

## Credit Constraints, Heterogeneous Firms and Loan Defaults\*

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In light of the recent financial and economic crisis the present paper analyzes the determinants of loan default. We employ a unique firm-level panel data of 700 bank loans given to small and medium sized enterprises in Slovakia between 2000 and 2005 to investigate three loan default hypotheses. Testing the Sector-Risk Hypothesis, we find that agri-food industry does not exhibit a higher default rate than other sectors. Testing the Firm-Risk Hypothesis, we find that highly indebted firms are more likely to default on their loan than other firms. Testing the EU Subsidy Hypothesis we find that the newly introduced subsidy system, which is decoupled from production, provides a secure source of income and hence reduces the probability of loan default.

*Key Words:* Bank credit; Loan default; Credit constraints; Heterogeneous firms.

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## 1. INTRODUCTION

The recent financial and economic crisis has hit financial markets particularly severely (IMF 2009; European Commission 2011). Since the beginning of the crisis in 2008, the credit default rate has increased significantly resulting in losses to the lending banks, which in turn have significantly reduced the issuance of new loans. Hence, from the perspective of banks, an important question is to identify the most risky firms and sectors. From the policy perspective an important question arises, which sectors/firms face the highest risk due to inherent structural differences, and hence require policy support?

In order to answer these questions, the present paper analyzes the determinants of the loan default rate. Empirically we investigate three loan default hypotheses. The *Firm-Risk Hypothesis* says that, due to firm-level idiosyncrasies, certain types of firms are more likely to default than others. The *Sector-Risk Hypothesis* says that, due to sector-specific inherent structural differences, the agricultural sector is more exposed to credit default than other sectors. The *Subsidy Hypothesis* says that because the EU subsidies are decoupled from production and hence from the systemic and idiosyncratic risks inherent to agriculture, they improve the agricultural firms' ability to repay bank loans.

Whereas the literature on loan defaults in developed countries' financial markets is extensive and conclusive (e.g. Lízal 2002; Jacobson et al. 2005; Agarwal and Hauswald 2007), there is considerably less evidence on loan default rates in transition economies generally (Fidrmuc and Hainz 2010), and in agriculture particularly (Featherstone et al. 2006; Jouault and Featherstone 2006; Udoh 2008).<sup>1</sup> Agricultural credit markets are, however, of great interest for policy makers in transition economies, where

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<sup>1</sup>The present paper extends the analysis of Fidrmuc and Hainz (2010), who analyze the determinants of firm defaults with respect to liquidity, profitability, indebtedness, and the legal form. In addition to Fidrmuc and Hainz, we attempt to identify differences in defaults of agricultural and food processing firms compared to firms in other sectors.

agricultural sector is considerably more important than in developed economies. Loans in agriculture may be more risky than loans in other sectors due to agriculture-specific structural characteristics: (i) significant time lag between input purchase and production sale due to seasonal character of agricultural production; (ii) complex management environment due to biological character and spatially separated production; (iii) lower value of farm collateral due to asset specificity of agricultural production; (iv) costly monitoring of farm activities for lender; and (v) volatility in agricultural firms' performance due to external factors which cannot be controlled either by firms or lenders (e.g. weather, diseases) (Binswanger and Rosenzweig 1986; Barry and Robison 2001). These characteristics of agricultural production affect the whole chain of agricultural credit market: from lending pattern of lenders to borrowers' behavior in terms of loan demand, utilization and default.

In order to test the theoretical hypotheses, we employ a unique set of panel data on loans given to around 700 agricultural and non-agricultural small and medium sized enterprises in Slovakia between January 2000 and June 2005. This period is particularly well suited to address the question of credit risk, because the rate of loan growth was rather moderate, and the average loan default rate for small and medium sized enterprises was 6.0 per cent (9.7 per cent for agricultural firms).

