

**DETERMINANTS OF TRADE CREDIT FINANCING: A DYNAMIC
ANALYSIS COMPARING AGRI-FOOD COOPERATIVES AND NON-
COOPERATIVES**

MCarmen Martínez-Victoria¹

Mariluz Maté-Sánchez-Val²

¹University of Almería, Department of Economics and Business.

**Corresponding author: mcmvic@ual.es*

²Technical University of Cartagena, Financial Economics and Accounting.

mluz.mate@upct.es

Abstract

Purpose – The particular characteristics of agri-food cooperatives reduce their ability to access external financial resources. The purpose of this paper is to explore the factors influencing the agri-food cooperatives' trade credit operations by measuring their accounts receivable and comparing the results with agri-food investor-owned firms (IOFs).

Design/methodology/approach – The authors apply a partial adjustment model (PAM) estimated using a dynamic panel model with a two-step general method of moments (GMM) estimator to a sample of 11,930 Spanish agri-food cooperatives and IOFs for the period 2011–2018.

Findings – The study concludes that cooperatives and IOFs have an accounts receivable target, which they attempt to achieve rapidly. Cooperatives tend to behave as IOFs do, but they present lower adjustment coefficients. This difference seems to be explained by the unique characteristics of cooperatives which set different economic and social goals, not just profit maximization as IOFs. The findings show differences between the financial and commercial purposes of the cooperatives and IOFs as a result of their internal management policies. Larger cooperatives with access to external financial sources, positive cash flows and operational necessities will grant trade credit.

Originality / value – This study gives interesting implications for cooperative managers and policymakers to help them to understand the strategies behind trade credit policies. Previous empirical studies on the agri-food sector are scarce and focus on IOFs without considering the role of trade credit in European cooperatives.

Keywords – Accounts receivable, cooperatives, partial adjustment model, agri-food companies.

Paper type – Research paper.

1. Introduction

The availability of external financial resources for small and medium enterprises (SMEs) is one of the most important issues discussed in the corporate financing literature and by policymakers (Carbó-Valverde *et al.*, 2016). Besides bank lending, trade credit is the most popular method of giving short-term financial support to SMEs (Alarcón, 2011; Carbó-Valverde *et al.*, 2016). Operating outside of the banking system and without official control, trade credit occurs when suppliers allow their clients to hold up payments for goods and services received. These suppliers allow trade credit for achieving commercial and operational benefits, which also means bearing the risk of default (Grau & Reig, 2018). Berger and Udell (1998) showed that trade credit provides nearly as much debt financing to the SMEs as the commercial banks in the United States. Moreover, Barrot (2016) describes a three-to-one ratio between trade credit and bank loans for the aggregated balance sheets of non-financial companies in the United States. In the European Union (EU), trade debtors represent around 30% of total assets (Giannett *et al.*, 2011). In particular, this source of financing plays an important role in the Mediterranean countries. In Spain, the importance of trade credit transactions is reflected by financial statistics—about 41.8% of the SMEs apply trade credit in commercial transactions to support their current liabilities, when they have difficulty accessing external financial funds or suffer from high bank credit costs (Guariglia & Mateut, 2006; Ferrando & Mulier, 2013; Cesgar, 2018).

Despite its economic importance, there is a limited understanding of the reasons for trade credit use. The financial literature highlights that trade credit characteristics differ among industries and countries. The empirical studies on the agri-food sector are scarce and focus on investor-owned firms (IOFs) without considering the cooperatives. In a cooperative, trade credit allows member producers to finance short-term input needs, particularly during financial crises or for financially constrained firms. This helps cooperatives alleviate the capital market constraints of their ailing members. In this sense, cooperatives supply credit on sales to their members during liquidity-constrained periods (McKee *et al.*, 2020). In other words, cooperative companies provide short-term financing by offering trade credit to their member producers when they cannot find it elsewhere. There is no doubt that trade credit practices offer competitive advantages and help

cooperatives to potentially increase their sales (McKee *et al.*, 2020). However, cooperatives must balance the cost and benefits of using this mechanism because of the risk of default.

Cooperatives are the backbone of agri-food activities; they amplify the bargaining power of their producers and improve their positions in the agri-food markets (Figueiredo & Franco, 2002; Garrido-Chamorro, 2013; Figueiredo & Franco, 2018). They increase the added-value in the agri-food value chain by facilitating agri-product processing and strengthen the sector's commercialization and internationalization (Soboh *et al.*, 2009). Unlike the IOFs, which operate according to the interests of investors, cooperatives have a peculiar relationship with their members (such as owners, users, managers, and/or beneficiaries), who simultaneously play different roles (Hansmann, 1996; Nilsson, 1996; Soboh *et al.*, 2009). Thus, cooperatives are formed to achieve various goals, not just profit maximisation (Parliament *et al.*, 1990; Boyle, 2004; Ortmann & King, 2007; Martínez-Victoria *et al.*, 2018a; 2018b). The objectives of cooperatives are focused on members' welfare maximisation, minimising member prices for inputs and maximising those for outputs (Martínez-Victoria *et al.*, 2018b). The success of these cooperatives depends on member satisfaction, which, in turn, depends on cooperatives' contribution towards enabling members to achieve their economic and social goals (Figueiredo & Franco, 2014; Lienbrand & Ling, 2018). In this sense, members' level of satisfaction depends on the prices and the quality of services (economic goals), the degree of interaction with other members, and the level of information (e.g., market prices) provided by the cooperative company. As a result, members' satisfaction influences the success of the cooperative (Hansen *et al.*, 2002; Arcas-Lario *et al.*, 2012; Arcas-Lario *et al.*, 2014). This increases the likelihood of managers making decisions for self-gain to the detriment of cooperative members (Nilsson, 2004; Arcas-Lario *et al.*, 2014). A divergence of objectives between principals (members) and agents (managers) leads to agency conflicts and costs (Jensen & Meckling, 1976; Arcas-Lario *et al.*, 2014). The cooperatives also face investment constraints and decision-control problems as a result of three investment-related incentive problems—the “free-rider,” “horizon,” and “portfolio” (risk) problems (Cook, 1995; Fulton, 1995; Nilsson, 2001; Cook & Burrell, 2009; Mínguez-Vera *et al.*, 2010). This becomes more evident as the heterogeneity among the cooperative members

grows with the age of the cooperative (Cook, 1995; Nilsson, 2001; Cook & Iliopoulos, 2000; Nilsson *et al.*, 2012). First, cooperatives suffer as a result of imbalance emerging from a joint asset ownership, open membership, and low or no entry fees in cooperative companies. In these cases, new members are allowed to enjoy the accumulated assets, which encourages them to be free riders (Royer, 1999). Second, there is a lack of incentives for cooperative members to participate in long-term investments (Vitaliano, 1983; Royer, 1999). This is because the cooperative members only obtain benefits from investments made during their membership with the cooperative. Third, given that cooperative decisions are collectively adopted, members do not have the option of selecting risk preferences as per their personal risk profile (Vitaliano, 1983; Fulton & Giannakas, 2013). Thus, from a theoretical perspective, cooperatives seem to be less efficient than the IOFs. However, the empirical results do not support this claim (Boyle, 2004; Hardesty & Salgia, 2004; Fazzini & Russo, 2014; Martínez-Victoria *et al.*, 2018a), given that certain benefits from cooperative companies cannot be extended to the IOFs.

Thus, the arguments explaining the factors determining trade credit usage in IOFs are probably not transferable to cooperatives. Consequently, it is expected that the distinctive characteristics of cooperatives have an impact on their use of trade credit. Given the relevant role of cooperatives in the agri-food sector, this study attempts to determine whether the trade credit decisions in these companies follow a partial adjustment process. In this regard, Pike and Chen (2011) showed that companies settle trade-credit target values for buyers by monitoring their trade credit levels. García-Teruel and Martínez-Solano (2010a) confirmed that although companies set a target value for the trade credit policy, they cannot meet the accounts receivable targets immediately. Based on a dynamic model, they reveal the existence and role of the adjustment costs in delaying the adjustment process towards the benchmark. Following this argument, we consider this specification to compare the trade credit values between the cooperatives and the IOFs. We also analyse the differences in the factors influencing the trade credit grants, by considering the financial, operational, and commercial factors in cooperatives and IOFs.

To analyse these factors, for the period 2011–2018 we develop an empirical application based on a sample of 11,930 agri-food SMEs. To the best of our knowledge, previous studies have not

considered the role of trade credit in European cooperatives. Based on the literature on IOFs, this study assumes that the trade credit granted follows a dynamic process, which means that firms cannot immediately adjust toward their target trade credit levels because of the existence of adjustment costs. Based on this assumption, we apply a partial adjustment model (PAM) estimated using a dynamic panel model with a two-step general method of moments (GMM) estimator. This allows us to control for the heteroscedasticity across firms. This comparison between cooperatives and IOFs provides a greater understanding of the Spanish cooperatives' levels of investment in assets. We analyse the effect of trade credit as a mechanism to attract clients and increase revenues in agri-food cooperatives. Our results indicate that cooperatives and IOFs have an accounts receivable target, which they attempt to achieve rapidly. They also show that cooperatives and IOFs have different sales policies and working capital management practices. Regarding whether theories explaining the application of trade credit in the IOFs can be extended to the cooperatives, we show that the cooperatives and IOFs have the same operational factors but different financial and commercial factors.

