Financial constraints in economic transition: Empirical evidence from Ukrainian large farms

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ABSTRACT

This paper addresses the question of financial constraints in Ukrainian agriculture in transition. The main objective is to reveal the evidence of the both phenomena, soft budget constraints and credit rationing, investigating investment behaviour of large farms in Ukraine. Our empirical analysis is based on unbalanced panel data containing 529 agricultural enterprises from three Ukrainian regions between 2001 and 2005. Estimates of the Euler investment equation for several sub-samples reveal a dissimilar level of financial constraints. We confirm the presence of the soft financial environment (soft budget constraints) for the Ukrainian large farms being in an unconstrained financial regime. The farms belong to this regime if they receive credits after being unprofitable in two consecutive years. The other farms defined a priori as being in an constrained financial regime face evidence of credit rationing. With regard to the empirical results, we derive macroeconomic implications of financial constraints in the agriculture of Ukraine.

Keywords: transition agriculture**,** investment, soft budget constraints, credit rationing, Ukraine

1 INTRODUCTION

Economic literature broadly approved that investment is an important constituent of firms' structural change. The need of structural development is particularly high in transition countries but capital required for necessary investments is characterised by difficult access. Since equity capital has been lacking, debt is a main source of financing. However, even capital markets mainly represented by bank-oriented systems are still underdeveloped in transition countries. For instance, banks are often undercapitalised, only a low number of loan contracts exists, and a lack in non-banking financial institutions is present. Therefore, the supply of external capital to finance ongoing investment does not meet the high capital demand. As a consequence, potential investment is hindered and structural change slows down. In this paper we highlight the current status of financing and investment in the agricultural sector of Ukraine. Several Ukrainian politicians and scientists affirm that the agricultural enterprises cannot borrow at the market interest rate. These experts call for government subsidies and for creation of state-owned fund organisations. Other experts argue that this would not solve the problems of rural finance. They point out the following weaknesses of newly restructured large farms: low profitability, high production and market risks, significant transaction costs, and lack of collateral (STRIEWE et al. 2001a). The problem is also aggravated by the weaknesses of the banking sector in Ukraine, indicated by a slow institutional change, lack of efficient credit registration, non-transparent accounting system, and imperfections of bankruptcy procedures and banking law (STRIEWE et al. 2001b). For all that, we do not pretend to give here an unequivocal answer as to whether the financial support of Ukrainian agriculture should be strengthened, changed or even remain. Our aim is to investigate empirically the relationship between investment and financing in Ukrainian large farms. As previous studies are mainly based on descriptive techniques, there is a lack in explaining the investment-financing relationship in Ukrainian agriculture with a stronger theoretical background. Such findings may be useful in forecasting possible macroeconomic implications of financial constraints in economic transition.

The new institutional theory is commonly applied for explaining the investment decisions under imperfect capital markets. Within this approach, two opposite hypotheses can be found with regard as to how investment and financing opportunities are related in transition process.

The first one, credit rationing theory (STIGLITZ and WEISS 1981), is based on the presence of information asymmetries in the lender-borrower relationship. Thus, firms' demand for external funds of capital is confronted with a small supply. Firms are not able to borrow the desired amount of capital despite their willingness to pay the current interest rate. Being credit rationed, firms face an underinvestment problem during economic transition. Empirical applications of credit rationing theory and capital market imperfections are comprehensively reviewed in HUBBARD (1998) and in PETRICK (2005). The second theoretical approach, the concept of soft budget constraints, SBC (KORNAI et al. 2003), focuses on the state bailing-outs for unprofitable enterprises with subsidies, credits, tax privileges, and other policy instruments. Under soft macroeconomic conditions, firms' investment rates are comparably high as capital access is increased due to public support. The SBC phenomenon in former socialist countries is caused by government paternalistic objectives in order to provide economic and social stability after the beginning of transition.