Our results have important policy implications for policy makers in transition economies. By implementing policies that address agriculture-specific risk and information asymmetry, borrowers would default less often on loan repayment, which in turn may induce the lenders to relax the rationing of credit supply, resulting in better liquidity and credit constraint conditions of agricultural farms, and hence higher productivity and income.

## 2. TESTABLE HYPOTHESES

According to Lízal (2002); Jacobson et al. (2005); and Agarwal and Hauswald (2007), loan default is closely related to corporate bankruptcy and hence must be studied together. On the one hand, the main determinants of bankruptcy are related to problems of indebtedness, profitability, liquidity and solvency (Altman 1968). On the other hand, firms are more likely to default, if they are less profitable, less liquid, highly indebted, or if the legal system does not create efficient incentives to repay the loans (Alary and Gollier 2004; Beaver 1966). According to Ciaian et al. (2012), an important source of loan default in agriculture is over-indebtedness, which reduces the incentives to increase the success of the firm, but increases incentives to undertake risky investments, resulting in even higher default rate. Also firm profitability and liquidity can contribute toward explaining the determinants of loan default. Low profitability may reflect

failure of investment, whereas low liquidity can cause financial bottlenecks, which may also result in defaults. The legal form of the firm may also have implications on default, because it affects the liability of the borrower and hence it determines the benefits and costs from the loan default (see Bester, 1987, 1994; Holmström, 1996, and Hainz, 2003). Further firm-level idiosyncrasies affecting loan default rate are local weather shocks, local crop and animal diseases, and farm household life crises. Given that these idiosyncratic shocks are specific to firms, they may cause higher default rates among some types of firms compared to others (*Firm-Risk Hypothesis*).

The agricultural sector may face higher risk and hence may default more likely than other sectors, because agricultural production is subject to sector-specific systemic risk (e.g. due to whether, diseases). Complex management environment of agricultural activities (e.g. due to lengthy biologically based production, importance of external factors in farm performance; spatially separated production; significant lag between the time of input purchase and the time of production sales; etc.), makes the monitoring of firm performance more difficult and costly both for firms and lenders. This may degenerate to ex-post moral hazard behavior of borrowers thus increasing the default rate in the agricultural sector. Given that the causes of these types of risks are specific to agriculture, they may cause higher default rates in agriculture compared to other sectors (*Sector-Risk Hypothesis*).

With the EU accession, Slovakia adopted the Common Agricultural Policy (CAP). The primary objective of the new agricultural subsidy system (SAPS) was to provide income support to agricultural firms. In addition, the SAPS may affect also rural credit markets, because they present a relatively safe form of payment from the EU budget and hence provide a secure income stream. Given that the SAPS is decoupled from production and hence from the systemic and idiosyncratic risk inherent to agriculture, likely it will reduce the overall uncertainty of agricultural income.<sup>2</sup> We expect that the SAPS would improve the agricultural firms' ability to repay bank loans (*Subsidy Hypothesis*).

### 3. ECONOMETRIC SPECIFICATION

Following Altman (1968) and Beaver (1966), in order to study the determinants of loan defaults of agricultural and non-agricultural firms, we estimate several specifications of probit models. Our dependent variable is the conditional probability that firm  $i$  defaults on its loan at time  $t$ , given

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<sup>2</sup>The subsidies implemented before the EU accession were linked to production activities and thus were more susceptible to production risks (Ciaian and Swinnen 2009).

the available information set,  $\Omega$ , on firm  $i$  at time  $t - 1$ :

$$P(q_{i,t} = 1 | \Omega_{t-1}) = \beta_1 + \beta_2 C_{i,t-1} + \beta_3 L_{i,t-1} + \beta_4 P_{i,t-1} + \beta_5 S_{i,t-1} + Z_{i,t} \gamma + \epsilon_{i,t} \quad (1)$$

where  $C$ ,  $L$ , and  $P$  denote financial ratios on firms' indebtedness, liquidity and profitability, and  $Z$  is a vector of additional control variables (time and legal form dummies). In order to identify inter-sectoral differences in loan default, we include sectoral dummies,  $S$ . In selected specifications we include also time effects, which cover the business cycle and bank-specific developments. In order to address potential endogeneity issues, all explanatory variables are lagged by one year, hence we can consider them to be exogenous.

