The role of debt in financing French farm investments

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The purpose of this paper is to investigate the role of indebtedness in the capital structure of French farms, in order to understand how they finance their investments. The methodology is based on three main theoretical frameworks associated with capital structure in the financial literature: the trade-off theory, the pecking order theory and the signaling theory. We use data from the Farm Accountancy Data Network (FADN) during the period 2000-2014, which are representative of French professional farms. A simultaneous equation model (3SLS) is estimated in order to explain the financing of farms by short- and long-term debt and the level of investments. The paper complements previous studies by validating parts of the financial literature for farm businesses. Notably, the model reveals that farmers prefer to finance their investments using first internal funds, second long-term debt and third short-term debt. Over the years, the capital structure of French farms remains quite stable, although it has progressively integrated more short-term debt. Practical implications in terms of farm financing are then suggested.

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Keywords: Debt, Capital structure, Agricultural finance, France

1. Introduction

For decades, a large number of choices have been available to finance firm investments. Among all the businesses sectors, agriculture can be seen as a special case in terms of financing (Barry and Robison, 2001). While many industrial and commercial firms have generally a direct access to capital markets and exhibit a relatively sophisticated capital structure, accessible financial sources are relatively limited for most farms, whose resources mainly depend on internal funds, or short and long term financial debt (Danilowska, 2009). Each of these financing sources has its advantages and drawbacks.

Historically, farmers have usually preferred internal funds because of their apparent lower cost and risk (Barry et al., 2000). Debt is generally associated with lower tax payments but higher cost and risk (Zhao et al., 2008). When equity and debt are combined, farms are supposed to benefit from a more robust capital structure brought by internal funds as well as a leverage effect brought by debt (Bierlen et al., 1999). In practice, farmers often decide which financial strategy to select given their current financial wealth, their own financial needs and the perspectives of their business (Benjamin and Phimister, 2002).

The capital structure of a firm (*i.e.* the level of debt) and its evolution play traditionally a central role in the financial management of a business. In their seminal work, Modigliani and Miller (1958) stated that, in perfect markets, neither capital structure choices nor dividend policy decisions matter. Since then, owing on market imperfections, many authors have advocated that the choice of different financing sources may greatly affect firm value. These studies gave birth to different theories on optimal capital structure (debt ratio). Among them, the trade-off theory (Miller, 1977), the pecking order theory (Myers, 1984), and the Signaling Theory (Ross, 1977) are probably the most famous and the most empirically validated. Given the significant relationship between capital structure and firm competitiveness (Myers, 1984), an in-depth look at how financing decisions are made is meaningful and important for farmers.

While the literature in agricultural economics has already considered issues related to investments and financing, much remains to be done when considering the key role of indebtedness. Among the few studies that have applied financial theories to farms, Zhao et al. (2008) emphasize the role of signaling on farm capital structure in conjunction with the pecking order and trade-off theories. Rossi et al. (2015) find similar results for Italian SMEs in the agro-food sector. Yet, most existing works have

essentially considered the dynamics and cost of investments though neglecting the dynamics of financing as long as funds were available (Bojnec and Latruffe, 2011). Debt appears to be considered in more detail when investments are made under financial constraints such as credit rationing. This is typically the case with transition economies (Foltz, 2004; Latruffe, 2005; Petrick, 2004) or when the economies face a financial crisis associated with a credit crunch (Imro et al., 2017).

Studies conducted at the European scale suggest the existence of different pattern of financing and investments across countries (Myyra et al., 2011). France has the largest utilized agricultural acreage of the European Union and this country is also the biggest producer of agricultural goods[1]. By contrast, little interest has been paid until now to the dynamics of French farms financing while the French agriculture knows a double agricultural crisis with low revenues and declining economic performance (Bureau et al., 2015) coupled with succession failure (Burton and Fischer, 2015).

The objective of this paper is twofold: First, to identify the role of indebtedness in the financing of French farms investment and to assess how it has evolved over time. Second, to assess which financial theories of capital structure apply to French farms, by performing an empirical study. This work aims at providing an innovative insight on the relationship between the conditional theories of capital structure and empirical studies related to farms by proposing testable hypotheses. While the capital structure, indebtedness and investments of French farm is closely studied by the Ministry of Agriculture (Agreste, 2015), the reasons of their dynamics remain to be understood.

The empirical analysis relies on the database of the Farm Accountancy Data Network (FADN) for the period 2000-2014. By construction, FADN data are representative of French professional farms of commercial size, especially in terms of productive orientation. Because of the numerous accounting and financial elements included in this database (products and charges, balance sheets and income statement), it appears to be the most complete and the most appropriate to capture the financial structure of farms.

