Financial constraints and farm investments in Slovenia

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Jel classification: C33, G31, H25, Q14

Abstract

The paper investigates financial constraints and investment behaviour in Slovenian agriculture using Farm Accountancy Data Network employing a bootstrap Least Squares Dummy Variables Corrected sample selection model. The baseline Euler equation model is controlled for the impacts of off-farm income, farm efficiency, family farm organization, and financial status for differentials across farms. We find that the off-farm income and being family farm have less impact on farm investments. More technically efficient farms invest less than less efficient farms. The indebted farms use debts and invest more than non-indebted farms. The results indicate the persistence of financial constraints for farm investments, particularly for family farms. As guidelines for economic policy is suggested more effective financial support through the creation of beneficial lines of credit designed specifically to support viable farm investments, particularly for family farms, which prevails in the country's farm structures. Finally, more effective policy mechanism is needed for the heavy indebted farm households, which is of relevance also for other transition and emerging market economies.

Keywords: *off-farm income, farm investment, Euler equation, panel data analysis, Slovenia.*

Résumé

Dans ce travail, nous avons examiné les contraintes financières et le comportement d'investissement dans le secteur agricole slovène en nous appuyant sur le réseau d'information comptable agricole et à l'aide d'un estimateur LSDV (Least Squares Dummy Variables) corrigé. Nous avons appliqué l'équation standard d'Euler pour évaluer l'incidence du revenu extra-agricole, du rendement agricole, de la dimension familiale de l'exploitation et du statut financier sur les écarts observés entre les exploitations. Nous avons constaté que le revenu extra-agricole et la dimension familiale de l'exploitation ont une moindre incidence sur les investissements agricoles. Les exploitations techniquement plus performantes investissent davantage par rapport aux exploitations moins performantes. Les exploitations endettées ont recours à l'endetteemnt et investissent plus que les exploitations non endettées. Les résultats indiquent la persistance des contraintes financières pour les investissements agricoles, notamment dans le cas des exploitations familiales. Comme indication de politique économique, nous suggérons un soutien financier plus efficace à travers la création de lignes de crédits avantageuses, spécialement conçues pour encourager des investissements agricoles viables, en particulier pour les exploitations familiales qui sont prédominantes dans la structure agricole du pays. Enfin, nous signalons la nécessité d'un mécanisme politique efficace pour les familles agricoles fortement endettées, ce qui serait également utile pour d'autres économies de marché émergentes et les économies en transition.

Mots-clés: Revenu extra-agricole, investissement agricole, équation d'Euler, analyse des données de panel, Slovénie.

1. Introduction

There is a large body of empirical work on the significance of internal finance in influencing firm-level investment (Bond and Van Reenen, 2007). Empirical evidence from Central and Eastern European (CEE) countries shows that farms' investment activities seriously decreased immediately following the introduction of reforms (Bokusheva *et al.*, 2009). However, the enlargement of the European Union (EU) provides additional opportunities for the new EU member states from the CEE countries to increase the investment activities in agriculture. The research on investments behaviour in the CEE economies has largely investigated possible presence of capital market imperfections and the persistence of soft budget constraint before the EU enlargement (Bakucs *et al.*, 2009; Zinych and Odening, 2009; Latruffe *et al.*, 2010; and Bojnec and Latruffe, 2011). Our research focuses on financial constraints for farm investments in Slovenia after the accession to the EU in 2004[1].

The contribution of the study to the previous analyses is to apply several farm specific variables including off-farm income, farm efficiency, farm indebtedness and farm organization, which may influence farm-level investment behaviour. Farm investments behaviour is analysed using Euler equation to calculate the coefficients of elasticities for the farm investment pertaining to individual explanatory variables. It is expected that these additional explanatory variables influence farm investment decisions. Furthermore, we classify the sample of farms into groups according to several organisational characteristics to check the robustness of our results.

The rest of the paper is organized as follows. The next section presents an overview of the literature on investment behaviour. In the third section, a model of farm investment decision and its specification with the estimation methodology and data are described. The fourth section reports econometric estimation results, which are discussed. Final section provides conclusions and implications.

