Financial constraints and investment in Ukrainian agriculture

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Abstract

This paper addresses the question of financial constraints in Ukrainian agriculture during the transition process. The main objective is to reveal the evidence of soft budget constraints (SBC) investigating investment behaviour of large farms in Ukraine. Our empirical analysis is based on panel data containing 700 agricultural enterprises from 3 Ukrainian regions between 2001 and 2004. Estimates of the Euler investment equation for several sub-samples reveal a dissimilar level of financial constraints. We confirm the hypothesis about the soft financial environment (SBC) for the Ukrainian large farms being in an unconstrained financial regime. The farms face this regime if they receive credits being unprofitable in two consecutive years. A weak financial discipline in unconstrained (unprofitable) farms in connection with credit rationing among the constrained farms endangers the tendency of lumpy investment in agriculture of Ukraine.

Keywords: transition agriculture, investment, soft budget constraints, Ukraine

1. Introduction

Investment is an important component of firms' structural change widely discussed in the economic literature. Investment demand in transition countries is particularly high, but capital access needed for investment can be characterised as rather difficult in those countries. Since equity capital has been lacking, debt capital is a main source of financing. However, capital markets are underdeveloped in transition countries. In this paper we highlight the current status of financing and investment in the agricultural sector of Ukraine. During the past decade, Ukrainian agricultural reform has been limited by the government's desire to ensure political control over agricultural production through the large farms. We do not pretend to give an unequivocal answer whether the financial support of Ukrainian agriculture should be strengthened, changed or even remain the same. Moreover, the aim of this paper is to empirically investigate the relationship between financing and investment in Ukrainian large farms. Our empirical analysis is based on both neoclassical and neo-institutional approaches of the investment theory. Neo-institutional theory provides two opposite hypotheses as to how investment and financing opportunities are related. The first one is the credit rationing theory (STIGLITZ and WEISS 1981), which builds on information asymmetries in the lender-borrower relationship. Empirical applications of credit rationing theory and capital market imperfections are comprehensively reviewed in HUBBARD (1998) and in PETRICK (2005). Another theoretical approach is the concept of soft budget constraints (KORNAI et al. 2003). The term 'SBC' refers to the state bailing-outs for unprofitable enterprises with subsidies, credits, tax privileges, and other policy instruments, in order to provide economic and social stability in the transition process. The underlying theories were mostly reviewed as two contrasts, although they are rather supplementary if applied to understanding the peculiarities of transition economy. Our study addresses therefore the following questions:

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- What is the state of the art in explaining financing and investment during the 'stop-and-go' transition in Ukrainian agriculture?
- Are all the Ukrainian large farms really financially constrained, or is there evidence of soft budget constraints at least for a part of those?

2. Literature review on relationship between investment and finance

The empirical studies at the end of the 1980's intensified the discussions about the role of financing for investment decisions. Capital market imperfection due to asymmetric information (STIGLITZ and WEISS 1981) or agency problems (JENSEN and MECKLING 1976) cause a wedge between the costs of external and internal financing. Relying on Stiglitz-Weiss ideas MYERS and MAJLUF (1984) developed the so-called pecking order, or finance hierarchy theory: firms first finance new investment internally from their profits and then with low risk debt. Provided that investment is only sensitive to internal funds if there are financial constraints, it is common to include cash flow into the investment analysis as a standard measure of internal sources (FAZZARI et al. 1988).

In this decade several authors have dealt with empirical investigation on the SBC in post-socialist countries (LIZAL and SVEJNAR 2002, KONINGS et al. 2003, HANOUSEK and FILER 2004, RIZOV 2004, COLOMBO and STANCA 2006). A positive relationship between financial measures and investment is interpreted as evidence of credit rationing, whilst under perfect capital markets this coefficient should be negative or, more likely, null or non-significant. Nevertheless, in a transition economy, the null signals that the firms access to bank loans does not correlate with their efficiency (i.e. the SBC are possible). The negative coefficient means a strong evidence of the SBC because the firms potentially have an unlimited loan access.

