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Financial evaluation and credit access of agricultural firms

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Abstract

Agricultural firms are characterized by significant investments, both in fixed capital and in working capital. To finance investments, in addition to equity capital, access to credit becomes essential. Concerning this topic, various researches have shown that agricultural firms have difficulty accessing credit, due to reduced average size of farms, often poor financial culture and difficulty in communicating with lenders. To facilitate relations between agricultural firms and lenders in Italy, various regulatory provisions, over time, have changed the regulatory framework of agricultural credit. The offer of credit lines is today wide, even if granting of credit favors larger and more structured firms, and credit is concentrated in a few Italian regions. Public intervention through guarantees, and the introduction of a non-possessory revolving pledge, have favored access to credit for agricultural firms in recent years. The business cases analyzed have highlighted how investments of firms in fixed capital for the purchase of plants, and working capital, for aging of productions, amplify financial needs of firms and make it necessary to evaluate financial sustainability of operations. Recent increase in loans for ESG investments, and consequent regulatory framework, can facilitate financing of agricultural firms, enhancing their social role also in favor of smaller firms, cooperatives and firms in disadvantaged areas.

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Introduction

Agricultural firms provide for production of food and have significant effects on the environment, on consumer health and on the protection of rural territories (De Luca *et al*., 2015; Lanfranchi *et al*., 2015). Economic and social roles, and significant impact for circular economy given by farms have been considered and protected by a series of legislative interventions at national and international level, including forms of aid (Zarbà *et al*., 2021).

Agricultural firms have specific financing needs (Lehenchuk *et al*., 2012); these firms require investments in agricultural fund and in production cycle which often make them capital-intensive firms and consequently expand their financing needs (European Court of Auditors, 2015; Omobitan *et al*., 2022).

Food protected with collective EU marks PDO (protected designation of origin) and PGI (typical geographical identification) and TSG (traditional specialty guaranteed) play an important role from an economic, social and environmental point of view. In Italy (ISMEA, 2022), production value of PDO, PGI and TSG products is 19.1 billion euros (21% of agri-food production), of which 10.7 billion is for exports, equal to 20% of total Italian agri-food exports; there are 845 PDO, PGI and TSGs (3,069 in Europe), of which 526 are wines; the sector employs 198,842 operators, organized in 291 consortia for the protection of typical products. Italy is, therefore, the first European country for the number of PDO, PGI and TSG products, followed by France (698 productions) and Spain (349 productions). The analysis of the access to credit of companies producing collective brand products assumes a particular interest, in fact; 1) production specification (Disciplinare di Produzione, in Italian) define mandatory production rules that influence the duration of production cycles and the consequent financing needs (Iotti & Bonazzi, 2014); 2) there are many small and medium enterprises (SMEs) operating in the sector which, as various researches have highlighted, have difficulties in accessing credit compared to large enterprises (Agyapong, 2021; García-Sánchez, 2021; Rossi *et al*., 2015); 3) operate in local contexts where the banking system has a lower presence and breadth of supply of financing instruments (Hasan *et al*., 2017; Meslier *et al*., 2020). PDO, PGI and TSG productions also play an important role in creation of tourist circuits linked to food and local territories (Cavicchi & Santini, 2019; Mauracher *et al*., 2016; Selvaggi *et al*., 2023) and in promotion and export of Made in Italy food in the international market (Belletti *et al*., 2009; Scuderi *et al*., 2019). Furthermore, investments in collective mark products may have characteristics of adherence to the guidelines on environmental, social, and governance (ESG) investments which represent one of the major areas of expansion of financial markets and attraction of investments in international markets.

Agricultural firms have production characteristics that influence investments in fixed capital (Kussainov *et al*., 2016; Lososová *et al*., 2020; Sidorenko *et al*., 2021) and investment in working capital (Fernández-López *et al*., 2020; Zabolotnyy & Sipiläinen, 2020); these investments have two consequences: 1) the need to adequately define the sources' adequate financial coverage; 2) the need to verify financial sustainability of these investments through adequate valuation ratios. The starting point of the reflection on financing needs of agricultural firms is the legal framework that defines agricultural entrepreneur contained in Art. 2135 of the Italian Civil Code (Alessi, 2019); this definition provides for a legal bond between the fund, the activities connected to it, and the activity of agricultural entrepreneur (Goldoni, 2019). It is, therefore, necessary (Ruozi, 1999; Capitanio & Adinolfi, 2009; Lucifero, 2009; Ray, 2019) to investigate the relationship between farm and bank in order to: 1) evaluate how to reduce information asymmetry; 2) analyze demand and supply of credit to agricultural firm; 3) analyze characteristics of agricultural credit compared to credit in other sectors.

Given the statutory definition, it emerges that agricultural firms must acquire the necessary capital to carry out the activity, manifesting medium and long-term financing needs for the acquisition of land, buildings and agricultural production equipment (Koloszko-Chomentowska & Sieczko, 2016; Clapp, 2019; Szymańska *et al*., 2021). Furthermore, agricultural activity takes place with processing cycles often lasting one year, with cycles of aging of the products also lasting several years, including various typical PDO and PGI products (Masarova *et al*., 2017). These production specificities of agricultural firms lead to an expansion of working capital cycle, with consequent short and medium-term financing needs that financial intermediaries have progressively satisfied over time with loans intended for the agricultural sector (Dono *et al*., 2021). Loans for agricultural firms are, in some cases, declinations of loans already present in the credit market for commercial firms but, in other cases, they are loans specifically designed to meet the needs of agricultural firms and capture the needs of financing that these firms manifest; these loans are placed in the context of agricultural credit (Trequattrini, 1994).

The aim of this work is to: 1) carry out an analysis of financing needs of agricultural firms; 2) frame the national rules relating to financing of agricultural firms; 3) present some technical forms of financing foreseen by credit system for agricultural sector; 4) explain the methods of assessing creditworthiness of agricultural firms; 5) expose some significant cases of access to credit and economic/financial performance of agricultural firms; 6) propose some concluding considerations and pose some open questions for future research and reflections.

1. Background

Agricultural firms are characterized by a high capital intensity, i.e. the ratio between invested capital and turnover generated by firms is high, and it is very common to find cases in which capital invested in agricultural activity is often higher than the volume of sales generated by a firm in one year (Borsotto *et al*., 2011; Chinnici *et al*., 2013; Commissione delle Comunità Europee, 1976; Morrison, 1997, 1999); capital intensity generates financing needs, as the invested capital must be financed with sources of financing, which include equity capital contributed by the entrepreneur, and debts of an operational nature. Capital intensity is not found in all agricultural firms, but is influenced by type of activity carried out, by strategic choices of the entrepreneur and by the stage of the life cycle in which firm is located (Ebben & Johnson, 2011; Kropp & Katchova, 2011; Ma *et al*., 2020; Peón & Martínez-Filgueira, 2020; Stillitano *et al*., 2018; Wang *et al*., 2020).