Our article is organized as follows. The first section is devoted to the theoretical role of indebtedness in the choice of investments, along with the formulation of research hypotheses. The second section is focused on the empirical framework, including a description of the database and econometric modelling. The third section displays, analyses and discusses the results of the econometric model. The fourth section concludes.

[1] Some figures are available on the website of the French Ministry of Agriculture: http://agriculture.gouv.fr/overview-french-agricultural-diversity

2. Theoretical framework: Indebtedness and investments, the capital structure of farms

Several theories have been proposed to explain how companies select their sources of financing, including the trade-off theory (Miller, 1977), the pecking order theory (Myers, 1984), and the signaling theory (Ross, 1977).

2.1 The trade-off theory

In the trade-off theory, the managers (or owners) seek to optimize the debt ratio of the firm in order to maximize its value, thus lowering their average cost of capital. This maximization is obtained by considering the trade-off between the costs and benefits of borrowing (Myers, 1984): interest tax shields from indebtedness are balanced against the costs of financial distress, namely legal and administrative bankruptcy costs, moral hazard, monitoring and contracting costs.

These two factors influence the firms' financing decisions toward an optimal debt ratio in a sequential way: First, the interest tax shield outweighs other costs and pushes managers to finance their investments with long term debt. Second, indebtedness increases credit and liquidity risk, until the point where there is no additional benefit in financing investments by debt: tax benefits are then equal to the bankruptcy and agency costs associated with debt. The static trade-off theory predicts that firms have target debt ratios and will adjust to these targets.

However, in reality, when firms deviate from their target debt ratio, the existence of adjustment costs prevents firms from making a total adjustment to that ratio, and so firms make a partial adjustment of debt towards the optimal debt ratio (López-Gracia and Sogorb-Mira, 2008). Besides, the optimal debt ratio may vary over time due to unstable internal and external environment like volatile interest rates. The trade-off theory allows for incomplete adjustment and changes in the target debt ratio by firm and by period of time (Flannery and Rangan, 2006).

2.2 The pecking order theory

In Myers and Majluf (1984), managers prefer retained earnings to debt, short-term debt over long-term debt and debt over equity to finance their investments. First, the pecking order theory asserts that firms show a distinct preference for using internal finance (such as retained earnings or excess

liquid assets) over external finance due to the information asymmetry between managers/owners and investors. This information asymmetry arises from capital market imperfections. Managers/owners know more about the firm's prospects than external investors (debt lenders or external shareholder). This situation results in an increase of agency costs for external investors in order to screen and monitor borrowers (Jensen and Meckling, 1976). Parts of these costs are finally transferred from the lenders to borrowers, bearing additional agency costs to the firm. In the absence of investment opportunities, firms retain profits and may exhibit a financial slack in order to avoid having to raise external funding in the future.

Second, if internal funds cannot finance investment opportunities, firms may look for external financing, and if they do so, they will choose among the different external funding sources in order to minimize additional costs of asymmetric information. In that case, issuing equity becomes more expensive as asymmetric information between insiders and outsiders increases. Managers and inside investors have more information (like the true distribution of the firm future returns) than outsiders. As the risk of the firm's return is unknown to potential investors, they are forced to rely on noisy signals such as the firm's level of debt in order to determine the risk of their investment. Firm's value may be underpriced by the market (Myers and Majluf, 1984). For these reasons, managers prefer debt whenever possible. The results from many empirical studies conducted by Baskin (1989), Jensen et al (1992) and Shyam-Sunder and Myers (1999) support the effectiveness of the pecking order theory.

2.3 The signaling theory

The signaling theory was first conceptualized by Spence (1973) who claimed that a good firm can distinguish itself from a bad firm by sending a credible signal about its quality to outside investors. The signal will have an impact only if the bad firm is unable to send the same signal. In fact, if the cost of the signal is higher for the "bad type" than that of the "good type" company, the bad type may not find it worthwhile. Ross (1977) showed how debt could be used as a costly signal to separate the "good" from the "bad" firms.

Owing on the asymmetric information between managers and investors, signals from firms are crucial to obtain financial resources. In that context, managers (the insiders) know the true distribution of firm returns, but (external) investors do not. A higher debt suggests good financial and business perspectives in the future, because of the application of the leverage effect and the

need for the company to pay back its debt. Consequently, "high-quality" firms would use more debt than "low-quality" companies. In the same spirit, farm managers will also have incentives to get external financing by adopting such financing strategies. Unlike corporate firms which offer signals (dividend or repurchase shares from stock market) to investors, farm managers will mostly send signals to all potential lenders: typical signal sent by farms include their profitability and income, as well as the historical performance record measured by the return on assets (Zhao et al., 2008).