3. Financing and investment in Ukrainian agriculture

It is an open public issue as to what extent the Ukrainian agriculture demonstrates financial wealth. The annual machinery depreciation exceeds ten times the replacement machinery investment. Only a small part of depreciation costs is used for the fixed assets purchase while another part fills the gap in current assets. Equity capital being lacking still provides about 80 percent of financial resources in agricultural enterprises (KOBZEV et al. 2004). Agricultural land that is under the moratorium on sale at least until 2007 cannot be used as a mortgage. Agriculture receives about 16 percent of the total bank credit volume in Ukraine (CHAPKO 2003). The credit demand is covered at 50 percent level for variable inputs and at two percent level for long-term debt. Evidence of lacking bank crediting is based both on peculiarities of agricultural production, which provoke the current mismatch between the debtor's solvency and the costs of credit, as well as on the weak institutional power of Ukrainian financial markets. The share of important for investment long-term loan segment in agricultural sector represents only 15 percent of the total bank credit portfolio (CHAPKO 2003).

On the contrary, the farm debt problem is often called a credit 'chimera' (SEDIK 2003) because the main gap in financing Ukrainian large farms seems not to be lacking debt but lacking profits. The low profits are caused by forcible public policies instruments, such as subsidies for input and output purchases, agricultural tax and import tariff discounts, local trade restrictions etc. The large farm sector absorbs considerable labour share, which is particularly indicative of hidden unemployment. Thus, former *kolkhozes* are still playing the role of a social buffer in rural areas and cannot be easily liquidated in case of serious financial problems.

4. Investment modelling framework under financial constraints

In the investment literature of the last twenty years, the Euler equation approach was intensively applied. It requires equality between the marginal product of capital and the cost of capital. The equation includes marginal adjustment costs of investing now and marginal costs of investing the next period. This marginal condition takes into account the financial constraint expressed as increasing cost of debt in 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:

$$V_t = \max_{I_t, L_t} E_t\left[\sum_{\tau=0}^{\infty} \theta_{t+\tau} d_{t+\tau}\right], \text{ s. t.}^1 \quad (1)$$

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

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

Here V_t is the discounted maximised value of firm dividends; E_t is expectation at time *t*; d_t are dividend payments; $\pi_t(.)$ is profit function; K_t is beginning-of-period capital stock; L_t is vector of variable inputs; I_t is investment, and r_t is interest rate. D_{t-1} is the beginning-of-period debt, B_t is the new borrowing, R_t are repayments, $\overline{d_t}$ - minimum dividend payments; $\overline{R_t}$ - minimum repayments, and δ - depreciation rate. $g(B_t)$ are transaction costs associated with new borrowing (e.g. arrangement and commission fees). $\theta_{t+\tau}$ is a discount factor, such that

$$\theta_{t+\tau} = \begin{Bmatrix} \prod_{n=0}^{\tau-1} \frac{1}{1+r_{t+n}},\ \forall \tau > 0 \\ 1,\ \tau = 0 \end{Bmatrix} \quad (2)$$

The maximisation function given in (1) can be rewritten as the dynamic programming problem[2]. As shown by BOND and MEGHIR (1994), the following Euler equation holds for a standard profit-maximising firm under perfect capital market:

$$-(1-\delta)\theta_{t+1}\frac{\partial \pi_{t+1}}{\partial I_{t+1}} = -\frac{\partial \pi_t}{\partial I_t} - \frac{\partial \pi_t}{\partial K_t} + \varepsilon_{t+1} \quad (3)$$

where ε_{t+1} is an expectation error term. Empirical specification of the firm investment model follows after defining the profit function $\pi_t(.)$ as**:**

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

where w_t is the price of variable factor inputs, p_t is the output price, and p_t^I is 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 $G(I_t, K_t)$ is quadratic adjustment cost function with an adjustment cost parameter α:

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

It can be derived that:

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

[2] For detailed derivation of the Euler investment equation under financial constraints, see RIZOV (2004).

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

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

The first term in equation (6b) expresses the relative operating profit, which highly correlates with relative cash flow (CF). Using equations (6a) and (6b) one can reformulate (3) as:

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

where $\phi_{t+1} = \frac{p_{t+1}}{p_t}\left(\frac{1-\delta}{1+r_t}\right)$ is a firm-specific real discount factor on new investment, and $J_t = \frac{1}{p_t}\left(\frac{r_t p_t^I + (p_t^I - p_{t+1}^I + \delta p_{t+1}^I)}{1+r_t}\right)$ reflects the user (opportunity) costs of capital.

