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Debt Sustainability Assessment in the Biogas Sector: Application of Interest Coverage Ratios in a Sample of Agricultural Firms in Italy

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Abstract: The biogas sector in Europe and Italy is attracting growing investment, combining agricultural activity, the circular economy, and renewable energy production. Firms in the sector widely use debt capital and, for this reason, there is a need to evaluate the structure of investments, financing, and debt service capacity calculated by applying interest coverage ratios (ICRs). ICRs are widely used by banks in granting loans, and calculation of ICRs allows managers and policy makers to correctly evaluate firms' performance in the sector. In this research, based on a sample of 160 observations, the structure of investments and sources of financing of firms in the biogas sector, operating in northern Italy, are analyzed. ICRs are calculated with different approaches to establish which ICRs provide the most reliable results in the application. The research analyzes the correlations and highlights significant differences between ICRs. The research highlights some important findings: (a) the NWC is negative in 109 out of 160 observations and, therefore, constitutes a source of financing in the majority of observations; (b) ICRs based on EBITDA and CF are above the threshold value of "1" in 143 and 145 observations, respectively, while ICRs based on EBIT, OCF, and UFCF are above the threshold value of "1" in 132, 133, and 122 observations, respectively. The research allows the conclusion that the ICRs based on EBITDA and CF tend to overestimate results; ICRs based on EBIT, OCF and UFCF are preferable, and can therefore be applied by managers, banks, and policy makers and be used as debt covenants. For the calculation of the repayment of the NFP, the research has highlighted that ICRs in which the cost of the debt is deducted from the numerator are preferable. The research can thus be usefully applied and expanded to other territories, or by considering a larger sample with the aim of inferring conclusions of general validity.

Keywords: biogas plant; agricultural firm; circular economy; debt covenant; interest coverage ratios (ICRs); net working capital (NWC)

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1. Introduction

Agriculture has played a central role in human history, being a major source of food with significant side effects; in fact, firms operating in the agri-food sector not only meet food demand, but also play a role in food security, local production, social and employment promotion, environmental protection, and the circular economy [1–3]. Today, the use of renewable energy has significant impacts on agriculture and land use, and various studies have highlighted how renewable energies can promote the development of the territory and the multifunctional role of agricultural activity. The European Commission states that efficient and sustainable production, processing, and utilization of biomass for energy are essential for maximizing greenhouse gas reductions and preserving ecosystem services [4]. Bioenergy is seen as a sustainable alternative in EU's renewable energy goals for 2030, but their greenhouse gas (GHG) savings may be affected by land-use-change emissions. Assessing global GHG savings from regional bioenergy targets is complex because of land-use change (LUC) effects, requiring careful analysis to prevent negative impacts [5]. Other authors have examined the growth in the biomethane sector, highlighting that its use as a renewable energy source could strengthen sustainable development and contribute to achieving the objectives of the circular economy [6,7]. In particular, biomass plants have a close relationship with agricultural production in many regional areas, particularly in the bioenergy sector [8]. Integrating agricultural activities with renewable energy production through biogas has several benefits: it helps farmers to efficiently manage waste and residues, reduces agricultural emissions, and improves soil quality and biodiversity on farmland. These activities are progressively acquiring a prominent role in agricultural activity, given the need to mitigate global warming, reducing the use of fossil fuels and guaranteeing the energy self-sufficiency of the European Union countries. Various studies have analyzed investments in biogas plants related with agricultural activity, frequently supported by public policies for agri-food investments in sustainability, with dedicated funds at local and national levels, and also with European funds [9,10]. In fact, energy production from renewable sources is generally valued as a positive externality that can provide benefits to local communities that exceed the cost of the granted public resources [11]. The application of cost benefit analysis to this topic is particularly important when considering the environmental role of renewable energy, especially with regard to the sustainable development of rural areas [12–14]. This is particularly true for renewable energy firms, which are capital-intensive and apply financial debt to finance fixed capital expenditures, as several studies have shown [15,16]. Investments in the biogas sector are associated with the role of agricultural firms in the circular economy; in fact, alongside the traditional functions of agriculture, such as food production and job creation, there are associated agri-environmental functions of protecting the territory, fighting food waste, and reusing waste from agricultural production [17–19].

Various legislative interventions aimed at guaranteeing direct incentives to firms that have made investments capable of generating positive externalities have followed in recent decades. This started with Directive 2001/77/EC, which stimulates energy production in Europe by impacting the renewable energy sources used for electricity production in the European Union that use biomass in biogas plants for the production of electricity. The EU defines biomass as the "the biodegradable fraction of products, waste and residues from biological origin from agriculture, including vegetal and animal substances, from forestry and related industries, fisheries and aquaculture, as well as the biodegradable fraction of waste, including industrial and municipal waste of biological origin" [20].

The production of energy from renewable sources therefore allows an improvement in collective well-being and, for this reason, it has been the subject of support interventions by several governments. The methods for encouraging the production of electricity from renewable energy sources were established in Italy by a Ministerial Decree (DM) issued in Italy on 6 July 2012, which gives the right to incentives for the construction of power plants not less than 1 kW. The plants can satisfy the incentive requirements if they comply with the sustainability criteria of the European Regulation (Directive 2009/28/EC and Directive 2009/30/EC, applicable in Italy with Decree 28/2011 and Decree 55/2011). These interventions by the policy maker are part of public policies to support firms and determine the use of public resources. The efficient use of public resources is important for sustainable development, especially in the current context, where available public resources are decreasing. Some authors have examined the biomethane sector in the Italian context and emphasized that public investments in renewable energy positively affect overall welfare by integrating the livestock supply chain downstream [21,22]. Other authors have examined the efficiency of public funds utilization for climate neutrality in European Union countries, indicating that investing public funds in renewable energy for climate change could be a positive step to enhance social welfare [23]. Other authors, particularly in the Italian context, have suggested that integrating renewable energies with ecosystem services could enhance biodiversity in rural and forestry areas [24]. Thanks to these public policies, in recent years, renewable energy sources have had an increasingly significant impact on electricity production in the European Union (EU) following the publication of Directive 2001/77/EC for the development of the use of renewable energy in Europe [25].