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[1] On 1st May 2004, the following CEE countries entered in the EU: the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia. Yet, at the same time in two Mediterranean countries entered the EU: Cyprus and Malta. Further EU enlargements have included the following CEE countries: Bulgaria and Romania on 1st January 2007 and on 1st July 2013, Croatia entered as the EU-28 member state.

2. A Literature Survey

A body of literature has developed on investment behaviour in Western market economies. In particular, Serrasqueiro *et al.* (2012) for Portuguese small and medium size enterprises (SMEs) found that cash flow, age, growth opportunities and gross national product are of greater importance for stimulating investment in new SMEs than in the existing ones and opposite sales, while debt and interest rate are of greater importance in reducing investment in new SMEs than in the existing ones. The persistence of investment over time is greater in new SMEs than it is in the existing SMEs. Additionally, De Bondt (2013) presented changes in the public views about business, financial institutions, government, regulation and globalization after the crisis in restoring public trust in policy-makers.

For developing countries, there is a rare focus on investment behaviour models, but farm efficiency models are applied. Lachaal *et al.* (2002) analyzed technical efficiency of dairy production in Tunisia using data envelopment analysis (DEA) and efficiency scores determinants using a Tobit model. Dhehibi *et al.* (2014) analyzed determinants of total factor productivity in Tunisian agriculture. Chebil *et al.* (2015) analyzed technical, scale and economic efficiencies for a sample of irrigated wheat farms in Tunisia using DEA method and efficiency scores determinants using a Tobit model.

Regarding the CEE economies, four main strands of literature have been developed on the investment behaviour and explanation concepts for investment behaviour and/or investment reluctance in general with some applications to CEE economies.

First, following Fazzari *et al.* (1988) and Benjamin and Phimister (2002) among others, for Western market economies, few studies have investigated the effects of capital market imperfections on the investment behaviour in transformation economies. Investment decisions by neoclassical theory are independent of financial decisions under perfect capital market conditions, but this does not hold for the case of capital market imperfections, which are characterised by informational asymmetries and agency problems pertaining to transaction costs between lenders and borrowers. These problems may lead to credit rationing without or only limited access of firms/farms to debt (Stiglitz and Weiss, 1981), which can be particularly relevant in newly established market economies in CEE countries. Therefore, it has not been surprising that a body of empirical literature for existence of capital market imperfections in firms (Budina *et al.*, 2000; Lizal and Svejnar, 2002; Rizov, 2004) and farms (Petrick, 2004; Latruffe, 2005; Bakucs *et al.*, 2009; Bokusheva *et al.*, 2009; Latruffe *et al.*, 2010; Bojnec and Latruffe, 2011; Fertő *et al.*, 2012) in CEE economies has been developed.

Second, additional motivation of research for investment behaviour in CEE economies is usually to test the persistence of soft budget constraint (Kornai, 2001; Kornai *et al.*, 2003). If soft budget constraint is still persistent that may lead to a postponed restructuring. Soft budget constraint may be more important in the farming sector because government supports to the farm sector are much higher than firms in manufacturing.

Third, there is an emerging literature and empirical studies on real options models with irreversibility, uncertainty and the opportunity to wait on optimal investment decisions (Oude Lansink and Stefanou, 1997; and Gardebroek and Oude Lansink, 2004) and risk aversion into dynamic investment models (Coyle, 2005; Sckokai and Moro, 2009; Serra *et al.*, 2009). So far this strand of literature has largely focused more on Western than on CEE economies.

Finally, Hüttel *et al.* (2010) aimed to disentangle the impact of capital market imperfections on investment behaviour from investment reluctance explanation owing to irreversibility and uncertainty.