Capital market imperfections due to asymmetric information or agency problems (JENSEN and MECKLING 1976) should cause a wedge between the costs of external and internal financing. Provided that investments are only sensitive to internal funds if there are financial constraints, it is common to include the firms' cash flow into the investment equation as a standard indicator of internal sources (FAZZARI et al. 1988). If the firm's opportunity cost of internal funds are substantially lower than its cost of external finance, investment-cash flow sensitivity rises with increasing cost wedge. The negative or non-significant cash flow-investment relationship is usually interpreted as evidence of perfect capital markets. This means that the firm's internal and external funds are perfect substitutes. Accordingly, there is need to clarify whether such a negative relationship can argue for perfect capital markets in transition economies, or is it a signal of soft budget constraints. Several authors deal with empirical investigation on financial constraints in post-socialist transition countries. LIZAL and SVEJNAR (2002) clarify the investment sensitivity to financial constraints in Czech industry. The authors point out a positive relationship between financial measures and investment which indicates evidence of credit rationing. Under perfect capital markets, this coefficient should be negative or, more likely, null or non-significant. In a transition economy, the null signals that the firms access to bank loans does not correlate with their efficiency (i.e. SBC are possible). The negative coefficient means a strong evidence of SBC because firms potentially have an unlimited loan access. On the contrary, HANOUSEK and FILER (2004) interpret a positive coefficient on financing-investment relationship as a sign of attractive investment alternatives. Firms with low profits, which invested on average more, are classified as 'not financially unconstrained'. As the latter finding simply points out a need of additional structural transformations, the SBC hypothesis is rejected in this paper. To our knowledge, there are only few SBC studies related to the lagged transition economies of the former Soviet Union. E.g., BEZLEPKINA and OUDE LANSINK (2003) analyse the impact of capital structure on efficiency of large farms in Russia. Their special attention is paid to credits and subsidies that may weaken the optimising behaviour of the unprofitable enterprises. Consequently, the authors argue for hardening SBC.

Empirical studies about the investment-financing relationship in economic transition mainly focus on either credit rationing and soft budget constraints across industry enterprises. However, there is a lack in applications of these theoretical concepts when explaining the impact of financial constraints on investment in the agricultural sector, which still plays an important role in transition economies lagging behind. Our paper addresses therefore the following questions: (i) What are the latest ideas in interpreting investment-financing relationship during the 'stop-and-go' transition in Ukrainian agriculture? (ii) Are the Ukrainian farms really financially constrained, or is there evidence of soft budget constraints

at least for a few of those farms? (iii) What are the macroeconomic implications of financial constraints in the agriculture of Ukraine? We suggest that SBC are still present in large farms in Ukraine that have inherited good relationships with the authorities and financial institutions. The evidence of SBC is empirically analysed in the large farm sector in three Ukrainian regions representing different environmental and economic conditions of agricultural production. For this purpose we provide an econometric estimation of a Euler investment equation conjecturing that SBC farms reveal less sensitivity of investment to the capital structure.

The remainder of the paper is structured as follows. In the second section, we explain common tendencies of investment and financing in Ukrainian agriculture. The third part provides a structural model of investment using the Euler equation approach. Estimation methodology and data are discussed in the fourth section. The fifth part consists of empirical results and discussion on macroeconomic implications of the financial constraints. The final section concludes.

2 INVESTMENT AND FINANCING DRAWBACKS IN UKRAINIAN AGRICULTURE

For a better understanding of the current situation with investment and finance, we briefly resume some historical facts. Transition process in Ukrainian agricultural sector can be characterised by two main phases of agricultural reform: the period from 1991-1999, dominated by large soviet-style enterprises, and after 1999, with newly established small and medium sized farms. SEDIK et al. (2000) show that between 1991 and 1999 the bank credits to the agriculture sector were often replaced by the so-called 'commercial' credits, i.e. prolonged obligations to suppliers, customers, and the state. The government supported farms through write-offs of old debts, state orders, and state commodity credits. However, old persistent farms structures, without completed property rights reform and under lacking internal financial discipline, discouraged the farm management from new investments. Despite an increasing number of emerging small farms, the large enterprises, former state and collective farms, remain most important because of traditionally land intensive farming in Ukraine and attitudes of the government to maintain the control over agricultural production (SWINNEN 2006). Consequently, the current investment share of Ukrainian agriculture in the national economy sways at five percent level compared to 16 percent at the very beginning of the nineties (see table 1). The annual machinery depreciation exceeds ten times the replacement machinery investment. Only a small part of the cash flow is used for investments, whilst the major part is spent for variable inputs. The absolute sum of on-farm investment increased slightly first from the beginning of this decade. The question arises whether the investment restraints should be put down to the weak market-oriented motivation of newly established agricultural structures and incompetence of the farms' managers, or are financial constraints a major factor influencing the farms' investment behaviour.

Table 1: Investment in Ukrainian agriculture related to the other economic fields[1]

Years	National economy, Mio. UAH[2]	Agriculture		Processing industry		% of 1991-1995[3]		
		Mio. UAH	Share, %	Mio. UAH	Share, %	National economy	Agri-culture	Proces-sing industry

1991-1995	30316	4853	16.0	1726	5.7	100.0	100.0	100.0
1996-2000	12462	690	5.5	756	6.1	41.1	14.2	43.8
2001-2005	28761	1542	5.4	2408	8.4	94.9	31.8	139.5

Notes: [1]in national comparison prices, developed and introduced by the State Statistical Committee of Ukraine; comparison year is 2000; [2] UAH is the abbreviation for Ukrainian currency; [3]annual average level
Source: Ukrainian Academy of Agricultural Sciences 2005, State Statistical Committee of Ukraine 2007