The transition to bioenergy enables the use of waste, including waste from agricultural production, for energy production by allowing the adoption of the circular economy (CE) paradigm. Various studies have considered the CE to be the most promising development in agricultural activity as a driver of sustainable development [26,27]. The adoption of CE models applied to agricultural activity has fostered and been driven by changes in public policy, both globally and at the local level, with consequent legislative interventions [28–30]. The transition to circular economy models affecting agricultural activity is also due to changes in sensitivities reflected in changes in consumer preferences, resulting in the adoption of supply strategies that respect circular economy principles [31].

In 2021, the European Union (EU) produced around 44% of its own energy, while 56% was imported, confirming the strategy of increasing the energy self-sufficiency of EU member countries, and of the EU as a whole [32]. Energy transition affects other sectors, including that of building regeneration, leading to an improvement in energy performance. This has been observed in the Italian case, where some authors have highlighted that investment in energy renovation, besides improving the comfort of the building for residents, allows for enhancing the energy performance of the building, which is a good monetary investment because it reduces future heating and cooling expenses, and consequent energy costs. [33]. The same result was achieved by some authors who dealt with the restoration of historical buildings in the UK [34]. Other authors have focused on the monetary valuation of the environmental aspects related to improving building quality [35]. In 2021 [36–38], the mix of energy sources available in the EU was composed as follows: crude oil and petroleum products (34%), natural gas (23%), renewable energy (17%), nuclear energy (13%), and solid fossil fuels (12%).

Italy has always suffered from a problem of a lack of energy self-sufficiency. In particular, Italy has satisfied its energy needs with important methane gas and petroleum derivatives. Only in recent years has a policy aimed at pursuing energy self-sufficiency using renewable energy sources been adopted. The sector has attracted growing capital, both in terms of risk capital and in terms of financing. There have also been various public support interventions in the biogas sector. Investments in renewable energy have been proven to generate high performance in agri-food firms [39,40], allowing the development of agri-environmental services and attract capital from the market, in Italy and in various European countries. Some authors have examined the appeal of renewable energy investments using data envelopment analysis (DEA), emphasizing its critical application for decision making, particularly among policy makers in the renewable energy sector [41]. Other authors have investigated the business models of individual firms concerning their ability to attract investments in renewable energy [42]. The importance of feasibility studies in facilitating investment viability [43], and the significance of effective risk management strategies to attract investments [44], have been extensively described in other research. Thanks to these trends, biogas plants for the production of electricity connected to agricultural firms have undergone a notable development in Italy in the last 10 years, both in terms of their number and the production of electricity, with a greater concentration in the northern regions of the country [45–47]. Firms operating in the biogas sector have noteworthy characteristics that are the reason for the research. They represent an interesting development in agricultural activity, classifiable as a connected activity, which has significant effects on the CE for the generation of energy. Therefore, this represents an area that has been the subject of many studies [48–50] and which is believed will be further developed to pursue strategic objectives of a political, economic, and social nature [51–53]. Firms operating in the sector, as some studies have already shown, have adequate capacity to support debt repayment and create value [54], even if they require large amounts of capital [55] in the form of debt capital or risk capital. Therefore, it is necessary to evaluate the firms' ability to meet financial commitments using adequate evaluation indices, including preventively in the planning phase [56]. The biogas sector, and ESG compliant investments in general, are attracting a growing volume of capital and, therefore, firms in the sector may be able to raise capital on the market so as to further develop the sector or related sectors in the field of alternative energy [57,58].

Article 2135 of the Civil Code (R.D. 16 March 1942, n. 262) defines an agricultural entrepreneur as a person who carries out land cultivation, forestry, animal breeding, and related activities. The related activities can be differentiated, depending on their legal source, into typical and non-typical. Among the activities connected to agriculture that are not typical, and therefore are fully classifiable as an agricultural activity, is the production of biomass. Related to the agricultural activities, biomass production is understood as the biodegradable component of products or waste obtained through agricultural and forestry activities [59,60].

The definition of agricultural firms has two significant effects on management: (1) agricultural firms regulated by art. 2135 of the Italian Civil Code, and therefore also the related activities, are exempt from the bankruptcy to which commercial firms are subjected; (2) agricultural firms are subject to a preferential tax regime, which affects both agricultural activities in the strict sense and related activities. Taxation for agricultural firms has always been extremely favorable, as the sector bears a biological and atmospheric risk which can put production at risk, which is considered an additional risk compared to the risks to which commercial firms are subject [61–64].

Several studies [65–68] have highlighted that there are two main agricultural taxation models, namely the Anglo-Saxon taxation model (ASTMAg), applied in the United States and the United Kingdom, and the Continental European countries' taxation model (EUTMAg). The ASTMAg model provides for the taxation of agricultural activities on the basis of the income tax principle and the taxation is the same as for non-agricultural activities. The EUTMAg model generally applies a single tax both on goods used in agricultural production and on income deriving from agricultural activity.

Firms operating in the biogas sector are also subject to this preferential taxation on a cadastral basis as long as the principle of prevalence is respected, which provides that the majority of the raw material used in the biogas plant derives from connected agricultural activity, as clarified by the Italian Revenue Agency (Agenzie delle Entrate, *in Italian*) with rulings consolidated over time [69–72]. For larger firms, art. 1 paragraph 423 of Law 266/2005 establishes that agricultural renewable plants are subject to a flat rate tax applied on 25% of the total amount of the revenues from energy production over 2400 MWh per year for biogas. Related agricultural activities are subject to a preferential tax regime typical of agricultural activities as long as the principle of prevalence is respected, i.e., prevailing conditions of use of the products coming from the agricultural firm compared to those purchased by third parties.