More specifically for CEE economies, the previous studies on investment behaviour in CEE economies have employed three main types of models: First, accelerator- and augmented-type by the cash flow models in assessing the impact of financial constraints on investment behaviour (Latruffe, 2005; Bakucs *et al.*, 2009; Latruffe *et al.*, 2010; Bojnec and Latruffe, 2011). Second, a series of Euler equations of investment in order to address problems associated with controlling for investment opportunities, soft-budget constraints and transaction costs by generating an observable classification rule of firms/farms (Rizov, 2004; Bokusheva *et al.*, 2009). Third, the joint impact of capital market imperfections and irreversibility on investments simultaneously in the relation between a standard dynamic stochastic q models and real options models applied to West and East Germany farm-level panel data (Hüttel *et al.*, 2010).

The focus of this paper is on the investigation of a relationship between farm investment decisions and off-farm income (Ahituv and Kimhi, 2002; Hertz, 2009). In addition, some additional farm-level explanatory variables are included in the regression framework specification using Euler equation.

3. Methods

Methodology to estimate econometric models is developed in four steps. First, we employ model developed by Bond and Meghir (1994) assuming that the farm investment behaviour is modelled as 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 (Bokusheva *et al.*, 2009; Zynch and Odening, 2009):

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

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 the 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, Euler equation investment model additionally includes the quadratic terms of debt (D) variable (Rizov, 2004):

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

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

Third, the augmented investment model in addition to the model from the previous step includes separately the following controlling explanatory variables (X_{it}): off-farm income, farm efficiency, and family farm organization:

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

Our aim is to clarify whether off-farm income has an effect on the different farm investment decisions to test the validity of the presence of soft budget constraint and credit constraint. Recent literature on rural development explains multifunctional and synergistic function of agricultural households in combination with other sources of employment and incomes (Bojnec and Fertő, 2013; and Unay Gailhard and Bojnec, 2015). Income diversification of rural households can be driven by different determinants such as higher returns to labour and/or capital in off-farm economy as well as by risks pertaining to farm input market imperfections. We analyse the impact of off-farm income on farm investments. Off-farm income is a dummy variable, which takes value one if a farm has off-farm income, and zero otherwise. We expect that off-farm income may influence the investment decisions with possible differences across farms depending on farm efficiency (Bojnec and Latruffe, 2009, 2013), which is measurd with stohastic frontier analysis (SFA) scores (Bakucs *et al.*, 2010). Therefore, in addition to off-farm income, farm investments are specified with the SFA scores as an additional explanatory variable for an augmented investment model specification. The SFA is a technical efficiency scores based on a study by Battese and Coelli's (1995) panel SFA approach using translog specifications. It is expected that more SFA efficient farms invest more than less efficient farms.

Family farm organization vs. non-family farm organization is included as an explanatory variable by using a family farm dummy variable, which takes value one if farm is a family farm based on Hill's (1993) classification. We do not have any a priory expectation, whether family or non-family farms are investing more.

Finally, Rizov (2004) argues that Euler equation should control the financial status of a farm, because specifications of equations (2) and (3) do not provide appropriate explanation of farms' investment behaviour. In order to take into account different financial status, we introduce in the farms' investment behaviour the interaction effects of the baseline model explanatory variables for lagged investments, lagged cash flow, and lagged sales with farm financial status (Borrow), off-farm income, and family farm organization, respectively. A financial status of farms is defined according to Rizov (2004). We employ following criteria to separate the entire analysed farm sample into a priori unconstrained and constrained subsamples. Farms are considered unconstrained if they borrow in at least two consecutive years. Thus, we define a Borrow variable as a dummy variable, which takes value one if a farm is unconstrained, and zero otherwise. Because the level of new borrowing is implicitly incorporated in the debt-to-capital ratio, there is no need to keep the Borrow variable in the specification with a sample separation. Therefore, we empirically estimated the following equation:

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

To correct the unbalanced nature of our data, we estimate equations (1) to (4) with a generalised version of bias corrected LSDVC estimator proposed by Bruno (2005). A selection indicator r_{it} is defined such that r_{it}=1 if (y_{it}, x_{it}) is observed and r_{it} =0 otherwise. From this, the dynamic selection rule s (r_{it}, $ri_{,t-1}$) is created, that selects only the observa-

tions that are usable for the dynamic model, namely those for which both current values and one-time lagged values are observable.