The paper is organised as follows. Section 2 shows the determinants of trade credit granted by cooperative firms and develops our testable hypothesis. Section 3 presents the data, the dynamics of trade credit and the partial adjustment model, the variables and the empirical model. Section 4 includes the results. Finally, we include the discussion and conclusions of this study in Sections 5 and 6.

2. Determinants of trade credit in cooperative firms: accounts receivable

Cooperatives are conditioned by their inherent limitations. They accumulate shared capital by virtue of the principle of voluntary and open membership. The limitations of cooperatives in accessing external sources of funding are conditioned by the relationship between stakeholders, driving them to resort to internal financing through reserve funds. Cooperatives also distribute their benefits to their users through pricing, offering higher selling prices to their suppliers (Hernández-Espallardo *et al.*, 2013). Therefore, cooperatives and IOFs differ in terms of return, capital funding, and operational efficiency (Hendrikse & Bijman, 2002). The first step is to analyse whether theories explaining the use of trade credit in IOFs can be extended to

cooperatives. After examining the financial literature, we found that the application of trade credit in IOFs, evaluated in terms of investments in accounts receivable, is explained by three main factors. First, from an *operational* perspective, the separation of the delivery and the payment of goods can decrease the transaction costs and guarantee product quality (Emery, 1987). Second, from a *financial* viewpoint, suppliers can easily consider clients' financial behaviour and creditworthiness through business connections and promptly and efficiently assess customer defaults. They have the power to control customers' repayments by reducing the supply of goods and repossessing goods in the case of non-payment (Ono, 2001). Finally, from a *commercial* perspective, some researchers (Petersen & Rajan, 1994; 1997) state that suppliers offer discounts to clients who pay early, and, hence, there is a different pricing for early and late-paying customers. Based on these observations, we evaluated the possibility of extending these practices to cooperatives.

Trade credit can be seen as a promotional tool to attract clients. The marketing theory states that sellers have an opportunity to relax their credit terms to stimulate sales (Emery, 1984). In the agri-food sector, Alarcón (2011) confirmed a positive relationship between sales volume and accounts receivable. This shows that agri-food companies grant trade credit as a mechanism to increase their market competitiveness. Cooperatives can even extend payment periods for customers who are usually the members of the cooperative. One of the peculiarities of this sector lies in its shorter credit terms owing to the highly perishable nature and rapid turnover of the products offered (Long *et al.*, 1993). García-Teruel and Martínez-Solano (2010a) found that firms use trade credit as a guarantee of product quality. Furthermore, given that the transactions involve regular product delivery, the use of trade credit provides cost savings by separating the shipment from the payment and improving competitiveness (Cheng & Pike, 2003). Although the use of trade credit enables cooperatives to increase sales volume and reap its benefits, they also face repayment risk and internal competition for funds (McKee *et al.*, 2020). Overall it is expected that the separation of delivery and payment will result in operating efficiencies, eventually increasing sales in cooperatives. Therefore, we propose the following hypothesis:

H1: *Cooperative companies use trade credit to recover falling sales.*

The ability to grant trade credit depends on the ease of obtaining debt and the associated financial costs. Mateos-Ronco and Guzmán-Asunción (2018) showed that cooperatives tend to follow the pecking order theory in their financial decisions. In other words, to obtain funding, cooperative companies resort to debt (negotiated or non-negotiated) only when facing internal resource constraints. Although the use of debt generates tax advantages, these companies do not see this characteristic as an incentive to use external financing. Despite this, cooperatives tend to take a conservative approach, assuming fewer risks and applying retained profits instead of external financing (Soboh *et al.*, 2011; Martínez-Victoria *et al.*, 2018a).

Furthermore, cooperative members' relationships also determine their access to external debt, which results in agency problems and information asymmetry (Mateos-Ronco & Guzmán-Asunción, 2018). Cooperatives also suffer from time-horizon problems. This refers to the lack of incentive for cooperative members to engage in long-term projects. This happens when the project's duration is longer than the project owner's membership duration (Vitaliano, 1983; Royer, 1999). This opportunistic behaviour by members prevents cooperatives from availing themselves of substantial external debt. The horizon problem decreases the members' ability to invest in long-term projects and encourages their preference for projects with short-term payoffs (Borgen, 2004; Fulton & Giannakas, 2013). Finally, the cost of external debt is another financial factor determining the level of credit granted. The high financial costs of obtaining funds means that firms have less incentive to offer trade credit or relax their payment terms (Alarcón, 2011). This includes both cooperatives and IOFs. Based on this review, we propose the following hypothesis:

H2: Cooperatives do not use external funding (debt) to increase their trade credit.

The level of benefit generated by a company (measured as gross profit over sales) also determines the level of trade credit it grants (Petersen & Rajan, 1994). Profit margins help companies differentiate prices, given that similar products are sold at different price points to different clients. McKee *et al.* (2020) stated that trade credit helps increase the profitability of cooperatives by gratifying producers' short-term financial needs. However, the interpretation of profitability ratios in cooperatives is a complex area of analysis because it tends to be biased. Cooperatives

have the specific objectives of profit maximisation and member welfare. They distribute most of their benefits among the members by maximising supplier-member prices, which results in a “zero surplus” (Hernández-Espallardo *et al.*, 2013). Thus, cooperatives have lower profitability values than that of IOFs (Soboh *et al.*, 2009; 2012). Petersen and Rajan (1997) confirmed that companies with high profitability values tend to increase their sales volume. Cooperative managers are careful not to overuse assets and accept many late-paying customers, in order to avoid negative effects on their firms’ value (Martínez-Victoria *et al.*, 2018a). Therefore, we postulate the following:

H3: Cooperatives do not use their profits to obtain more trade credit.

Finance literature shows that companies try to adjust asset liquidity to the duration of debt settlement. Companies tend to guarantee that the cash flow created by assets covers their debt payments (Myers, 1977). Petersen and Rajan (1997) and Niskanen and Niskanen (2006) concluded that companies with larger investments in current assets extended more credit to their suppliers. García-Teruel and Martínez-Solano (2010b) found that companies increase their accounts receivable when they have positive cash flows. The results may be somewhat different in the context of agri-food cooperatives. Hendrikse and Veerman (2001) pointed out that cooperatives face a series of problems when members make important investment decisions. Cooperatives adopt a prudent approach in order to protect themselves from the risk of defaulting on short-term liabilities (Oustapassidis *et al.*, 1998). Furthermore, cooperatives have serious agency problems owing to the separation between owners’ and management responsibilities and the consequent information asymmetries (Cook, 1995). Nilsson (2018) highlighted that these problems are aggravated in collectively owned organisation by unclear property rights and restrictions on the transferability of remaining claimant rights. Some authors have argued that companies can reduce agency problems to match the maturity of their obligations and the liquidity of their short-term assets (Myers, 1977; García-Teruel & Martínez-Solano, 2010b). Thus, in order to guarantee the availability of short-term financial resources and avoid liquidity problems, cooperatives take a safe position because of the pressure exerted by cooperative members to adjust their cash budgeting. To test this relationship, we formulate the following hypothesis:

H4: *Cooperatives do not set aside internal surplus funds to offer more financing to their customers.*

The provision of trade credit involves the transmission of credit from healthy companies with high creditworthiness and easy access to financial markets to other firms with limited access to bank debt (Alarcón, 2011). A firm's creditworthiness is tested by using the firm size and age as proxy variables. These indicators represent a company's credit ability, reputation, and capacity to access alternative financial funds. Several studies have discussed the positive (Dary & James, 2018) and negative relationships (García-Teruel & Martínez-Solano, 2010a; Alarcón, 2011) between accounts receivable and size. Large companies will have high creditworthiness and easy access to financial market to grant more trade credit to customers than small companies (Pertersen & Rajan, 1997). However, literature shows mixed result. For instance, Alarcón (2011) pointed out that small companies seem to be more motivated to provide credit because they have less reputation and pursue motives such as sales promotion. Furthermore, customers with a strong market position could exert pressure to buy their goods on credit when the seller is small (Van Horen, 2007). Concerning agri-food cooperatives, these firms face a series of drawbacks associated with property rights constraints, agency theory, and information asymmetry (Royer, 1999; Cook & Iliopoulos, 2000; Fulton & Giannakas, 2013). As cooperatives grow, the growing division between owner and management roles generates agency problems (Jensen & Meckling, 1976; Cook, 1995). This causes management conflicts in cooperatives which could accentuate differences in their financial objectives in relation to IOFs. Martínez-Victoria *et al.* (2018a) showed that age and size influence the financial variables of agri-food cooperatives. Larger firms tend to provide larger benefits given their economies of scale, while younger firms are more financially constrained. Hirsch and Hartmann (2014) showed that larger cooperatives tend to be more profitable than smaller ones and that they have more advantageous market positions and substantial bargaining power over the retailers. With respect to age, younger and middle-aged cooperatives are more financially constrained than those of mature businesses because financial restrictions are tighter in the early phases of their development (Oliveira & Fortunato, 2006). Young companies use more trade credit to obtain better results (Grau & Reig, 2018). They apply

trade credit as a tool to stimulate sales during the initial years of operations; as they age, they reduce the use of trade credit (García-Teruel & Martínez-Solano, 2010a). Hence, we derive the following hypothesis:

H5: *Small and young cooperatives grant more credit than those of the large and mature cooperatives to increase their market presence.*

Finally, an extension of trade credit allows clients to confirm the quality of the acquired goods (Long *et al.*, 1993). Firms without a reputation must grant a long-term trade credit for product quality testing. By selling on credit, small, new, or less well-established companies can improve their competitiveness in relation to similar suppliers (Alarcón, 2001; Dary & James, 2018). During this period, trade credit acts as a promotional or commercial tool because customers pay after evaluating the merchandise received (e.g., quality and quantity). In particular, agri-food companies offer trade credit as an indication that their food products are of superior quality, given the lower probability that low-quality suppliers would extend credits. Nevertheless, companies producing easy-to-observe perishable products usually extend less trade credit with shorter terms (Long *et al.*, 1993; Pike *et al.*, 2005). Dary and James (2018) revealed that the verification theory of trade credit is influenced by the sub-agri-food industry in which the agri-food company operates. For example, it is easier to observe the quality of fruit and vegetable products than that in the beverage and bakery sub-industries. Therefore, firms operating in the former sector supply less trade credit than those in the latter. Since agri-food cooperatives are characterised by high-quality product standards, they grant short-term credit despite the nature of their products (Long *et al.*, 1993; Dary & James, 2018). Based on this review, we propose the following hypothesis:

H6: *Cooperative companies do not apply trade credit as a commercial tool.*

Table I shows the explanatory determinants of accounts receivable and their relationships in agri-food cooperatives.

INSERT TABLE I

3. Data and methodology

3.1. Data

The data for this study came from the SABI (Sistema de Análisis de Balances Ibéricos) database, developed by Bureau van Dijk. We collected Spanish agri-food[1] SMEs accounting data from 2011 to 2018, constructing a balanced panel of nearly 12,000 firm-year observations. In order to obtain this sample, we dropped 500 registers for which there was not available information in each year. This represented 4% of the initial number of observations. Companies were selected in function of the criteria included in the National Classification of Economic Activities (NACE, 2007). The Spanish agri-food sector contributes around 9.2 per cent of the country's Gross Domestic Product (GDP) and offers jobs to over two million citizens (MAGRAMA, 2018). In 2018, the Spanish agri-food sector was ranked the fourth largest European exporter (eighth largest in the world), with an export quota of over 8.8 per cent. The exports and imports of this sector account for around 16.9 per cent (49,502 million euros) and 11.4 per cent (37,384 million euros) of the Spanish economy (MAGRAMA, 2018). We eliminated companies with mistakes in their financial statements, or those which showed signs of noncompliance with accounting basics, for instance, unbalanced balance sheets. To mitigate the impact of outliers in our analysis, we discarded observations if they fell into the 1% tails of the distribution of their respective variables (Chaddad *et al.*, 2003; 2005; Faulkender & Wang, 2006). As a result, our final sample consists of a balanced panel with 11,930 firm-year observations, of which 280 are cooperatives.

3.2. Partial adjustment model

The static specifications generally applied to determine trade credit factors work under the assumption that companies make instantaneous adjustments toward their target values for receivables. In accordance with García-Teruel and Martínez-Solano (2010b), we assumed that the adjustment process toward target values is not immediate, but that there is a time lag for companies to reach these target values. This dynamic process is caused by the costs firms incur if their levels diverge from the target value. To mitigate this effect, companies tend adjust their

values toward the average value. In particular, the adjustment process is enabled by two motivating factors: managers' actions and passive industry factors (Lev, 1969; Lee & Wu, 1988; Wu & Ho, 1997). In this sense, managers can reach their targets applying accounting procedures or considering specific values in their ratios controlled through business strategies (Wu & Ho, 1997). For instance, they could change the valuation method of inventories, which would have an impact on total current assets. But managers do not control passive forces depending on variations in market characteristics. For instance, high profitability ratios attract new companies to particular sectors. This situation increases competition in that sector and decreases profitability ratios (Peles & Schneller, 1989; Davis & Peles, 1993). In accordance with the literature, we assumed that the target ratio (REC_t^*) is determined as the average ratio of different firms' characteristics for each firm i with $i = 1, \dots, N$ (Lev, 1969; Wu & Ho, 1997; Gallizo & Salvador, 2003; Gallizo *et al.*, 2008) as in (1):

$$REC_{it}^* = \alpha + \sum_{k=1}^K \gamma_k x_{kit} + u_{it} \quad (1)$$

where α represents a constant factor, x a set of k explanatory factors with γ_k the coefficients to be calculated and u_{it} an error term. Based on a model proposed by García-Teruel and Martínez-Solano (2010b), we evaluated trade credit considering that accounts receivable in the period t conform to a target value represented by REC_t^* . Considering (1), the partial adjustment hypothesis for accounts receivable (REC) is tested using the following equation (2):

$$REC_{it} - REC_{it-1} = \beta (REC_{it}^* - REC_{it-1}) \quad (2)$$

where $REC_{it} = (REC_{1t}, REC_{2t}, \dots, REC_{Nt})$ and $REC_{it-1} = (REC_{1t-1}, REC_{2t-1}, \dots, REC_{Nt-1})$ represent the $(N \times 1)$ vectors of the accounts receivable in t and $t - 1$ respectively for the company i , with $i = 1, \dots, N$ with β as the adjustment coefficient. Eq. (2) assesses the amount (β)

in which the accounts receivable (REC_{it}) varies ($REC_{it} - REC_{it-1}$) depending on the previous year's discrepancy between the accounts receivable (REC_{it-1}) and the target value REC_t^* . If $\beta = 0$ then REC_{it} and REC_{it-1} are equal and there is no adjustment process. When the value of $\beta = 1$, REC_{it} is equal to REC_{it}^* and therefore, there is a full adjustment process toward the target. An adjustment coefficient β between zero and one indicates that accounts receivable decreases by a β percentage of the disparity with the target value. Thus, we will find a convergence process regarding the target value. Eventually, when the coefficient β does not belong to the interval $(0,1)$, we get a divergent process. A value of $\beta < 0$ implies that there is an escalating trend of accounts receivable over time with no convergence. In contrast, if $\beta > 1$ we find an unstable behaviour over time with no adjustment. Substituting (1) into (2) we obtain:

$$REC_{it} = \alpha\beta + (1 - \beta) REC_{it-1} + \sum_{k=1}^K \beta\gamma_k x_{kit} + \beta u_{it} \quad (3)$$

which can be expressed as:

$$REC_{it} = \theta + \delta_0 REC_{it-1} + \sum_{k=1}^K \delta_k x_{kit} + \varepsilon_{it} \quad (4)$$

where $\theta = \alpha\beta$; $\delta_0 = (1 - \beta)$; $\delta_k = \beta\gamma_k$ and $\varepsilon_{it} = \beta u_{it}$.

3.3. Variables

We selected different factors that determine the levels of accounts receivable in agri-food cooperatives and IOFs. The dependent variable of the model[2] is the level of trade credit extended (REC), defined as the ratio of accounts receivable to firm's sales. For the explanatory variables, sales growth is evaluated as the ratio $sales_t$ to $sales_{t-1}$ (GSALES). Access to short-term external financing is represented by current liabilities to total assets (STLEV). The cost of financial debt (FCOST) is calculated as the cost of finance on total liability minus accounts payable (García-Teruel & Martínez-Solano, 2010a). Gross profit margin is computed as gross profit over sales (GPROF). This variable is applied to contrast the impact of a company with a high profit margin on trade credit granted. Cashflow is measured as net profit plus depreciation over sales (Niskanen & Niskanen, 2006; García-Teruel & Martínez-Solano, 2010a). This variable

shows the ability to generate cash internally (CFLOW). Product quality (TURN) is evaluated as sales to total assets minus accounts receivable (Long *et al.*, 1993; Pike *et al.*, 2005). Finally, creditworthiness is evaluated through firm age and size (Petersen & Rajan, 1997; Ng *et al.*, 1999; Danielson & Scott, 2004; Niskanen & Niskanen, 2006). This variable represents a firm's credit reputation and level of access to financing. Age is computed as the logarithm of years in business (LAGE) and size is based on the log of total assets (SIZE). As can be seen in Table II, the correlation coefficients between the accounts receivable and the explicative variables differ between cooperatives and IOFs. For cooperatives (Panel A), the Pearson correlation matrix shows a negative and significant relationship with FCOST, TURN, AGE and SIZE and a positive relationship with STLEV, CFLOW and GPROF. Panel B (Table II) provides a positive correlation between REC and STLEV, FCOST, CFLOW, GPROF, GSALES, SIZE and AGE while TURN is negative. All the estimations were significant at the 1% level.