Main barriers in receiving bank credits are high interest rates, lacking collateral in form of plant and equipment, and complicated bureaucratic procedures. Moreover, agricultural land that is under the moratorium on sale until 2008 cannot be used as a collateral. Further important factors of the low credit supply are short credit history and imperfect information about potential borrowers. Agriculture receives about 16 percent of the total bank credit volume in Ukraine (CHAPKO 2003). Even so, the issued loans cover only 50 percent of the credit demand for variable inputs, and two percent for long-term debt. The banks contribute about a half of the external financial resources received by the agricultural enterprises. The remaining parts are credits from input suppliers, processing industry, leasing companies, credit unions, and other corporate and private enterprises. On the other hand, the farm debt problem is often called a 'chimera' (SEDIK 2003) because the gap in financing Ukrainian large farms seems not to be lacking debt but lacking profits. Low profits are explained to appear from public policy instruments that rather hamper economic reforms, despite their 'good' intentions. Those are subsidies for input and output purchases, agricultural tax and import tariff discounts, local trade regulations etc. However, in this chapter we do not aim at precise response on the question whether the Ukrainian large farms are constrained or not. The mainly descriptive literature on financing problems in agriculture of Ukraine is often ambiguous in attempts to find unique answer to this question. From our viewpoint it is because of lacking empirical analysis on investment-financing relationship in the large farm sector.

3 MODELLING INVESTMENT UNDER FINANCIAL CONSTRAINTS

The Euler equation approach is commonly applied in investment literature and based on the equality between the marginal product of capital and the cost of capital including marginal adjustment costs of investing now and marginal costs of investing in the next period (WHITED 1992). This marginal condition allows to take into account financial constraint expressed as the increasing cost of debt in the case of growing leverage (BOND and MEGHIR 1994). RIZOV (2004) derives the model of investment in transition from the first order conditions for a profit-maximising firm under perfect capital market conditions, where equity capital and borrowing are perfect substitutes:

$$V_t = \max_{I_t, L_t} E_t \left[\sum_{\tau=0}^{\infty} \theta_{t+\tau} d_{t+\tau} \right]^{1}, \tag{1}$$

s. t.: $d_t = \pi_t(K_t, L_t, I_t) - r_{t-1} D_{t-1} + B_t - g(B_t) - R_t$

$d_t \geq \overline{d_t}$; $K_t = (1-\delta)K_{t-1} + I_t$; $D_t = D_{t-1} + B_t - R_t$; $B_t \geq 0$.

Here V_t is the discounted maximised value of firm dividends. E_t is expectation at time *t*, d_t are dividend payments, and $\pi_t(.)$ is the profit function. K_{t-1} represents the beginning-of-period capital stock, L_t is vector of variable inputs, I_t is investment, and r_t is interest rate.

[1] We refused to use the index *i* for number of a firm before dealing with an empirical Euler equation and panel data set.

D_{t-1} denotes the beginning-of-period debt, B_t is the new borrowing, R_t are repayments. $\overline{d_t}$ and $\overline{R_t}$ are minimum dividend payments and minimum repayments, respectively, and δ is the depreciation rate. The transaction costs $g(B_t)$ associated with new borrowing (e.g. arrangement and commission fees) are assumed to be proportional to the debt volume: $g(B_t) = \gamma B_t$. Referring to RIZOV (2004), the minimum level of dividend payments may be set at zero without loss of generality of the model. $\theta_{t+\tau}$ is a discount factor, such that

$$\theta_{t+\tau} = \begin{cases} \prod_{n=0}^{\tau-1} 1/(1+r_{t+n}), & \forall \tau > 0 \\ 1, & \tau = 0 \end{cases}. \tag{2}$$

If $\theta \to 1$ it implies that the firm is long-term forward looking. If $\theta \to 0$ the firm faces rather unstable economic conditions, which results in a higher rate of return. The maximisation function given in (1) can be rewritten as a dynamic programming problem[2]:

$$V_t(K_{t-1}, D_{t-1}, \overline{R}_t) = \max_{I_t, L_t} \{\pi_t((1-\delta)K_{t-1} + I_t, L_t, I_t) - r_{t-1}D_{t-1} + B_t - \gamma B_t - R_t$$
$$+ \theta_{t+1} E_t \left[V_{t+1}((1-\delta)K_{t-1} + I_t, D_{t-1} + B_t - R_t, \overline{R}_{t+1}) \right] \}, \tag{3}$$
$$\text{s. t.: } \pi_t((1-\delta)K_{t-1} + I_t, L_t, I_t) - r_{t-1}D_{t-1} + B_t - \gamma B_t - R_t \geq \overline{d}_t; \text{ and } B_t \geq 0,$$

where K_{t-1} and D_{t-1} are state variables.