4. Data

The Slovenian Farm Accountancy Data Network (FADN) data for the period 2004-2008 for farms above two European Size Units are used in the empirical analysis. The nominal data were deflated by inflation indices with the base period in 2004=100. Data on inflation indices are obtained from the Statistical Office of the Republic of Slovenia.

5. Results of Descriptive Statistics

5.1 Descriptive Statistics of Baseline Model Variables

Descriptive statistics of variables used in the baseline model specification for the Slovenian farms indicate three empirical-statistical facts (Table 1).

Table 1 - *Descriptive Statistics of Baseline Model Variables, 2004-2008.*

Variable	Number of observations	Mean	Std. Dev.	Minimum	Maximum
Investment $_t$ $(I/K)_t$	2237	0.050	0.098	-0.207	1.738
Cash flow $_t$ (CF_t)	2237	0.032	0.183	-1.076	6.973
Sales $_t$ (S_t)	2237	0.133	0.187	-0.261	7.063
Debt $_t$ (D_t)	2237	0.030	0.069	0.000	0.912

Source: Authors' calculations based on the Slovenian FADN data.

First, according to the size of the mean values, the debt size of farms is smaller than the cash flow of farms, while the size of the farms investment is greater than the cash flow of farms, but smaller than the farms sales. This suggests that the Slovenian farm investments are likely to be to a greater extent financed by cash flow of farms and to a lesser extent by debts of farms or loans obtained by farms.

Second, both standard deviation and minimum and maximum values of the analysed variables indicate the lowest variability for the Slovenian farm debts and the greatest variability for the sales of farms as well as for the cash flow of farms. This suggests possible risk aversion by the Slovenian farms in taking loans, which are causing farm debts, while variations in sales of farms and cash flows of farms are caused by both specific farming and market conditions.

Third, negative minimum values are found for farm investments, cash flow and sales. For farm investments indicate farm disinvestments for some of the Slovenian farms. This might be associated with farms with negative cash flows and/or sale flows. Negative cash flow is when receipts are smaller than expenditure for the accounting year (see definition of variables in Appendix 1). We have identified 5 observations with negative minimum values for sales, which are explained with purchases of livestock greater than all other possible farm sources of outputs and sales.

5.2 Descriptive Statistics of Farms by Income Sources and by Type of Organization

The Slovenian farms by income sources are distinguished in the following two groups: farms with off-farm income and farms without off-farm income. Except for sales, the mean values for investment, cash flow and debt variables between farms with and without off-farm income are rather similar (Table 2). This is also confirmed by the Kruskal-Wallis test, which indicates significantly different mean values between farms with and without off-farm income only for sales variable at less than 5% significance level.

The Slovenian farms by type of organization are distinguished in the following two groups: family and non-family farms. To do this empirically, Hill's (1993) family farm classification is used. As can be seen from Table 2, except for cash flow variable, there are significant differences in the mean values of the analysed variables between the higher mean values for non-family farms than family farms for investment, sales and debt variables. This evidence implies that non-family farms are likely to be bigger, particularly in terms of their sales, than family farms. Non-family farms investments are likely to be to a greater extent based on obtained loans, which results in higher debts. Finally, both family and non-family farms are rather similar regarding cash flow role for farm investments.

Table 2 - *Mean Values of Variables by Farm Income Sources and Types of Farm Organisation.*

	without	with	Kruskal-Wallis test
	off-farm income		p-value
Investment $_t$	0.051	0.049	0.0670
Cash flow $_t$	0.032	0.031	0.5744
Sales $_t$	0.147	0.122	0.0001
Debt $_t$	0.030	0.026	0.3032
Hill classification	non-family farm	family farm	
Investment $_t$	0.084	0.044	0.0001
Cash flow $_t$	0.029	0.032	0.9163
Sales $_t$	0.222	0.117	0.0001
Debt $_t$	0.049	0.025	0.0001

Source: Authors' calculations based on the Slovenian FADN data.