INSERT TABLE II

Table III summarizes the descriptive statistics of previous variables for both agri-food cooperatives and IOFs. The mean values of accounts receivable represent 22.43% of sales for cooperatives and approximately 26.93% for IOFs. Alarcón (2001) reported the level of accounts receivable, for Spanish agri-food companies, represents 29% of their assets, García-Teruel and Martínez-Solano (2010b) found trade credit supply constitutes 15% for Spanish agricultural companies during the period 1997-2001 and Dary and James (2019) showed a low level of investment in trade credit (12%) for US public agro-food industry. Furthermore, a long cash-conversion cycle will benefit to their member producers but their dependence on external financial funds will increase. Taken together, mostly of cooperatives use more short-term debt than long-term debt because of their financial constrains (Russel *et al.*, 2017; Piccoli *et al.*, 2021). Therefore, this result could be motivated as a preference for adopt a more conservative outlook.

The agri-food companies are predominantly micro (50%) and small (42%), where medium-sized companies only represent 8% over the total. Based on their age[3], the companies are classified into two groups: 48.8% are middle-aged firms (5-24 years) and 50.2% are old firms (more than 25 years). Annual sales growth has been around 13.79% and 15.95% for both cooperatives and

IOFs. These companies finance around 55.84% of their sales with current liabilities in the case of cooperatives, and 76.29% for IOFs. In addition, they generate cash flows of 7.30% and 8.21%, respectively.

INSERT TABLE III

3.4. Empirical model

Based on previous studies, we included the explanatory factors which influence the determination of accounts receivable. In particular, we consider the following empirical specification (5) where we distinguish between cooperatives and IOFs through multiplicative dummy factors:

$$\begin{aligned}
 REC_{it} = & \theta + \delta_0 REC_{it-1} + \delta_1 c_i REC_{it-1} + \delta_2 SIZE_{it} + \delta_3 c_i SIZE_{it} + \delta_4 AGE_{it} \\
 & + \delta_5 c_i AGE_{it} + \delta_6 STLEV_{it} + \delta_7 c_i STLEV_{it} + \delta_8 FCOST_{it} \\
 & + \delta_9 c_i FCOST_{it} + \delta_{10} CFLOW_{it} + \delta_{11} c_i CFLOW_{it} + \delta_{12} TURN_{it} \\
 & + \delta_{13} c_i TURN_{it} + \delta_{14} GPROF_{it} + \delta_{15} c_i GPROF_{it} + \delta_{16} GSALES_{it} \\
 & + \delta_{17} c_i GSALES_{it} + \delta_{18} c_i GDP_t + \varepsilon_{it}
 \end{aligned} \tag{5}$$

where c_i is a dichotomic variable with value 1 if the firm is cooperative and zero otherwise. The residual term ε_{it} , includes two elements: μ_i and φ_t . The former evaluates the individual (company) effects in the model which are independent and identically distributed $N(0, \sigma_{\mu_i}^2)$. The second element evaluates temporal effects in the model which are independent and identically distributed $N(0, \sigma_{\varphi_t}^2)$. In accordance with previous studies (García-Teruel & Martínez-Solano, 2010a), the individual effects represent particular firms' characteristics related to their organizational skills and/or management processes, which are not included in the model. The estimation process (5) is based on a dynamic panel process given that the lagged dependent variable is included as an explanatory factor. The static estimations are inconsistent even if the spatial-temporal error terms ε_{it} are uncorrelated because REC_{uit-1} is correlated with μ_i . In addition, the intragroup estimator, which estimates the transformed model into deviations from average variable values, is not consistent due to the correlation between the differences $(REC_{it-1} - \underline{REC}_{it-1})$ and $(\varepsilon_{it} - \underline{\varepsilon}_{it})$. The OLS model of first differences is also inconsistent

given that ΔREC_{it-1} and $\Delta \varepsilon_{it}$ are correlated because REC_{it-1} and u_{it-1} are correlated (García-Teruel & Martínez-Solano, 2010a). Arellano and Bond's (1991) two-step GMM estimator for the dynamic PAM model takes into account heteroscedasticity across firms. The two-step GMM system specification uses the conditions of available moments by merging a set of conditions achieved from the different equations where lagged levels are applied as instruments and with an added set of moment conditions provided from the equation in level (McGuinness *et al.*, 2018). This estimator controls the potential endogeneity due to the inclusion of a lagged dependent variable. Moreover, the consistency of the GMM system depends on the validity of the instruments and the set of specification tests. First, we consider the lagged dependent variable and the explicative variables as endogenous. This assumption is made since explanatory variables are built from financial firm parameters, and as such, cannot be considered exogenous (Kremp *et al.*, 1999; García-Teruel & Martínez-Solano, 2010b). Next we apply the lagged variables as instruments. These instruments are expected not to correlate with the error term in the current period (Wooldridge, 2002). Applying lagged explanatory variables as instruments only solves a part of endogeneity if there is no first-order autocorrelation in the residuals of the model (Bellemare *et al.*, 2017) and if the instruments are themselves not relevant explanatory factors in the model (Reed, 2015). In order to contrast first order autocorrelation in the model, we computed the Arellano and Bond (1991) AR test. Table V rejects the null hypothesis of no first-order autocorrelation which would indicate the inappropriateness of using lagged values as instruments. Despite this result, we mitigate possible endogenous bias applying thrice-lagged values of the explicative variables and twice-lagged in the dependent variable (Martínez-Victoria *et al.*, 2018a; McGuinness *et al.*, 2018). The applied GMM estimator is consistent when there is no second-order serial correlation between the error term of the first-differenced equation. In order to test this condition $E[\Delta \varepsilon_{it}, \Delta \varepsilon_{it-2}] = 0$, we built an $AR(2)$ statistic following an $N(0,1)$ distribution under the null hypothesis. In addition, to check whether the model was correctly specified, we used two criteria. We computed the Sargan-Hansen (1958) test and the test for second-order serial correlation of the residuals in the differenced equation. The Sargan-Hansen test contrasted the over-identifying restrictions for the GMM estimators. A Sargan-Hansen test rejects too frequently

if there is heteroscedasticity in the model. In addition, we carried out a Wald test. This is applied to test the joint significance of the trade credit determinants. This test is asymptotically distributed as χ^2 under the null hypothesis of no relationship.

4. Results

4.1. Descriptive analysis

Table IV evaluates the following question: *are there differences between cooperatives and IOFs in their accounts receivable by year?* The results show differences in the average values of accounts receivable between cooperatives and IOFs during the period, except for 2014. The investment in accounts receivable is higher for IOFs throughout the period 2011-2018. This result reveals that cooperatives tend to exhibit more conservative financial behaviour to protect themselves against the risk of clients defaulting on current liabilities. Also, it is important to note that agri-food cooperatives have occupied a position of relative firmness and even increased their income and employment rates during the recent economic crisis (Garrido-Chamorro, 2013). In particular, this resilience and importance were demonstrated in terms of economic activity in Spain during the last recession (Baamonde, 2013; Ruiz-Jiménez *et al.*, 2013). The results also seem to confirm customers' greater dependence on IOFs as providers of credit compared to cooperatives. During a credit crisis, trade credit providers play a significant role as lenders to financially-constrained firms because these constraints affect more firms and with greater severity during a financial crisis (Carbó-Valverde *et al.*, 2016). Results indicate that IOFs tended to increase short-term financing to their customers throughout the period 2011-2018. In the next Section, we present an in-depth study that was performed to discover the determinants of this divergence between company types.

