461.7	T = 4
profit	overall	-2156.686	91446.9	-1348836	991704	N = 684
	between		70185.06	-657418	624468.7	n = 171
	within		58806.71	-693574.7	710221.3	T = 4
invest	overall	33660.27	499366.5	-932631	9422424	N = 513
	between		271027	-145018	2833003	n = 171
	within		419759.7	-3731973	6623082	T = 3
capital	overall	165188.4	743371	237	1.06e+07	N = 684
	between		640743.3	265.1	5419907	n = 171
	within		379277.8	-2845967	6767995	T = 4
CF	overall	-4299.735	88683.52	-1194370	761902	N = 513
	between		38014.82	-273710.3	90035.67	n = 171
	within		80157.87	-1068236	888036.3	T = 3

Table 4. Foreign owned firms.

Variable		Mean	Std. Dev.	Min	Max	Observations
sales	overall	59049.21	107943.7	0	704418	N = 300
	between		106106.4	0	622127.5	n = 75
	within		22499.3	-65475.29	172057.6	T = 4
profit	overall	-2327.587	15231.38	-168868	61632.1	N = 300
	between		10241.1	-66163.25	16920.05	n = 75
	within		11321.09	-105032.3	62666.86	T = 4
invest	overall	25787.91	165824.6	-94908	1910055	N = 225
	between		104411.5	-52523.67	697737	n = 75
	within		129202.9	-662508.1	1238106	T = 3
capital	overall	112729.7	253161.2	94.2	2520037	N = 300
	between		214922.6	332.575	998278	n = 75
	within		135507.6	-458722.3	1634489	T = 4
CF	overall	-5936.505	37614.73	-339972	42199	N = 225
	between		26439.08	-174780.7	21688	n = 75
	within		26871.62	-171127.8	175775.2	T = 3

Table 5. All firms

Variable		Mean	Std. Dev.	Min	Max	Observations
sales	overall	26102.17	196755.5	0	5667167	N = 5296
	between		192943	0	4702874	n = 1324
	within		38817.38	-1521748	990395.4	T = 4
profit	overall	-30.62449	35850.46	-1348836	991704	N = 5296
	between		27296.06	-657418	624468.7	n = 1324
	within		23250.86	-691448.6	712347.4	T = 4

invest	overall	6185.195	184272	-932631	9422424	N = 3972
	between		101391.9	-145018	2833003	n = 1324
	within		153886.4	-3759448	6595607	T = 3
capital	overall	49551.89	334759.9	4	1.06e+07	N = 5296
	between		303995	110.15	5419907	n = 1324
	within		140369.5	-2961603	6652358	T = 4
CF	overall	-168.8191	37688.73	-1194370	761902	N = 3972
	between		17961.09	-293499.3	90035.67	n = 1324
	within		33136.12	-1064105	892167.2	T = 3

APPENDIX B
Regressions Outputs

```
Regression with robust standard errors                Number of obs =    3972
                                                      F( 19,  1323) =15492.25
                                                      Prob > F      =  0.0000
                                                      R-squared     =  0.7698
Number of clusters (id) = 1324                        Root MSE      =  .53697

------------------------------------------------------------------------------
             |               Robust
      netinv |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dsale |  -.0583046   .0456314    -1.28   0.202    -.1478224    .0312132
          cf |   -.005288    .002369    -2.23   0.026    -.0099354   -.0006405
       y2001 |  -.0020079   .0164236    -0.12   0.903    -.0342271    .0302112
       y2002 |   .0587579   .0204045     2.88   0.004     .0187292    .0987866
        priv |   .0085771   .0153547     0.56   0.577    -.0215451    .0386994
        stat |  -.0215763   .0232299    -0.93   0.353    -.0671478    .0239952
        forn |  -.0356514   .0494257    -0.72   0.471    -.1326127    .0613099
         big |   .1541853   .0330029     4.67   0.000     .0894417     .218929
      medium |   .0574039   .0108522     5.29   0.000     .0361146    .0786932
     bigsale |   .0615142   .0417417     1.47   0.141    -.0203729    .1434013
  mediumsale |   .0659387   .0457023     1.44   0.149    -.0237182    .1555956
    fornsale |   .4315577   .1927432     2.24   0.025      .053442    .8096733
    privsale |   .0252486   .0062676     4.03   0.000     .0129532    .0375441
    statsale |    .189667   .1416154     1.34   0.181    -.0881483    .4674823
       bigcf |  -.4731879   .2815452    -1.68   0.093    -1.025512    .0791359
    mediumcf |  -.0109018   .0034967    -3.12   0.002    -.0177614   -.0040422
      forncf |   .0062509   .0028714     2.18   0.030      .000618    .0118839
      privcf |   .0060846   .0025125     2.42   0.016     .0011556    .0110135
      statcf |   .0103802   .0045488     2.28   0.023     .0014567    .0193038
       _cons |    -.05601   .0122155    -4.59   0.000    -.0799737   -.0320462
------------------------------------------------------------------------------
```

```
Fixed-effects (within) regression               Number of obs      =      3972
Group variable (i): id                          Number of groups   =      1324

R-sq:  within  = 0.7638                         Obs per group: min =         3
       between = 0.7555                                        avg =       3.0
       overall = 0.7611                                        max =         3

                                                F(16,2632)         =    531.97
corr(u_i, Xb)  = -0.0038                        Prob > F           =    0.0000

------------------------------------------------------------------------------
      netinv |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dsale |  -.0730515   .0323216    -2.26   0.024    -.1364298   -.0096733
          cf |  -.0043942   .0010768    -4.08   0.000    -.0065057   -.0022827
       y2001 |  -.0064396   .0213523    -0.30   0.763    -.0483087    .0354295
       y2002 |   .0497281   .0214464     2.32   0.020     .0076745    .0917816
        priv |  (dropped)
        stat |  (dropped)
        forn |  (dropped)
         big |   .3912342   .0817688     4.78   0.000     .2308966    .5515718
      medium |   .1852704   .0546616     3.39   0.001     .0780863    .2924544
     bigsale |   .0775779   .0322719     2.40   0.016     .0142971    .1408587
```

```
  mediumsale |   .0713424   .0325904     2.19   0.029     .0074369    .1352478
    fornsale |   .3473532   .0449802     7.72   0.000     .2591531    .4355534
    privsale |   .0248553   .0024687    10.07   0.000     .0200145    .0296961
    statsale |   .1779141   .1155501     1.54   0.124    -.0486641    .4044923
       bigcf |   -.434835   .0143108   -30.39   0.000    -.4628966   -.4067735
    mediumcf |  -.0106389   .0011367    -9.36   0.000    -.0128679   -.0084099
      forncf |   .0056284   .0019913     2.83   0.005     .0017237    .0095332
      privcf |   .0052202   .0011779     4.43   0.000     .0029105    .0075299
      statcf |   .0085265   .0020227     4.22   0.000     .0045604    .0124927
       _cons |  -.1539601   .0381772    -4.03   0.000    -.2288205   -.0790997
-------------+----------------------------------------------------------------
     sigma_u |  .31602806
     sigma_e |  .54662779
         rho |  .25051374   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(1323, 2632) =     0.89          Prob > F = 0.9906
```