2.4 Research hypotheses

Many studies (Myers, 1984; Barry and Ellinger, 2012) demonstrated that these theories do not contradict each other and can work together with different time horizons: the trade-off theory is more addressed to the long-term equilibrium between different financial sources whereas the pecking order theory rather concerns short term financial decisions. The joint consideration of these three theories implies to test three research hypotheses.

H_1. French farms have long- and short-term debt targets and they partially adjust debt levels towards them each year.

H_2. French farms rank their financing sources in the following way: cash flows, short-term loans and long-term loans.

H_3. French farms owners have to signal their performance to lenders in order to reduce agency costs. These signals are composed of cash flows, short- and long-term debt levels, and profitability.

These three hypotheses will be jointly tested using the following empirical framework.

3. Empirical framework

This section presents the empirical framework of our study. We start by presenting the database, with a highlight on the main variables used. Then, we detail our empirical model.

3.1 Database

In order to examine the capital structure of French farms, we use data from the French Farm Accountancy Data Network (FADN) for the period 2000-2014. These data are both the most precise available at the individual level and the most complete and recent that we have. It is worth noticing that the FADN sample includes only commercial farms which, by definition, reach a minimum economic size (gross income of at least 25,000 €). Furthermore, the sample is based on a defined stratification (geographic location, economic and technical orientation and physical size), and extrapolation factors are computed. Our study is then representative of French professional farms.

Table 1 below specifies the variables used to test the hypotheses defined above.

Table 1. List of variables used in the analysis

3.2 Econometric model

According to the literature (Vogt, 1994; Barry, Bierlen and Sotomayor, 2000; Zhao, Barry and Katchova, 2008; Tian, 2013), the most adequate model to test our research hypotheses consists in three simultaneous equations which take into account the variation of long-term debt, short-term debt and investments. As a consequence of the sample rotation, the panel is unbalanced and we take into account annual effects.

$$vltd_{it} = \alpha_1 + \alpha_2 vstd_{it} + \alpha_3 vinv_{it} + \alpha_4 CF_{it} + \alpha_5 vltd_{it-1} + \alpha_6 FE_{1i} + \alpha_7 YE_{1t} + \varepsilon_{it} \quad (1)$$

$$vstd_{it} = \beta_1 + \beta_2 vltd_{it} + \beta_3 vinv_{it} + \beta_4 CF_{it} + \beta_5 vstd_{it-1} + \beta_6 FE_{2i} + \beta_7 YE_{2t} + \mu_{it} \quad (2)$$

$$vinv_{it} = \gamma_1 + \gamma_2 vltd_{it} + \gamma_3 vstd_{it} + \gamma_4 CF_{it} + \gamma_5 ltd_{it-1} + \gamma_6 std_{it-1} + \gamma_7 ROA_{it-1} + \gamma_8 vltd_{it-1} + \gamma_8 vstd_{it-1} + \gamma_9 CF_{it-1} + \gamma_{10} FE_{3i} + \gamma_{11} YE_{3t} + \nu_{it} \quad (3)$$

Where: *ltd* is the stock long-term debt, *vltd* is the variation of long-term debt, *std* is the stock short-term debt, *vstd* is the variation of short-term debt, *vinv* is the variation of investments, *CF* is the value of annual cash-flows, *ROA* is the return on assets, FE are fixed effects, YE are year effects, ε, μ and ν are the error terms, assumed to be *iid*. *i* and *t* respectively index farms and the time period. Given we consider all farms of commercial size included in FADN data, variables are scaled by the closing valuation of total assets for each period *t* considered. By construction, *ROA* and *YE* are already normalized.

The estimation of simultaneous equations can be performed using several techniques (OLS, 2SLS or 3SLS). We choose to adopt a Three-Stage-Least Squares (3SLS) which takes into account potential correlation between cross-equation error terms. This method appears to be the most appropriate with correctly identified equation systems (Biørn, 2016). For the purpose of the analysis, we consider a model with fixed effects in order to account for the unobserved farm effects such as non-random variables. Then, we eliminate them by subtracting the within-firm mean of each variable (Tian, 2013).

4. Results

In this section, we start by presenting some descriptive statistics. We then develop the results of the econometric modelling.