Financing needs of agricultural firms

Financing needs of firms is shared in financing needs for financial coverage of investments in fixed assets and in working capital. Distinction between fixed capital and working capital takes into consideration speed of conversion of these investments into cash flows available (cash conversion) cycle for payment of firm debts, repayment of loans taken out and remuneration of equity capital (Renborg, 1970; Jose *et al*., 1996; Ehrhardt & Wachowicz, 2007; Sardaro *et al*., 2017; Wang, 2019; Lin & Lin, 2021). For this reason, traditional corporate accounting tools are not adequate, because they provide classification of the values of corporate activity according to the principle of destination of investments, without indicating speed of conversion into cash flow. It is therefore necessary for agricultural firms to adopt principles of financial reclassification of values (Kaplan & Zingales, 1997; Morales-Díaz *et al*., 2018; Khanal & Omobitan, 2020; Welc, 2022), taking into consideration the moment of financial manifestation of values through cash flows and, consequently, being able to estimate the ability to meet financial commitments.

Investments in fixed capital are able to generate income and financial flows only in medium and long term, due to the contribution they make to production activity (Su *et al*., 2015; Grashuis & Dary, 2017; Kussainov *et al*., 2021; Omobitan & Khanal, 2022). This contribution is deferred over time and the investment activity anticipates the generation of income and financial flows; since these are benefits deferred over time, these flows are subject to business risks. Investments in fixed capital generate financial coverage

needs with sources of capital that are available in medium/long term (St-Pierre *et al*., 2000; Escalante & Barry, 2003; Denis & Sibilko, 2010; Kropp & Katchova, 2011; Langemeier, 2018). It is necessary that loans are repaid in times compatible with the capacity of investments to generate adequate financial flows to support debt service, according to the deadlines which are regulated in loan agreements between firms and lenders; debt contracted must be repaid increased by cost of debt, given by the interest on debt and any ancillary charges such as commissions and expenses for credit relationship management services (Van Binsbergen *et al*., 2010). Financing of investment needs of agricultural firms is also significant with regard to working capital cycle (Bieniasz & Gołaś, 2011; Gołaś, 2013; Wassie, 2021). The extension of the duration of agricultural transformation has effects on financial needs of agricultural firms, whether it is necessary to finance only the duration of annual cultivation cycle, or whether the need for financing also concerns aging phase, in which case the duration of the cycle can also have a multi-year duration. There may be the case in which agricultural firms, in order to reduce financing needs, decide to modify production mix, so as to combine productions characterized by a longer working capital cycle with other productions, that require less capital and, consequently, less funding (Maksim *et al*., 2014; Sánchez *et al*., 2018; Box *et al*., 2018).

Recent research highlights some structural shortcomings that have a negative effect on ability of agricultural firms to access credit in Italy (European Commission, 2020): 1) Average firm size of the sector, characterized by small farms, causes difficulties in value creation chain, diseconomies in production costs and lower valorization in terms of production prices; 2) Presence of a large number of family-run firms with little or no formal accounting, which hinders ability of farmers to access bank credit due to information opacity in accessing credit; 3) Absence of accounting statements increases information asymmetry; this concerns smaller firms which are perceived by banking system as more risky due to a lack of information base; 4) Low level of financial literacy among segments of agricultural community, especially small farms.

National rules relating to financing of agricultural firms

In Article 2135 of the Civil Code, the definition of agricultural entrepreneur refers to the connection of a firm's activity with land and with the processing, conservation and marketing activity that an agricultural entrepreneur carries out on the goods produced in the firm. Agricultural entrepreneurs, unlike commercial entrepreneurs, are not subject to insolvency proceedings of a bankruptcy nature and, therefore, the qualification of a

firm as agricultural has immediate civil law effects. Distinction between agricultural entrepreneur and commercial entrepreneur concerns the nature of activity carried out and does not concern size of firm activity or legal form assumed by the agricultural activity.

Exemption of agricultural entrepreneur from bankruptcy proceedings has historical reasons, already considered in the bankruptcy law of 1942 (R.D. 16 March, 1942, n. 267); the reason for this exemption is to be disclosed (Mozzarelli, 2014): 1) in the importance of agricultural activity within national production structure and in the importance of food production for the purpose of food self-sufficiency; 2) in the particular subjection to additional risks with respect to commercial firms to which an agricultural entrepreneur is by nature subjected. On this subject, there is a need to consider the relevant debate on agricultural credit defined as a set of financial means in favor of economic subjects operating in the primary sector; the origin of agricultural credit is traced back to Law 1760/1928, from which the specialization of credit in agriculture originates.

The discipline of agricultural credit (ISMEA, 2007) has an important discipline with Articles 43 and 44 of Legislative Decree 385/1993, Consolidated Banking Act (Testo Unico Bancario, TUB, in Italian). In particular, Art. 43 of TUB, regulates agricultural credit as a credit whose object is granting of loans for agricultural activities and related activities; fishing credit has as its object granting of loans for fishing and aquaculture activities, as well as those connected or collateral to them; TUB indicates among connected or collateral activities: farmhouse, manipulation, conservation, transformation, marketing and valorization of products. Art. 43 of TUB indicates that agricultural and fishing credit operations can be carried out through the use of an agricultural bill and fishing bill, which are equivalent to all effects of Law as to an ordinary bill. Art. 43 of TUB, therefore, regulates the use of an agricultural bill as a form of financing that can be used in the context of agricultural credit. Agricultural bills are issued by the person requesting a loan, and are executive titles that allow agricultural firm to obtain short-term credit lines granted by credit institutions, precisely through the discount of agricultural bills; agricultural bills are distinguished from ordinary bills because they present a facilitated fiscal discipline, established by Art. 3 of Law 185/1992. ISMEA (Istituto di Servizi per il Mercato Agricolo Alimentare, in Italian) and can provide a subsidiary guarantee for agricultural credit operations pursuant to Article 43 of TUB.

2. Materials and methods

Technical forms of financing envisaged by credit system for agricultural sector

Financing institutions tend to expand the offer of loans to agricultural firms, so as to operate more profitably in the credit market, acquiring new customers by: a) anticipating financing needs of firms; b) building long-term relationships with client firms; c) diversifying offers of credit instruments with respect to competing financial intermediaries; d) more precisely estimate risk associated with loans, so as to be able to offer credit at better pricing conditions than competitors and, consequently, make its offer of credit lines more attractive than competitors due to lower pricing (Lufburrow *et al*., 1984). Pursuing an increase in the circulation of information useful for correct assessment of creditworthiness makes it possible to reduce information asymmetry as much as possible; 1) favoring access to credit for the most efficient firms; 2) reducing cost of credit as a result of reduction in pricing of transactions determined by the increase in competition on the side of credit offer and by better assessment of risk of transactions; 3) reducing delinquencies on credit lines due to improved creditworthiness assessment; 4) reducing demand for collateral.

Financial intermediaries offer agricultural firms diversified instruments to meet their needs; this diversification takes place: 1) according to duration of credit line; 2) according to the method of calculating interest rate; 3) depending on the presence of ancillary guarantees. Distinction based on duration of various credit lines is useful since duration of credit line is aimed at aligning duration of investments in terms of maturity.