Given these premises set out in the introduction, this research aims to answer some research questions (RQs) using a sample of 16 firms operating in the biogas sector, on a series of 10 years of data, for a total of 160 observations:

1. The first research question concerns the structure of investments and sources of financing to understand the levels of debt, and the types of debt distinct in nature, resorted to by firms in the sector (RQ1).
2. The second research question concerns the analysis of the interest coverage ratios (ICRs), i.e., indices that verify the financial sustainability of firms' access to credit [73,74], applied to the firms in the sample to verify whether the firms are able to pay the cost of debt (RQ2a), are able to repay the financial debt (RQ2b), and are able to jointly repay the financial debt and pay the cost of debt (RQ2c).
3. After applying the ICRs, this research develops two other research questions, which concern the analysis of the correlation between ICRs (RQ3) and the verification of the statistically significant difference between ICRs (RQ4).

The answer to the RQs has three general objectives: (1) verify whether firms in the biogas sector, which require high amounts of capital often raised as debt capital, are able to pay the cost of debt and repay the debt contracted; (2) analyze, between the various

ICRs, whether there are correlations and/or significant differences, so as to identify the ICRs that are more correctly applicable; and (3) make the information of the previous objectives (1) and (2) available to the policy maker who has committed in the past, and still commits, significant public resources in the sector, so as to be able to evaluate: (3a) whether these resources are used in business with prospects of continuity; (3b) the ICRs that are most correctly applicable, so as to require the processing of these indices when applying for access to public funding.

The research answers all these questions and, in summary, the following can already be observed from the introduction: (1) Regarding RQ1, the firms in the biogas sector included in the sample are heavily indebted, and widely use financial debt and net working capital for the financing of investments, and, therefore, the calculation of the ICRs becomes imperative. (2) The ICRs analyzed have an asymmetric distribution shape, with high kurtosis, and are therefore divergent from the normal distribution. The ICRs are highly correlated with each other but it emerges that there are statistically significant differences between the medians of the ICRs which, therefore, cannot be used as alternatives to each other, given that they are different from each other. (3) The policy maker should be advised that not all ICRs are adequate for evaluating the relationship of biogas firms with financiers and that, in any case, these firms need adequate tools to control the payment of debt service, considering the high level of capital intensity and leverage found in the firms in the sector sample.

2. Materials and Methods

To answer the RQs, the research plan considers the data of a sample of 16 agricultural firms operating in the sector of electricity generation from biogas plants; a 10-year time series is considered, for a total of 160 observations, from 2012 to 2021. The research sample includes firms that are legally and operationally based in the regions of Emilia Romagna, Lombardy, and Veneto, in the northern part of Italy. All the firms in the sample are active in the form of capital firms, specifically limited liability firms (società a responsabilità limitata, *in Italian*) or joint stock firms (società per azioni, *in Italian*), as defined respectively by articles 2462 and 2325 of the Italian civil code.

The extraction of the firms to be included in the sample was carried out via the database of the Regulatory Authority for Energy, Networks and the Environment [75]. From an original sample of 85 firms, the research sample was selected according to this research plan: (a) cooperative firms were excluded from the sample; 12 firms that are active in the form of cooperative firms were excluded; (b) included firms exclusively carry out electricity production activities from biogas plants and therefore have characteristics as special purpose vehicles (SPVs); the information for the selection of firms was found by reading the additional notes attached to the firms' annual report and, consequently, 43 firms were excluded because they operate in agricultural activities, and not only in energy production using biogas plants; (c) the database was further refined by excluding 14 other firms, including 10 firms for which the annual account was not filed in the public database and 3 firms presenting a partial series of annual accounts. Therefore, the final database used in the research comprised 16 agricultural firms operating as an SPV in the biogas sector, with a complete 10-year annual account time series, for a total of 160 observations.

All data were extracted from the AIDA database, which is available free of charge for research purposes at the University of Parma. All data used for the research are public. Data analysis was performed with (a) MS Excel™ and (b) IBM™ SPSS Statistics, version 29. It is necessary to specify in the research plan that sole proprietorship and partnership firms were excluded from the sample because the annual reports on these firms are not public.

To address RQs, we utilized firms' annual accounts as a source of data, which serve as the statistical foundation commonly employed by banks and financiers for evaluations. Specifically, we examined the mean and median values, standard deviation (S.D.), skewness (g1), and kurtosis (g2) of the sample observations of the firms. This enabled us to quantify the key economic and financial metrics of the sample observations. To proceed with the analysis, it was necessary to assess whether the distribution of the observations adhered to a normal distribution. To this end, we applied the Shapiro–Wilk test. Subsequently, two statistical tests were conducted. The first test pertained to correlation, utilizing the non-parametric Spearman's rho approach (ρ), while the second involved assessing the null hypothesis of inequality between median values, using the T-Wilcoxon for paired samples test. This methodology allowed us to determine the correlation between ICRs calculated using the economic approach (EA) and the cash flow approach (CFA), as well as to ascertain whether they exhibited statistically significant differences. The finding holds theoretical significance as it enabled us to discern potential disparities between the EA and CFA approaches in computing ICRs. Moreover, the practical relevance is noteworthy, as ICRs derived from various approaches are extensively utilized by banks, companies, and policy makers to assess credit accessibility and project financing within the renewable energy sector.

The Du Pont approach, which applies financial ratios (FRs), is widely applied and is the subject of several studies to assess firms' performance [76–80]. FRs are frequently applied by banks to evaluate the firms' rating [81–87]. Among the FRs, interest coverage ratios (ICRs) are widely applied by banks and managers to assess the sustainability of a firm's financial cycle [88]. Many studies have also analyzed the application of ICRs as debt covenants (DCs) in financing operations [89–91]. The importance of DCs has been the subject of several studies, which have highlighted that the use of DCs makes it possible to reduce the variability in the loan portfolio of bank financing, controlling the agency problem and reducing opportunistic behavior caused by information asymmetry. This approach aligns with the managerial theory of the firm and addresses agency costs, as outlined in the seminal work of Jensen and Meckling [92]. In this field of research, some authors have examined the impact of debt covenants on debt pricing [93], while others have focused on their role in accessing credit and alleviating financial constraints [94]. Additionally, regarding the reduction in information asymmetry, other authors have explored the function of debt covenants in mitigating the risk of fraud and bankruptcy [95]. A recent study has provided a novel perspective by investigating how companies assess the presence of debt covenants and their influence on seeking alternative financing sources [96].