4.1 Descriptive statistics

As shown in Table 2, the capital structure of French farms is mainly based on equity, which covers 59% of total assets value on average (Table 3). Debt is less preferred and farmers combine long-term (25%, 89 k€) and short-term liabilities (19%, 48 k€).

Table 2. Summary statistics of French farms

French farms had on average 351 k€ of owned assets over the period 2000-2014. Net investments increased by 24.8 k€ on average each year. At first look, it seems that these new investments were financed by indebtedness which increased slightly by more than 1.8 k€ on average each year. However, most of funding comes from self-financing given the observed cash-flow and profit levels. One should note that the values of the standard deviation, minimum and maximum for all these indicators denote the heterogeneity of the sampled farms.

The relative importance of short-term debt raises the issue of financial stability given that (1) associated interest rates are usually more expensive and (2) this debt has to be paid back within one year. Despite the existence of some extreme situation (e.g. negative value of equity, which denote highly distressed farms unable to payback their debt), standard deviations remain at low levels.

Table 3. Summary statistics of the capital structure of French farms

Figure 1 complements the analysis. Distributions for the stock long- and short-term debts are skewed to the left, many farms exhibiting no or little indebtedness. Conversely, the figure confirms that French farms intensively rely on equity to finance their activities.

Figure 1. Frequency of stock long-term debt, stock short-term debt and equity to total assets

Figure 2 exhibits the evolution of the capital structure of French farms over the period 2000-2014 with the same variables as above. Despite a small increase in the stock of (short-term) debt and the continuous and strong decrease of interest rates over the period (Petrick and Kloss, 2013), the relative proportion between debt and equity remains almost unchanged.

Figure 2. Evolution of stock long-term debt, stock short-term debt and equity to total assets

Financials flows are examined in Table 4. Annual variations appear to be very small, although some disparities exist among farms. The trend observed above is confirmed, *i.e.* an increase in short-term debt while short-term debt, cash-flows and investments are decreasing. The ROA is also slightly decreasing. All these figures describe the deterioration of the financial structure of French farms.

Table 4. Summary statistics of financial flows of French farms

Figure 3 complements the analysis. Distributions mainly emphasize the decrease of long-term debt in the capital structure of French farms with a distribution skewed to the left. Moreover, the distributions of short-term debt and investment are much pronounced than those of long-term debt and cash-flows.

Figure 3. Frequency of financial flows of French farms

Figure 4 exhibits the contrasted evolution of the main financial flows related to the capital structure of French farms. Volatility of cash-flows and ROA seems to increase over time, which translates the consequences of the deregulation of agricultural markets (Myyra et al., 2011). The strong correlation between these indicators is not surprising because the value of ROA is closely linked to

cash flows. The increase of short-term debt appears to be quite regular and so is the decrease of investments on the farm. Short-term debt fluctuations are also less volatile.

Figure 4. Evolution of financial flows of French farms

4.2 Econometric models

The results of the econometric models (3SLS simultaneous equations) are presented in Table 5.

Table 5. Econometric models

Our results show that we can validate the first hypothesis $\mathbf{H_1}$ related to the trade-off theory. Indeed, we found statistically significant negative coefficients on the lagged stock long-term debt (-0.058 ***) and short-term debt (-0.038***). This result demonstrates that French Farms have both short-term and long-term debt targets and partially adjust to them. Surprisingly, the adjustment factor is higher for long-term debt than for short-term debt, which may denote the sensitivity of lenders to the farmers' long-term commitments.

The estimation results partially support our second hypothesis $\mathbf{H_2}$ related to the pecking-order theory. As anticipated, we found statistically significant negative coefficients between long-term debt and short-term debt in the two first equations. However, while the coefficients associated with cash-flows are negative, they are not significant at all. It implies that this source of investment does not predetermine variation in indebtedness. The huge annual volatility of cash-flows (Figure 4) may be an explanation of this situation. We also observe at the same time a positive relationship between long-term debt (1.030***), short-term debt (1.384***) and investment as well as a negative relationship between cash-flows (-0.335***) and investment in the third equation. These results suggest that an increase in indebtedness is directly associated with new investments. Moreover, the coefficient of short term debt is higher than those of long term debt, which implies that farmers prefer short-term financing sources, as predicted by the pecking order theory.

Finally, the model provides some support to the third hypothesis $\mathbf{H_3}$. Lagged cash-flows (0.306***) have a positive and significant influence on the level of investments. However, lagged short-term debt (-0.046***) and long-term debt (-0.142***) negatively impact investments. Profitability measured through the ROA has no impact. Cash-flows are therefore the most relevant positive

signal sent to potential lenders, thus acting as a collateral. Conversely, past borrowings convey a negative signal because additional investments may result in increased debt and risk.

