Soft budget constraint and the reform of the Common Agricultural Policy: A comparative analysis

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A B S T R A C T

The article investigates farms' investment behaviour and presence of soft budget constraint in the agriculture of three Central and Eastern European countries using individual farm accountancy panel data for the 2007-2015 period. Farm gross investment is positively associated with farm gross investment in the previous year, real sales' growth, and public investment subsidies. Mixed results for debt square and cash flow variables imply different farms' investment behaviour pertained to different structures in investment sources between the analyzed countries, and particularly insignificant cash flow coefficients imply soft budget constraints for Hungarian and Slovenian farms.

Key words: Farm investment behaviour, Soft budget constraint, Investment subsidy, Panel data analysis, European Union

JEL classification: D81, D92, O12, Q12, C23

1. Introduction

There is a wealth of research on farm investment behaviour (e.g., Bierlen and Featherstone, 1998; Benjamin and Phimister, 2002; Petrick, 2004a, 2004b; Latruffe, 2005; Bakucs et al., 2009; Bokusheva et al., 2009; Zinych and Odening, 2009; Latruffe et al., 2010; Hüttel et al., 2010; Bojnec and Latruffe, 2011; Kallas et al., 2012). However, studies dealing with agriculture are generally limited to one country and exclude cross-country comparisons, except for Benjamin and Phimister (2002), and Fertő et al. (2017).

Previous research provides evidence of capital market imperfections in Central and Eastern European (CEE) countries during transition and after accession to the European Union (EU) (Latruffe, 2005; Bojnec and Latruffe, 2011, Bojnec and Fertő, 2016). Some papers tested hypothesis on the persistence of soft budget constraints in transition economies. However, soft budget constraints (SBC) may also persist once the countries have shifted to market economies, which may lead to a postponed restructuring (Kornai, 2001; Kornai et al., 2003). SBC may be more important in the agricultural sector, since farms' government support is generally much higher than subsidies aimed for firms in the manufacturing sector.

The aim of this paper is to investigate the presence of SBC and credit market imperfections in Estonian, Hungarian and Slovenian farms. An Euler equation model in a dynamic panel setting is applied as a methodological approach. The historical development and the evolution of farms in the EU vary by countries and also within the CEE region. In CEE countries, differentials in farm size and growth are caused by the initial conditions arising from the previous communist system and by the institutional and policy reforms of the 1990s. During the communist system Estonian and Hungarian agriculture were collectivised, the average farm size in this two countries was, and still is among the largest in Europe. In Slovenia the communist collectivisation failed and small-scale farm structure persisted, thus the average farm size is among the smallest in Europe (Bojnec and Latruffe, 2013). The evolution in farm structure in the EU is shaped by policy support, in particular by the Common Agricultural Policy (CAP) measures (Piet et al., 2012). Transition from centrally-planned to market economy in Slovenia has strengthened further development of small-scale family farms, while in Estonia and Hungary a bi-modal farm structure has emerged with a greater number of small-scale family farms and less numerous large-scale corporate farms. The proportion of small farms in Slovenian agriculture is much higher than in Estonia and Hungary. Therefore, our comparative analysis includes three countries with different historical-institutional developments and different farm structures: small-scale farms in Slovenia, and bi-modal structure with small-scale and large-scale farms in Estonia and Hungary.

Our study contributes to the literature by examining the empirical aspects of investment behaviour and financial constraints in CEE agricultural farms in Estonia, Hungary and Slovenia. There has been some previous research on the issue of investment - cash flow sensitivity. Bakucs et al. (2009), Bojnec and Latruffe (2011), Bojnec and Fertő (2016), and Fertő et al. (2017) found evidence of capital market imperfections in Hungary and Slovenia during transition. But no previous study focuses on whether such imperfections persist focusing after 2007 period or how these may vary between countries with different farming structures and historical-institutional development. Our comparative paper thus seeks to fill this gap using micro farm-level data.

The remainder of our paper has the following structure. In Section 2 we describe the Euler equation used in econometric estimations, and in Section 3 we discuss our data and provide descriptive statistics about the sample farms in Estonia, Hungary and Slovenia. In Section 4 we present our econometric empirical results. The final Section 5 sums up the main findings and discusses agro-food policy implications and suggestions for further work.