The empirical specification of the firm investment model[3] follows after defining the profit function $\pi_t(.)$ as:

$$\pi_t = p_t F(K_t, L_t) - p_t G(I_t, K_t) - w_t L_t - p_t^I I_t, \tag{4}$$

where w_t denotes the price of variable factor inputs, p_t the output price, and p_t^I the price of investment goods. $F(K_t, L_t)$ is assumed to be a linear homogeneous production function with constant returns to scale, and $G(I_t, K_t)$ quadratic adjustment cost function which is linearly homogeneous in investment and capital:

$$G(I_t, K_t) = \frac{\alpha}{2}\left(\frac{I_t}{K_t} - \beta \right)^2 K_t, \ \alpha, \beta \geq 0. \tag{5}$$

Here, α is an adjustment cost parameter, and β is a 'normal' rate of investment (WHITED 1992). This functional form does not refer to possible irreversibility of investment decisions and builds on theoretical statement that firms minimise their adjustment cost if β is close to the average investment-capital ratio. To allow for imperfect competition, we assume that the output price p_t depends on output. Because the net observable output function $Y(K_t, L_t, I_t) = F(K_t, L_t) - G(I_t, K_t)$ is also linearly homogeneous, it follows:

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[2] Detailed derivation of the Euler investment equation with transaction costs, dividend repayment constraint and borrowing constraint can be found in RIZOV (2004).

[3] BOND and MEGHIR (1994) derive the Euler investment equation from the first order conditions for a standard profit-maximising firm in a perfect capital market and after evaluation of the expectation at realised values: $-(1-\delta)\theta_{t+1}(\partial \pi_{t+1} / \partial I_{t+1}) = -(\partial \pi_t / \partial I_t) - (\partial \pi_t / \partial K_t) + \varepsilon_{t+1}$, where ε_{t+1} is an expectation error term. This equality presents the model without transaction costs and thus no different financial status across firms. These costs should be introduced through equation (3) in order to account for financial regimes that potentially occur when firms face the hierarchy of finance.

$$\frac{\partial \pi_t}{\partial I_t} = -\alpha p_t \left(\frac{I_t}{K_t}\right) + \alpha\beta p_t - p_t^I , \tag{6a}$$

$$\frac{\partial \pi_t}{\partial K_t} = p_t \left(\left(\frac{Y}{K}\right)_t - \frac{\partial F}{\partial L}\left(\frac{L}{K}\right)_t\right) + \alpha p_t \left(\frac{I}{K}\right)_t^2 - \alpha\beta p_t \left(\frac{I}{K}\right)_t . \tag{6b}$$

Furthermore, the marginal product of variable factors $\partial F / \partial L$ is approximated by w_t / p_t, without specifying a parametric form of the production function. The first term in equation (6b) expresses the relative operating profit that highly correlates with relative cash flow (CF). Expressions (6a) and (6b) can be replaced by the following equation:

$$\left(\frac{I}{K}\right)_{t+1} = \beta\left(1 - \frac{1}{\phi_{t+1}}\right) + \frac{1+\beta}{\phi_{t+1}}\left(\frac{I}{K}\right)_t - \frac{1}{\phi_{t+1}}\left(\frac{I}{K}\right)_t^2 - \frac{1}{\alpha\phi_{t+1}}\left(\frac{CF}{K}\right)_t + \frac{1}{\alpha\phi_{t+1}} J_t + \varepsilon_{t+1}, \tag{7}$$

where $\phi_{t+1} = p_{t+1} / p_t((1-\delta)/(1+r_t))$, and $J_t = 1/p_t((r_t p_t^I + (p_t^I - p_{t+1}^I + \delta p_{t+1}^I))/(1+r_t))$. ϕ_{t+1} denotes a firm-specific real discount factor on new investment, and J_t reflects the user (opportunity) costs of capital. As we do not attempt to estimate J_t directly, this term can be replaced in the empirical equation by firm and time specific effects. Furthermore, we introduce two additional variables into the model specification. The first is the output-capital ratio eliminated from the Euler equation under perfect market competition; otherwise the coefficient on this term controlling for imperfect competition as well as non-constant returns to scale should be positive. The second one is the squared debt-to-capital ratio that accounts for the inseparability of investment and borrowing decisions. The debt parameter is excluded under the debt irrelevance theorem of Modigliani-Miller and could otherwise be quadratic and positive (BOND and MEGHIR 1994). Rearranging variables provides the empirical Euler equation:

$$\left(\frac{I}{K}\right)_{i,t} = b_0 + b_1\left(\frac{I}{K}\right)_{i,t-1} + b_2\left(\frac{I}{K}\right)_{i,t-1}^2 + b_3\left(\frac{CF}{K}\right)_{i,t-1} + b_4\left(\frac{Y}{K}\right)_{i,t-1} + b_5\left(\frac{D}{K}\right)_{i,t-1}^2 + q_i + s_t + \varepsilon_{i,t}, \tag{8}$$

where $(I/K)_{i,t}$ is the investment-capital ratio of the firm *i* in the period *t,* $(I/K)_{i,t-1}$ is lagged investment-capital ratio, and $(I/K)_{i,t-1}^2$ is lagged squared investment-capital ratio indicating the speed of investment adjustment. $(CF/K)_{i,t-1}$ represents lagged cash-flow-to-capital ratio, $(Y/K)_{i,t-1}$ is lagged output-capital ratio, and $(D/K)_{i,t-1}^2$ stands for lagged squared debt-to-capital ratio. q_i and s_t reflect respective farm and time specific effects, and $\varepsilon_{i,t}$ are composite error terms assumed to be iid.

Under the null hypothesis of perfect capital markets, $b_1 \geq 1$, $b_2 \leq -1$, $b_3 \leq 0$, $b_4 \geq 0$, $b_5 = 0$. It can be shown that $b_1 = (1+\beta)/\phi_{t+1} \geq 1$ if $\beta \geq 0$ and $\phi_{t+1} \leq 1$; $b_2 = -1/\phi_{t+1} \leq -1$ if $\phi_{t+1} \leq 1$, and $b_3 = -1/\alpha\phi_{t+1} < 0$ if $\alpha > 0$ and $\phi_{t+1} \leq 1$.

In order to incorporate the empirical implications of the credit rationing and SBC theories into the econometric model, we should find sensitivity of investment to measures of internal finance. The theoretical model implies that under perfect capital market hypothesis, a farm can raise as much finance as desired at a given cost of capital. If this assumption is incorrect then the cash flow term may reflect liquidity constraints. Usually it holds that a positive cash flow coefficient in estimated Euler equation ($b_3 > 0$) notices binding liquidity constraints, i.e.

existence of credit rationing[4]. More questionable is the interpretation of the non-positive or null coefficient of the financial variable. In transition economy, a significant non-positive cash flow parameter ($b_3 \leq 0$) may indicate the evidence of soft budget constraints as soon as firms do not rely on equity capital. This soft financial environment exists because of preferential financial treatments provided by the government.

Accounting for the investment-financing relationship in a simple linear fashion presented in equation (8) is obviously inadequate because of the non-linearity implied by the financial regimes. However, it is possible to identify ex ante potentially constrained firms, but it is almost impossible to identify the exact years during which a farm is constrained. Thus, it is difficult to differentiate between firm-specific effects on investment and the effects of financial constraints (KAPLAN and ZINGALES 1997), which requires to determine exogenously the premium on external finance and furthermore whether a firm is confronted with more or less severe market imperfections. A good way to differentiate would be to interact the indicator for the availability of internal funds like cash flow with a time-varying variable proxying relevant farm characteristics.

In this study, we use the debt-to-capital ratio as an indicator of financial status. Accordingly, we first divide ex ante the observed Ukrainian farms into the two different financial regimes (constrained and unconstrained) applying two sample selection criteria from RIZOV (2004). The first sample selection criterion is that the firms with borrowing in two consecutive years hold as unconstrained, while the dummy X for financial constraints equals zero. The remainder are constrained firms for which the dummy X equals one. Thus, the a priori constrained firms' observations are considered by additional regressors and denoted by X. These additional regressors should indicate the difference between the constrained and unconstrained sub-sample (BOND and MEGHIR 1994). The second sample selection criterion is that the firms receiving credits in two consecutive years and non-negative profits are unconstrained. Other firms are held as constrained. Hence, variables $X(I/K)$, $X(I/K)^2$, $X(CF/K)$, and $X(Y/K)$ denote the difference between the coefficients on each initial variable from equitation (8) across the two sub-samples.

We doubt that two sample selection criteria used by RIZOV (2004) are sensitive enough to divide the farms exactly into constrained and unconstrained financial regimes. However, the less impact of cash flow in the unconstrained regime is expected by using the first criterion, which enables to show explicitly all the farms potentially facing soft budget constraints. Furthermore, the firms can be a priori classified as operating under the soft macroeconomic conditions if they receive some credit support irrespective of their financial situation. Our third sample separation criteria is that unconstrained farms borrow even after being classified as non-profitable in two consecutive years. SCHAFFER (1998) states that the SBC farms are those farms which receive credits facing both financial and economic distress. He defines economic distress as a present negative sum of sales profit plus depreciation. Financial distress is indicated by a negative profit before taxes. We concentrate on the financial distress indicator.