INSERT TABLE IV

4.2. Multivariate analysis

The analysis started with a pool OLS estimation, fixed effects and random effects panel regressions[4], reported in Appendix Table A2. We tested our hypothesis using a two-step system GMM joint estimation distinguishing between cooperatives and IOFs through multiplicative dummy factors (see Table V[5]). In order to estimate the dynamic panel data model, we regressed

accounts receivable over their explicative variables by incorporating instrumental variables. The dependent variable was twice period-lagged while the explanatory variables were thrice-lagged values. Regarding post-estimation proofs, we found that the global validity of the model's conditions was confirmed by the Sargan-Hansen Test (under the null hypothesis that the instruments used were valid). In addition, a non-significant AR(2) indicated that there were no problems with serial correlation in the residuals. The Wald test was also significant, validating the joint significance of the trade credit determinants. Thus, the results obtained in the different estimations (Model 1 and 2) were consistent. In Model 1, columns 2 and 3 (Table V), show the estimation results (Eq. 5) for cooperatives and IOFs. REC_{t-1} is positive and significant in both models, where accounts receivable has a significant dynamic character following an adjustment process toward the target value. As in García-Teruel and Martínez-Solano (2010b) and Alarcón (2011), there is not an immediate adjustment process in the short run. Sales growth (GSALES) is negative and significant for IOFs while cooperatives reveal a non-significant coefficient. The evolution of sales affects companies' decisions about whether and how much trade credit to grant. To get more information about the effect of this variable over accounts receivable, we substitute GSALES for PGSALES and NGSales to analyse the effect when there is a positive or negative sales growth. Negative sales growth (NGSALES) is negative and significantly related to the trade credit supplier for cooperatives and IOFs. Companies tend to use this mechanism as a promotional tool to recover falling sales. In the case of cooperatives, this relationship is more pronounced. Thereby, companies apply trade credit to encourage sales when they suffer from economic recession, assuming more risk. This result coincides with previous studies, such as Niskanen and Niskanen (2006) and García-Teruel and Martínez-Solano (2010b). The results confirm our Hypothesis 1.

The possibility of obtaining financial debt is a key factor in the level of accounts receivable. Financially constrained firms have more difficulty utilizing credit to increase sales. Short-term finance (STLEV) is positive and significant for agri-food cooperatives and IOFs (Model 1 and 2). Our findings show that companies grant more credit when they have access to short-term financing. Results seem to confirm that firms allow postponed payments until the maturity of their

liabilities. Cooperatives tend to adopt a more conservative strategy, taking fewer risks (Mateos-Ronco & Guzmán-Asunción, 2018). Although they could face problems associated with the property rights, their structure also provides benefits. Cooperative companies grant trade credit when they have other alternative funding options, balancing the benefits of doing so. These companies finance cooperative members' purchases through the extension of trade credit. As stated by Alarcón (2011), Martínez-Solano and García-Teruel (2010a), and Dary and James (2018), companies with credit facilities from banks will finance the purchases of their customers. Our findings are in line with theirs, which does not support Hypothesis 2. With regard to the cost of external finance (FCOST), it is positive and significant only for IOFs. We have not found significant effects of FCOST over accounts receivable in cooperatives. They do not rest their decisions about granting further trade credit on the price of capital. In other words, the price of capital is not taken into consideration by cooperatives when they have to make decisions about granting trade credit. Martínez-Solano and García-Teruel (2010b) also found the same relationship.

As expected, we find that the coefficients of variable GPROF are not significant for either cooperatives or IOFs (Model 1). The price discrimination theory is not confirmed in our findings. Thus, our results are different from those of García-Teruel and Martínez-Solano (2014). In cooperatives, profit margins tend to be biased because firms prioritize the distribution of profits among members through pricing or the increment of their funds. As before, we included the variables PGPROF and NGPROF to analyse the different effects of positive and negative operating margins (Model 2). In cooperatives, the results show the lack of importance that operating margins have in providing more sales credit. The findings also indicate the irrelevance of negative gross profit margins (NGPROF) on the dependent variable, since positive gross profit margins (PGPROF) are only significant and positive in the case of IOFs. Firms with larger positive margins tend to use trade credit to finance sales to liquidity-constrained firms. This result supports Hypothesis 3.

With regard to CFLOW, a greater capacity to generate internal funds increases the capacity to offer more finance, but only for cooperatives (the coefficient is significant and positive). It's true

that cooperative companies tend to play it safe by implementing a conservative structure. However, they attempt to balance their short-term liquidity requirements applying their lower leverage. However, the variables PCFLOW and NCFLOW, which represent positive and negative cash flows, give us relevant information about this relationship (Model 2). Companies consider granting trade credit to clients when they present positive cash flows (PCFLOW), but negative cash flows (NCFLOW) have no significant effect on this decision. Therefore, cooperatives adopt a safe position, offering financing to their clients when they show the ability to create internal resources since this can reduce agency problems. Niskanen and Niskanen (2006) and García-Teruel and Martínez-Solano (2010b) also concluded that companies with strong internal funds extend more credit than other companies. Thus, Hypothesis 4 is not confirmed. TURN coefficients are negative and significant only for IOFs. In general, companies use this factor as a commercial tool to support and maintain their customer relationships. However, agri-food cooperatives do not encourage sales to their members-producers through this means because they already have a close relationship with them. They do not need to validate the quality of the products received. The same results were also obtained by Long *et al.* (1993) and Dary and James (2018). This provides support for Hypothesis 6. The size variable shows that larger companies provide more credit than smaller ones. In Model 1, there is a positive and significant relationship between accounts receivable and IOF size. This differs from García-Teruel and Martínez-Solano's (2010b) results, which showed that as larger firms generally have well-established reputations, they do not need to use trade credit to provide quality assurance. We introduce a quadratic term of size to analyse the presence of non-linearities in Model 2. We find that size (positive) and its quadratic term (negative) are significant. In particular, size has a positive and significant sign for cooperatives and IOFs, which becomes negative when we consider the square term of this variable. According to previous literature, a positive relationship would be expected. However, from our analysis we found that this variable changed to negative when companies reached a substantial size. This could be explained by the difficulties faced by large companies when they reach an unwieldy size. Agency problems tend to increase with company size, and this problem is even more accentuated in cooperatives. These difficulties could well constrain the

financial role of large companies when providing financing to their clients (Alarcón, 2011). Finally, we do not find that younger cooperative firms supply more financing to their customers nor was age squared significant. Therefore, the life stages of cooperatives do not influence their levels of accounts receivable. However, in the case of IOFs, the maturity of companies influences their capacity to grant trade credit. Therefore, Hypothesis 5 is not confirmed.

INSERT TABLE V

5. Discussion

The objective of this work is to study the impact that financial, operational, and commercial factors have on the determinants of trade credit in the agri-food context. In particular, we analyse the different behaviour between cooperatives and IOFs when deciding to grant trade credit to their clients. Previous literature (García-Teruel & Martínez-Solano, 2010b; Grau & Reig, 2018; Dary & James, 2018; 2019; see Section 2 for more studies) only extends the study of this topic to the agri-food sector without taking into account the role of cooperative companies. McKee et al.'s (2020) was the only study that analysed how trade credit use affects retail input price changes in a sample of 18 agricultural cooperatives in Nebraska and Iowa. However, an open question is whether structural weakness and the variety of objectives related to these companies cause cooperatives to act differently than IOFs (Cook, 1995; Fulton, 1995; Nilsson, 2001; Cook & Burrell, 2009; Mínguez-Vera *et al.*, 2010).

INSERT TABLE VI

Results show high trade credit adjustment coefficients, demonstrating that the dynamic process toward target levels is relatively swift. This quick adjustment is in line with the results by García-Teruel and Martínez-Solano (2010b). In addition, IOFs present higher values than cooperative companies with significant differences. Although cooperatives tend to behave as IOFs do, they present lower adjustment coefficients, explained by their unique characteristics. Cooperatives tend to adjust their levels of accounts receivable to their target levels, balancing the costs and benefits of doing so. However, their financial decisions are contingent upon their members' benefits and welfare, whereas IOFs focus on profit maximization. Thus, different sets of goals could partially affect the reaction toward the trade credit target presented by cooperatives. In

particular, results indicate that cooperatives and IOFs have the same operational purposes but differ in their financial and commercial goals (see Table V). Cooperatives use trade credit to recover falling sales (Mckee *et al.*, 2020) and also depend on external financial debt (STLEV) to increase their accounts receivable as Piccoli *et al.* (2021). Furthermore, they use their positive cash flow to extend more trade credit, like IOFs. Chaddad (2005) highlighted that cash flow level appear to be a relevant tool in the investment behaviour of cooperatives especially to small companies. Nevertheless, the literature highlights that cooperatives tend to use external debt only when internal resources are insufficient due to agency problems and asymmetrical information (Mateos-Ronco & Guzmán-Asunción, 2018), even when the use of debt generates tax advantages (see Tax Regime of Cooperative Law 20/1990 of 19 December 1990). Our findings reveal that members are willing to use short-term debt to finance the use of trade credit, thus avoiding the horizon problem (Borgen, 2004; Fulton & Giannakas, 2013; Russell *et al.*, 2017). Therefore, cooperatives present problems related to rights issues, but their organisations offer advantages that are not extendible to IOFs. Cooperatives do not use their profitability to gratify producers' short-term financial needs. Cooperatives distribute their benefits to their members through the maximization of supplier-members' prices, resulting in a "zero surplus" (Soboh *et al.*, 2009; 2012; Hernández-Espallardo *et al.*, 2013). Thus, they allocate the level of profitability to further increase their sales.