Equation (1) includes the key factors identified in the literature on default probability estimations (Chan-Lau, 2006), credit scoring models (Miller and LaDue 1989; Mester 1997), and enterprise restructuring in transition economies (Ciaian and Kancs 2011; Ciaian et al. 2012). The control variables follow the traditional literature on financial ratios and bankruptcies (Altman 1968; and Beaver 1966). Following Mester (1997) and Berger et al. (2005), we only include robust variables, which are fewer than in credit scoring models.

In extensive sensitivity analysis we also control for possible nonlinearities.<sup>3</sup> However, the quadratic terms were insignificant for all explanatory variables. Similarly, the Link test for model specification (Pregibon 1980) reveals no problems with the specified model.<sup>4</sup>

#### 4. DATA

In order to test the three loan default hypotheses empirically, we employ a unique firm-level panel data set on small and medium sized enterprises in Slovakia for the period between 2000 and 2005. The data comes from a major commercial bank in Slovakia that issues different types of loans to firms in all sectors and regions of the country.<sup>5</sup>

The data set consists of two main parts. The first part provides information about whether a firm defaulted on its loan during the five partially overlapping periods of 18 months. The individual reporting periods start in January (e.g. the first period being January 2000 to June 2001, the last

<sup>3</sup>These results are available from the authors upon request.

<sup>4</sup>The link test is based on the regression of the left hand variable (default probabilities in our case) on the fitted values from the tested regression as well as the squares of those values. The values squared should not be significant if the model is specified correctly.

<sup>5</sup>For a more detailed description of the data see Fidrmuc and Hainz (2010).

period being January 2004 to June 2005). Note that the default companies are dropped from the sample after the period in which the insolvency occurred. In order to ensure consistency between the time periods, firms who repaid their loans before the end of the payment period are also dropped from the sample.<sup>6</sup> The data set includes only firms with double-entry book-keeping in order to guarantee a reliable data base. As usual, the original indicators were checked on consistency before the estimations.

The second bloc of our data set includes selected financial indicators from firms' annual balance sheets published in December of the respective year before the reported period (e.g. December 1999 is used for the explanation of defaults between January 2000 and June 2001).<sup>7</sup> All indicators are defined as shares in the total assets or liabilities. The total sales describe the size of firms, and are used for the definition of the small and medium size enterprises: total sales between SKK 30 million (approximately EUR 1 million) and SKK 300 million (approximately EUR 10 million). The majority of analyzed firms have total sales in the lower range of the above spectrum.

Following the general practice in loan default literature (Lízal 2002; Jacobson et al. 2005; Agarwal and Hauswald 2007), we define the default if a loan is written off, or after the repayment delay exceeds 90 days. Alternatively, defaults are also counted if the bank classifies a borrower as substandard, doubtful or loss-making during the observed period. With few exceptions, the bank has terminated the relationships with defaulting companies after either eventual repayment of the obligations or after the company became bankrupt. The data set does not provide any data for recoveries of defaulting companies, which are supervised by a specialized unit of the bank.