2. Methodology

We start with the model developed by Bond and Meghir (1994) assuming that the farm investment behaviour is a dynamic process which describes capital accumulation rates in individual periods. Thus, our baseline investment or adjustment costs model specification is defined by the following Euler equation:

$$\left(\frac{I}{K}\right)_{it} = \alpha_0 + \alpha_1 \left(\frac{I}{K}\right)_{it-1} + \alpha_2 \left(\frac{I}{K}\right)_{it-1}^2 + \alpha_3 \left(\frac{CF}{K}\right)_{it-1} + \alpha_4 \left(\frac{S}{K}\right)_{it-1} + d_t + \beta_i + v_{it}, \quad (1)$$

where the investment (I) of farm i in a particular year t is defined not only by sales growth (S) and farm liquidity proxied by cash flow (CF) in the year t-1, but also by farm investment in the year t-1. All variables are normalised by capital (K). From the theoretical model we can derive the following hypotheses. It is expected that the coefficient of the lagged investment term α_1 is positive and greater than one if the farm's real discount rate is positive. The coefficient of the squared investment term α_2 is expected to be negative and greater than one in absolute value, reflecting costs of adjustment that are increasing and convex in the size of investments. The sign of the coefficient of cash flow term α_3 should be negative or not significant under the assumption that the farm can raise as much money as it desires at a given cost. A positive and significant cash-flow coefficient is usually interpreted as an indicator of financial constraints. Under assumption of perfect competition and constant return to scale α_4=0, thus a positive sign on the sales variable implies the presence of imperfect competition in the output market.

Second, we include in the Euler equation investment model the quadratic term of debt (D) variable (Rizov, 2004):

$$\left(\frac{I}{K}\right)_{it} = \alpha_0 + \alpha_1 \left(\frac{I}{K}\right)_{it-1} + \alpha_2 \left(\frac{I}{K}\right)_{it-1}^2 + \alpha_3 \left(\frac{CF}{K}\right)_{it-1} + \alpha_4 \left(\frac{S}{K}\right)_{it-1} + \alpha_5 \left(\frac{D}{K}\right)_{it-1}^2 + d_t + \beta_i + v_{it}. \quad (2)$$

The specification in equation (2) allows testing for non-separability between investment and borrowing decisions (Bond and Meghir, 1994). The coefficient of the D variable, α_5 is expected to be zero under perfect capital markets ($\alpha_5 = 0$). It may be positive and significant ($\alpha_5 > 0$) signalling that the firm relies on borrowing for financing its investment, whilst if it is negative ($\alpha_5 < 0$) it can be interpreted as an indicator of bankruptcy costs.

Third, we include the investment subsidy (X) as a controlling explanatory variable into the model derived in the previous steps. Thus we estimate the augmented investment model of the form:

$$\left(\frac{\mathrm{I}}{\mathrm{K}}\right)_{\mathrm{it}} = \alpha_0 + \alpha_1\left(\frac{\mathrm{I}}{\mathrm{K}}\right)_{\mathrm{it}-1} + \alpha_2\left(\frac{\mathrm{I}}{\mathrm{K}}\right)_{\mathrm{it}-1}^2 + \alpha_3\left(\frac{\mathrm{CF}}{\mathrm{K}}\right)_{\mathrm{it}-1} + \alpha_4\left(\frac{\mathrm{S}}{\mathrm{K}}\right)_{\mathrm{it}-1} + \alpha_5\left(\frac{D}{K}\right)_{it-1}^2 + \alpha_6\left(\frac{\mathrm{X}}{K}\right)_{\mathrm{it}} + \mathrm{d_t} + \beta_\mathrm{i} + \mathrm{v_{it}} \quad . \qquad (3)$$

Two definitions of investment subsidy are used in the empirical procedure, first a continuous variable (X/K_{it}), and second a dummy (DX_{it}), which takes the value of one, if the farm has received an investment subsidy in a given year and zero otherwise.