6. Econometric Results

The econometric results are presented in four steps. First, we present the baseline investment model or the baseline adjustment cost model. Second, we present the estimated Euler equation models. Third, we present the estimated augmented investment models for indebtedness, off-farm income, farm efficiency and family farm organization. Finally, we present augmented investment models with the interaction effects for financial status or farm indebtedness, off-farm income, farm efficiency and family farm organization.

6.1. Baseline Model

The baseline adjustment cost model is equivalent to the profit maximizing model with perfect capital markets. It is presented in Table 3 as Model 1.

Table 3 - *LSDVC Sample Selection Models Results for the Full Sample.*

	Model 1	Model 2	Model 3	Model 4	Model 5
Investment $_{t-1}$	0.687***	0.556***	0.547***	0.543***	0.552***
Investment^2 $_{t-1}$	-0.459***	-0.412***	-0.409***	-0.388***	-0.406***
Cash flow $_{t-1}$	0.365***	0.273***	0.273***	0.302***	0.278***
Sales $_{t-1}$	-0.340***	-0.253***	-0.254***	-0.286***	-0.258***
Debt^2 $_{t-1}$		0.378***	0.377***	0.320***	0.375***
Off-farm income			0.014		
Efficiency				-1.046***	
Family farm^{Hill}					0.010
N	1407	1407	1407	1407	1407

Note: Dependent variable is gross investment$_{t,t-1}$ to capital. All explanatory variables are divided by capital. N = number of observations. ***/**/*: statistically significant, respectively at the 1%, 5%, and 10% levels, based on bootstrapped standard errors with 500 replications. Source: Authors' calculations based on the Slovenian FADN data.

The regression coefficients on explanatory variables are of the following signs: positive for lagged investment, less than minus one for lagged investment square, positive for lagged cash flow, and negative for lagged sales. The current farm investments are significantly positively associated with the lagged farm investments and the lagged farm cash flow, but significantly negatively associated with the lagged farm sales and the lagged farm investment square. The significantly positive lagged cash flow coefficient – contrary to the perfect capital market assumption – reflects liquidity constraints or higher relative marginal profitability. The sensitivity of the farm investment to the lagged farm cash flow is consistent with the presence of differential financial status in terms of differential transaction costs in borrowing across farms and thus suggests the presence of financial constraints for the Slovenian farms. These results and findings are largely similar to previous studies on the financial constraints and farm investment behaviour in Slovenian agriculture (Bojnec and Latruffe, 2011, Fertő *et al.*, 2012) and in agriculture of some other CEE countries in transition from central planning to a market economy (Latruffe, 2005; Bokusheva *et al.*, 2009; Zinych and Odening, 2009).

6.2. Augmented Model

The augmented Euler equation of farm investment with included the square of the ratio of lagged long-term farm debt to farm capital stock (Debt$^2_{t-1}$) is presented in Table 3 as Model 2. The estimated Euler equation in Model 2 reinforced the previous results with slightly lower, but statistically significant regression coefficients, and confirmed the significant positive association of the current farm investments with the lagged farm debt square.

The Debt$^2_{t-1}$ coefficients – also in Models 3 to 5 in Table 3 – are significantly positive at the 1 percent significance level. This suggests that investment and financing decisions cannot be separated. This result with a significant positive regression coefficient is similar to Bokusheva *et al.* (2009) and Zinych and Odening (2009 for farm investment behaviour in Russian and Ukrainian agriculture, but different from Rizov (2004) who found a significant negative association for investment behaviour in Romanian manufacturing firms.

6.3. Augmented Models for Off-Farm Income, Farm Efficiency and Family Farm Organization

The previous literature has investigated the impact of off-farm income on farm investment behaviour in transition and emerging market economies with mixed and ambiguous results and findings (Hertz, 2009; Ji *et al.*, 2012; Su *et al.*, 2015). Our models 3 to 5 in Table 3 present the separate impact of off-farm income, farm efficiency and family farm organization on the Slovenian farm investments. Except for technical efficiency scores, they are found insignificant. This implies that the econometric results do not confirm hypotheses that the Slovenian farm investment depends on off-farm income and on family farm organization. Finally, a significant negative regression coefficient for technical efficiency scores indicates that the Slovenian farms with a greater technical efficiency invested less. This finding is opposite to our expectation that more efficient farms invest more than less efficient ones using stochastic frontier scores as explanatory variables.