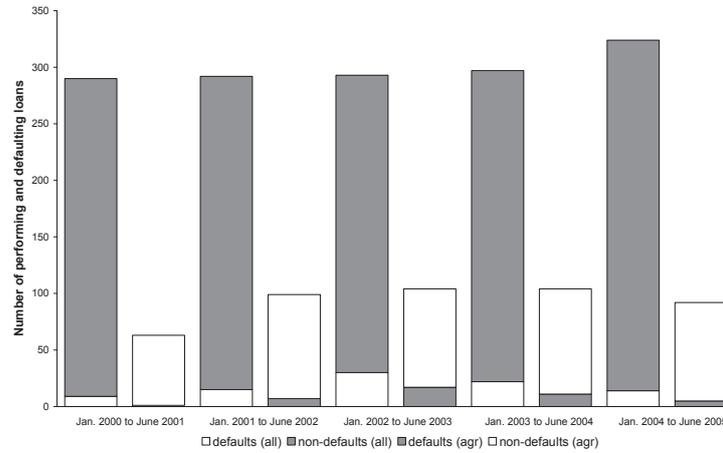
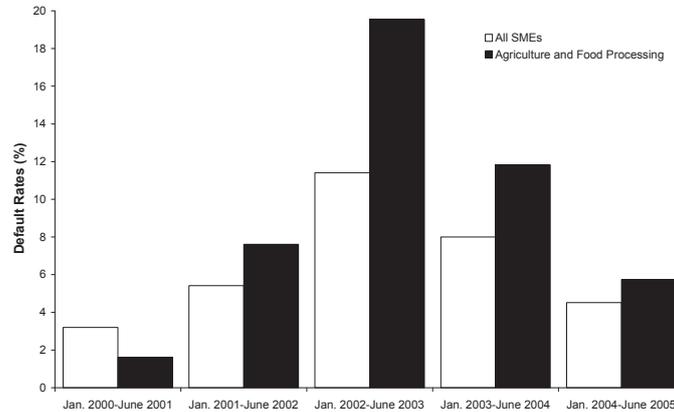
Figure 1 shows the development of loans granted and defaulted during the period analyzed. Figure 1 suggests only a slightly higher default rate between January 2002 and June 2003 in general, but a higher default increase for the agricultural sectors (see Figure 2). This pattern of development corresponds to the business cycle in Slovakia, which illustrates a higher sensitivity of agricultural sector to external economic conditions. Similarly, we can see a moderate expansion of credits to small and medium sized enterprises in 2004 and 2005. This development pattern approximately follows the development of credits granted in Slovakia (NBS 2008).

For the whole period, we have 1496 observations available for 667 small and medium sized enterprises, 90 of which (6.0 per cent of all observations) defaulted on their loan repayment during the observation period. In the

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<sup>6</sup>The debtors are unlikely to default if credits are already nearly repaid. The inclusion of those firms could bias the results.

<sup>7</sup>Unfortunately, the lack of data on fixed assets as a proxy for collateral restricts our analysis in this respect.

**FIG. 1.** Development of Loans and Defaults**FIG. 2.** Defaults Rates by Periods and Sectors

subsample of agricultural and food processing companies, we have 462 observations of which 41 firms defaulted (8.9 per cent). Among all Slovak banks, the average share of non-performing loans in the total assets decreased from 24.3 per cent in 2000 to 7.2 per cent in 2004 (EBRD, 2005a). Thus, the quality of banks' portfolio is above average.

According to our data, the default rates in Slovakia are (slightly) above the international figures. Agarwal and Hauswald (2007) and Jacobson et al. (2005) report a default rate of 2.7 per cent for small and medium sized enterprises in the US and default rates between 0.9 and 2.3 per cent

for Sweden. In turn, Altman and Suggitt (2000) report average default probabilities for a five year period (measured by a similar indicator based on the number of issuers) of about 4.5 per cent for loans to companies with an original S&P rating B and 23 per cent for companies with rating Caa.<sup>8</sup> Regarding the agricultural sector, historical trends in five US states provided in the study of Kim (2005), indicate a declining share of defaulted agricultural loans' form around 6 per cent in 1985 to around 1 per cent in 2003. Featherstone et al. (2006) report a similar default level (1.8 per cent) for the period 1995-2002 in eleven US states. Jouault and Featherstone (2006) report an upper rate of defaulted agricultural loans in north-eastern France amounting to 6.3 per cent of total loans. In contrast, Nigerian data reported in Udoh (2008) indicate rather widespread defaults for government sponsored agricultural loans: between 30 and 45 per cent of loans completely defaulted; between 40 to 50 per cent were partly repaid, whereas only between 15 and 25 per cent were fully repaid.