Investigating the SBC our main interest focuses on the cash flow variable. In the case of developed market economies, a low cash flow sensitivity of investment ($\alpha_3 \leq 0$) is usually interpreted as evidence of perfect capital markets. However, this conclusion is not appropriate in agriculture where policy support is typical. Presence of generous agricultural subsidiy may imply a soft financial environment, where unprofitable farms may access to credit. This provision of money allows for the realization of investments independent of cash flow. Consequently, these farms exhibit a lower cash flow sensitivity of investment, which translates into a nonsignificant cash flow parameter in the Euler equation. That implies a nonpositive cash flow parameter that may indicate the presence of the SBCs phenomenon rather than perfect capital market conditions. Thus, a significant sensitivity of investment with regard to cash flow ($\alpha_3 > 0$) may reflect the process of budget constraints' hardening, or binding liquidity constraints.

It is important to note that the SBC is a complex phenomena resulting serious difficulties for empirical analysis. Literature identifies several sources of the SBC including altruistic political behaviour, dynamic commitment problem or passive creditors (see Kornai et al., 2003). Due to this complexity, it is difficult to establish a clear relationship between the presence of SBCs and the farm's financial strategy. Zynich and Odening (2009) emphasise that analysing the investment–financing relationship in a simple linear fashion as in Eq. (2) is obviously inadequate because of the nonlinearity implied by the different finanical situations of farms. Besides the borrowing farms that are considered as a priori unconstrained, other farms do not receive loans and thus should face a different sensitivity of investment demand to the capital structure. Thus, it is difficult to differentiate between the firm- or farm-specific effects on investment and the effects of financial constraints (Kaplan and Zingales, 1997), which requires determining exogenously the premium on external finance, and furthermore, whether a firm/farm is confronted with more or less severe market imperfections.

Thus following Rizov (2004) and Zynich and Odening (2009) we divide the total sample into two subsamples according to their financial status. We employ an indicator for the availability of external funds, that is, the financial status, as a time-specific dummy variable, z. This variable equals one when no new borrowing is present, and zero otherwise. More specifically, farms are considered unconstrained if they borrow in at least two consecutive years. The dummy interacts with the other variables from Eq. (2) for the constrained regime and expresses the difference between the two financial regimes. Because the level of new borrowing is implicitly included in the debt-to-capital ratio, we omit the latter variable in the specification with a sample separation. Thus we estimate the following model.

$$\left(\frac{I}{K}\right)_{it} = \alpha_0 + \alpha_1 \left(\frac{I}{K}\right)_{it-1} + \alpha_2 \left(\frac{I}{K}\right)_{it-1}^{2} + \alpha_3 \left(\frac{CF}{K}\right)_{it-1} + \alpha_4 \left(\frac{S}{K}\right)_{it-1} + \alpha_5 z \left(\frac{I}{K}\right)_{it-1} + \alpha_6 z \left(\frac{I}{K}\right)_{it-1}^{2} + \alpha_7 z \left(\frac{CF}{K}\right)_{it-1} + \alpha_8 z \left(\frac{S}{K}\right)_{it-1} + \alpha_9 \left(\frac{X}{K}\right)_{it} + d_t + \beta_i + v_{it}\ . \quad (4)$$

We employ the Generalized Method of Moments (GMM) estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998), also referred to as GMM-system estimator. Windmeijer (2005) proposes a finite sample correction that provides more accurate estimates of the variance of the two-step GMM estimator (GMM-SYS). As the t-tests based on these corrected standard errors are found to be more reliable, the paper estimates the coefficients using a finite sample correction.

In addition, we imposed outlier rules by removing farms from econometric estimations if their investment-to-capital ratio is above 99% in absolute value (as in Benjamin and Phimister, 2002).

3. Data

Our analysis is based on Estonian, Hungarian and Slovenian individual farm data. The data are extracted from national Farm Accountancy Data Network (FADN) databases, which provide homogenous accountancy data for farms through the EU. Only farms above a specific size threshold are included in the FADN, the threshold being two European Size Units (ESUs; one ESU is equivalent to 1,200 euros of gross margin). FADN implements yearly survey to farm businesses employing bookkeeping, with a rotating panel of about five years. It follows, that our panel datasets are unbalanced. The time span of the unbalanced panel dataset used for analysis is the 2007-2015 period for each of the analyzed three countries.