6.4. Augmented Models for the Interaction Effects

The empirical Euler equations of the Slovenian farm investment in the presence of differential financial status (borrow), off-farm income, farm efficiency and family farm organization, respectively, across the Slovenian farms are tested by using the sample selection criterion, which are interacted with the baseline explanatory variables (Table 4). Similar estimation approach has been used previously by Bokusheva *et al.* (2009) and Zinych and Odening (2009). However, they have used different variables in the interaction effects and thus direct comparisons of similarity and differences of the empirical results are not possible. In our case of the Slovenian farms, for farm financial status or borrow, this is a dummy of all farms that borrow in at least two consecutive years. To distinguish two different regimes for farm technical efficiency, we define a dummy variable Efficiency^M which takes value one if a farm's technical efficiency using SFA scores is higher than the median value of SFA scores, and zero otherwise. We have to eliminate interaction effects with squared term of investment behaviour due to multicollinearity issues.

Table 4 indicates that the regression coefficients for the lagged farm investment remained significantly positive, while the coefficient on the lagged squared farm investment term remained smaller than minus one, but became insignificant in the case of Hill's farm classification. This

suggests that a family farm organization is found to be constrained by capital market imperfections in farm investment behaviour, but this does not hold for farms with financial status borrowed, off-farm income and for more technically efficient farms. The regression coefficients for the lagged farm cash flow remained significantly positive, while significantly negative for the lagged farm sales. These results reinforced the previous finding on the Slovenian farms financial constraints (Bojnec and Latruffe, 2011, Fertő *et al.*, 2012) as well as for farms in some other transition CEE economies (Latruffe, 2005; Bokusheva *et al.*, 2009; Zinych and Odening, 2009).

However, there are considerable differences and mixed results in the regression coefficients for the interaction terms. They are of mixed signs for the interaction terms with the lagged farm investment: significantly negative with the family farm organization and significantly positive with the off-farm income. The latter finding implies that off-farm income provides opportunities for farm investments for farms with off-farm incomes.

The interaction term with the lagged farm cash flow is significantly negative with the farm financial status borrowed and more technically efficient farms (significant at 10 per cent significance level), but insignificant in other cases. This might suggest a presence of a soft budget constraint for a sub-sample of farms that borrowed in at least two consecutive years and to a lesser extent for more technically efficient farms.

The interaction term with the lagged farm sales is significantly positive with the family farm by Hill's classification and insignificant in other cases. Family farm investments seem to rely significantly on farm's ability to sale their products and on associated own financial resources, which is in line with the previous findings by Bojnec and Latruffe (2011).

7. Conclusions

The financial constraints are still important for investments in CEE economies. While this topic is relevant in general, financial constraints for investments can be even more strengthened during economic slowdown and financial crisis with limited access to finance for investments. Without investments CEE economies can have difficulties not only to catch up with more developed economies, but also to assure sustainable economic and rural development.

We find that the impact of off-farm income on farm investment is mostly insignificant. This ambiguous result can be explained by trade off in farm investment behaviour of farm households with off-farm income, which makes income variability of farm households smoother and can be invested in farm growth and/or in other non-agricultural activities on farm as well as for farm household investment activities outside the farm. Similar mixed findings on the impact of off-farm income on farm investment behaviour are reported also for some other transition and emerging market economies (Hertz, 2009; Ji *et al.*, 2012; Su *et al.*, 2015).

The hypothesis that more technically efficient farms invested more than less technically efficient farms using technical efficiency scores was rejected. The empirical results confirmed the presence of capital market imperfections for the Slovenian farm investments, particularly for family farms, which are prevailing in the Slovenian farming structures. As argued by Bojnec and Latruffe (2011) capital market imperfections have hindered growth and development of family farms in Slovenia.