Our data sample does not include companies without bank loans.<sup>9</sup> Nevertheless, the descriptive statistics reported in Table 1 show that on average the share of credits is rather small (15 per cent of total liabilities for full sample and 11 per cent for agricultural and food subsample). By contrast, we have firms from those with nearly zero loans up to those with 85 per cent of total liabilities. This shows that the selection bias should not play an overwhelmingly important role in our data set.<sup>10</sup>

## 5. RESULTS

The estimation results are reported in Tables 2-4. Specifications (1), (3), and (5) report the basic model, where we include the explanatory variables, covariates, and dummy variables for agriculture and food processing sectors. In the augmented model (specifications (2), (4), and (6)) we also account for time, legal form and sectoral effects (other than agriculture and food processing).<sup>11</sup> In specifications (3) - (6) we regroup the whole sample into lowly and highly indebted firms. The highly indebted group includes firms with the share of bank loans above the median, whereas lowly indebted firms are firms below the median.

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<sup>8</sup>The latter firm group analyzed by Altman and Suggitt (2000) is most suitable to be used as comparison point for small and medium size enterprises.

<sup>9</sup>Approximately 56 per cent of Slovak small and medium sized enterprises had no loans in 2005 (EBRD, 2005b).

<sup>10</sup>Also other authors find that the selection bias is not severe in similar types of samples (Chakraborty and Hu 2006).

<sup>11</sup>The default effects of sectoral dummies (i.e. construction, commerce, other services, agriculture primary, food processing) in specifications (2), (4), and (6) are compared relative to the default pattern of firm in that industry.

**TABLE 1.**

Descriptive Statistics of Selected Variables

	Total sales SKK million	Bank loans, debts	Earnings before taxation	Cash and bank accounts
Full sample (all firms)				
A: Non-default companies				
Mean	100319	0.152	0.033	0.298
Max	298431	0.853	0.488	27.727
Min.	30115	-	-0.321	-
Std. Dev.	65584	0.125	0.078	0.832
B: Default companies				
Mean	114200	0.177	-0.038	0.1
Max	291358	0.666	0.171	0.715
Min.	30142	0.006	-0.617	-
Std. Dev.	71465	0.147	0.119	0.138
Agricultural and food processing firms				
A: Non-default companies				
Mean	116716	0.108	0.006	0.23
Max	291358	0.56	0.206	3.969
Min.	30142	0	-0.253	-0.048
Std. Dev.	73206	0.088	0.05	0.322
B: Default companies				
Mean	93663	0.154	-0.035	0.07
Max	295424	0.483	0.125	0.519
Min.	30320	0.006	-0.617	0.003
Std. Dev.	61935	0.136	0.13	0.093

Notes: see section 4 for description of variables.

Our results suggest an adverse and significant effect of indebtedness on loan default (specification (1) in Table 2). This effect is robust to the inclusion of time and industry dummies, as well as dummies indicating the legal form of the firms (specification 2). Our results suggest that loan default is more likely by highly indebted firms (specifications (5) and (6)). The credit issuer bank still owns relatively efficient tools for assessing the *a priori* risk,<sup>12</sup> which is confirmed by the non-significant bank loan coefficient for lowly indebted firms (see specifications (3) and (4)).

<sup>12</sup>Unfortunately, we cannot include information on collateral, which is not available in the data set. Possibly collateral and interest rates are high enough to guarantee profitability in the presence of higher risk firms too. We also computed the implicit loan-specific interest rate similarly to Fidrmuc and Hainz, (2010) from the available indicators, which was insignificant.

TABLE 2.