The variables used are available in the FADN database (European Commission, 2006). Gross investment is the FADN variable coded SE516 (‘gross investment’), defined as the difference between purchased and sold assets. The cash flow variable is the FADN variable coded SE526 ('cash flow'), defined as the difference between the farm receipts and expenditure for the accounting year, not taking into account operations on capital and on debts and loans. The investment subsidy variable is the FADN variable coded SE406 ('subsidies on investment'); these subsidies include subsidies on agricultural land, buildings, rights, forest land including standing timber, machinery and equipment, and circulating capital. The sale growth variable is proxied by the change in total output between two consecutive years; total output is the FADN variable coded SE131 ('total output'), defined as the total of output of crops and crop products, livestock and livestock products and other output. Debt is defined as the sum of short (SE490) and long term (SE495) loans. All the above listed variables are related to capital, which is the FADN variable coded SE436 ('total assets'), including fixed and current assets owned by the farm. The FADN variables are deflated by price indices which are obtained from the national statistical offices of Estonia, Hungary and Slovenia.

Table 1 presents descriptive statistics of the data used. Gross investment to capital is the highest for Estonian farms and the lowest for Slovenian farms on average. The data shows disinvestments by some farms in Estonia, Hungary and Slovenia. Looking dynamically over time, gross investment to capital has been rather stable at lower level for Slovenian farms, but has explored cyclical pattern in development for Estonian farms, and has increased rapidly for Hungarian farms since 2013 (Figure 1).

Real sale growth to capital is the highest for Estonian farms and the lowest for Slovenian farms on average. As for real cash flow to capital, it is the highest for Estonian farms and the lowest for Slovenian farms on average. Except for real sale growth to capital in Estonia, real sale growth to capital, and real cash flow to capital varies within the samples from negative to positive values in each of the three analyzed countries.

Public investment subsidy in period *t-1* to capital is on average similar at lower level for Hungarian and Slovenian farms, but a slightly higher for Estonian farms. While evolution in development of public investment subsidy in period *t-1* to capital has been rather stable for Hungarian and Slovenian farms, it has explored substantial cyclical oscillations for Estonian farms (Figure 2).

Debt is the highest for Estonian and to a lesser extent for Hungarian farms and the lowest for Slovenian farms.

4. Econometric results

Our econometric results suggest that the current farm investments are significantly and positively associated with the lagged farm investments, but the regression coefficients are less than one in absolute value, which is valid for each of the analysed countries (Table 2).

The regression coefficient of the squared investment term is significantly positive for Estonia and significantly negative for Hungary and Slovenia, but less than one in absolute value for each of the countries model specification. The small regression coefficients of the squared investment term in Estonia indicate that under unstable macroeconomic conditions (such as economic crisis, and Russian export embargo) farms use large discount rates in investment planning. These mixed results imply complexity in investment adjustment costs in relation to the size of investments.

Our estimations confirm the positive and significant association between farm gross investment and farm real sale growth for each country, implying that the investment behaviour of farms is driven by the presence of imperfect competitive output market conditions and the farm abilities to sell output and invest in such a market environment. These results are in line with findings of previous studies set in Hungary and Slovenia before (Bakucs et al., 2009; Bojnec and Latruffe, 2011) and first years after the EU accession (Bojnec and Fertő, 2016; Fertő et al., 2017).

Farm gross investment is negatively and significantly associated with cash flow for Estonia, confirming the absence of financial constraints. The results are insignificant for Hungary and Slovenia. Insignificant cash flow coefficients imply soft budget constraints for Hungary and Slovenia. Notice that earlier studies find is the positive and significant parameter estimate of the lagged cash flow for Hungary and Slovenia between 2004 and 2008, which confirms strong financing–investment relationships across the farms and, therefore, capital market imperfections (Bojnec and Fertő, 2016; Fertő et al., 2017).

The significantly positive regression coefficients of squared debt variable suggest that investment and financing decisions cannot be separated in Slovenia as farms may rely on borrowing for financing its investment confirming finding for previous period (Bojnec and Fertő, 2016; and Fertő et al., 2017). This result is also similar to Bokusheva *et al.* (2009), Zinych and Odening (2009), for farm investment behaviour in Russian and Ukrainian agriculture, respectively. The significantly negative coefficients of squared debt variable as an indicator of bankruptcy costs suggest that investment and financing decisions can be separated in Estonia. Similarly to earlier study (Fertő et al., 2017) we find the insignificant coefficients of the squared debt variable to be close to zero that imply perfect capital markets for Hungary.