6. Conclusion

The question that we introduce is whether the operational, financial, and commercial factors that determine the trade credit granted by IOFs can be extended to agri-food cooperatives. Researchers wonder about whether cooperative characteristics cause them to perform differently from IOFs. Matters that are especially problematic for cooperatives are the internal constraints derived from different economic agents' goals and the separation between owner and management functions when cooperatives grow. We find that cooperative agri-food companies have a target level of accounts receivable defined by the mean value of the sector where the company is producing. However, the adjustment process toward the optimum level is not immediate and companies tend to reduce this gap to avoid extra costs. Applying a PAM based on the GMM methodology and

distinguishing between cooperatives and IOFs, the results confirm that Spanish agri-food businesses follow a PAM, with quicker adjustment for IOFs than cooperatives. Agri-food companies have a trade credit benchmark and take decisions to restore this target value. Empirical trade credit studies in the agri-food sector are unusual, particularly from a dynamic perspective. Thus, this study provides a greater understanding of the levels of investment in assets made by Spanish cooperatives. With regard to the determining factors of trade credit granted, three hypotheses are confirmed. We find that larger cooperatives with access to external financial sources, positive cash flows, and operational necessities determine the level of trade credit granted. Nevertheless, factors such as age, the cost of external debt, gross profit margins, and turnover assets are not significant to accounts receivable in cooperative companies. The results obtained in our study have relevant implications for cooperative managers and policymakers to help them understand the strategies behind trade credit policies. First, it is worth noting that the analysis is directed toward agri-food cooperatives, which play a key role in the Spanish agri-food sector. Second, cooperatives that facilitated the use of trade credit can have a negative impact on its survival if managers do not follow good business practices. This is due to the cost of over-investing in accounts receivable. Proper management of working capital provides cooperatives with a useful tool to improve their financial indicators. Third, agri-food companies have established target values in order to monitor the changes in trade credit granted. The proper use of trade credit also reduces the time horizon problems and information asymmetries that have an impact on cooperative investments. However, policymakers should support a more efficient legal framework in order to help companies that reach high levels of arrears. Politicians should focus on new inter-firm financing sources that allow strong financial firms to develop principal roles in financial coverage for new and weak agri-food companies.

Finally, it should be noted that this research could be complemented with an analysis of customers' points of view. In addition, our study could include certain selection biases given that we worked with a balanced panel. Finally, the use of a sample of SMEs prevents us to extend previous conclusions to larger companies. Future studies should analyse the determinants of trade

credit received by cooperatives and IOFs (accounts payable), adjusting for previous sampling limitations.

Notes

1. See NACE 2009. <http://ec.europa.eu/eurosta>. The sub-sectors analysed are the following NACE codes: cereals (111, 4621), fruits (112, 122-125, 4631, 1032, 1039), milk (141, 1053, 1054), wine (121, 1102), meat (142, 145-147, 149, 1013), oil (1043), support (161, 162, 1091), mixed (150) and other activities (NACE codes corresponding to an agri-food sector not previously included).
2. See Appendix 1 (Table A1) to get more details about the construction of the variables.
3. Following Berger and Udell (1998) classification, we considered two groups of firms in function of their ages: middle-aged firms (5–24 years), and old firms (more than 25 years).
4. The similarity between complementary estimations (see Appendix Table A2) and GMM results confirm the robustness of the findings.
5. To provide robustness to our results, we re-estimated the model considering a paired sample of cooperatives and IOFs. In accordance with previous literature, estimations with paired subsamples avoid biased estimations given the different proportions of cooperatives and IOFs in the initial sample (Lambrecht et al., 2016). Thus, we built a subsample of paired cooperatives-equal number of cooperatives as IOFs- using a stratified random process based on firms' characteristics. In particular, we considered different stratifications by firm size, age and sector. Estimation results were analogous under this distribution.

References

- Alarcón, S. (2011). The Trade Credit in the Spanish Agro-food Industry Mediterranean. *Journal of Economics, Agriculture and Environment (New Medit)*, 10(3), 51–57.
- Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The review of economic studies*, 58(2), 277-297.
- Baltagi, B.H. (2008). *Econometric Analysis of Panel Data*. Chichester, UK: John Wiley and Sons
- Barro, R.J., Sala-I-Martin, X. (1992). Convergence. *Journal of Political Economy* 100, 223–251.
- Barrot, J.N. (2016). Trade Credit and Industry Dynamics Evidence. *The Journal of Finance*, LXXI (5), 1975–2016.

- Bellemare, M.F., Masaki, T., & Pepinsky, T.B. (2017). Lagged explanatory variables and the estimation of causal effect. *The Journal of Politics*, 79(3), 949-963.
- Berger, A., & Udell, G. (1998). The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. *Journal of Banking and Finance*, 22(6-8), 613-673.
- Borgen, S.O. (2004). Rethinking incentive problems in cooperative organizations *Journal of Socio-Economics*, 33(4), 383-393.
- Boyle, G.E. (2004). The economic efficiency of Irish dairy marketing co-operatives. *Agribusiness*, 20(2), 143-153.
- Carbó-Valverde, S., Rodriguez-Fernandez, F., & Udell, G.F. (2016). Trade credit, the financial crisis, and firm access to finance. *Journal of Money, Credit and Banking*, 48(1), 114-143.
- Cheng, N.S., & Pike, R. (2003). The trade credit decision: Evidence of UK firms. *Managerial and Decision Economics*, 24(6-7), 419-438.
- Cook, M.L. (1995). The future of US agricultural cooperatives: A neo-institutional approach. *American Journal of Agricultural Economics*, 77(5), 1153-1159.
- Cook, M.L., & Burrell, M.J. (2009). A cooperative life cycle framework Paper presented at the International Conference "Rural Cooperation in the 21st Century: Lessons from the Past, Pathways to the Future," The Hebrew University of Jerusalem, Rehovot, Israel.
- Cook, M.L., & Iliopoulos, C. (2000). Defined property rights in collective actions: The case of US agricultural cooperatives. In Ménard, C (Ed), *Institutions, Contracts and Organization: Perspectives from New Institutional Economic* (pp 335-348) London: Edward Elgar Publishing.
- Emery, G.W. (1987) An Optimal Financial Response to Variable Demand. *Journal of Financial and Quantitative Analysis*, 22(2), 209-225.
- Danielson, M.G., & Scott, J.A. (2007). A note on agency conflicts and the small firm investment decision. *Journal of Small Business Management*, 45(1), 157-175.
- Dary, S.K., & James, H.S. (2018). Trade credit supply in African agro-food manufacturing industry: determinants and motives. *Agricultural Finance Review*, 78(3), 312-329.

- Dary, S.K., & James, H.S. (2019). Does investment in trade credit matter for profitability? Evidence from publicly listed agro-food firms. *Research in International Business and Finance*, 47, 237-250.
- Davis, H. Z., & Peles, Y. C. (1993). Measuring equilibrating forces of financial ratios. *Accounting Review*, 68(4), 725-747.
- Fama, E.F., & French, K.R. (2002). Testing trade-off and pecking order predictions about dividends and debt. *The Review of Financial Studies*, 15(1), 1-33.
- Faulkender, M., & Wang, R. (2006). Corporate financial policy and the value of cash. *The journal of finance*, 61(4), 1957-1990.
- Figueiredo, V., & Franco, M. (2018). Wine cooperatives as a form of social entrepreneurship: Empirical evidence about their impact of society. *Land Use Policy*, 79, 812-821.
- Fulton, M., & Giannakas, K. (2013). The future of agricultural cooperatives. *Annual Review of Resources Economics*, 5(1), 61-91.
- Gallizo, J.L., & Jiménez, F., & Salvador, M. (2002). Adjusting financial ratios: a Bayesian analysis of the Spanish manufacturing sector. *Omega*, 30(3), 185-195.
- Gallizo, J.L., & Salvador, M. (2003). What factors drive and which act as a brake on the convergence of financial statements in EMU member countries? *Review of Accounting and Finance* 1(4), 49-68.
- Gallizo, J.L., & Gargallo, P., & Salvador, M. (2008) Multivariate partial adjustment of financial ratios: a Bayesian hierarchical approach. *Journal of Applied Econometrics*, 23(1), 46-64.
- Giannetti, M., Burkart, M., & Ellingsen, T. (2011). What you sell is what you lend? Explaining trade credit contracts. *Review of Financial Studies*, 24(4), 1261–1298.
- Garrido-Chamorro, C. (2013). *Estructura del cooperativismo agroalimentario en España*. In Colección Mediterráneo Económico 24: El papel del cooperativismo agroalimentario en la economía mundial (pp. 173-190). Almería: Cajamar Caja Rural.
- García-Teruel, P.J., & Martínez-Solano, P. (2010a). Determinants of trade credit: A comparative study of European SMEs. *International Small Business Journal*, 28(3), 215-233.