5. Conclusion

In this article, we have proposed a study of the capital structure of French farms by focusing on the role of debt in financing investments. This work relies on the financial literature - trade-off theory, pecking order theory and agency theory - that has been developed over several decades, although with limited interest in the agricultural sector. Using the FADN database 2000-2014, we were able to provide some new insight about the capital structure and indebtedness of French farms and the way they finance their investments. The econometric model takes into account 3 simultaneous equations (3SLS) with short-term debt, long-term debt and investments as dependent variables.

The results showed that farms prefer to finance investments using first internal funds, second long-term debt and third short-term debt. Over the years, the capital structure of French farms remains quite stable, although it has progressively integrated more short-term debt. The reason may probably lie in the conjunction of lower interest rates and increasing risks in farm revenue. Indeed, cash-flows appeared to be very volatile among years while they remain a strong signal addressed to lenders. Consequently, farms have adapted their capital structure, while refereeing to a target of indebtedness as indicated by the econometric model.

This summarized portrait of the capital structure of French farms provides some improved knowledge on the way they finance their operating activities and investments. A direct application of this work is related to the farm value on the market. Indebtedness can indeed send either a positive signal on the farm value in case of profitability or a negative signal in case of over-indebtedness or low profitability.

The analysis would deserve to be deepened by considering more precisely some economic and technical productive orientation, some of them (e.g. cattle breeding and wine-growing) being more capital-intensive. Special emphasis should also be paid to the trend towards an increase of short-term financing. Such financing appears to be easier to obtain from banks. However, it does not guarantee a stability of the financial structure of farms, which may weaken their sustainability in the long run.