4 ESTIMATION METHODOLOGY AND DATA

Our empirical analyses are based on data provided by the State Statistical Committee of Ukraine. This is an unbalanced panel data set collected from 700 agricultural enterprises in

[4] We are aware of the critique on monotonic cash flow-investment relationship provided by KAPLAN and ZINGALES (1997). However, the discussion about sensitivity of investment to cash flow depending on different levels of the cost premium for external funds is left for future research.

three Ukrainian regions (*oblasts*) between 2001 and 2005. Available are 3426 observations from Zhytomyr, Cherkasy and Mykolayiv oblasts which represent different natural and economic zones of agricultural production. Zhytomyr region is located in the North, Cherkasy region in the Middle, and Mykolayiv region in the South of Ukraine. The variables for the econometric estimation are calculated from the annual farms' balance sheets and income statements [5]. All variables were normalised by the value of capital stock and deflated by the respective price indexes for industry goods and agricultural products. Unfortunately, we could not obtain the regional price indexes to cover financial characteristics of different oblasts. We expect, however, that those will be reflected in farm specific effects.

Controlling for outliers reduced our sample from 700 to 636 farms. On average, between 2001 and 2005 the observed farms carried out negative investments. This evidence of shrinking investment should be taken into account when analysing the investment-financing relationship. Here, we concentrate our analysis on the positive investment observations ($(I/K)_{it} > 0$) for which the Euler investment equitation is required to hold. Those are in total 1443 observations from 529 farms, or 46 percent of the analysed sample. We abstract from the correction of the possible selection bias as POLDER and VERICK (2004) argue that these procedure may not be significant when explaining the positive investment path.

The standard tests give evidence on significant individual effects in our data set[6]. In all estimations, time dummy variables were included to control for time specific effects. In order to sweep out the individual specific effects in a dynamic panel context usually first differencing is used. However, first differenced OLS is still biased. Hence, the most efficient estimator, Generalised Method of Moments (GMM) should be applied. The first-differenced GMM estimator (ARELLANO and BOND 1991) is based on removing individual effects and then performing a modified instrumental variables procedure. This estimation method requires the validity of crucial assumptions about no second-order autocorrelation of the error terms ($\Delta\varepsilon_{i,t}$). As the lagged regressors are not correlated with remaining disturbances but potentially can be predetermined by some past events, their second and higher order lags are valid instruments for equation in differences. An improved GMM estimator called 'system GMM' (BLUNDELL and BOND 1998), additionally uses the respective lagged differences as instruments for the level equations. The latter significantly improves the results in case of weak initial instruments and short panels. Both first-differenced and system GMM estimates can be corrected for heteroscedasticity (two-step GMM). It is reasonable to consider the estimated coefficients from the first step because of possible distortions of standard errors. We expect that system GMM estimator provides more satisfactory results to be confirmed by the Hansen (Sargan) test for overidentifying restrictions. This test is a standard one which proves the orthogonality conditions for instruments involved in the GMM estimation. Additionally, we test the sample for absence of second-order autocorrelation[7]. Besides the model specification for the whole sample described by equation (8), we also estimate the model with different financial regimes. The constructed X -regressors are endogenous. Thus, these are also instrumented using second and higher order lags.

5 RESULTS AND DISCUSSION

The used sample covers 529 farms over five years. The overidentifying restrictions associated with the empirical model are not rejected by the data. In table 2 we present the results derived

[5] Detailed description of the variables calculation is available on request from the authors.
[6] Under usual tests are meant Hausman specification test, Breush-Pagan (Lagrange Multiplier) test for random effects, and F-test for fixed effects. For future details, see BALTAGI (2001). We use STATA 9.
[7] See ARELLANO and BOND (1991).

by using the system GMM estimator as those are more satisfactory. For each variation of the Euler equation the results of the unconstrained and constrained sub-sample are given.

We start with the whole sample without selection and analyse parameter values from the model specification without and with debt variable. The positive coefficients of the lagged cash flow from the second and third column of table 2 confirm the strong investment-financing relationship across the farms and, therefore, binding liquidity constraints. The small coefficients of the squared investment term indicate that under unstable macroeconomic conditions (non-transparent agricultural policy, high inflation rates, price fluctuations etc.), farms use large discount rates in investment planning ($\phi_{t+1} > 1$). Admittedly, BOND and VAN REENEN (2003) argue that the unobserved heterogeneity of the real discount factor on new investment ϕ complicates the parameter estimation in the Euler investment equation. This heterogeneity in ϕ can reflect the differences in the structure of capital assets used by different farms, or the differences in the required rates of return. Small and non-significant positive coefficients of the output-capital ratio cannot confirm the evidence of imperfect competition on agricultural product markets in Ukraine and non-constant returns to scale, at least for the model specification without sample selection. Introducing the debt-to-capital ratio improves the model specification indicated by the value of the Hansen (Sargan) test. The coefficient on this variable is positive and significant, which indicates a strong relationship between investment and availability of external financing.