The covenants applied in bank loan contracts [97–99] are financial leverage and the current ratio; ICRs are also frequently applied. Certain economic margins, such as EBIT, have traditionally been applied to test a firm's ability to pay debt costs, and ICRs are calculated and applied in DCs. However, EBITDA and EBIT do not directly represent cash flows (CFs) available to pay debt costs, but rather provide an approximation; if EBITDA/EBIT-based ICRs differ from CF-based ICRs, ICRs provide distorted information about a firm's ability to sustain its debt cycle [100]. Banks often include one or more FCs in their financing contracts that impose a minimum ICR. The methodology of calculating ICRs requires exposing two calculation approaches. The first calculation approach is the economic approach (EA), which is considered the traditional approach for calculating ICRs. EA calculates the ICRs while considering, in the numerator of the formulas, economic (income) margins; therefore, it is necessary to develop these margins. To calculate the value of production in the current period, we summed up the value of the turnover in the current period with the value of the inventory variation for the stored production (unsold production), according to Equation (1) [101]:

$$VP_t = T_t + (I_t - I_{t-1}) = T_t + \Delta I_{t,t-1} \quad (1)$$

where VP_t is the value of production at moment t, T_t is turnover (sales) at moment t, $\Delta I_{t,t-1}$ is the variation in stocks related to unsold production, I_t is the value of stocks related to unsold production in the current period, and I_{t-1} is the value of stocks related to unsold production in the base (reference) period.

In Equation (1), for a given time (t), T_t are sales (turnover) at time t, I_t and I_{t-1} are inventories at time t and t − 1; $\Delta I_{t,t-1}$ is the variation of inventories during the fiscal year.

The first explicit margin utilized in the EA approach is EBITDA (earnings before interest, tax, depreciation, and amortization), calculated according to Equation (2):

$$EBITDA_t = VP_t - (M_t + S_t + R_t + L_t + O_t) = VP_t - MC_t \quad (2)$$

where VP represents the value of production, calculated as the cumulative value over the fiscal year from its inception to its end. The operative monetary values are raw material costs (M_t), costs for services (S_t), rent and leasing costs (R_t), labor costs (L_t), and other operative costs (O_t). We express $M_t + S_t + R_t + L_t + O_t = MC_t$, where MC_t is the total amount of monetary cost. MC is the amount of cost with a direct impact on the firm's liquidity. To apply EA, we have to summarize non-monetary operating costs for amortization of tangible and intangible fixed assets (D_t) and depreciation and risk provisions (A_t). In Equation (2), several studies have shown that EBITDA could be used to approximate [101–104] the creation of liquidity and its costs, such as net of non-monetary costs ($D_t + A_t$). The application of EBITDA to approximate cash creation, however, requires a steady state, given by two hypotheses: (1) investments in fixed capital are equal to D + A; and (2) there are no changes in sales and there are no changes in the duration of the cash conversion cycle (CCC). The CCC is the sum of the extension granted to customers in terms of accounts receivable (AR_DAYS), plus the duration of the transformation cycle in the warehouse in days (INV_DAYS), minus the duration of the extension granted by suppliers in terms of accounts payable (AP_DAYS), as follows: CCC = AR_DAYS + INV_DAYS − AP_DAYS. The second explicit margin utilized in the EA approach is EBIT (earnings before interest and tax), calculated according to Equation (3):

$$EBIT_t = EBITDA_t - (D_t + A_t) \quad (3)$$

The EBIT margin is widely applied by professionals to quantify the result of operational management, before the payment of financial charges. The balance of financial operations (SF), in terms of interest income and interest expenses, is calculated according to Equation (4):

$$SF_t = {}^{-}I_t + {}^{+}I_t \quad (4)$$

where ${}^{-}I_t$ represents interest expense at time t and ${}^{+}I_t$ represents interest income at time t; the profit before taxes (${}^{bT}\Pi_t$) is calculated according to Equation (5):

$$^{bT}\Pi_t = EBIT_t - SF_t \quad (5)$$

where SF is subtracted, because by convention ${}^{+}I_t > {}^{-}I_t$. The profit available for the remuneration of equity holders is computed as per Equation (6):

$$^{aT}\Pi_t = {}^{aT}\Pi_t - T_t \quad (6)$$

where ${}^{aT}\Pi_t$ is profit after taxes (${}^{aT}\Pi_t$) and is given as follows and T_t represents income taxes. We can proceed by applying the cash flow approach (CFA) to the calculation of the ICRs; it is now necessary to use the calculation method of other margins of a financial nature, which can be used in the calculation of the ICRs, alternatively to the margins calculated with the EA. If, in fact, EA uses intermediate income margins, CFA applies different types of available cash flow (CF); for CFA calculation, it is necessary to apply the cash flow statement (CFSta), which is the table used to calculate the CFs. The CFSta is widely applied in practice [105], and is governed by international [106–108] and Italian accounting standards [109]. It has also been studied in various studies, including those relating to agri-food [110–112]. The first financial margin calculated with CFSta is cash flow (CF), calculated according to Equation (7):

$$CF_t = {}^{aT}\Pi_t + (D_t + A_t) + SF_t \quad (7)$$

An additional financial margin, defined as operating cash flow (OCF), is calculated according to Equation (8):