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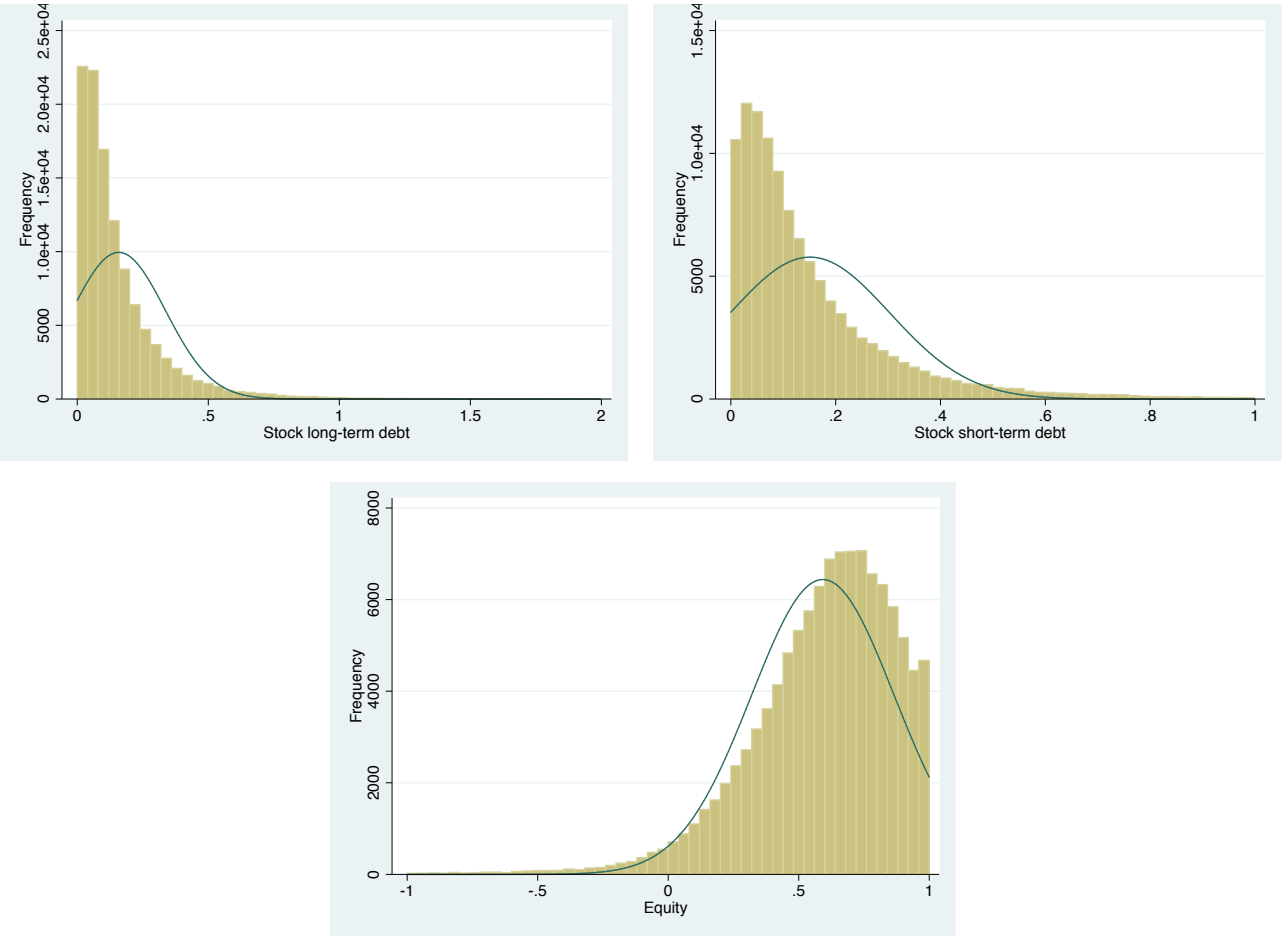
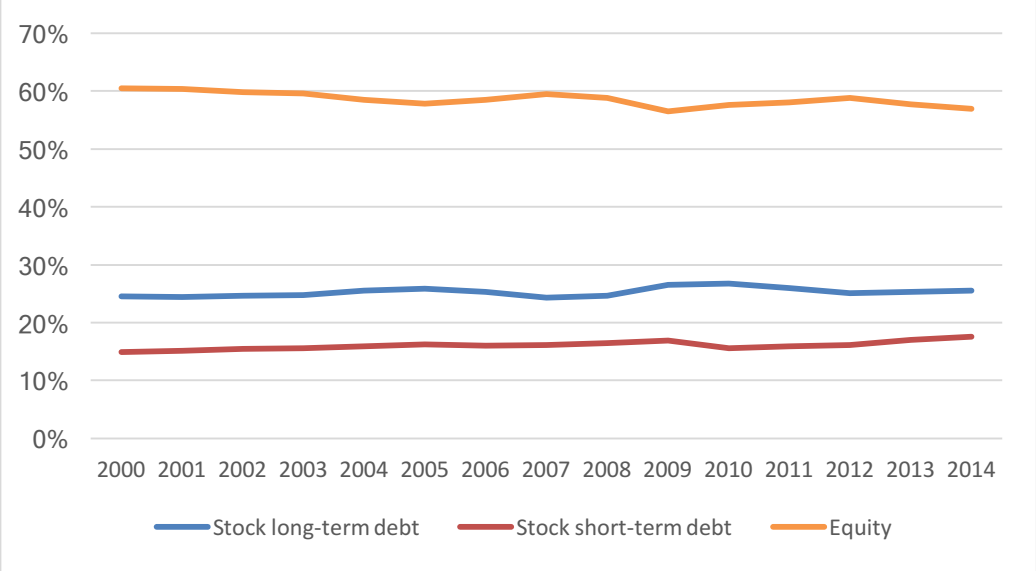
Figure 1. Frequency of stock long-term debt, stock short-term debt and equity to total assets