Finally, farm gross investment is found to be positively and significantly associated with public investment subsidies for each of the analysed countries confirming findings by earlier study (Fertő et al., 2017). The regression coefficient is greater than one for Hungary and less than one for Slovenia and Estonia. Public investment subsidies can mitigate capital market imperfections in the short-term. On the long run, the farm's ability to successfully compete in the output market by selling produce and securing a sufficient cash flow for investment is crucial.

The general specification of the Euler investment equation does not account for different financial regimes which imply the unequal sensitivity of farms' investments to financial restrictions. Now we turn to investigate the impact of an ex-ante sample separation into the two financial regimes (Table 3). The first four coefficients relate to the sub-sample where the basic Euler equation is expected to be valid even in the presence of market imperfections, while the remaining four coefficients estimate the difference between the coefficients on each variable across the two sub-samples.

We find significantly positive regression coefficients for the cash flow variable in Estonia and Slovenia with continouos subsidy specification, whilst the regression coefficients of cash flow are insignificant for Hungary in unconstrained sample. The positive and significant relationship in Estonia and partly in Slovenia contradicts the hypothesis that financial constraints are not present in this group and hence investment decisions are independent from the availability of internal funds. Even more striking is the negative cash flow regression coefficient for the constrained subsample in Estonia similarly to Ukrainen farms (Zinych and Odening, 2009). In addition, regression coefficients of cash flow are insignificant in Hungary and Slovenia.

How can we explain these mixed results? First, one should note that farms in the a priori constrained group have lower investment-to-capital rates than those in the unconstrained group in Estonia (0,05 and 0.14) and lesser extent for Slovenia (0.04 and 0.06) and in Hungary (0.05 and 0.07). In the presence of investment subsidies probably relatively small amounts of credit are required for the investment expenditures, the role of cash flow as a proxy for net worth (collateral) is questionable. Thus cash flow, may not play a crucial role for investment decision in each countries.

In contrast, a priori unconstrained farms invest more especially in Estonia, on average, and therefore require additional capital volume for growth. In addition, subsidy rate is at similar level in Estonia in both subsample. Hubbard (1998) points out, if the capital demand can be covered by debt capital, the availability of internal finance is required. In addition, the low level subsidy rate can not compensate the financial constraints. Hence, the role of cash flow is significant at a higher level for the unconstrained subsample, which is expressed in terms of a positive cash flow parameter in the investment equation. In contrast, the insignficant cash flow coefficients in Hungary implying soft budget constraints can be explained by the relatively lower level investment rate with higher level subsidy rate. We find mixed results for Slovenia with strongly positive and insignficant cash flow estimates.

Regarding to other control variables we can observe considerable differences between two subsamples in each countries. The current farm investment is significantly and positively associated with the lagged farm investment for Hungary and Slovenia for unconstrained sample, but significantly and negatively associated with the lagged farm investment for financially constrained farms. The regression coefficients for Hungary and Slovenia remained less than one in absolute value. For Estonia the regression coefficients are largely insignificant, except for unconstrained farms with continuous subsidy specification.

The regression coefficients of the squared investment term are significantly positive for Estonian financially constrained and unconstrained farms, and significantly negative for financially constrained farms and significantly positive for financially unconstrained farms in Hungary and Slovenia. The regression coefficients for Slovenian farms are greater than one in absolute value, implying adjustment costs that are increasing and convex in the size of investments.

In general our estimations confirm the positive and mostly significant association between farm gross investment and farm real sale growth for financially unconstrained farms in Estonia and Hungary confirming that the investment behaviour of farms is driven by the presence of imperfect competitive output market conditions and the farm abilities to sell output and invest in such a market environment. There is a considerable difference in the sign of the regression coefficient between financially constrained and unconstrained farms in Slovenia, while findings are similar to Estonia in both subsamples.

Farm gross investment has remained positively and mostly significantly – except for Slovenian farms with dummy – associated with public investment subsidies for each of the analysed countries. The regression coefficient has remained greater than one only for Hungary and less than one for Slovenia and Estonia.

In sum, similarly to Rizov (2004), Bokusheva et al. (2009) and Zinych and Odening (2009) our estimations suggest, that there are significant differences in the investment behaviour of sub-samples of farms separated according to their financial status in each of the three analyzed countries.