Instruments for financing investment needs in fixed capital are satisfied by taking out loans to be repaid in the medium/long term. In particular, they characterize the offer of loans for agricultural firms (Romania, 1986; Masindi, 1998; Fontana, 2012; Tirelli-Palummeri, 2016; Iotti, 2022): 1) Endowment loans, without mortgage guarantee, with legal lien; these loans are aimed at meeting financing needs for the endowment of durable investments, such as the purchase of live-stock and dead-stock. Among investments that have financial coverage with the endowment loans there are also intangible investments, such as so-called milk quota for production of protected cheeses. These loans may have a collateral guarantee provided by credit consortia and/or public entities, such as ISMEA; 2) Long-term loan with mortgage guarantee; these are loans, governed by Art. 1813 of the Civil Code, in the long term to be allocated to investments for the purchase of agricultural land which makes up the fund, for construction or restructuring of agricultural structures. In general, the loan is assisted by a real mortgage guarantee on the real estate that is the object of investment. This form of

financing provides for the payment of repayment installments, consisting of principal and interest, according to an amortization plan which is defined by contract at the time the loan is stipulated. At the beginning of the term of loan contract, a period in which only interest is paid may be envisaged; this period is defined as pre-amortization and has the purpose of allowing the farm to put the assets object of the investment into operation. A particular case, among long-term transactions, is a land loan governed by Art. 38 of TUB. This loan is disbursed by banks and is characterized by a first degree mortgage guarantee on properties; the land loan satisfies financing needs of agricultural firms, as banks often use this form of financing to provide agricultural firms with capital necessary for investments in the agricultural fund, both for the component that concerns land and for the component that concerns the buildings. Art. 44 of the Italian TUB is the regulation envisaged for land credit operations and applies to agricultural credit and fishing credit secured by a mortgage on real estate; this regulation allows land credit regulation to be extended to agricultural credit operations guaranteed by mortgages on buildings. 3) Agricultural leasing; this is the traditional leasing contract, used, however, in the context of agricultural activity and to meet financing needs of agricultural firms. Leasing contract may relate to immovable property, such as land or buildings, or movable property, such as plant, equipment and machinery. In the case of real estate leasing, the durations will generally be longer, and similar to the durations envisaged for mortgage loan contracts; this extension of duration has the purpose of guaranteeing financial sustainability of the leasing transaction. Property leasing will have a shorter duration; this duration is generally aligned with useful life of the assets acquired through leasing. For financing of working capital cycle, financial intermediaries offer firms various instruments for financing these investment needs (Carluccio *et al*., 2020; Iotti, 2022). In particular, the following characterize this type of financing for agricultural firms: 1) Operating financing, without a mortgage guarantee for financing of advance expenses; these are agricultural loans guaranteed by legal privilege. These loans are aimed at meeting financing needs given by the advance of costs of agricultural activity. In agricultural activity, cost advances are typical during land cultivation or livestock breeding phase. These loans allow agricultural firms to have the capital necessary for cultivation of land during the agricultural year, waiting for the receipts deriving from sale of firm productions. Capital is made available to the farm in a single deadline, or within the limits of a pre-established ceiling and calculated on the basis of an estimate of the costs of agricultural year shared between firm and lending bank. These loans have a short-term duration. 2) Operational financing for financing corporate inventory stock cycle; these are loans, without a mortgage guarantee, assisted by a legal privilege. The management loans

allow the rotation of firm warehouse and the replacement of goods in the warehouse ready for sale with others to be sent for aging. Capital is instead disbursed to the farm in a single solution. The traditional conditions for quantifying cost of loan transaction apply to these loans, since the transaction can be regulated at both a fixed interest rate and at a variable interest rate. These loans can be assisted by real guarantees, such as pledge on agricultural productions covered by the loan, even with a non-possessory pledge, governed by Art. 1 the Legislative Decree 59/2016 and subsequent amendments. With Law Decree n. 59/2016, modified and converted into law with Law n. 199/2016, the regulation of non-possessory pledge was introduced; the Law provided for the issuance of the Decree of the Ministry of Economy and Finance of 25 May, 2021, n. 114, which established the computerized register for the registration of non-possessing movable pledges with the Revenue Agency (D'Addezio, 2021). Regulation of pledge goes beyond the traditional norm of pledge provided for by Article 2784 and following of the Civil Code, according to which pledge of movable property is constituted with the delivery to the creditor of the thing or of the document which gives exclusive availability of the thing. The most relevant regulatory precedent of non-possessory pledge is the provision relating to pledge on controlled denomination of origin hams, pursuant to Law no. 4011. Commercial practice of lenders thus began to use a pledge rotation clause for financing of agricultural firms (Balbusso, 2022); this clause provides that the object of pledge can be replaced over time without this involving novation of the guarantee (Catalano, 2022). The rule on the revolving pledge provides that entrepreneurs registered in the register of firms can establish a non-possessory revolving pledge to guarantee credits granted to them or to third parties, present or future, if determined or determinable and with the provision of the maximum guaranteed amount, inherent to the exercise of the firm. The loss of the element of exhaustion and consequent usability of asset covered by the guarantee are expressly foreseen because the Law establishes that the financed firm is authorized to transform or sell or in any case to dispose of the assets encumbered by pledge. Non-possessory pledge differs from pledge envisaged by Article 2784 and following of the Civil Code due to the absence of dispossession and possibility of continuing to dispose of the asset covered by the guarantee. Art. 78, paragraph 2-duodecies of the decree-law of 17 March, 2020, n. 18, coordinated with the conversion law of 24 April, 2020, n. 27 (D.L. Cura Italia, in Italian) and extended the possibility of constituting the revolving pledge, originally limited to Parma PDO Ham (law 24 July, 1985, n. 401) and aged cheeses (decree of the Ministry of Agricultural, Food and Forestry Policies (MiPAAF) of 26 July, 2016, n. 188), to PDO (Protected Designation of Origin) and PGI (Protected Geographical Indication) products. In particular, it is envisaged that the

aforesaid products can be subjected to a revolving pledge by identifying them through documents or annotations in special registers (ABI, 2021).

In addition to loans that have been discussed, which are specific for satisfying financing needs of agricultural firms, short-term loans can be used, also in the primary sector, which can be used by commercial firms to satisfy financing needs of working capital, such as current account credit lines and forms of advances on commercial credits; these technical forms of financing are similar to what applies to firms in sectors other than agriculture and therefore do not require specific treatment here.

Financial assessments and access to credit are also being investigated in commercial firms (Beck & Demirguc-Kunt, 2006; Sufi, 2009; Fawzi *et al*., 2015; Purnima *et al*., 2021), but the objective of the work is to carry out an in-depth analysis of the instruments that are typical of financing of agricultural activity or which, while not typical of financing of agricultural activity, present, when applied to agricultural activity, elements of typicality or interest that can be usefully exposed for understanding the coverage of financing needs of these firms (Yaron, 1992; Beck & Demirguc-Kunt, 2005; Dodson, 2014; Turvey, 2017; Pokharel *et al*., 2019).

Methods of assessing creditworthiness of agricultural firms

Agricultural firms have characteristics linked to the need for investment in agricultural fund and in production cycle, which often make them capital-intensive firms and, consequently, expand their financing needs (Ferrarini, 1998; Viviani, 2008; Paoloni *et al*., 2022). In fact, invested capital, which is represented in the assets section of balance sheet of annual account statements, has financial coverage with the liabilities of balance sheet, i.e. the set of sources of capital financing. these funding sources are divided into: 1) equity capital; 2) debt capital. An increase in invested assets therefore determines an equal need for an increase in sources of financing, divided into equity capital, financial and non-financial debt capital (Titman & Wessels, 1998). Capital contributed by the entrepreneur, i.e. equity capital or risk capital, is remunerated by firm profits according to risk-return relationship which provides for an increase in the remuneration expected by investors as the risk increases (Fama & French, 1993; Vassalou & Xing, 2004; Smith, 2019).