Financial constraints are further investigated by the ex ante sample division into the different financial regimes. We first estimate the parameter with two sample selection criteria referring to RIZOV (2004). In both cases the results on the cash flow parameter shown in the fourth and fifth column of table 2 have the following signs: $b_3 \geq 0$ for the a priori constrained sample of farms, and, surprisingly, $b_3 > 0$ for the unconstrained sample. However, as expected, less impact of financial variable is revealed by using the first criteria, which ex ante selects all the farms potentially facing SBC into the unconstrained sub-sample. The analysed data indicate that a priori constrained farms have low investment rates or even disinvest. As no credits are required for the investment expenditures, this diminishes the role of cash flow as proxy for net worth (collateral). Profits are mainly used to cover variable costs, or in order to distribute among farm managers and owners.

For further explanation, we can use the free cash flow concept developed by JENSEN (1986). Free cash flow is "cash flow in excess required to fund all projects that have positive net present values discounted at the relevant cost of capital". Observed positive links between investment spending and internal finance in unconstrained regime may reflect some manager's decisions to ignore signals from market valuation in favour of overinvestment.

Table 2: GMM estimates of the Euler investment equation with sample selection: 529 farms, 2001-2005

Parameter	Without debt	With debt	First criterion	Second criterion	Third criterion
			Unconstrained sub-sample		
b_1	0.3147**	0.2984 **	0.6953**	0.5691**	7.8759**
	(0.1499)	(0.1488)	(0.0589)	(0.1009)	(2.6277)
b_2	-0.3008**	-0.2684**	-0.5525**	-0.4685**	-16.5966**
	(0.1261)	(0.1270)	(0.0369)	(0.0590)	(5.2535)
b_3	0.2360*	0.2273**	0.1251**	0.1509**	-0.7672**
	(0.0700)	(0.0726)	(0.0079)	(0.0095)	(0.2836)

b_4	0.0168	0.0173	0.0426**	0.0417**	-0.3419**
	(0.0271)	(0.0289)	(0.0038)	(0.0067)	(0.1634)
b_5		0.1463**			
		(0.0573)			
		Constrained sub-sample			
b_1			-0.3809**	-0.2179*	-8.0905**
			(0.0638)	(0.1209)	(2.6911)
b_2			0.3918**	0.3037**	16.6755**
			(0.0418)	(0.0742)	(5.2716)
b_3			0.0586**	0.0037	1.0409**
			(0.0153)	(0.0199)	(0.2208)
b_4			-0.0071	-0.0066	0.3809**
			(0.0057)	(0.0083)	(0.1693)
m_2 test	0.272	0.397	0.503	0.295	0.186
Hansen (Sargan) test	0.535	0.561	0.094	0.276	0.900

Notes: Standard errors are reported in the parentheses. All equations include time dummies. ***, **, and * denote the significance at 1%, 5%, and 10% level, respectively. p-values of the Wald test for joint significance of regressors are not higher than 5%. m_2 test is the test for absence of second-order autocorrelation, and Hansen (Sargan) test is the test for overidentifying restrictions.

Source: Own calculations based on data set provided by the State Statistical Committee of Ukraine

Also, managers may invest in non-value maximising activities (e.g., expensive cars or offices). Otherwise, current profits may not play the crucial role in investment decisions if they are used for dividend payments, for distribution between some managers or even for social consumption. Unfortunately, we are not able to clarify specific financial goals for every analysed farm because of lack in required qualitative data. Thus, the certain levels of free cash flow raise farms expenditures independent of expected future profitability. This could be the reason why the positive correlation between cash flow and investment is weak or non-significant in a priori constrained sub-sample. Similar argumentation can be found in KAPLAN and ZINGALES (1997). HUBBARD (1998) explains the increase of capital demand which is supported by our data. Ex ante unconstrained firms invest more on average and, therefore, need an additional capital volume for growing. If their demand can be covered by debt capital, the availability of internal finance (vs. collateral) is required. Hence, the role of cash flow in receiving credits is significant at the higher level for the unconstrained sub-sample, expressed in terms of a positive cash flow parameter in the investment equation. Consequently, farms defined as unconstrained according to the second sample separation criterion are in fact constrained because of an excessive demand for capital. Therefore, when explaining investment decisions, it is important to consider carefully which farms are really constrained and hence, farm classification becomes crucial.