- García-Teruel, P.J., & Martínez-Solano, P. (2010b). A dynamic approach to accounts receivable: a study of Spanish SMEs. *European Financial Management*, 16(3), 400-421.
- García-Teruel, P.J., & Martínez-Solano, P. (2014). Trade credit and SME profitability. *Small Business Economics*, 42(3), 561-577.
- Grau, A.J., & Reig, A. (2018). Trade credit and determinants of profitability in Europe: The case of the agri-food industry. *International Business Review*, 27(5), 947–957.
- Greene, W. (2008). *Econometric Analysis*. Ed. Prentice Hall.
- Hendrikse, G.W., & Bijman, J. (2002). On the emergence of new growers' associations: self-selection versus countervailing power. *European Review of Agriculture Economics*, 29(2), 255–269.
- Hendrikse, G.W., & Veerman, C.P. (2001). Marketing cooperatives and financial structure: a transaction costs economics analysis. *Agricultural Economics*, 26(3), 205-216.
- Hernández-Espallardo, M., Arcas-Lario, N., & Marcos-Matás, G. (2013). Farmers' satisfaction and intention to continue membership in agricultural marketing co-operatives: neoclassical versus transaction cost considerations. *European Review of Agricultural Economics*, 40(2), 239-260.
- Hirsch, S., & Hartmann, M. (2014). Persistence of firm-level profitability in the European dairy processing industry. *Agricultural Economics*, 45(S1), 53–63.
- Jensen, M.C., & Meckling, W.H. (1976). Theory of the firm: managerial behavior, agency costs and owner- ship structure. *Journal of Financial Economics*, 3, 305–360.
- Kremp, E., Stöss, E., & Gerdesmeier, D. (1999). Estimation of a Debt Function: Evidence from French and German Firm Panel Data, in: A. Sauvé and M. Scheuer, eds., *Corporate Finance in Germany and France: a Joint Research Project of the Deutsche Bundesbank and the Banque de France*, (Deutsche Bundesbank and Banque de France), 139-194.
- Lambrecht, I., Vanlauwe, B., & Maertens, M. (2016). Agricultural extension in Eastern Democratic Republic of Congo: does gender matter? *Eur. Rev. Agric. Econ*, 43(5), 841–874.
- Lev, B. (1969). Industry averages as targets for financial ratios. *Journal of Accounting Research*, 7(2), 290–299.

- Liebrand, C.B., & Ling, K.C. (2014). Member satisfaction with their cooperatives: Insights from Dairy Farmers. USDA Rural Development, Rural business-cooperative programs, Research Report 229.
- Long, M.S., Malitz, I.B., & Ravid, S.A. (1993). Trade Credit, Quality Guarantees, and Product Marketability. *Financial Management*, 22(4), 117.
- McKee, G., Jacobs, K.L., & Kagan, A. (2020). Trade Credit Use in Agricultural Cooperatives: Pricing and Firm Performance. *Journal of Cooperatives*, 35, 74.
- MAGRAMA. (2018). *Informe anual de comercio exterior agroalimentario pesquero y forestal*. Ministerio de Agricultura, Pesca y Alimentación.
- Martínez-Victoria, M.C., Maté-Sánchez-Val, M., & Arcas-Lario, N. (2018a). Financial behavior of cooperatives and investor-owned firms: An empirical analysis of the Spanish fruit and vegetable sector. *Agribusiness*, 34(2), 456–471.
- Martínez-Victoria, M.C., Maté-Sánchez-Val, M., & Arcas-Lario, N. (2018b). Spatial determinants of productivity growth on agri-food Spanish firms: a comparison between cooperatives and investor-owned firms. *Agricultural Economics*, 49, 213–223.
- Mateos-Ronco, A., & Guzmán-Asunción, S. (2018). Determinants of financing decisions and management implications: evidence from Spanish agricultural cooperatives. *International Food and Agribusiness Management Review*, 21(6), 701–722.
- McGuinness, G., Hogan, T., & Powell, R. (2018). European trade credit use and SME survival. *Journal of Corporate Finance*, 49, 81-103.
- Mínguez-Vera, A., Martín-Ugedo, J.F., & Arcas-Lario, N. (2010). Agency and property rights theories in agricultural cooperatives: Evidence from Spain. *Spanish Journal of Agricultural Research*, 8(4), 908-924.
- Myers, S.C. (1977) Determinants of corporate borrowing. *Journal of Financial Economics*, 5(2), 147–175.
- NACE, 2007. Statistical classification of economic activities in the European Community (NACE). Eurostat, statistics explained. <http://ec.europa.eu/eurostat/statistics->

explained/index.php/Glossary:Statistical_classification_of_economic_activities_in_the_European_Community_(NACE)

Nilsson, J. (2001). Organisational principles for co-operative firms. *Scandinavian Journal of Management*, 17(3), 329–356.

Niskanen, J., & Niskanen, M. (2006). The determinants of corporate trade credit policies in a bank-dominated financial environment: the case of Finnish small firms. *European Financial Management*, 12, 81–102

Ng, C.K., Smith, J.K., & Smith, R.L. (1999). Evidence on the determinants of credit terms used in interfirm trade. *The Journal of Finance*, 54(3), 1109-1129.

Oliveira, B., & Fortunato, A. (2006). Firm growth and liquidity constraints: A dynamic analysis. *Small Business Economics*, 27(2-3), 139-156.

Ono, M. (2001) Determinants of Trade Credit in the Japanese Manufacturing Sector. *Journal of the Japanese and International Economies*, 15(2), 160–177.

Ortmann, G.F., & King, R.P. (2007) Agricultural Cooperatives I: History, Theory and Problems. *Agrekon*, 46(1), 18–46.

Oustapassidis, K., Vlachvei, A., & Karantininis, K. (1998). Growth of investor owned and cooperative firms in Greek dairy industry. *Annals of Public and Cooperative Economics*, 69(3), 399-417.

Parliament, C., Lerman, Z., & Fulton, J. (1990) Performance of cooperatives and investor-owned firms in the dairy industry. *Journal of Agricultural Cooperation*, 5(479), 1–16.

Peles, Y., & Schneller, M. (1989). The duration of the adjustment process of financial ratios. *The Review of Economics and Statistics*, 71(3), 527–532

Petersen, M., & Rajan, R. (1994). The Benefits of Lending Relationships: Evidence from Small Business Data. *The Journal of Finance*, 49(1), 3–37.

Petersen, M., & Rajan, R. (1997). Trade Credit: Theories and Evidence. *The Review of Financial Studies*, 10(3), 661–691.

Piccoli, P., Bianchini Junior, N., Coser, J., & Moreira, V. R. (2020). Short-term financial sustainability of agricultural cooperatives. *Agricultural Finance Review*, 81(3), 444–457.

- Pike, R., Cheng, N.S., Cravens, K., & Lamminmaki, D. (2005). Trade credits terms: asymmetric information and price discrimination evidence from three continents. *Journal of Business, Finance and Accounting*, 32,1197–1236.
- Russell, L. A., Briggeman, B. C., & Featherstone, A. M. (2017). Financial leverage and agency costs in agricultural cooperatives. *Agricultural Finance Review*, 77(2), 312–323.
- Reed, W.R. (2015). On the practice of lagging variables to avoid simultaneity. *Oxford Bulletin of Economics and Statistics*, 77(6), 897-905.
- Royer, J.S. (1999). Cooperative organizational strategies: A neo-institutional digest. *Journal of Cooperatives*, 14, 44–67.
- Ruiz-Jiménez, C., García-Martí, E., & Hernández-Ortiz, M.J. (2013). Cómo responden a la crisis económica actual las sociedades cooperativas agrarias. El caso de las almazaras cooperativas andaluzas. *REVESCO: Revista de Estudios Cooperativos*, 113, 120-149.
- Summers, B., & Wilson, N. (2003). Trade credit and customer relationships. *Managerial and Decision Economics*, 24(6-7), 439-455.
- Ullah, S., Akhtar, P., & Zaefarian, G. (2018). Dealing with endogeneity bias: The generalized method of moments (GMM) for panel data. *Industrial Marketing Management*, 71(November 2017), 69–78.
- Soboh. R., Lansink, A.O., Giesen, G., & Van Dijk, G. (2009). Performance measurement of the agricultural marketing cooperatives: The gap between theory and practice. *Review of Agricultural Economics*, 31(3), 446–469.
- Soboh. R., Lansink, A.O., & Van Dijk, G. (2011) Distinguishing Dairy Cooperatives from Investor-Owned Firms in Europe Using Financial Indicators. *Agribusiness*, 27(1), 34–46.
- Van Horen, N. (2007). Customer market power and the provision of trade credit: Evidence from eastern Europe and central Asia. *World Bank Policy Research Working Paper*, 4284.
- Valentinov, V., & Iliopoulos, C. (2012). Property Rights Problems in Agricultural Cooperatives: A Heterodox Institutional Perspective. *Journal of International Agricultural Trade and Development*, 61(3), 139-147.

Wooldridge, J. (2002). *Econometric Analysis of Cross Section and Panel Data*. Cambridge: MIT Press

Wu, C., & Ho, S.K. (1997). Financial ratios adjustment: Industry-wide effects on strategic management. *Review of Quantitative Finance and Accounting*, 9(1), 71–88.