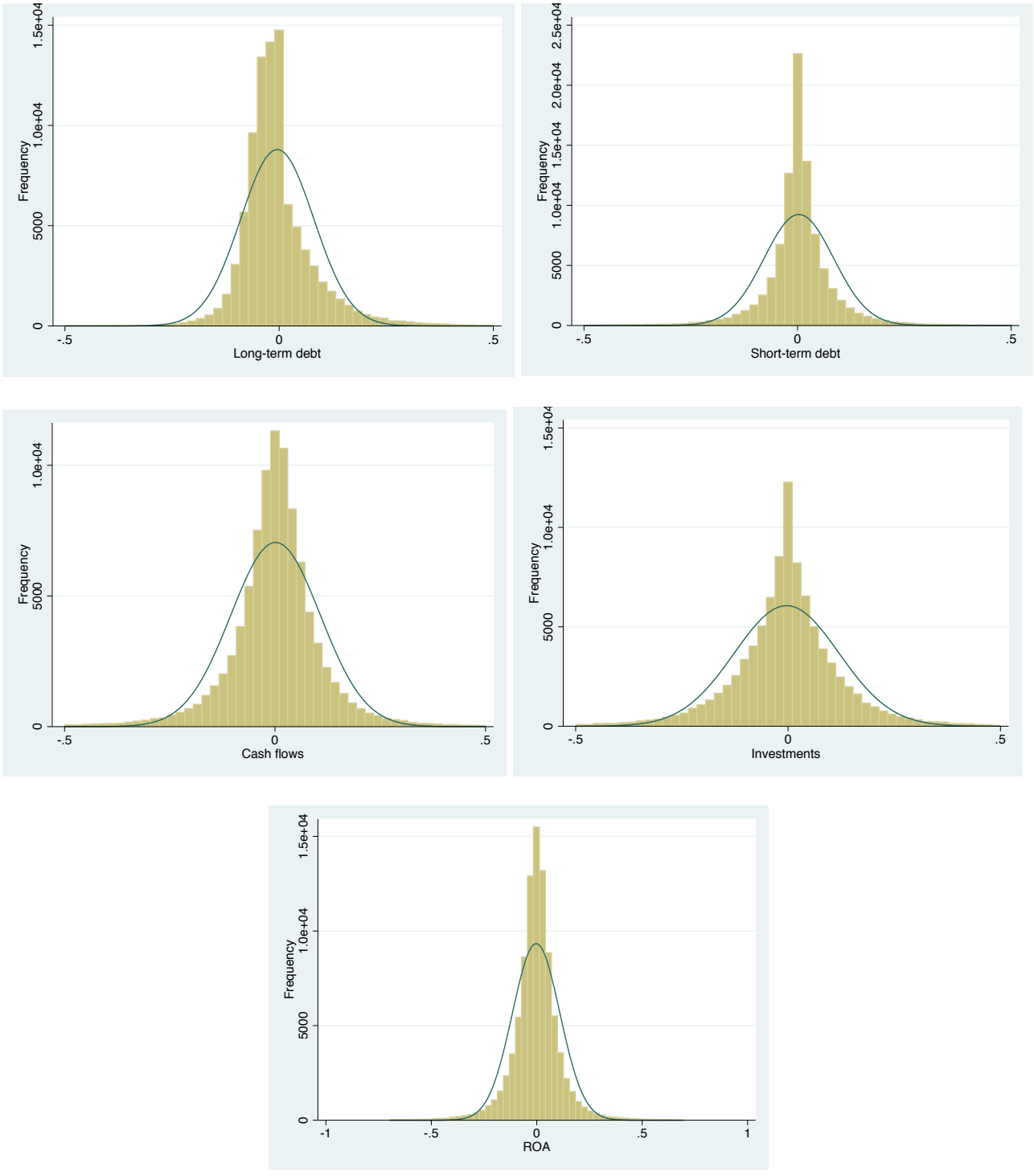
Key: Original values with normal adjustment.
Source: Own calculations based on the FADN database 2000-2014.

Figure 2. Evolution of stock long-term debt, stock short-term debt and equity to total assets



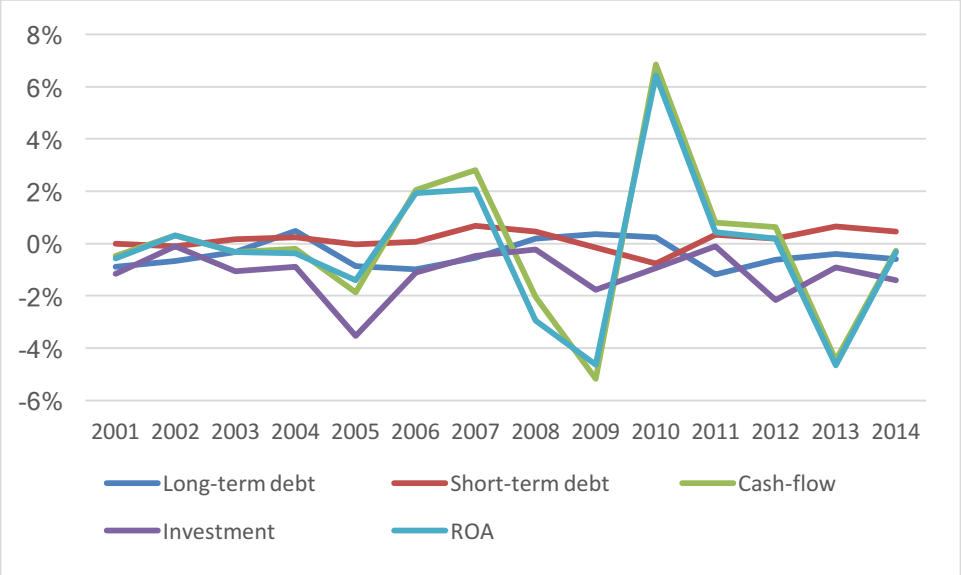
Source: Own calculations based on the FADN database 2000-2014.