As we do not attempt to estimate directly J_t, this term will be replaced in the empirical equation through the firm specific effects q_i and time effects s_t. Furthermore, we introduce two additional variables. The first is the output-capital ratio $\left(\frac{Y}{K}\right)_t$ controlling for imperfect competition and non-constant returns to scale. The second one is the squared debt-to-capital ratio $\left(\frac{D}{K}\right)_t^2$ that accounts for the inseparability of investment and borrowing decisions. After rearranging variables we get a basic empirical Euler equation describing the investment behaviour of the firms:

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

Under the null hypothesis of perfect capital markets, $b_1 \geq 1,\ b_2 \leq -1,\ b_3 \leq 0,\ b_4 \geq 0,\ b_5 = 0$. In order to incorporate the empirical implications of the pecking order theory, we suppose that a positive cash flow coefficient in estimated Euler equation ($b_3 > 0$) notices binding liquidity constraints, i.e. existence of credit rationing. More questionable is the interpretation of the non-positive coefficient. In transition economy a significant non-positive cash flow parameter ($b_3 \leq 0$) indicates not the presence of perfect capital markets, but rather the evidence of soft budget constraints as soon as firms do not rely on equity capital. The farms can be a priori classified as operating in the soft macroeconomic environment if they receive some credit support although being unprofitable during several years. Accounting for the financing-investment relationship in a simple linear fashion presented in this paper is obviously inadequate because the non-linearity implied by the financial regimes may be important. Hence, we will ex ante divide the Ukrainian farms into the two different financial regimes (constrained and unconstrained) applying the financial proxy variable approach (BOND and MEGHIR 1994, RIZOV 2004).

5. Estimation methodology and data

When the regressors in the dynamic panel data set correlate with the residuals because of individual specific effects, the most efficient estimator is the Generalised Method of Moments (GMM). ARELLANO and BOND (1991) developed the first-differenced GMM that is based on removing individual effects and then performing a modified instrumental variables procedure. As the lagged regressors are not correlated with remaining disturbances but potentially can be predetermined by some past events, their values lagged two periods or more are valid instruments for equation in differences. An improved GMM estimator called 'system GMM' and introduced by BLUNDELL and BOND (1998) additionally uses the differences as instruments for the level equations. Our empirical analyses are based on panel data collected in 700 agricultural enterprises from 3 different Ukrainian regions (*oblasts*) between 2001 and 2004. The data for the econometric estimation were calculated from the farms' balance sheets and income statements. All variables were normalised by the capital stock and deflated by the price index of industry goods or agricultural commodities, respectively. Controlling for outliers reduced the analysed sample from 700 to 606 farms. In fact, the observed farms carried out negative investments between 2001 and 2004.

The usual tests performed in econometric software STATA 9 reveal the evidence of significant individual and time specific effects in our data set[3]. Therefore, the time dummy variables were additionally included into the estimation. We expect that the system GMM estimator will provide more satisfactory results confirmed by Hansen (Sargan) test for overidentifying restrictions, which proves the orthogonality conditions for several instruments involved into the GMM estimation. Additionally, we test the sample for absence of second-order autocorrelation[4]. Furthermore, the dummy variables approach has been used for dividing the sample into the constrained and unconstrained financial regimes. According to RIZOV (2004) the first sample selection criteria is that the farms with the borrowing in two consecutive years hold as unconstrained, and the dummy X for financial constraints equals zero. The rest are constrained farms for which the dummy X equals one. The second sample selection criteria is that the farms with the borrowing in two consecutive years are unconstrained if their profits are non-negative.

6. First empirical results and discussion

The system GMM estimates of the Euler investment equation (8) for the sample of 606 farms indicate that the overidentifying restrictions associated with the model were not rejected by the data (see table 1). The positive coefficients of the lagged cash flow parameter confirm the hypothesis about strong investment-financing relationship across farms and, therefore, about binding liquidity constraints. We should carefully consider the negative parameter on the lagged investment-capital ratio. This can be a signal that the farms practise to reduce their investments in the consecutive years. Significant positive coefficients of the output-capital ratio reveal the evidence of imperfect competition on agricultural product markets in Ukraine. It can also signal the non-constant returns to scale under which most farms operate. Introducing the debt-to-capital ratio does not much improve the model specification indicated by the value of Hansen (Sargan) test. Further, we estimate the cash flow parameter of the Euler investment equation with two sample selection criteria described in the previous

[3] Under usual tests are meant Hausman specification test, Breush-Pagan (Lagrange Multiplier) test, and F-test. See BALTAGI (2001) for detailed explanation on testing procedures.