$$OCF_t = CF_t - (NWC_t + NWC_{t-1}) \tag{8}$$

where NWC_t is net working capital and is the sum of accounts receivable (AR) plus the value of inventories stock (INV) minus the accounts payable (AP), as follows: NWC = AR + INV − AP. The management NWV cycle is a strategic variable in the management of corporate liquidity, and defines working capital management (WCM), which has been the subject of many studies [113–116]. A WCM strategy in which NWC < 0 is called aggressive WCM, because payables to suppliers (AP) are greater than receivables from customers (AR) and inventories in stock (INV), as follows: AP > AR + INV. In other words, CCC is financed by suppliers and NWC represents a source of financing. On the other hand, NWC > 0 is called conservative WCM, because payables to suppliers (AP) are lower than receivables from customers (AR) and inventories in stock (INV), as follows: AP < AR + INV. In other words, CCC represents an investment that is only partially financed by suppliers. For definition, if NWC > 0 ⇒ CCC > 0 and vice versa. The dynamics of NWC has a direct effect on the generation of liquidity and, consequently, in the calculation of ICRs in the FA. In fact, we can express $\Delta^{+}NWC_{t,t-1} \Rightarrow \Delta^{-}OCF_{t,t-1}$, so that an increase in NWC implies an increase in the absorption of liquidity with a reduction in OCF ($\Delta^{-}NWC_{t,t-1} \Rightarrow \Delta^{+}OCF_{t,t-1}$). An increase in inventories ($\Delta^{+}I_{t,t-1}$), as a positive income item, implies a reduction in OCF $\Delta^{\pm}It,t-1 \Rightarrow \Delta^{\mp}OCF_{t,t-1}$ with $|\Delta^{\pm}I_{t,t-1}| = |\Delta^{\mp}OCF_{t,t-1}|$ according to Equation (9):

$$UFCF_t = OCF_t - (FAI_t + FAI_{t-1}) - (D_t + A_t) \tag{9}$$

where $UFCF_t$ is unlevered free cash flow and FAI is investment in fixed assets. Given OCF_t, the liquidity absorption in FAI has an effect on $UFCF_t$, given that $[(FAI_t - FAI_{t-1}) - (D_t + A_t)] > 0 \Rightarrow \Delta\text{-}UFCF_{t,t-1}$, and vice versa. $UFCF_t$ is the cash flow available after $\Delta^{\pm}FAI_{t,t-1}$. The cash flow available to remunerate financial equity capital is the free cash flow to equity (FCFEt), which is a measure of cash flow used to express the availability of the monetary amount available for the distribution of dividends to equity holders, and is calculated according to Equation (10):

$$FCFE_t = UFCF_t - SF_t \tag{10}$$

If FCFE > 0, it is then possible to pay to equity holders the dividend in a share α of profit that is $1 \geq \alpha \geq 0$ without increasing the financial debt (NFP). FCFE can also be used for making non-discretionary investments or for repaying NFP.

Given EA and CFA for ICR calculation, in this research we propose a panel of 15 ICRs applied to data observations. ICRs are divided into 2 categories; the ratios ICR1 and ICR6 are marked with the letters "EA", which express the EA application (ICR1_EA to ICR6_EA); the ratios from S7 to S15 are marked with the letters "CFA", which express a cash flow type approach (ICR7_CFA to ICR15_CFA). We use the "EA" approach to formulate ICRs expressing firms' capacity to cover the cost of debt (SF) using an EA margin:

$$ICR1\_EA_t = EBITDA_t : SF_t \tag{11}$$

Equation (11) expresses a firm's capacity to cover SF with an EBITDA margin.

$$ICR2\_EA_t = EBIT_t : SF_t \tag{12}$$

Equation (12) expresses a firm's capacity to cover SF with an EBIT margin. The application of ICRs could also consider the repayment of the NFP, and therefore we can calculate the capacity of firms to repay the NFP using an economic value stream:

$$ICR3\_EA_t = EBITDA_t : NFP_t \tag{13}$$

Equation (13) expresses a firm's capacity to perform NFP repayment with an EBITDA margin. For the purposes of calculating ICRs, NFP is the net financial position, which is defined as [117] "*cash and cash equivalents plus readily monetizable securities, time deposits and financial collateral provided, less financial borrowings, plus positive and minus negative fair values of derivative financial instruments*".

$$\mathrm{ICR4\_EA_t = EBIT_t : NFP_t} \quad (14)$$

Equation (14) expresses a firm's capacity to perform NFP repayment with an EBIT margin. We can add the cost of debt (SF) consideration by modifying Equation (13), and then formulate according to Equation (15):

$$\mathrm{ICR5\_EA_t = (EBITDA_t - SF_t) : NFP_t} \quad (15)$$

where the deduction of SF from the EBITDA margin is explicitly considered to quantify the firm's capacity to repay NFP. Accordingly, Equation (14) can also be modified:

$$\mathrm{ICR6\_EA_t = (EBIT_t - SF_t) : NFP_t} \quad (16)$$

where the deduction of SF, in this case from the EBIT margin, is explicitly considered to quantify the firm's capacity to repay the NFP. We now consider the CFA approach to calculate the ICRs:

$$\mathrm{ICR7\_CFA_t = CF_t : SF_t} \quad (17)$$

In Equation (17), the ICR is calculated with respect to the ability of CF to cover SF; Equation (17) could be rewritten considering OCF as a relevant financial margin:

$$\mathrm{ICR8\_CFA_t = OCF_t : SF_t} \quad (18)$$

In Equation (18), the relevant margin for calculating ICR is OCF; we can formulate another ICR:

$$\mathrm{ICR9\_CFA_t = UFCF_t : SF_t} \quad (19)$$

In Equation (19), the relevant margin for calculating ICR is UFCF. In Equations (17)–(19), we apply financial margins, calculated with CFA, to quantify a firm's capacity to cover the cost of debt (SF). The application of ICRs could even consider NFP repayment:

$$\mathrm{ICR10\_CFA_t = CF_t : NFP_t} \quad (20)$$

In Equation (20), the relevant margin is CF.

$$\mathrm{ICR11\_CFA_t = OCF_t : NFP_t} \quad (21)$$

In Equation (21), the relevant margin is OCF.