The case of cooperative firms is interesting as they can overcome difficulties of accessing capital market through widespread participation in capital and voting mechanisms that favor managerial turnover and consequently investor confidence (Cook, 1995; Rinaldi & Cavicchi, 2016; Briggeman *et al*., 2016; Royer, 2017; Pokharel *et al*., 2019; Grashuis & Ye, 2019; Grashuis, 2020; Royer & McKee, 2021).

In financial assessment, it is necessary to calculate that return on invested capital is greater than cost of debt financing (Guida & Sabato, 2017; Ozdagli, 2012), also in agricultural and agri-food firms (Fenyves *et al*., 2020; Santosa, 2020; Tripathy & Shaik, 2019). Cost of financial debt occurs through payment of interest to lenders increased by commissions on credit lines granted and costs for services. Cost of financial debt has characteristics that distinguish it from equity capital: 1) remuneration of lenders is independent of firm results, except for forms of mezzanine financing; in some cases, a change in the interest rate is envisaged as firm performance varies, with application of specific covenants (Rajan & Winton, 1995); 2) cost of financial debt is, therefore, explicit, and is part of firm costs, and has a non-residual nature, thus differentiating itself from remuneration of equity capital, which has a residual nature (Sabasi *et al*., 2021). It should be noted that the characteristics of cost of financial debt, which has a contractual obligation of remuneration regardless of obtaining of profits, are determined by postponement of shareholders' loans and by contributions of equity capital with respect to financial debt and other firm debts in case of default of the firm. Furthermore, financial debt can be backed by various forms of collateral which have the characteristic of attributing to lenders a privilege, given by pledge or mortgage governed by the Civil Code, or a signature guarantee such as the surety, always governed by the Civil Code (Gan, 2007; Jiménez *et al*., 2006). Collateral allows lenders to be able to claim other assets, distinct from firm assets, or to acquire specific privileges on portions of firm assets, as in the case of a mortgage. Thanks to collateral, lenders reduce expectations of loss in the event of default of lender (Ono & Uesugi, 2015) and as a result they may envisage reductions in pricing of financing transactions (Beyhaghi, 2022). In the relationship between firm and bank, in general, and between farm and bank in particular, the reciprocal transfer of information becomes essential, in order to reduce information asymmetries (Gabbi *et al*., 2020). The relationship between bank and firm is based on a long-term relationship in which both parties to the relationship allow the other party to know quantitative and qualitative elements of the relationship. The bank must make transaction costs and, in general, contractual terms of loan transactions available to the firm, in terms of duration, risks for financed firm and type of service offered. Firms must make available to the bank, for the purpose of assessing creditworthiness, quantitative and qualitative data that allow the bank to assess riskiness of the loan requested by the firm and, consequently, to define whether this loan can be granted, and under what conditions of price, duration, and with any request for collateral guarantees (Matias Gama & Dias Duarte, 2015).

Verification of financial balance of firms is necessary in assessing creditworthiness (Basel Committee on Banking Supervision, 2021; Kim &

Katchova, 2020); reference is made to: 1) structural balance between funding sources, i.e. the breakdown of structure of funding sources between equity capital and debts and, as regards debts, between financial debts and non-financial debts (Rajan & Zingales, 1995); 2) coverage of cost of debt and remuneration of equity capital; particularly (Iotti & Bonazzi, 2015; Dothan, 2016), ratios are applied which evaluate the coverage of cost of debt, called interest coverage ratios (ICR); 3) alignment between incoming and outgoing cash flows to verify financial sustainability of debt service; in particular, ratios called debt service coverage ratios are applied (DSCR). Difficulties in accessing credit for agricultural firms are given by: 1) presence of financial constraints to which firms are unable to submit, such as adequacy of financial structure, adequacy of ICRs and DSCRs, compliance with loan covenants, adequacy of collateral requested by lenders (Rampini & Viswanathan, 2013); 2) shortcomings of financial system and/or capital market, in relation to both equity capital market, in terms of market breadth and depth, and debt capital market, in terms of the supply of loans to firms, by technical form, adequacy to the needs of various sectors, territorial coverage of loan offer (Paravisini, 2008; Meslier *et al*., 2022).

In financial assessment necessary for assessing creditworthiness, annual account statements are the main document that allows calculation of financial ratios, i.e. ratios between annual account statement values that have the purpose of expressing firm's performance and, in a synthetic way, estimating probability of default (Soliman, 2008; Lian *et al*., 2016). In agricultural firms, annual account statements are an essential source for assessing creditworthiness and can be usefully integrated with sector and market performance data (Dono *et al*., 2022). First studies in this research area are due to Beaver (Beaver, 1966), Altman (Altman, 1968) and Ohlson (Ohlson, 1980) who applied multivariate discriminant analysis (MDA). MDA was then also applied for the insolvency forecast for agricultural firms (Johnson & Haegn, 1973). More recent applications have made it necessary to estimate the probability of default using Logit and Probit models (Miller & LaDue, 1989; Lyubov & Pederson, 2003; Hofner *et al*., 2017) while the most recent developments in the prediction of insolvency are given by applications of neural network analysis (NNA), back propagation neural network (BPNN) and other estimation techniques that do not need to assume a given default probability distribution and are usefully applicable in big data analysis (Bennouna & Tkiouat, 2018; Horak *et al*., 2020; Abid *et al*., 2022).

For the purpose of assessing creditworthiness, a trend analysis of the regularity of relationship between firm and credit system is also necessary, which is kept under observation through the Central Credit Register (Centrale Rischi, in Italian) held at the Bank of Italy; this information database collects information that financial intermediaries send to the Bank of Italy on a

monthly basis, noting the amount of credit facilities, the related uses, any overdrafts and the presence of prejudicial events in relationship between firm and credit system. Attention to the early emergence of crisis symptoms has application in the early warning principle, i.e. an early emergence of the so-called warning signals, with application of the so-called forward looking approach (Mansi *et al*., 2011; Ashraf *et al*., 2019; Klopotan *et al*., 2018). This approach is due to the organic reform of the business crisis, which has found application in national legislation with Legislative Decree no. 14/2019 "Corporate crisis and insolvency code". The early emergence of symptoms of difficulty, in relationship between bank and firm, favors access to credit for firms that can reasonably repay loans received; in this way, it is possible to reduce the insolvencies in banking sector and favor efficient functioning of credit market (Fama, 1970; Fama, 1998; Wurgler, 2000). To achieve this goal in Italy, ISMEA and Moody's KMV have created a specific rating model for Italian agricultural and agri-food firms; the objective of the model is to evaluate creditworthiness of firms in various sectors of Italian agriculture; the rating has the objective of facilitating transmission of information between agricultural firms and lending credit institutions, with the aim of facilitating access to credit for agricultural firms. ISMEA has developed three models: 1) for corporations, with annual account statement; 2) for small and medium-sized farms, with no annual account statement obligation; 3) for agricultural cooperatives.