[4] See ARELLANO and BOND (1991).

chapter. In both cases the results shown in the fourth and fifth column of table 1 have the following signs: $b_3 \leq 0$ for the a priori constrained sample of farms, and $b_3 > 0$ for the unconstrained sample. However, using the first criteria, which ex ante selects all the farms potentially facing the SBC into the unconstrained sub-sample, reveals less impact of the financial variable.

Table 1. GMM estimates of the Euler investment equation with sample selection: 606 farms, 2001-2004

Parameter	Without debt	With debt	First criteria	Second criteria	Third criteria
		Unconstrained sub-sample			
b_1	-0.1149***	-0.1148	-0.2605***	-0.2909***	-0.0721
	(0.0369)	(0.0367)	(0.0753)	(0.0785)	(0.5015)
b_2	0.0061	0.0055	0.0129	0.0343	-0.0037
	(0.0395)	(0.0398)	(0.0803)	(0.0891)	(0.4774)
b_3	0.1449*	0.1489**	0.3773*	0.4523**	-2.1882*
	(0.0774)	(0.0775)	(0.2052)	(0.2336)	(1.1715)
b_4	0.1201***	0.1185***	0.2140***	0.2489***	-0.2449
	(0.0319)	(0.0320)	(0.0570)	(0.0734)	(0.2372)
b_5		0.0608			
		(0.3586)			
		Constrained sub-sample			
b_1			0.0748	0.0989	-0.1383
			(0.0778)	(0.0805)	(0.5019)
b_2			-0.0203	-0.0349	0.0005
			(0.0938)	(0.0971)	(0.4785)
b_3			-0.4369**	-0.4509**	2.1889*
			(0.2105)	(0.2175)	(1.1969)
b_4			0.0669**	0.0287	0.5124**
			(0.0340)	(0.0345)	(0.2156)
m_2 test	0.972	0.974	0.823	0.843	0.276
Hansen (Sargan) test	0.414	0.560	0.092	0.477	0.235

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 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 Sargan (Hansen) test is the test for overidentifying restrictions.

Source: Own calculations

Therefore, in explaining investment decisions it is important to consider carefully which farms are really constrained. With respect to farms being constrained, besides no access to credit, they must exhibit demand for credit. The farms that do not need credit are not really constrained even though they do not borrow. An alternative way to test for

the SBC will be then to look at an a priori unconstrained sub-sample where farms borrow but also make losses. The estimation results shown in the last column of table 1 confirm the correct testing for the SBC. The model is now able to differentiate better between the two financial regimes. The unconstrained farms reveal strong evidence of the soft financial environment. Thus, the empirical results on financing-investment relationship confirm the SBC hypothesis for the Ukrainian large farms being in an unconstrained financial regime.

7. Conclusions

In this paper we aimed to analyse the linkages between the investment in 700 Ukrainian large farms and their financing constraints between 2001 and 2004. For this purpose the Euler investment equation approach was used. The first empirical results reveal that the model of a perfect capital market was rejected for large farm sector in Ukraine. Our hypothesis about the soft macroeconomic environment (soft budget constraints) could be confirmed for a part of observed farms. The farms were defined a priori as financial unconstrained if these received credits being unprofitable in two consecutive years. Other sample separation criteria discussed in the literature and applied in our analyses failed in attempting a correct indication of the financial regimes.

We realise that the analysed sample is slightly small to be considered optimal. As soon as required data from Ukrainian farms is available, the next step in the empirical analysis will be the estimation of the Euler investment equation for a longer time period. We learned that the sensitivity of the sample separation criteria is an important factor in explaining investment behaviour with financial constraints. The first empirical results presented here do not pretend to build an unique opinion on the level and implications of financial constraints. Certainly, a weak financial discipline in unconstrained (unprofitable) farms in connection with credit rationing among the constrained farms endangers the tendency of lumpy investment. However, it is rather a speculative question about the survival of unprofitable farms as long as those remain a big social buffer in rural areas. Macroeconomic evaluation of both phenomena, soft budget constraints and credit rationing, in agriculture of Ukraine is an important issue for the further research.

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