$$\mathrm{ICR12\_CFA_t = UFC_t : NFP_t} \quad (22)$$

In Equation (22), the relevant margin is UFCF. In Equations (20)–(22), we apply financial margins calculated with CFA to quantify the firm's capacity to repay NFP. It is suggested that the formulation of Equations (20)–(22) be improved by taking into account the cost of debt (SF) in quantifying the repayment of the NFP. We can therefore rewrite Equations (20)–(22):

$$\mathrm{ICR13\_CFA_t = (CF_t - SFt) : NFP_t} \quad (23)$$

In Equation (23), the deduction of SF, in this case from the CF margin, is explicitly considered to quantify the firm's capacity to repay NFP.

$$\mathrm{ICR14\_CFA_t = (OCF_t - SFt) : NFP_t} \quad (24)$$

In Equation (24), the deduction of SF from the OCF margin is explicitly considered to quantify the firm's capacity to repay NFP.

$$ICR15\_CFA_t = (UFCF_t - SFt) : NFP_t \quad (25)$$

In Equation (25), the deduction of SF from the UFCF margin is explicitly considered to quantify the firm's capacity to repay NFP. ICRs with CFA are calculated by directly exposing the CFs and not by approximating the CF through profit margins (EBITDA and EBIT). ICRs with CFA are calculated considering, in the respective formula, the cost of income taxes (T_t), which is considered in the CFs, while it is not considered in EBITDA and EBIT.

In this research, the number of useful observations varies between two indicator groups: one comprising ICRs with SF as the denominator, and the other with NFP as the denominator. ICRs calculating NFP repayment are meaningful only when NFP > 0, indicating it as a financing source. Conversely, if NFP < 0, representing an investment, ICR calculation is irrelevant as there is no debt to repay. Out of 160 observations, 147 indicated NFP as a financing source, allowing ICR calculation using NFP as the denominator. For all 160 observations, ICRs with SF as the denominator were calculated. The cash flow adequacy approach surpasses the traditional collateral-based creditworthiness assessment approach and, therefore, applies it to the provisions of compliant banking regulations resulting from Basel II and Basel III agreements [118–120].

For the assessment of creditworthiness, several studies have shown that, even in the renewable energy sector, financial operations have the characteristics of legal isolation and isolation of financial flows [121,122]. These characteristics assimilate financing operations in renewable energy to pure project financing operations (PFOs), conducted on special purpose vehicles (SPVs). The European Commission has underscored the challenges faced by agricultural businesses in accessing financial resources, citing factors such as high capital investment relative to turnover, the average age of entrepreneurs, and the prevalent lack of financial literacy among operators, particularly among smaller entities [123]. Regarding this topic, a recent study for Italy dealt with the evaluation of investments in the biogas sector, proposing a theoretical approach to estimate the return on investments in biogas sector investments in the presence of incentives by applying the real options approach [124]. Other studies have developed the topic of measuring the financial sustainability of investments in the food sector in general and biogas in particular [125,126]. Recent research has dealt with the methodologies for drawing up feasibility plans for agricultural biogas plants, applying the approach to companies in the Ukrainian territory [127] and Thailand [128]. Another study analyzed the topic of feasibility in the biogas sector from the point of view of the bank financing the investment [129].

3. Results

3.1. Main Result for RQ1

It is useful to present the results of the research starting from the balance sheet data which, as is known, show the investments and sources of financing. In Table 1, we apply a balance sheet scheme compliant with the format total asset/total source (TA/TS); the table shows the descriptive statistics data for all 160 research observations. Table 2 shows the balance sheet data of the firms in the sample observations; data are divided into an active section, which represents investments (TA), and a passive section, which represents sources of financing (TS).

The data highlight that the majority of investments are in FAI, i.e., land, plant, and machinery. FAI absorbs 67.22% of TA; the value is confirmed by the median (69.89% of TA). Investments in WC^{+}_TOT have a lower impact, and are on average 28.02% of TA, while liquidity is 4.76% of TA. The research highlights that equity capital is a very modest source of funding, funding only 6.28% of investments on average, with 1.25% being the median value. Instead, the first source of financing is the FD, which is 55.73%, on average, of the financing sources (56.51% for the median value); WC^{-}_TOT, as a financing source, is 37.98% of the financing sources. It can be observed that is $WC^-\_TOT > WC^+\_TOT$ and this has consequences that NWC has a negative value and firms apply, on average, an aggressive WCM strategy. The majority of the observations in Table 1 have g1 values close to zero, and therefore the distribution is symmetrical. There is a notable asymmetry in the distribution of E (g1 equal to 1.80), expressing positive asymmetry (g1 > 0) and high kurtosis, with a g2 value equal to 2.78. The asymmetric distribution, with kurtosis, of indicator E highlights that the use of E has a median value lower than the mean. Therefore, we can infer that there are many observations with relatively low E, and some anomalous observations with higher E. The value of indicator A, even if characterized by asymmetry and high kurtosis, does not prejudice the research, given the very low mean and median value of these balance sheet data.

Table 1. Descriptive statistics of balance sheet (TA/TS format).

Indicators	Mean EUR	Mean %TA	Median EUR	Stand. Dev.	Skewness g1	Kurtosis g2
A	181	0.00%	0	1670	9.95	103.17
FAI	3,456,535	67.22%	3,545,633	1,574,913	−0.30	−0.18
WC^+_TOT	1,441,004	28.02%	1,369,951	666,303	0.96	1.31
L	244,615	4.76%	247,261	168,572	0.66	0.24
TA	**5,142,336**	**100.00%**	**5,073,237**	**1,751,374**	**−0.03**	**−0.33**
E	323,060	6.28%	63,528	559,473	1.80	2.78
WC^-_TOT	1,953,298	37.98%	1,514,912	1,304,276	1.30	1.41
FD	2,865,978	55.73%	2,866,649	1,686,850	0.24	−0.21
TS	**5,142,336**	**100.00%**	**5,073,237**	**1,751,374**	**−0.03**	**−0.33**

A—Receivables from company shareholder; FAI—investment in fixed assets; WC^+_TOT—positive working capital (investment); L—positive liquidity; TA—total asset (investment); E—Equity (risk) capital; WC^-_TOT—negative working capital (source of capital); FD—financial debt (source of capital); TS—total source (source of capital).