Sector-Specific Determinants of Loan Default, January 2000 - June 2005

	Full sample		Low indebtedness level		High indebtedness level	
	Basic model	Ext. model	Basic model	Ext. model	Basic model	Ext. model
	(1)	(2)	(3)	(4)	(5)	(6)
Cash and bank accounts	-0.110*** (-3.70)	-0.096*** (-4.46)	-0.096** (-2.09)	-0.059** (-2.09)	-0.117*** (-13.57)	-0.107*** (-8.92)
Bank loans	0.068** -2.16	0.067*** -3.76	0.029 -0.32	-0.016 (-0.30)	0.156*** -7.75	0.136*** -5.04
Earnings before taxation	-0.308*** (-6.11)	-0.282*** (-4.63)	-0.313*** (-8.59)	-0.177*** (-7.64)	-0.217*** (-6.09)	-0.234*** (-8.88)
Agriculture dummy	0.019 -1.34	0.014 -0.91	-0.006 (-0.75)	-0.010** (-2.04)	0.104*** -6.65	0.129*** -5.68
Food processing dummy	0.026 -1.32	0.021 -1.19	-0.008 (-0.33)	-0.007 (-0.89)	0.061*** -21.25	0.079*** -11.54
Indebtedness level	All	All	Low	Low	High	High
Number of observations	1496	1496	748	716	748	748
Pseudo-R2	0.141	0.186	0.197	0.292	0.14	0.164
Log-likelihood	-292.1372	-276.991	-134.317	-117.155	-148.629	-144.451

Notes: All indicators are defined as a share of total liabilities/assets. The sample with the high level of indebtedness includes firm bank loans as a share of total liabilities above the median. The coefficients report changes in the probability for an infinitesimal change in continuous explanatory variables.  $z$  statistics computed with robust standard errors adjusted for clustering on two-digit industries in parentheses and  $p$ -values in brackets. Time effects, legal form effects, and detailed industrial effects are not reported. \*, \*\*, \*\*\* denote significance at the 10, 5 and 1 per cent level respectively.

According to the results reported in Table 2, we find that those firms that have relatively high cash amounts and finance available in their bank accounts (relative to total assets) are significantly less likely to default on their loans. Second, we find that companies with high earnings before taxation are less likely to default on their loan than the average of the sample. Thus, our empirical results confirm the *Firm-Risk Hypothesis* that firms are more likely to default if they face liquidity problems (cash and bank accounts) and low profitability (earnings before taxation). These results are in line with the theoretical literature on principal-agent problems (Stiglitz 1987), and the empirical literature on the determinants of corporate bankruptcy (Altman 1968; Altman and Suggitt 2000; Bris et al. 2006; Fidrmuc and Hainz 2010).

The sector dummy variables for primary agricultural and food processing firms are not significant in specifications (1) and (2), implying that there is no difference in default rates between firms operating in the agri-food sectors and firms operating in other sectors (Table 2). Hence, our results do not support the *Sector-Risk Hypothesis*. This could be due to strong

TABLE 3.

Determinants of Loan Default and EU Integration, January 2000 - June 2005

	Full sample		Low indebtedness level		High indebtedness level	
	Basic model	Ext. model	Basic model	Ext. model	Basic model	Ext. model
	(1)	(2)	(3)	(4)	(5)	(6)
Cash and bank accounts	-0.108*** (-3.73)	-0.097*** (-4.56)	-0.079** (-2.03)	-0.060** (-2.07)	-0.118*** (-15.64)	-0.108*** (-9.96)
Bank loans	0.069** -2.23	0.066*** -3.71	0.017 -0.2	-0.013 (-0.23)	0.158*** -8.51	0.139*** -5.51
Earnings before taxation	-0.312*** (-5.10)	-0.287*** (-4.29)	-0.299*** (-6.96)	-0.189*** (-5.88)	-0.210*** (-5.53)	-0.230*** (-7.67)
Agriculture dummy	0.028** -2.38	0.018 -1.38	0.002 -0.33	-0.009* (-1.88)	0.103*** -6.9	0.124*** -5.4
Food processing dummy	0.033 -1.43	0.024 -1.26	-0.007 (-0.34)	-0.007 (-0.88)	0.077*** -8.51	0.092*** -7.56
EUAgr dummy	-0.024** (-2.00)	-0.015 (-1.18)	-0.021*** (-0.34)	-0.011 (-1.49)	0.001 -0.08	0.01 -0.81
EUFood dummy	-0.021 (-0.80)	-0.01 (-0.34)			-0.028 (-1.01)	-0.021 (-0.63)
Indebtedness level	All	All	Low	Low	High	High
Number of observations	1496	1496	744	712	748	748
Pseudo-R2	0.150	0.188	0.232	0.298	0.145	0.167
Log-likelihood	-289.313	-276.345	-128.295	-115.967	-147.852	-144.083