3. Results

To apply what was developed in the methodological part, two cases concerning financial evaluation and access to credit in the agri-food system are carried out. These cases relate to productions with Protected Designation of Origin (PDO) for products that require aging times envisaged by the relative production regulations (Disciplinare di produzione, in Italian). These cases may be of interest as (Paoloni *et al*., 2020): 1) firms in the sectors concerned, which relate to the major sectors of PDO production in Italy, have financing needs in fixed assets to finance the fixed production structures necessary for the processing of the product and its storage; 2) firms of the sectors have financing needs in working capital cycle to finance aging of product and this financing need is determined by production regulations which define the minimum duration of aging of production; 3) working capital cycle of these productions can be financed by credit institutions through revolving pledge.

Case 1), Firms operating in aging of Parmigiano Reggiano PDO cheese (Parmigiano Reggiano DOP, denominazione di origine protetta, in italian)

The first case presented relates to balance sheet data of a sample of 8 firms operating in Parmigiano Reggiano PDO cheese aging sector. Overall, annual account statements for 5 years were used, for a total of 40 observations. Parmigiano Reggiano PDO cheese is regulated by production regulations in force since 30/03/2018 and by Regulation (EU) n. 794/2011 of the Commission of 8 August 2011 approving the amendments to the specification of Parmigiano Reggiano PDO.

Parmigiano Reggiano PDO cheese, in 2021, was the first PDO product for annual turnover (ISMEA, 2022), with 1.607 billion euros of production value (ISMEA, 2022) and the annual production was 155, 277 tons in 2021. The value at consumption stage is 2,756 billion euros. Parmigiano Reggiano PDO is produced in the provinces of Parma, Reggio Emilia, Modena, Mantova, south of Po river, and Bologna, left of Reno river. Parmigiano Reggiano PDO has great importance in the economy of these provinces; it characterizes the livestock activity which is directed to production of milk for subsequent transformation into cheese. In the production district, a large part of agricultural activity and related activities are aimed at bovine milk production chain; also technical services, production of machinery and equipment, aging and trade of production, and also financial services operate in the Parmigiano Reggiano PDO supply chain to provide services.

Parmigiano Reggiano PDO is a hard, cooked and slow-aging cheese, produced with raw, partially skimmed milk from cows whose diet consists mainly of fodder from the area of origin. Milk cannot be subjected to heat treatments and use of additives is not permitted. Production regulations provide that after the salting phase, aging must last for at least 12 months. This provision of production regulations determines that firms of the sector must equip themselves with necessary storage structures for production in the course of aging or, alternatively, outsource this phase of production to third parties, with the payment of relative price of the service. Furthermore, the need to finance the cheese aging cycle for at least 12 months is determined, resulting in a need for investment, and the consequent need for financial coverage, for a period of at least 12 months. Firms in the sector therefore need significant capital to finance production cycle and it is therefore necessary that: 1) prepare adequate forecasts on the needs of prospective financial flows in order to facilitate dialogue with lenders in requesting credit lines necessary for financing of production; 2) determine financial structure in order to verify capital solidity; 3) calculate adequate ICRs and DSCRs ratios to verify the ability to cover cost of debt and debt service. This information is necessary not only for firm management, in order to

plan financial needs of firms, but also in relations with lenders, to guarantee information symmetry between firm and bank in the request for loans.

Table 1 - Case 1. Firms operating in aging of Parmigiano Reggiano PDO cheese - Balance sheet analysis (40 observations)

Balance sheet	**Mean**	**Mean**	**Median**	**Median**
	(€)	**(% TA)**	**(€)**	**(% TA)**
Fixed asset	3,628,603	17.54%	1,987,762	9.26%
Inventories (product stock)	16,570,645	54.16%	5,739,496	64.34%
Commercial credits	5,189,072	12.52%	1,137,932	11.15%
Non-commercial credits	1,340,025	13.73%	1,272,647	4.68%
Working capital investment	23,099,743	80.42%	8,424,271	88.77%
Liquidity	578,545	1.99%	286,743	1.93%
Accruals and deferrals investment	12,386	0.06%	8,456	0.05%
Total asset (TA)	27,319,277	100.00%	11,556,104	100.00%
Equity capital (E)	5,030,898	15.27%	1,041,815	11.89%
Financial debts within 12 months	11,982,494	32.20%	3,375,831	32.16%
Financial debts over 12 months	3,054,370	14.13%	1,643,388	5.96%
Financial debts total amount (FD)	15,036,865	46.32%	5,468,245	45.69%
Non-financial debts within 12 months	6,954,168	37.29%	4,054,082	29.38%
Non-financial debts over 12 months	–	0.00%	–	0.00%
Working capital source	6,954,168	37.29%	4,054,082	29.38%
Provisions for risks and charges	113,466	0.52%	28,865	0.02%
Severance indemnity fund (TFR)	107,028	0.36%	33,746	0.30%
Accruals and deferrals source	76,852	0.24%	3,500	0.02%
Third-party capital	22,288,379	84.73%	9,589,438	88.11%
Total source (TS)	27,319,277	100.00%	11,556,104	100.00%

Source: Balance sheet processed data.

Firms in dairy processing sector analyzed are characterized by high investments in the cycle of fixed investments and working capital. The absorption of capital in the active cycle determines a high use of financial resources, with an average high recourse to third-party capital. Balance sheet data (Table 1) shows that: 1) Firms in the sample need investments in working capital equal to 88.77% of investments (median figure); only 29.38% of investments are financed with net working capital as a source of financing. Consequently, active net working capital absorbs 59.39% of investments and

this quota of investments needs coverage with equity capital or with financial debts. 2) Equity capital finances 11.89% of investments. 3) Financial debts are the first source of capital, and finance 45.69% of investments.

Table 2 - Case 1. Firms operating in aging of Parmigiano Reggiano PDO cheese – Income statement (40 observations)

Income statement	**Mean**	**Mean**	**Median**	**Median**
	(€)	**(% TA)**	**(€)**	**(% TA)**
Sales	22,761,947	100.00%	8,199,589	100.00%
Production values	25,549,794	112.25%	7,711,741	94.05%
Raw Materials	–20,755,468	–91.18%	–5,977,941	–72.91%
Services	–1,894,604	–8.32%	–1,015,464	–12.38%
Rent	–90,965	–0.40%	–57,223	–0.70%
Cost of labor	–507,319	–2.23%	–183,683	–2.24%
Other Costs	–667,586	–2.93%	–152,127	–1.86%
EBITDA	1,633,852	7.18%	325,304	3.97%
Depreciation	–	0.00%	–	0.00%
Amortizations	–383,019	–1.68%	–225,630	–2.75%
EBIT	1,250,832	5.50%	99,674	1.22%
Interest charge (IC)	–421,796	–1.85%	–143,924	–1.76%
Extraordinary revenues and costs	97,101	0.43%	–611	–0.01%
EBT	926,138	4.07%	–44,861	–0.55%
Corporate tax	–407,594	–1.79%	–42,984	–0.52%
NET PROFIT (NP)	518,544	2.28%	–87,845	–1.07%

Source: Income statements processed data.