Table 2. Descriptive statistics of balance sheet (NIC/TNS format).

Indicators	Mean EUR	Mean %TA	Median EUR	Stand. Dev.	Skewness g1	Kurtosisg2
FAI	3,456,535	117.39	3,545,633	1,574,913	−0.30	−0.18
NWC	−512,114	−17.39	−319,740	1,285,753	−0.80	2.70
NIC	**2,944,422**	**100.00**	**3,027,341**	**1,714,646**	**0.12**	**−0.24**
E	323,060	10.97	63,528	559,473	1.80	2.78
NFP	2,621,362	89.03	2,564,045	1,679,489	0.30	−0.14
TNS	**2,944,422**	**100.00**	**3,027,341**	**1,714,646**	**0.12**	**−0.24**

NWC—net working capital; NIC—net invested capital; NFP—net financial position; TNS—total net source.

For this analysis, the aggregate data from Table 2 were calculated; the table shows the descriptive statistics data for all 160 research observations. Displaying the data as shown in Table 2 has the advantage of expressing, as fixed values, FAI among investments and E among financing sources. Instead, NWC and NFP can represent both investments and sources of financing.

Data show that NWC has a negative average value of (−)EUR 512,114, which is also confirmed by the median value of (−)EUR 319,740. If NWC is a source of financing (it is used in NIC with a negative sign), this source is superior to equity capital (E) which, therefore, is the third source of financing, last after NFP and NWC. The data highlight that NFP is the first source of capital, with an average value of EUR 2,612,362, which is also confirmed by the median value EUR 2,654,045. NFP, compared with the E value. This shows the negligible weight of E among the sources of financing of the firms and the high leverage strategy, confirmed by the NWC aggressive strategy, as a source of financing. As observed for the values shown in Table 1, the results of Table 2 confirm the asymmetry and high kurtosis for E, while the other indicators are symmetrical.

Other relevant results come from the analysis of the income statements of the firms in the sample (Table 3); the table shows the descriptive statistics data for all 160 research observations.

The data highlight some relevant results. The annual production value (VP) of the sample observations is 2040 EUR/Mil. (average) and 2235 EUR/Mil. (median); VP, unique among the indicators in Table 3, has high negative skewness (−2.04) and high kurtosis (3.81).

The asymmetry confirms the analysis of the mean value, which is lower than the median; this result expresses that, in the sample, there are some observations with abnormally low VP, where most of the observations concern large plants, with relatively higher VP. The EBITDA margin is 25.22% on average (median value 23.51%) VP. The observations on EBITDA indicate that the firms in the sample reach a level of performance on EBITDA that makes them interesting as target firms for investors who, according to various literature, consider the level of EBITDA discriminant for target firms for acquisition [130,131]. The incidence of D + A is 14.69% on average, with a median of 15.02%, of VP; this evidence confirms that investments in FAI are high compared to VP. As a result, the EBIT margin is significantly reduced compared to EBIT (10.53% on average and an 8.12% median of VP). The value of EBIT must be observed in relation to net interest (SF), which erodes EBIT, since SF is 6.75% on average and has a 5.93% median of VP. Profit, before (${}^{bT}\Pi$) and after (${}^{aT}\Pi$) taxes, has a low value compared to VP, i.e., 0.82% and 0.28%, respectively (median value), which are higher than mean values.

Table 3. Descriptive statistics of income statement (value added format).

Indicators	Mean EUR	Mean %VP	Median EUR	Stand. Dev.	Skewness g1	Kurtosis g2
(+) VP	2,040,565	100.00	2,235,027	527,982	−2.04	3.81
(−) MC	−1,526,005	−74.78	−1,608,769	418,869	1.08	1.46
(=) EBITDA	**514,560**	**25.22**	**525,560**	**297,575**	**−0.23**	**−0.28**
(−) D + A	−299,662	14.69	−335,707	153,858	0.72	−0.42
(=) EBIT	**214,897**	**10.53**	**181,528**	**206,987**	**0.35**	**0.24**
(+/−) SF	−137,762	−6.75	−132,628	86,381	−0.33	−0.49
(=) ${}^{bT}\Pi$	**77,135**	**3.78**	**18,235**	**200,880**	**0.24**	**1.62**
(+/−) T	−19,798	−0.97	−10,920	43,619	−0.01	3.52
(=) ${}^{aT}\Pi$	**57,337**	**2.81**	**6318**	**170,602**	**0.44**	**2.48**

VP—value of production; MC—monetary costs; EBITDA—earnings before interest, taxes, deprecations and amortizations; D + A—Deprecations and amortizations; EBIT—earnings before interest and taxes; SF—net interest; ${}^{bT}\Pi$—profit before taxes; T—income taxes; ${}^{aT}\Pi$—profit after taxes.

Analyzing the CFSta for observations (Table 4) highlights other noteworthy findings; the table shows the descriptive statistics data for all 160 research observations. Indicators in Table 4 expresses the cash flow generation data for the observations included in the sample.

Table 4. Descriptive statistics of cash flow statement (indirect format).

Indicators	Mean €	Median €	Stand. Dev.	Skewness g1	Kurtosis g2
(+) **CF**	**494,762**	**502,813**	**274,525**	**−0.23**	**−0.28**
(+/−) $\Delta^{\pm}$NWC	−233,452	−102,403	1,092,799	−1.24	6.87
(=) OCF	**261,310**	**412,681**	**1,187,955**	**−1.10**	**5.82**
(+/−) $\Delta^{\pm}$FAI	−78,710	−38,928	614,067	4.78	43.27
(=) UFCF	**182,600**	**290,779**	**1,332,646**	**−1.25**	**6.56**
(+/−) SF	−138,734	−133,652	85,043	−0.31	−0.49
(=) FCFE	**43,866**	**203,926**	**1,341,386**	**−1.37**	**6.64**

CF—cash flow; $\Delta^{\pm}$NWC—$\Delta^{\pm}$ in net working capital; OCF—operating cash flow; UFCF—unlevered free cash flow; SF—net interest; FCFE—free cash flow to equity.