5. Conclusion

We investigate farmers' investment behaviour in Estonia, Hungary and Slovenia using the Euler equation model. We find evidence of the existence of soft budget constraints in Hungarian and Slovenian farms during the post EU accession period and most recent reforms of CAP. Farm gross investment is positively associated with real sale growth, particularly in Estonia, suggesting that farm investment decisions are based on market conditions.

Farm gross investment is positively associated with public investment subsidies. Public programmes to support farm investment with subsidies seem to be successful in enhancing investment in these countries in the short-term. However, farms' investment behaviour pertaining to investment subsidies is more cautious in the long-term. This implies that investment subsidies can mitigate some capital market imperfections such as interest rate volatility, but that in the long-term what are crucial are farm competitiveness and its ability to successfully compete in the output market: selling and gaining sufficient cash flow enable investment and thus ensuring competitive survival and farm growth. In long-term improvement of farm profitability can play important role in vertical integration of farms in agri-food value chain (Grau and Reig, 2015).

We also show that the version of the estimated model allows for differential financial status across farms confirm the heterogeneity in farms' investment decisions. These differences in farm investment behaviour between sub-samples and the analyzed three countries confirmed the unequal sensitivity of farms' investments to financial restrictions.The large state intervention in the agriculture of developed countries is well known. In the EU for example, the cost of the CAP, amounts to about half of the EU budget. During the period studied, Estonian, Hungarian and Slovenian farmers could benefit from investment subsidies provided in the frame of the CAP. Our paper does provide evidence of soft budget constraints in Hungarian and Slovenian farms, and thus highlights the role of the state in shaping farm investment behaviour and the farming structure of the three countries studied. Therefore, soft budget constraints in agriculture can persist before and after accession to the EU and during long-way to market economies with possible implications on a postponed restructuring (Kornai, 2001; Kornai et al., 2003). State subsidies in agriculture help farms to cover their investment cost in the short-term, and therefore contribute to their survival. But by contrast to the soft budget constraints situation, investment subsidies in the period studied were not freely provided to farms: farmers needed to motivate their subsidy application with a detailed business plan, and usually obtained subsidies up to a specific share (generally, half) of the investment cost. While state subsidisation of farm investments may have some justification (e.g. food is crucial to a country; farms help maintain some economic activity in isolated areas; subsidies can give incentives to create positive environment externalities), it is nevertheless costly for the taxpayers. Further research could therefore investigate whether other less costly subsidisation channels are possible, such as zero interest state loans.

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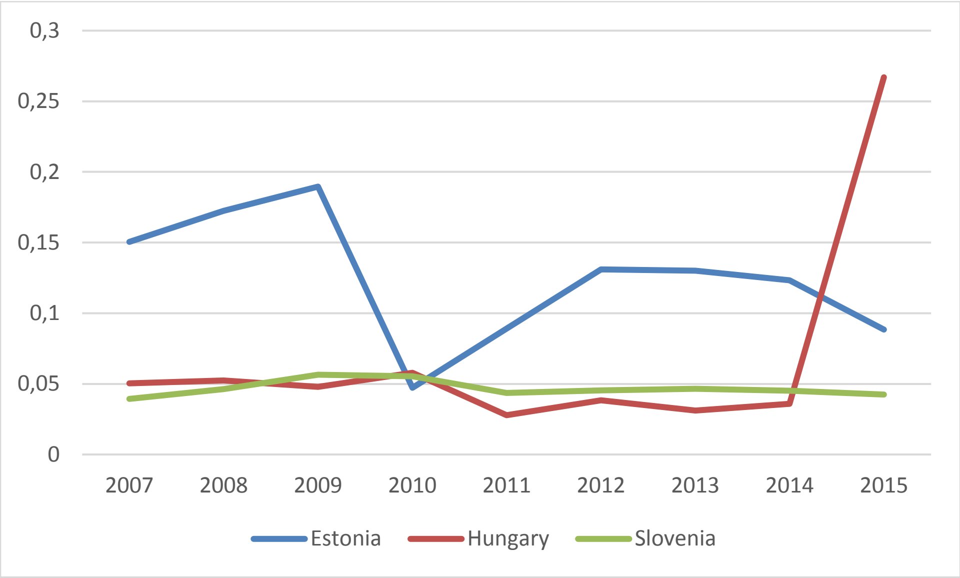
Table 1 Descriptive statistics (whole period averages).