Income statement data (Table 2) shows that: 1) Firms in the sample have modest profit margins (EBITDA and EBIT), 3.97% and 1.22% of sales, respectively, 2) cost per interest charge (1.76% of sales) is higher than intermediate profit margins. 3) Net profit for mean is positive, while it is negative for median. Given the high investment, return on capital must be compared with cost of debt; some firms have a cost of debt higher than return on capital. Particular attention must be paid to the issue of payment of cost and service of debt. Traditional approach to assessing financial sustainability, based on an income approach, is not sufficient in firms in the sector and it is necessary to deepen the analytical tool with financial indicators. On the basis

of these data it therefore emerges that: a) firms in the sector need significant investments in equity capital which determine the relative financial coverage; b) equity capital has a modest weight among the sources of financing, while the main source of financing is bank debt capital; c) it is therefore important to assess that return on invested capital covers cost of bank debt, with an analysis of ROA and ROD ratios and calculation of ICRs, and that the sustainability of debt service is verified, with calculation of DSCRs.

Table 3 - Case 1. Firms operating in aging of Parmigiano Reggiano PDO cheese – financial ratios (40 observations)

Financial ratios	**Mean**	**Median**	**> 0**	**0 <**
	(€)	**(%)**	**(N.)**	**(N.)**
ROA (EBIT : TA)	4.58%	0.86%	31	9
ROD (IC : FC)	2.81%	2.63%	40	0
ROE (NP : E)	10.31%	–8.43%	16	24
			> 1	1 <
ICR1 (EBITDA : IC)	387.36%	226.02%	38	2
ICR2 (EBIT : IC)	296.55%	69.25%	17	23
ICR3 (OCF : IC)	290.52%	102.33%	21	19
ICR4 (UFCF : IC)	85.12%	67.23%	16	24
DSCR (UFCF : Debt service (DS))	60.11%	58.30%	12	28

Source: Annual account statement processed data.

Analysis of financial ratios (Table 3) shows that: 1) ROA is modest (4.58% average value and 0.86% median value); this ratio quantifies return on invested capital. ROD, which expresses cost of debt, has an average value of 2.81% and a median value of 2.63%. Median value of ROD is greater than ROA, this expresses that in the sample analyzed cost of debt (ROD) is greater than return on capital (ROA) with the consequent negative effect of financial leverage; an increase in the level of financial debt, with cost of debt and return on capital being equal, determines a reduction in profitability for shareholders (ROE) because capital is invested at a rate of return (ROA) lower than cost of debt (ROD). 2) The ability to pay cost of debt, calculated with ICRs, is verified if calculated with ICR1 and ICR3, while it is not verified if calculated with ICR2 and ICR4; these last two ICRs are more prudent than ICR1 and ICR3 because they consider more restrictive income and financial margins (EBIT and UFCF respectively). In 23 cases out of

40 (ICR2) and in 24 cases out of 40 (ICR4) the payment of debt course is not sustainable, because ICR value is less than 1. 3) The ability to pay debt service, calculated with DSCR, is not verified. In 28 out of 40 cases, the payment of debt service is not sustainable, because DSCR value is less than 1.

Case shows following conclusions: 1) In Parmigiano Reggiano PDO sector, the sample of firms analyzed shows that production specification causes an expansion of working capital cycle, which requires financial coverage. 2) Firms in the sample have financial debts as their main source of financing; for this reason, relationship with credit system and assessment of the sustainability of cost of debt and debt service, conducted using ICRs and DSCRs ratios, calculated on annual account statements and, if possible, using strategic planning tools become essential forecasts, such as the business plan; these tools comply with recent modifications made to Civil code in terms of adequate organizational arrangements and early warning, also envisaged in Crisis Code (Codice della Crisi, in Italian) which recently modified the provisions of Bankruptcy Law. 3) In the sample of firms, profit margins are modest and do not ensure payment of cost of debt, both in relation to financial leverage (ROA/ROD), and in relation to ICRs for median values of ICR2 and ICR4; debt service is also not guaranteed, as shown by calculation of DSCRs (median values).

Analysis of firms in the sample therefore shows that, in Parmigiano Reggiano PDO sector, firms need financing from credit institutions but, also, they must equip themselves with adequate business planning tools that allow them to verify their ability to meet cost of debt. This is particularly necessary in recent scenario which foresees, in addition to significant increases in production costs and changes in consumers' spending power, as regards relations between firms and banks: a) availability of new legislative measures (revolving pledge) which they have been implemented by credit system by making available to firms an expanded range of credit lines to support working capital cycle guaranteed by collateral in form of a revolving pledge; b) increase in interest rates, determined by the increase in reference rates on the market (EURIBOR and IRS) and increase in average spreads applied by the banks.

Case 2), Firms that operate in aging of Parma Ham PDO (Prosciutto di Parma DOP, denominazione di origine protetta, in italian)

The second case presented relates to balance sheet data of a sample of 88 firms operating in the meat processing sector and associated with Parma Ham PDO Consortium over a 5-year series for a total of 440 observations.

It should be noted that firms in the sample, despite being members of the PDO Parma Ham Consortium, produce other delicatessen products, such as hams not marked with the PDO designation and other delicatessen products which, in general, are characterized by less aging and lower production costs; in addition, some firms in the sample also have commercial activities, acquiring and reselling already aged products, or carrying out processing activities on behalf of third parties (Bonazzi *et al*., 2011a, 2011b).

The denomination of origin "Prosciutto di Parma" was initially legally protected at a national level since 1970 through Law of 4 July 1970 n. 506 and was then recognized as a PDO pursuant to EEC Regulation n. 2081/92 with EC Regulation n. 1107, dated 12.06.96. Production is regulated by production specification published in the Official Journal of the European Union n. C429 with "Publication of an application for approval of a non-minor modification of production specification pursuant to article 50, paragraph 2, letter a), of regulation (EU) no. 1151/2012 of the European Parliament and of the Council on the quality schemes of agricultural and food products 2022/C 429/08".

The estimated total consumer turnover of Parma Ham PDO was 2.171 billion euros for 2021 (ISMEA, 2022) at consumer stage level, of which 294 were intended for export; Parma PDO Ham is the third Italian production with PDO, PGI and TSG mark, at firm stage level, with 650 million euro of production value, after Parmigiano Reggiano PDO (1.607 billion euro of production value) and Grana Padano PDO (1.460 billion euro of production value) at consumer stage level. In 2021, there were 8,487,474 pork legs sent for PDO Parma Ham production, of which 7,705,379 were approved for PDO production (CSQA, 2022). In fact, 140 companies operate in the sector (Consorzio del Prosciutto di Parma, 2022), employing around 3,000 people, and process fresh pork legs which come from around 3,600 pig farms and 78 slaughterhouses. Parma PDO Ham is the first meat-based collective mark product in terms of turnover, companies and number of employees. It is a production of wide interest because it concentrates large capital and labor in a relatively small processing area. In addition to PDO Parma ham, companies in the sector can freely produce other processed meat products; therefore, transformation of pork meat characterizes the production area of Parma PDO Ham.

Production specification defines a minimum aging period of Parma Ham PDO of 14 months. This rule of the specification has two consequences: 1) aging determines an absorption of working capital necessary for the purchase of fresh pork leg and subsequent processing; 2) aging also leads to an increase in fixed capital investments, because companies in the sector require physical aging structures which therefore require fixed capital investments of buildings, plant and machinery.