Notes: All indicators are defined as a share of total liabilities/assets. The sample with the high level of indebtedness included firms bank loans as a share of total liabilities above the median. The coefficients report changes in the probability for an infinitesimal change in continuous explanatory variables.  $z$  statistics computed with robust standard errors adjusted for clustering on two-digit industries are reported in parentheses and  $p$ -values are reported in brackets. Time effects, legal form effects, and detailed industrial effects are not reported. \*, \*\*, \*\*\* denote significance at the 10, 5 and 1 per cent level, respectively. A - No food processing firms with low indebtedness level defaulted after the EU accession, therefore, the EU effect for this group could not be estimated.

subsidising of agricultural sector in Slovakia. Other sectors of the economy are not subject to comparable policy supports. Although subsidies granted to the agricultural sector before the EU accession were linked to production activities and thus were susceptible to production risks, they appear to bring agricultural firms to a similar position as firms operating in other sectors, which do not receive subsidies.

The results are different if we divide our sample into lowly indebted and highly indebted firms. We find that highly indebted firms in agriculture and food processing are more likely to default than in any other sectors in Slovakia (specifications (5) and (6) in Table 2). In contrast, the lowly

**TABLE 4.**  
Determinants of Loan Default in Agriculture and Food Industry, January  
2000 - June 2005

	Full sample		Low indebtedness level		High indebtedness level	
	Basic model	Ext. model	Basic model	Ext. model	Basic model	Ext. model
	(1)	(2)	(3)	(4)	(5)	(6)
Cash and bank accounts	-0.293*	-0.229**	-0.224	-0.0797	-0.382**	-0.390***
	(-1.78)	(-2.22)	(-0.96)	(-0.97)	(-2.15)	(-2.64)
Bank loans	0.269***	0.221***	-0.224***	-0.241***	0.385***	0.355**
	-3.34	-4.17	(-3.09)	(-2.73)	-2.75	-2.43
Earnings before taxation	-0.368***	-0.418***	-0.269***	-0.286***	-0.403***	-0.424***
	(-3.23)	(-8.27)	(-6.19)	(-4.53)	(-3.20)	(-3.20)
Food processing dummy	-0.016	-0.015***	-0.0119	-0.004	-0.022	-0.026**
	(-0.92)	(-2.90)	(-0.32)	(-0.29)	(-1.15)	(-2.00)
Indebtedness level	All	All	Low	Low	High	High
Number of observations	462	462	231	231	231	197
Pseudo-R2	0.149	0.238	0.110	0.263	0.195	0.262
Log-likelihood	-117.783	-105.517	-51.770	-42.850	-63.754	-55.297

Notes: All indicators are defined as a share of total liabilities/assets. The sample with the high level of indebtedness included firms bank loans as a share of total liabilities above the median. The coefficients report changes in the probability for an infinitesimal change in continuous explanatory variables.  $z$  statistics computed with robust standard errors adjusted for clustering on two-digit industries are reported in parentheses and  $p$ -values are reported in brackets. Time effects, legal form effects, and detailed industrial effects are not reported. \*, \*\*, \*\*\* denote significance at the 10, 5 and 1 per cent level, respectively.

indebted agriculture and food processing firms show equal default probabilities compared to other sectors.