Table I. Determinants of accounts receivable in agri-food cooperatives

Factors	Hypothesis	Explanation
Operational motives		
<i>Sales</i>	(+)	To stimulate cooperatives' sales, cooperative members could benefit from long-term periods of credit
Financial motives		
<i>Financing</i>	(-)	Cooperatives do not use more external debt to grant more credit. They tend to follow a self-financing culture
<i>Profit margin</i>	(-)	Cooperatives do not use excess profit margins to increase their benefits. They are distributed among members or used to increase mandatory reserve funds
<i>Asset liquidity</i>	(-)	Cooperatives match the maturity of their liabilities and the liquidity of their assets to reduce agency problems
<i>Creditworthiness</i>	(+)	Cooperatives grant credit to increase their creditworthiness. Small and young cooperatives need to improve their reputation in the market and reduce information asymmetries with their customers
	(+)	
Commercial motives		
<i>Product quality</i>	(-)	Cooperatives do not use trade credit to guarantee product quality due to the nature of agri-food products.

Note: The (-) and (+) signs are the hypothesis for each predictor variable in relation to the dependent variable.

Table II. Correlations**Panel A: Cooperatives**

	REC	STLEV	FCOST	CFLOW	TURN	GPROF	GSALES	SIZE	AGE
REC	1.00								
STLEV	0.3648**	1.00							
FCOST	-0.0337*	-0.0253*	1.00						
CFLOW	0.2557***	0.0942***	-0.0265	1.00					
TURN	-0.1812***	-0.1526***	0.0385	-0.1814***	1.00				
GPROF	0.0511**	-0.1300***	0.0172	-0.0427**	-0.0451**	1.00			
GSALES	-0.0184	-0.0209	-0.0023	0.0353**	-0.0029	-0.0211	1.00		
SIZE	-0.0062	-0.0769***	-0.0922***	-0.1251***	0.0008	-0.0893***	-0.0473**	1.00	
AGE	-0.0092***	-0.0814***	-0.0292	-0.1567***	-0.1026***	-0.0371**	-0.0048	0.3929***	1.00

Panel B: IOFs

REC	1.00								
STLEV	0.3305***	1.00							
FCOST	0.0088***	-0.0151***	1.00						
CFLOW	0.0417***	0.0024	0.0884***	1.00					
TURN	-0.1798***	-0.1165***	-0.03335***	-0.0381***	1.00				
GPROF	0.0565***	0.0765***	0.0040	0.0454***	-0.0224***	1.00			
GSALES	0.0194***	0.0168***	0.00310	0.0022	0.0021	0.0005	1.00		
SIZE	0.0814***	0.0384***	-0.0552***	0.0323***	-0.1232***	-0.0460***	0.0043	1.00	
AGE	0.0126***	-0.0136***	-0.0175	0.0002	-0.1006***	-0.0100***	-0.0521***	0.3108***	1.00

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table III. Summary statistics for variables, 2011-2018

	Cooperatives		IOFs		Welch's <i>t</i> -test
	Mean	SD	Mean	SD	<i>t</i>
REC	0.2243	0.2448	0.2693	0.3861	2.48 (0.000)
STLEV	0.5584	1.3651	0.7629	2.5926	6.73 (0.000)
FCOST	0.0208	0.0745	0.0217	0.0585	0.58 (0.561)
CFLOW	0.0730	0.1840	0.0821	0.8292	1.90 (0.057)
TURN	2.9743	4.2814	2.3036	3.4167	-7.27 (0.000)
GPROF	0.0020	0.0272	0.0047	0.0931	4.08 (0.000)
GSALES	0.1379	1.5911	0.1595	2.0741	0.622 (0.533)
SIZE	7.9358	1.6452	7.2854	1.5533	-18.30 (0.000)
AGE	3.3015	0.5951	2.8788	0.5710	-32.57 (0.000)

Note: We present the p-value of Welch's *t*-test in order to examine whether the mean values of explicative variables are different between cooperatives and IOFs. The Welch's *t*-test is a modification of Student's *t*-test, for unequal variances to check if two sample means are significantly different (Greene, 2008). p-value in parentheses.

Table IV. Average trade credit and *t*-test

Panel A: Annual description

	Accounts receivable		
	Coops	IOFs	<i>t</i>-test
2011	0.2323	0.2769	3.48 (0.001)
2012	0.2276	0.2765	3.82 (0.000)
2013	0.2376	0.2687	2.09 (0.045)
2014	0.2423	0.2650	1.29 (0.217)
2015	0.2113	0.2660	3.59 (0.000)
2016	0.2051	0.2726	4.85 (0.000)
2017	0.2175	0.2638	2.75 (0.006)
2018	0.2208	0.2651	2.85 (0.047)

Panel B: Pool data description

	Coops	IOFs	<i>t</i>-test
Accounts receivable	0.2243	0.2693	2.48 (0.000)

The accounts receivable variable is calculated as the ratio of accounts receivable to firm's sales. We present the p-value of Welch's *t*-test in order to examine whether the mean values of accounts receivable are different between cooperatives and IOFs. The Welch's *t*-test is a modification of Student's *t*-test for unequal variances to check whether two sample means are significantly different (Greene, 2008). Note: p-value in parentheses.

Table V. Determinants of trade credit evaluated with accounts receivable for the period 2011-2018.

	Model 1		Model 2	
	Cooperatives (multiplicative dummies)	IOFs	Cooperatives (multiplicative dummies)	IOFs
REC_{t-1}	0.4418*** (0.1256)	0.3897*** (0.0311)	0.4232** (0.1642)	0.3611*** (0.0327)
GSALES	0.0455 (0.0704)	-0.0603** (0.0268)	-	-
PGSALES	-	-	0.0533 (0.0711)	0.0138 (0.0451)
NGSALES	-	-	-0.3928*** (0.1340)	-0.2236* (0.1175)
STLEV	0.0411** (0.0187)	0.0304*** (0.0058)	0.0191** (0.0081)	0.0283*** (0.0098)
FCOST	0.2885 (0.7972)	0.2402* (0.1374)	0.2023 (0.7607)	0.2056* (0.1196)
GPROF	0.2206 (0.7146)	0.9646 (0.8147)	-	-
PGPROF	-	-	-0.0056 (0.4938)	0.0235* (0.6287)
NGPROF	-	-	-2.7934 (7.4450)	-10.2255 (6.5679)
CFLOW	0.4308* (0.2665)	0.0158 (0.0147)	-	-
PCFLOW	-	-	0.7433* (0.4450)	0.0153 (0.0103)
NCFLOW	-	-	0.0794 (0.0517)	0.1805 (0.1060)
TURN	-0.0073 (0.0027)	-0.0357*** (0.0011)	-0.0004 (0.0038)	-0.0032** (0.0013)
SIZE	0.0064 (0.0096)	0.0165** (0.0079)	0.0794** (0.03731)	0.1300*** (0.0168)

SIZE²	-	-	-0.0035** (0.0016)	-0.0069*** (0.0009)
AGE	-0.0027 (0.0229)	-0.0077** (0.0036)	0.0055 (0.1367)	-0.0069*** (0.0090)
AGE²	-	-	0.0135 (0.0194)	0.00563* (0.0032)
GDP	-0.0821* (0.095)		-0.1165 (0.855)	
Constant	0.0428** (0.0241)		0.4229*** (0.0916)	
AR(1)	-8.18***		-8.69***	
AR(2)	1.44		1.10	
Sargan-Hansen Test	170.51 (0.389)		230.91 (0.362)	
Wald test	743.38***		1,957.52***	
Observations	95,440		95,440	
IV	185		253	

The dependent variable “accounts receivable” is calculated as the ratio of accounts receivable to firm’s sales. Independent variables are measured as lags (t-3). **SIZE** is the log of sales; **LAGE** the log (1+ the age of the company); **STLEV** the short-term financing; **FCOST** the cost of outside financing; **CFLOW** the cash flows generated by the firm; **PCFLOW** the positive cash flows; **NCFLOW** the negative cash flows; **TURN** the assets turnover; **GPROF** the gross profit margin; **PGPROF** the positive gross profit margin; **NGPROF** the negative gross profit margin; **GSALES** the sales growth. The pooled OLS and fixed effect estimations are in the Appendix A2. All estimations have been carried out using the 2-stage GMM estimator. **AR(2)** is a test for second-order serial autocorrelation in first difference residuals, distributed asymptotically as $N(0,1)$ under the null hypothesis of no serial correlation. The Sargan-Hansen Test is a test of over-identifying restrictions distributed asymptotically under the null hypothesis of validity of instruments as Chi-squared. Standard errors in parenthesis. (*), (**), and (***) indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table VI. Trade credit adjustment coefficients

	Accounts receivable (β)	
	Model 1	Model 2
Cooperatives	0.5582	0.5768
IOFs	0.6103	0.6389
Significant differences	YES	YES

Welch's *t*-test is used to examine whether the trade-credit adjustment coefficients are different between cooperatives and IOFs. YES means the existence of significant differences between companies.