Therefore, among the most striking findings is that family farms were financially constrained more than non-family farms. The possible benefits from the soft budget constraints were transmitted to non-family farms, which to a greater extent use borrowed sources of finance than family farms. This finding is also confirmed by a highly significant negative coefficient on the lagged farm cash flow owing from the presence of the soft budget constraints as well as with the differential financial statuses indebted vs. non-indebted across farms, which is significantly negative in the interaction with the lagged farm cash flow. A debt (borrow) had a significant positive impact on farm investments. Therefore, the indebted farms invested more than non-indebted farms, because the former use debts for their farm investment activities. In an absence of effective policy mechanism for the heavily indebted farm households it is largely on the indebted farms how with the existing collateral resolve the accumulated debt problems.

The persistence of soft budget constraint may lead to a postponed farm restructuring particularly during economic and financial crisis. The persistence of financial constraints for farm investments, particularly for family farms, have implications for economic policy for more effective financial support through the creation of beneficial lines of credit designed specifically to support viable farm investments, particularly for family

Table 4 - *LSDVC Sample Selection Models Results Considering Various Attributes of Farms.*

	borrow	off-farm income	efficiency^{M}	family farm^{Hill}
Investment $_{t-1}$	0.601***	0.689***	0.601**	0.508***
Investment^2 $_{t-1}$	-0.340***	-0.819***	-0.394***	0.166
Cash flow $_{t-1}$	0.569***	0.397***	0.423***	0.401***
Sales $_{t-1}$	-0.213***	-0.263***	-0.234*	-0.386***
Investment $_{t-1}$*X	-0.157	0.367*	-0.203	-0.522**
Cash flow $_{t-1}$*X	-0.301***	-0.066	-0.130*	-0.048
Sales $_{t-1}$*X	-0.042	-0.051	-0.040	0.181**
N	1407	1407	1407	1407

Note: N = number of observations. ***/**/*: statistically significant, respectively at the 1%, 5%, and 10% levels based on bootstrapped standard errors with 500 replications.
Source: Authors' calculations based on the Slovenian FADN data.

farms, which prevails in the country's farm structures. A greater role should be given in providing support for farmers with a lack of knowledge how to prepare viable investment project for a competitive global environment with a focus on more likely missing business and farm entrepreneurial skills and activities.

Among issues for future research is to conduct a similar and/or comparative study for other CEE countries and to apply more sophisticated investment decision models. In addition to comparative results and findings this can provide comparative and more effective policy mechanism that are needed for investment behaviour and the heavy indebted farm households in the CEE transition and emerging economies. Finally, the focus of the analysis can be also on different stages of economic growth and recession with use of updated data in order to check for possible impacts of financial crises and recovery on investment decisions. As macroeconomic performances by the EU member states differ during the financial crisis, this can cause also different sector performances, including for farm investment behaviour.

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Appendix 1 - *Definition of variables.*

SE131 = Total output. Total of output consists of crops and crop products, livestock and livestock products and of other output. Sales and use of (crop and livestock) products and livestock + change in stocks of products (crop and livestock) + change in valuation of livestock – purchases of livestock + various non-exceptional products.

SE436 = Total assets. Only assets in ownership are taken into account. Capital indicators are based on the value of the various assets at closing valuation= Fixed assets + current assets.

SE490 + SE495 = Debt. It is defined as the sum of short and long term loans.

SE490 = Long and medium-term loans. Loans contracted for a period of more than one year.

SE495 = Short-term loans. Loans contracted for less than one year and outstanding cash payments.

SE516 = Gross Investment on fixed assets. It is defined as Purchases – Sales of fixed assets + Breeding livestock change of valuation.

SE526 = Cash Flow (1). It is defined as the holding's capacity for saving and self-financing = Receipts – Expenditure for the accounting year, not taking into account operations on capital and on debts and loans.

Source: FADN (2010).