Firms in the sector are characterized by investments in fixed capital (property, plant and machinery) and in working capital, including firm warehouse of the pork leg in the course of aging, which determine the need to raise risk or debt capital to cover to financial needs, also determined by the warehouse cycle, for times ranging from 14 to 24/36 months. It is therefore necessary to quantify return on equity capital and the management cash flows to assess whether these are sufficient to guarantee the payment of debt service contracted for loans. In firms in the sector, this assessment is relevant due to the time lag that exists between economic cycle and financial cycle.

Table 4 - Case 2. Firms operating in aging of Parma Ham PDO - Balance sheet analysis (440 observations)

Balance sheet	**Mean**	**Mean**	**Median**	**Median**
	(€)	**(% TA)**	**(€)**	**(% TA)**
Fixed asset	7,201,023	48.72%	6,001,609	47.99%
Inventories (product stock)	6,025,022	40.76%	4,998,037	39.97%
Commercial credits	890,023	6.02%	1,136,009	9.08%
Non-commercial credits	540,031	3.65%	500,982	4.01%
Working capital investment	7,455,076	50.44%	6,635,028	53.06%
Liquidity	109,036	0.74%	285,009	2.28%
Accruals and deferrals investment	15,009	0.10%	8,660	0.07%
Total asset (TA)	14,780,144	100.00%	12,505,311	100.00%
Equity capital (E)	3,023,830	20.46%	2,503,938	20.02%
Financial debts within 12 months	5,004,609	33.86%	4,401,039	35.19%
Financial debts over 12 months	2,119,082	14.34%	1,702,928	13.62%
Financial debts total amount (FD)	7,123,691	48.20%	6,103,967	48.81%
Non-financial debts within 12 months	4,005,988	27.10%	3,430,871	27.44%
Non-financial debts over 12 months	120,569	0.82%	85,002	0.68%
Working capital source	4,126,557	27.92%	3,515,873	28.12%
Provisions for risks and charges	98,022	0.66%	50,117	0.40%
Severance indemnity fund (TFR)	329,054	2.23%	201,331	1.61%
Accruals and deferrals source	78,990	0.53%	23,891	0.19%
Third-party capital	11,756,314	79.54%	9,895,179	79.13%
Total source (TS)	14,780,144	100.00%	12,505,311	100.00%

Source: Balance sheet processed data.

The analysis of balance sheet data (Table 4) shows that the first investment item of firms is fixed assets, i.e. investments in buildings, plant and machinery, equipment, and any long-term intangible and financial investments. Investments in fixed assets are permanently invested capital and absorb approximately 47.99% of investments. The second most important investment item is the warehouse, i.e. the complex of pork legs in aging, in the various stages of this, from the initial processing to the aged product ready for sale. The duration of ham processing cycle is more than 14 months due to production specification, but often active aging, for commercial reasons, up to 24/36 months, and this leads to an increase in stock. Investment in inventory stock becomes an almost immobilized capital, in any case with conversion into cash over 12 months; the incidence of inventory on total investments is approximately 40%. The incidence of receivables from customers is significant, and equal to approximately 9% of invested assets; firms in the sector show a significant absorption of money also due to the deferred collection granted to customers. these delays occur in relation to large-scale retail trade (GDO).

Equity capital is not the first source of financing among the sources of financing for firms; equity contributed by shareholders of firms, or reinvested, finances about 20% of investments. Financial debts are the first source of financing (48.81% of invested capital), with a prevalence of loans aging within 12 months (35.19% of invested capital) compared to loans aging beyond 12 months (13.62%). This situation is also due to the particularity of the sector which sees the need for investments in working capital; a part of this capital (including the thigh in the initial stages of processing) is transformed into cash in a period of more than 14 months (for example, consider an average aging period of 24 months to which to add a further 3 average months for extension granted to customers). Data of firms in the sample, in face of high investments in fixed assets, indicating that the choice of alignment of loan maturities is not adequate. In fact, the sum of equity capital and financial payables due beyond 12 months is not able to give financial coverage to fixed assets.

Data show that it is therefore necessary to finance part of the inventories with medium-term credit lines, to align the repayment terms of these loans with the potential collections deriving from the transformation, sale and collection cycle. Trust Consortia (Consorzi Fidi, in Italian), by means of an accessory guarantee signed in favor of credit institutions that finance firm, can facilitate access to credit for firms in the sector on medium-term financing lines (between 18 and 60 months); these lines of financing can also be assisted by non-possessory revolving pledge. In the case of firms in the sample, this financial coverage is not sufficient and this determines non-sustainability of financial cycle, as shown by data in Tables 5 and 6.

Table 5 - Case 2. Firms operating in aging of Parma Ham PDO – Income statements (440 observations)

Income statement	Mean (€)	Mean (% TA)	Median (€)	Median (% TA)
Sales	12,002,891	100.00%	7,550,013	100.00%
Production values	11,603,037	96.67%	7,600,318	100.67%
Raw Materials	–6,404,382	–53.36%	–3,980,937	–52.73%
Services	–1,802,362	–15.02%	–1,098,397	–14.55%
Rent	–155,637	–1.30%	–95,933	–1.27%
Cost of labor	–1,115,607	–9.29%	–856,361	–11.34%
Other Costs	–454,659	–3.79%	–315,308	–4.18%
EBITDA	1,670,390	13.92%	1,253,382	16.60%
Depreciation	–125,303	–1.04%	–99,837	–1.32%
Amortizations	–508,933	–4.24%	–377,609	–5.00%
EBIT	1,036,154	8.63%	775,936	10.28%
Interest charge (IC)	–448,005	–3.73%	–495,334	–6.56%
Extraordinary revenues and costs	11,020	0.09%	51,351	0.68%
EBT	599,169	4.99%	331,953	4.40%
Corporate tax	–299,018	–2.49%	–189,560	–2.51%
NET PROFIT (NP)	300,151	2.50%	142,393	1.89%

Source: Income statement processed data.

Data in income statement (Table 5) show that: 1) economic data of firms in the sample show an average production value of 12.0 million euros per firm; this value is higher than median value (7.5 million euros) and expresses that small and medium-sized firms prevail; Some large firms are included in the sample which are also active in other delicatessen sectors and not in production of Prosciutto di Parma PDO. The highest cost incidence is that of raw materials, which absorb about 53% of the value of production. Fresh pork leg to be processed and ancillary processing materials are the main cost items of firms in the sector. Analysis shows that costs for services also have a high incidence, equal to approximately 15% of the value of production; among the services, the industrial ones have an impact in particular, on energy costs for the functioning of the cold rooms, the costs for external processes, such as the boning services carried out by specialized artisan firms, in addition to commercial costs, for mediations on sales and on purchase, in particular in the case of sale of production through agents. On

the other hand, compared to other sectors, the weight of cost of labor is quite low, accounting for about 10% of the value of production; firms in the sector therefore confirm the characterization of being activities with a high capital intensity, and modest recourse to labor. 2) Firms in the sample have profit margins (EBITDA and EBIT) higher than Parmigiano Reggiano PDO cheese sector and respectively 16.60% and 10.28% of sales; cost per interest charge (6.56% of sales) is lower than intermediate profit margins. Data show erosion of profitability due to financial management, which becomes a critical area of management. This erosion is negatively affected by modest profit margins, on the one hand, and high corporate debt, on the other, which also influences cost of average debt. Financial valuation is useful for accessing credit, as shown by financial ratios in Table 6. The results of analysis suggest that it is necessary to apply a financial valuation approach, based on valuation of cash flows. Financial approach makes it possible to provide information that is not highlighted by traditional analysis, based only on income statement.