ENDOGENEITY TEST

```
      Source |       SS       df       MS              Number of obs =    2648
-------------+------------------------------           F(  4,  2643) =  536.20
       Model |  3676775.31     4  919193.828           Prob > F      =  0.0000
    Residual |  4530808.16  2643  1714.26718           R-squared     =  0.4480
-------------+------------------------------           Adj R-squared =  0.4471
       Total |  8207583.47  2647  3100.71155           Root MSE      =  41.404

------------------------------------------------------------------------------
 dsale       |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 dsale       |
         L1  |   .0339352   .1628825     0.21   0.835    -.2854549    .3533253
  Cf         |
         L1  |   .0062033   .0255023     0.24   0.808    -.0438032    .0562099
 profit      |
         --  |    6.36021   .1374392    46.28   0.000      6.09071    6.629709
         L1  |   .4231771   .1853936     2.28   0.023     .0596458    .7867085
_cons        |   .3317152   .8064415     0.41   0.681    -1.249605    1.913036
------------------------------------------------------------------------------
```

```
Regression with robust standard errors                Number of obs =    2648
                                                      F( 19,  1323) =33694.15
                                                      Prob > F      =  0.0000
                                                      R-squared     =  0.8164
Number of clusters (id) = 1324                        Root MSE      =  .54128

------------------------------------------------------------------------------
             |               Robust
      netinv |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dsale |   .0359306    .056306     0.64   0.523    -.0745282    .1463893
          cf |   .0003124   .0010515     0.30   0.766    -.0017504    .0023752
       y2001 |  -.0361571   .0176083    -2.05   0.040    -.0707003   -.0016138
       y2002 |  (dropped)
        priv |    .002574   .0210716     0.12   0.903    -.0387634    .0439114
        stat |  -.0382447   .0333952    -1.15   0.252     -.103758    .0272687
        forn |   .0073375   .0520963     0.14   0.888    -.0948629    .1095379
         big |   .2145022   .0457351     4.69   0.000      .124781    .3042234
      medium |   .0543292   .0119416     4.55   0.000     .0309026    .0777558
```

bigsale	-.0375883	.0559306	-0.67	0.502	-.1473106	.0721341
mediumsale	-.0282358	.0561422	-0.50	0.615	-.1383732	.0819017
fornsale	.1343209	.0821216	1.64	0.102	-.0267819	.2954236
privsale	.0152929	.0179011	0.85	0.393	-.0198247	.0504105
statsale	.0504991	.0772013	0.65	0.513	-.1009512	.2019494
bigcf	-.6377949	.3059908	-2.08	0.037	-1.238075	-.0375147
mediumcf	.0004803	.0010204	0.47	0.638	-.0015215	.002482
forncf	.0429133	.0447287	0.96	0.338	-.0448335	.1306602
privcf	-.0002774	.0010768	-0.26	0.797	-.0023899	.001835
statcf	-.0010676	.0013082	-0.82	0.415	-.0036339	.0014987
sres	**-.0003371**	**.0002179**	**-1.55**	**0.122**	**-.0007646**	**.0000903**
_cons	-.0162364	.0176907	-0.92	0.359	-.0509414	.0184685