	Obs	Mean	Std. Dev.	Min	Max
Estonia (in euro) – 2007-2015					
$\left(\frac{\mathrm{I}}{\mathrm{K}}\right)_{\mathrm{it}-1}$	5,379	0.117	0.197	-.9964079	1
$\left(\frac{\mathrm{CF}}{\mathrm{K}}\right)_{\mathrm{it}-1}$	4,852	0.153	0.483	-5.079	17.430
$\left(\frac{\mathrm{S}}{\mathrm{K}}\right)_{\mathrm{it}-1}$	4,852	0.532	1.031	0.000	23.882
$\left(\frac{D}{K}\right)_{it-1}$	5,379	0.313	0.601	0.000	24.948
$\left(\frac{X}{K}\right)_{it}$	4,852	0.025	0.096	0.000	2.857
Hungary (in euro) – 2007-2015					
$\left(\frac{\mathrm{I}}{\mathrm{K}}\right)_{\mathrm{it}-1}$	17,426	0.071	0.133	-0.943	0.998
$\left(\frac{\mathrm{CF}}{\mathrm{K}}\right)_{\mathrm{it}-1}$	14,508	0.163	0.226	-9.108	4.613
$\left(\frac{\mathrm{S}}{\mathrm{K}}\right)_{\mathrm{it}-1}$	14,508	0.464	0.527	-0.486	15.306
$\left(\frac{D}{K}\right)_{it-1}$	17,426	0.199	0.339	-0.0001	25.718
$\left(\frac{X}{K}\right)_{it}$	17,426	0.004	0.019	0.000	0.503
Slovenia (in euro) – 2007-2015					
$\left(\frac{\mathrm{I}}{\mathrm{K}}\right)_{\mathrm{it}-1}$	8,173	0.045	0.076	-0.296	0.779
$\left(\frac{\mathrm{CF}}{\mathrm{K}}\right)_{\mathrm{it}-1}$	6,305	0.074	0.089	-0.762	1.935
$\left(\frac{\mathrm{S}}{\mathrm{K}}\right)_{\mathrm{it}-1}$	6,305	0.153	0.138	-0.109	3.156
$\left(\frac{D}{K}\right)_{it-1}$	8,173	0.022	0.063	0.000	0.864
$\left(\frac{X}{K}\right)_{it}$	6,305	0.006	0.031	0.000	1.689

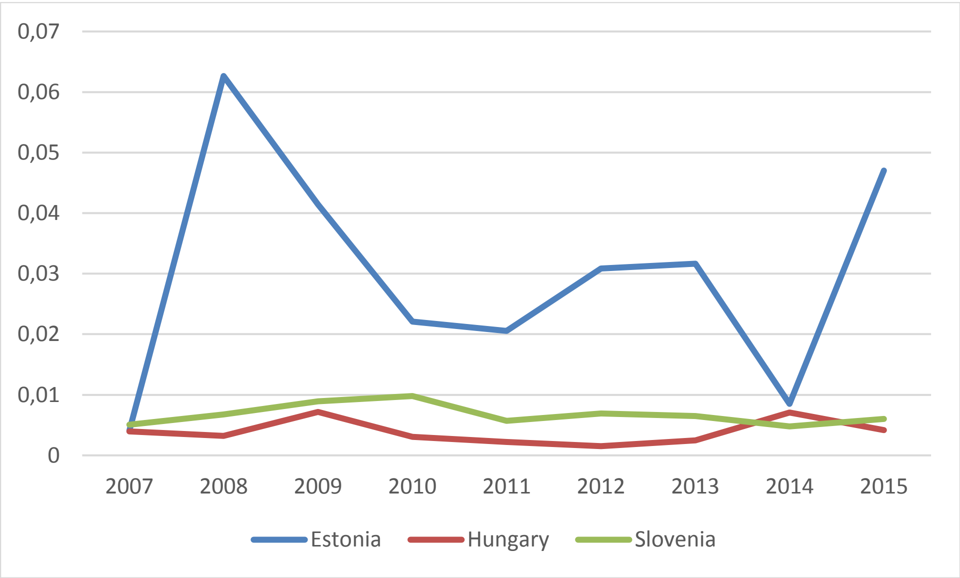
Source: authors' calculations based on FADN data for Estonia, Hungary and Slovenia.