Table 6 - Case 2. Firms operating in aging of Parma Ham PDO – financial ratios (440 observations)

Financial ratios	**Mean**	**Median**	**> 0**	**0 <**
	(€)	**(%)**	**(N.)**	**(N.)**
ROA (EBIT : TA)	7.01%	6.20%	401	39
ROD (IC : FC)	6.29%	8.11%	440	0
ROE (NP : E)	9.93%	5.69%	389	51
			> 1	1 <
ICR1 (EBITDA : IC)	372.85%	253.04%	395	45
ICR2 (EBIT : IC)	231.28%	156.65%	286	154
ICR3 (OCF : IC)	155.61%	90.11%	201	239
ICR4 (UFCF : IC)	80.72%	60.51%	184	256
DSCR (UFCF : Debt service (DS))	59.29%	55.12%	152	288

Source: Annual account statement processed data.

Analysis of financial ratios (Table 6) shows that: 1) Analysis of financial ratios of firms in the sample shows a return on equity capital expressed by return on equity (ROE) of 9.93% on an annual basis and 5.69% as median value. Operating return on capital, expressed by return on asset (ROA) expresses a yield result equal to 7.01% as an average value and 6.20% as a median value. cost of debt (ROD) is slightly lower than ROA in average terms, but higher in median terms (8.11%). It should be noted that firms in the

sample pay a higher cost of bank debt than the operating return on capital; this determines that the increase in bank debt, with the relative cost, entails, other conditions being equal, a reduction in firm profitability. 2) Ability to pay cost of debt, calculated with ICRs, is verified if calculated with ICR1 and ICR2, while it is not verified if calculated with ICR3 and ICR4; the latter two ICRs consider financial margins (OCF and UFCF respectively) for verifying the payment of cost of debt, contrary to ICR1 and ICR2 which use income margins for this verification. In 239 cases out of 440 (ICR3) and in 256 cases out of 440 (ICR4) the payment of debt course is not sustainable, because the value of ICR is less than 1. 3) Ability to pay debt service, calculated with DSCR, it is not verified. In 288 cases out of 440, the payment of debt service is not sustainable, because DSCR value is less than 1.

The analysis of the sample data allows the following conclusions: 1) Also in Parma Ham PDO sector, the sample of firms analyzed shows that production specification causes an expansion of working capital cycle, which requires financial coverage; production structures in terms of fixed capital represent the first capital investment. This characteristic of the invested assets of firms, characterized by rigidity in disinvestment and medium-long term conversion of invested assets, determines the need for sources of coverage for stable investments, in terms of equity capital or medium-long term debt. In firms in the sample, these medium-long term funding sources are not sufficient to finance fixed capital investments, highlighting an unbalanced financial structure and the consequent non-sustainability of relationship with lenders. 2) Firms in the sample have financial debts as their main source of financing; this source of funding is greater than equity capital. Assessment of financial sustainability conducted through calculation of ICRs and DSCRs highlights non-financial sustainability. In firms in the sample, data of the ratios express that financial sustainability is not verified if the ratios calculated with a financial approach are considered (ICR3, ICR4, DSCR) which allow to correctly express the misalignment between economic cycle and financial cycle which is evidently present in the sample firms. Calculating financial sustainability by applying the traditional ICR1 and ICR2 would determine overestimation of the ability of firms to pay cost of debt.

Conclusions and policy implications

The history of agricultural credit, and the analysis of related market, allows us to state that credit institutions have expanded their loan offer to agricultural and agri-food firms (Licciardo, 2020; Ricolli, 2021). This has also been possible thanks to recent regulatory changes that have affected rules on granting of credit, including non-possessory revolving pledge,

and have favored creation of credit instruments useful for supporting the development of firms in the sector. However, many critical issues remain concerning (Bank of Italy, 2022; ISMEA, 2021): 1) information asymmetry in relationship between firm and bank, in particular the transmission of adequate data for assessment of creditworthiness; this is particularly evident for smaller firms which have greater difficulties in accessing capital market; 2) a non-homogeneous territorial distribution at national level of the offer of agricultural credit, which is concentrated in some regions, in particular in Central and Northern Italy, where firms have larger average sizes; 3) need for credit instruments capable of supporting growth of smaller agricultural firms (micro-firms, first-generation firms and/or new firms mainly composed of young people, firms located in disadvantaged territories).

Credit market trends must consider that various quasi-equity instruments are present today in financial markets, at national and international level, and can be used to support the growth of firms, even smaller ones (European Commission, 2022). In particular, expansion of the capital market will be able to favor dimensional development of agricultural firms, birth of new firms even in disadvantaged areas, and access of larger firms to financial markets. In particular, these are: 1) access to stock market, also for the SME segment; 2) bond/mini-bond issues; 3) creation of investment funds specialized in agriculture and agri-food (De Filippis, 2021); 4) public intervention, also in the form of collateral guarantees. On this last point, ISMEA manages agricultural credit guarantee activities as required by Legislative Decree 29 March, 2004, n. 102, Article 17, and by Law 30 December, 2004, n. 311, Article 1, paragraph 512. ISMEA has incorporated Special Section of Interbank Guarantee Fund referred to in Article 21 of the Law of 9 May, 1975, n. 153 and in article 45, paragraph 4, of legislative decree of 1 September, 1993, n. 385.

Business cases highlight capital intensity of firms and need to support growth with short-term and better long-term credit lines, applying financial assessment to verify sustainability of debt service. Considerations made for the cases in question can be extended with further research to other sectors of the agriculture and agri-food system, in particular for sectors characterized by significant investment needs and, consequently, financing needs to be implemented using credit lines. However, it is necessary for agricultural and agri-food firms to follow a path of financial literacy, to reduce information asymmetry with lenders, for example by envisaging adoption of balance sheet formats or budgeting and reporting systems, in particular for adoption of strategic planning tools for communicating with investors.

The role of public institutions can have a positive impact by promoting: 1) research on economic and financial trends and on granting of credit; 2) application of scoring systems designed for agricultural and agro-

food sector; 3) innovation of financial instruments to meet the needs of firms, including smaller ones; 4) innovation of support and coverage of financial instruments for risk mitigation of firms to lenders; 5) financial literacy of sector operators, also in support of sector operators; 6) support to the Legislator in a regulatory review relating to agricultural credit and related instruments. Finally, market trends have shown that they take into consideration the role of ESG (environmental, social, and corporate governance) impact that characterizes agricultural firms (Li *et al*., 2023) and that distinguishes sustainable investments defined in the Regulation of European Union EU 2019/2088 of 27 November, 2019. ESG investments have been characterized by significant growth and are highly appreciated by investors with an increase in fundraising (Bank of Italy, 2022). Investments of agricultural firms, characterized by compliance with ESG investment regulations, will be able to find funding in capital markets.

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