With respect to farms being constrained, besides no access to credit, they must exhibit demand for credit. Farms without credit are not really constrained, even though they do not borrow. However, it is difficult to measure the level of the farms' real investment demand which has to be compared with the current state of financing across a priori constrained sub-sample. Also, we can hardly distinguish ex ante between the really constrained and unconstrained farms among those which receive credits in consecutive years. We mentioned before that enterprises in transition give evidence of high investment demand for structural improvements that is confronted with low funds supply on the underdeveloped capital markets. Therefore, Ukrainian farms can be classified as credit constrained in two cases. In the first case, a farm does not receive credits at all, which coincides with our first sample

separation criteria. The second case occurs when a profitable farm does not have sufficient credit access. Accordingly, the group of constrained farms should consist of those from the first case plus farms from the a priori unconstrained sample due to second sample separation criteria. A way to test for soft budget constraints will be then to look exactly at a sub-sample where farms receive credits but also make losses. Thus, the third criterion in our analysis is that the farms with negative profits and borrowing in two consecutive years operate in the soft macroeconomic environment.

With respect to this criteria, about ten percent of the observations belong to the unconstrained regime. Indeed, the estimation results, shown in the last column of table 2, confirm the correct testing for SBC. The model is now able to differentiate better between two financial regimes. The cash flow coefficient is negative in a priori unconstrained sub-sample and positive in constrained sub-sample. In other words, the empirical results on the finance-investment relationship confirm the SBC hypothesis for a small part of the Ukrainian large farms operating in relaxed financial regime. While unconstrained farms reveal the strong evidence of soft financial environment, the major part of observed farms face credit constraints. The empirical results presented here do not pretend to build an unique opinion on the level and implications of financial discipline in the large farms. On one hand, these farms may have easier access to credit as well as to the input and output markets. Such advantages are due to lower transaction costs and more initial wealth for self-financing in comparison to small farms. On the other hand, weak financial discipline in unconstrained (unprofitable) farms in connection with credit rationing among constrained farms endangers the tendency of capital misallocation in rural areas. This induces a comparatively slow and inefficient structural change in Ukrainian agriculture.

6 CONCLUSIONS AND IMPLICATIONS FOR FUTURE RESEARCH

In this paper we aimed to analyse the linkages between investment and financing constraints in Ukrainian large farms. For this purpose the Euler investment equation approach was used. The empirical results for both model settings, without and with sample separation, reject the hypothesis of a perfect capital market in the large farm sector of Ukraine. The results from the separated samples confirm the presence of either credit rationing and soft budget constraints. The positive cash flow coefficient for farms which are ex ante financially constrained gives evidence of credit rationing. The negative cash flow parameter for farms which are defined as being a priori financially unconstrained indicates the presence of SBC. Those farms invest even though being unprofitable during consecutive years and do thereby not rely on equity capital. However, our hypothesis about a soft macroeconomic environment (soft budget constraints) is only supported for a small part of observed farms. This shows that the appropriate sample separation is an important factor when explaining investment behaviour with financial constraints. For these results the sample separation is based on financial distress indicator, however, additional sample separation criteria failed in attempting a correct indication of the financial regimes.

The dual existence of soft budget constraints and credit rationing in large farm sector endangers the tendency of the wrong capital allocation and slow structural change in Ukrainian agriculture. Nevertheless, it is a rather speculative question if unprofitable farms should be liquidated. The large farm sector absorbs a considerable share of labour indicating hidden unemployment. Thus, former state and collective farms are still playing the role of a social buffer in rural areas and cannot be liquidated in the case of serious financial problems. An alternative way is the step-by-step acquisition of the SBC farms by more successful agricultural enterprises. Moreover, the establishment of a sound banking system may help to increase supply of external capital to the farms. In particular, rationed farms benefit from an

improved capital access. However, these farms should learn how to signal their financial wealth in order to receive credit. In the credit rationing equilibrium, the banks sorting among potential borrowers do not implicitly choose those loans with the highest total returns, which implies welfare loses. When credit is restricted, not necessarily the projects with the lowest return are terminated. Thus, banks need to develop an appropriate credit rating system to choose appropriate borrowers. Another source of external finance could be direct investment which may support the farms with financial constraints, but may also facilitate 'soft' takeovers of SBC farms.

For all that, direct investment is still hindered in the agricultural sector of Ukraine because of complicated bureaucratic procedures, the slow land market reform, and substantial price fluctuations on agricultural input and output markets. Going further into the problem of financial constraints, financial and sectoral development in transition process are directly influenced by the level of the macroeconomic and political stability. In this context, the state plays a crucial role in fostering sustainable business environment and regulatory framework for Ukrainian agriculture. Moreover, the state invisible hand is needed for non-farm employment diversification and infrastructure development in rural areas. These strategic policy objectives along with detailed macroeconomic evaluation of the both phenomena in Ukrainian agriculture, credit rationing and soft budget constraints, is an important issue for future empirical research.

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