Figure 3. Frequency of financial flows of French farms



Source: Own calculations based on the FADN database 2000-2014.

Figure 4. Evolution of financial flows of French farms



Source: Own calculations based on the FADN database 2000-2014.

Table 1. List of variables used in the analysis

Variables	Unit	Definition
Year	-	Year of the observation
Stock long-term debt	€	Closing valuation of loans whose maturity is higher than 1 year
Long-term debt	€	Annual variation in long-term debt
Stock short-term debt	€	Closing valuation of loans whose maturity is lower than 1 year, short-term loans and creditors
Short-term debt	€	Annual variation in short-term debt
Investment	€	Value of purchased minus sold fixed assets
Cash-flows	€	Total cash income minus cash expenses for operating activities
Profit	€	Net annual profit (or loss)
Total assets	€	Sum of fixed and current assets
ROA	-	Earnings before interests and taxes / Total assets

Table 2. Summary statistics of French farms

Variables	Mean	Std. Dev.	Min	Max
Cash-flow (1.000 €)	60.34	64.08	-520.65	3547.93
Long-term debt (1.000 €)	1.33	43.81	-1010.62	3573.75
Short-term debt (1.000 €)	1.52	36.52	-2055.11	1850.12
Investment (1.000 €)	24.85	60.60	-1365.27	5266.06
Stock value of long-term debt (1.000 €)	89.76	126.89	0.00	5569.96
Stock value of short-term debt (1.000 €)	48.82	90.92	0.00	6485.39
Profit (1.000 €)	40.82	55.26	-737.23	3421.98
Total assets (1.000 €)	351.02	351.39	1.36	16445.97

Key: Euro amounts are current euros.
Source: Own calculations based on the FADN database 2000-2014.

Table 3. Summary statistics of the capital structure of French farms

Variables	Mean	Std. Dev.	Min	Max
Total debt	0.41	0.30	0.00	15.39
Stock long-term debt	0.25	0.20	0.00	13.86
Stock short-term debt	0.16	0.19	0.00	7.57
Equity	0.59	0.30	-14.39	1.00

Key: Variables are measured in ratios to total assets.

Source: Own calculations based on the FADN database 2000-2014.

Table 4. Summary statistics of financial flows of French farms

Variables	Mean	Std. Dev.	Min	Max
Long-term debt	-0.00	0.09	-4.63	2.77
Short-term debt	0.00	0.10	-7.65	2.02
Cash-flow	-0.00	0.14	-21.14	3.27
Investment	-0.01	0.46	-153.76	6.41
ROA	-0.00	0.12	-1.88	1.38

Key: Variables are measured in ratios to total assets.

Source: Own calculations based on the FADN database 2000-2014.

Table 5. Econometric models

	3sls		
Variables	**Long-term debt**	**Short-term debt**	**Investment**
Endogenous variables			
Long-term debt		-0.728***	1.030***
Short-term debt	-0.733***		1.384***
Investment	0.383***	0.373***	
Exogenous variables			
Cash-flow	-0.003	-0.003	-0.335***
Lagged stock long-term debt	-0.058***		
Lagged stock short-term debt		-0.038***	
Lagged ROA			-0.001
Lagged short-term debt			-0.046**
Lagged long-term debt			-0.142***
Lagged cash-flow			0.306***
Time dummies			
Y=2002	0.000	0.000	0.000
Y=2003	0.006*	0.006	-0.009
Y=2004	0.017***	0.014***	-0.023*
Y=2005	0.003	0.003	-0.011
Y=2006	0.003	0.003	-0.002
Y=2007	0.010**	0.011**	-0.011
Y=2008	0.012***	0.011**	-0.020
Y=2009	0.012***	0.009*	-0.028*
Y=2010	0.009**	0.003	0.013
Y=2011	0.001	0.002	-0.003
Y=2012	0.012***	0.012**	-0.026*
Y=2013	0.009**	0.010**	-0.027*
Y=2014	0.007*	0.007*	-0.012
Constant	-0.019***	-0.024***	0.080***
Farm observations	77,002	77,002	77,002
$\chi 2$ for H_0 (All slope parameters = 0)	0.000	0.000	0.000

Key: *, ** and *** respectively denote significance at the 10%, 5% and 1% levels respectively.

Source: Own calculations based on the FADN database 2000-2014.