Table 4 reports estimation results for the subsample of agricultural and food industry firms. The estimated effects confirm approximately equal default probabilities between the agricultural and food industry in the basic specifications with no time, legal form and sectoral dummies (specifications (1), (3) and (5)). In contrast, in specifications (2) and (6) the estimates suggest that food processing firms are less likely to default than agricultural firms.

Table 3 extends the analyzes reported in Table 2 by including dummy variables EUAgr and EUFood which are interaction variables of an EU membership dummy that takes value one for the period of Slovakia's EU membership and zero otherwise and the sector dummies standing for agriculture and food processing, respectively. The new subsidy system introduced in Slovakia after the EU accession provides a secure income source to agricultural firms and hence likely reduces loan defaults, because the EU subsidies are decoupled from production risk since they are granted independently of production level and independently of whether firms produce

or not (*Subsidy Hypothesis*). In contrast, the previous subsidy system was linked to production level and hence was more risky. This implies that the dummy variables indirectly test the impact of decoupling of the CAP subsidies on loan default. According to the results reported in Table 3, there is sample evidence that the EU accession decreased default rates for primary agricultural firms. This is particularly the case for lowly indebted agricultural firms. These results indirectly indicate that the decoupling of EU subsidies from production risk tend to improve the default behavior of agricultural firms. The EUAgr dummy is negative and statistically significant for specifications (1) and (3).

## 6. CONCLUSIONS AND POLICY IMPLICATIONS

In light of the recent financial and economic crisis the present paper analyzes the determinants of loan default. Empirically we investigate three loan default hypotheses. The *Firm-Risk Hypothesis* says that, due to firm-level idiosyncrasies, certain types of firms are more likely to default than others. The *Sector-Risk Hypothesis* says that due to sector-specific inherent structural differences the agricultural sector is more exposed to credit default than other sectors. The *Subsidy Hypothesis* says that because subsidies are decoupled from production and hence from the systemic and idiosyncratic risk inherent to agriculture, they improve the agricultural firms' ability to repay bank loans.

In order to test the theoretical hypotheses, we employ a unique firm-level panel data set for loans granted to small and medium sized enterprises by one of the largest banks in Slovakia during the period 2000 and 2005. This period is particularly well suited for this type of analysis because loan growth was moderate and did not show the extremely high growth rates of the following years.

Testing the *Firm-Risk Hypothesis*, we find that the firms with relatively high cash amounts and finance available in their bank accounts (relative to total assets) are significantly less likely to default on their loans. We also find that companies with high earnings before taxation are less likely to default on their loans than the average of the sample. Thus, our empirical results confirm the *Firm-Risk Hypothesis*.

Testing the *Sector-Risk Hypothesis*, we find that on average the agricultural and food processing firms (full sample) do not exhibit a higher default rate than non-agricultural firms. However, when accounting for firm heterogeneity, we find that highly indebted agricultural and food processing firms default more often than highly indebted non-agricultural and non-food firms. Lowly indebted agricultural and food processing firms have equal default probabilities compared to other sectors.

Testing the *Subsidy Hypothesis*, which says that the new (decoupled) subsidy system (SAPS) introduced with the Slovakia's EU accession provides higher security of income and hence induces lower default rates, we find sample evidence supporting this hypotheses. However, more (detailed) data are necessary to provide more robust evidence for this hypotheses.

These results allow us to draw policy implications for agricultural credit policy. For an efficient implementation of rural credit policy, loans need to be targeted on those firms which due to inherent structural differences are particularly credit constrained, but not to be generally applied to all firms. Given that those farms which receive more subsidies tend to default less than farms with no or little subsidies, our results suggest that the CAP subsidies may contribute toward addressing the rural credit issue, implying that there may be less need for a specific credit support policy for agricultural firms.

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