Figure 1 Mean of investment capital ratios, 2007-2015



Source: authors' calculations based on FADN data for Estonia, Hungary and Slovenia.

Figure 2 Mean of investment subsidy capital ratios, 2007-2015



Source: authors' calculations based on FADN data for Estonia, Hungary and Slovenia.

Table 2. Dynamic Panel Model (GMM-SYS) estimations

	Estonia		Hungary		Slovenia	
	Sub. (Cont.)	Sub. (Dum.)	Sub. (Cont.)	Sub. (Dum.)	Sub. (Cont.)	Sub. (Dum.)
$\left(\frac{I}{K}\right)_{it-1}$	0.038**	0.041**	0.106***	0.121***	0.078***	0.153***
$\left(\frac{\mathbf{I}}{\mathbf{K}}\right)^{\mathbf{2}}_{\mathbf{it-1}}$	0.051***	0.050***	-0.387***	-0.431***	-0.125***	-0.167***
$\left(\frac{CF}{K}\right)_{it-1}$	-0.063***	-0.067***	0.009	0.006	-0.013	-0.054
$\left(\frac{S}{K}\right)_{it-1}$	0.129***	0.141***	0.015**	0.017**	0.054	0.081**
$\left(\frac{\mathbf{D}}{\mathbf{K}}\right)^{\mathbf{2}}_{\mathbf{it-1}}$	-0.002***	-0.002***	0.006	0.004	0.712***	0.690***
$\left(\frac{X}{K}\right)_{it}$	0.381***		1.629***		0.771***	
DX_{it}		0.071***		0.095***		0.033***
constant	0.050	0.044	0.152***	0.150***	0.015**	0.006
N	4852	4852	11890	11890	4947	4947
P. AR(2)	0.2141	0.2555	0.9343	0.6365	0.6207	0.4386
P. Sarg	0.3659	0.2378	0.3721	0.4170	0.0489	0.2736
P. Ch^2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: Outlier farms are farms for which the investment-to-capital ratio is above 99% in absolute value. All explanatory variables except subsidy are divided by capital. N: number of observations. ***/**/*: statistically significant, respectively at the 1%, 5%, and 10% levels.

Table 3. Dynamic Panel Model (GMM-SYS) estimations with sample selection

	Estonia		Hungary		Slovenia	
	Sub. (Cont.)	Sub. (Dum.)	Sub. (Cont.)	Sub. (Dum.)	Sub. (Cont.)	Sub. (Dum.)
$\left(\frac{I}{K}\right)_{it-1}$	0.006	-0.007	0.180***	0.198***	0.319*	0.260**
$\left(\frac{\mathbf{I}}{\mathbf{K}}\right)_{\mathbf{it-1}}^{\mathbf{2}}$	0.056***	0.160***	-0.512***	-0.569***	-1.200***	-1.148***
$\left(\frac{CF}{K}\right)_{it-1}$	0.026***	0.036***	0.009	0.006	0.395***	0.105
$\left(\frac{S}{K}\right)_{it-1}$	0.056***	0.070***	0.014**	0.017**	-0.339***	-0.125**
$z\left(\frac{I}{K}\right)_{it-1}$	0.090*	0.005	-0.462***	-0.478***	-0.559***	-0.325***
$\boldsymbol{z}\left(\frac{\mathbf{I}}{\mathbf{K}}\right)_{\mathbf{it-1}}^{\mathbf{2}}$	0.319***	0.277***	0.505***	0.558***	1.053***	1.027***
$z\left(\frac{CF}{K}\right)_{it-1}$	-0.126***	-0.143***	-0.004	-0.002	-0.182	-0.045
$z\left(\frac{S}{K}\right)_{it-1}$	0.012*	0.003	0.006	0.006	0.303***	0.268***
$\left(\frac{X}{K}\right)_{it}$	0.407***		1.642***		0.844***	
DX_{it}		0.069***		0.097***		0.008
constant	0.061***	0.039***	0.019***	0.018***	0.017**	0.014**
N	4852	4852	11890	11890	6305	6305
P. AR(2)	0.3327	0.2431	0.7326	0.4495	0.090	0.1651
P. Sarg	0.1734	0.0884	0.3776	0.4176	0.6656	0.4754
P. Ch^2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: See note to Table 2.