The CF has similar values for the mean and median value (EUR 494,762 and EUR 502,813 respectively); observations highlight a capital absorption in the NWC cycle of EUR 233,452 on average (median value EUR 102,403). NWC is a source of capital in the static analysis of the balance sheet; in the dynamic analysis, given by CFSta, it emerges that NWC as a source of capital is reduced and absorbs capital, and then research data expose a decline in NWC's aggressive management policy. OCF has a strongly differentiated value between the mean value and the median value; this is given by the lower median absorption of NWC compared to the average value. Median OCF (EUR 412,681) is approximately 18.5% of VP, a lower value than the median EBITDA (23.51%), but slightly higher than the median EBIT (15.02%). This result is further developed in the calculation of ICRs with the EA and CFA approaches. The observations highlight the generation of cash flows that are adequate for the coverage of SF with OCF. On this point, the following can be observed: (a) The impact of investments in FAI is limited (median value EUR 38,928). FAI is generally completed in the initial phase of the project, considering that the firms covered by the research are SPVs and, therefore, have made investments in the startup phase. (b) FAI is financially covered with E and NFP in general, while the OCFs and, consequently the UFCFs, are intended to cover the SFs and, if necessary, reduce NFP, according to a scheduled amortization plan. UFCF confirms the difference between the mean value and the median value (respectively, EUR 182,600 and EUR 290,779) and, therefore, results confirm the asymmetry of its distribution (g1 = −1.26). UFCF, in particular for the median value, is higher than SF (average value (−)EUR 138,734 and median value (−)EUR 133,652); SF has a modest asymmetry (g1 = −0.31). The observations highlight that (a) median UFCF is 221% of median SF, and this highlights the ability to cover SF also with UFCF; and (b) FCFE has a mean value of EUR 48,988 and median of EUR 223,758, with asymmetry of the distribution of FCFE (g1 = −1.37).

Some notes are further required regarding the signs of the margins calculated according to EA and CFA (Table 5); the table shows the results for all 160 research observations.

Table 5. Threshold value analysis of indicators calculated with EA and CFA approach.

Indicators	Indicator Value ≥ 0 (Absolute Value)	Indicator Value < 0 (Absolute Value)	Indicator Value ≥ 0 (Relative Value)	Indicator Value < 0 (Relative Value)
EBITDA	151	9	94.38%	5.63%
EBIT	142	18	88.75%	11.25%
$^{aT}\Pi$	119	41	74.38%	25.63%
CF	151	9	94.38%	5.63%
OCF	126	34	78.75%	21.25%
UFCF	123	37	76.88%	23.13%
FCFE	113	47	70.63%	29.38%
NFP	147	13	91.88%	8.13%
NWC	51	109	31.88%	68.13%

A large majority of observations for EA margins are >0, for both EBITDA and EBIT; it should be noted that 41 observations out of 160 (25.63%) are negative for $^{aT}\Pi$ and this can highlight that (a) an actual lack of value creation in some of the firms observed in the sample, and (b) a high incidence of D + A and, therefore, income generating capacity of the plants, at the end of the useful life, must be considered. All cash flow margins express a moderately negative asymmetry. As regards the margins calculated with CFA, if CF has positive values substantially in line with the EA margins, it is observed that OCF drops (126 positive observations out of 160), and this indicates that, in 34 cases out of 160 (21.25%), there is no financial sustainability for additional investments in FAI and for the payment of SF. UFCF data are substantially aligned with OCF (123 positive observations out of 160); therefore, as for $^{aT}\Pi$, FCFE observations are also partly negative, with 113 observations out of 160. In a reduced number of cases (13 observations out of 160), NFP is an investment and has a negative sign, and, therefore, for these observations, there is no need to cover the payment of NFP with EA or CFA margins. Furthermore, for 51 out of 160, NWC has a negative sign, and therefore it is a source of financing. The research therefore has an interesting result because there is evidence that the firms in the sample use, in addition to NFP, NWC as a source of financing.

3.2. Main Result for RQ2

The heart of the research findings is set out in Table 6, and the research highlighted these main results. The table displays descriptive statistics for 160 and 147 research observations, respectively, based on whether SF or NFP is the denominator of the calculated ICRs. First, median ICR1_EA (~4.05) is higher than median ICR2_EA (~1.13), with, respectively, 143 and 122 (as shown below, in Table 7) observations > 1, that is the threshold value of the sustainability of the SF payment, calculated with the application ICRs (RQ2a). The distributions are negatively asymmetric (g1) and differ from the normal distribution in the flattening (kurtosis) of the distribution (g2). Median ICR7_CFA (~3.85) is higher than ICR8_CFA (~3.37) and ICR9_CFA (~3.04) with, respectively, 145, 119, and 114 (as shown below, in Table 7) observations > 1; also, for these three ICRs, the distribution is negatively asymmetric (g1) and differs from normal in the kurtosis of the distribution (g2). It can be noted that the median value of ICR2_EA is lower than the other ICRs considered here, even if the number of observations > 1 is relatively high (122). This result highlights the concentration of this ICR around values slightly higher than the threshold value of 1. On this point, see, in the Appendix A, Figure A1a and Tables A1–A3, which confirm the result (for ICR2_EA, 71 observations where 1 < ICR2_EA ≤ 2).

Table 6. Descriptive statistics of ICRs calculated with EA and CFA approaches.

Indicators	Observ. n.	Mean	Median	Stand. Dev.	Skewness g1	Kurtosis g2	Shapiro–Wilk Test
ICR1_EA	160	−42.6839	4.0451	586.3646	−12.6355	159.7655	W-Stat = 0.0578 alfa = 0.0500 Not-Normal
ICR2_EA	160	−47.6612	1.1286	600.4990	−12.6123	159.3582	W-Stat = 0.0582 alfa = 0.0500 Not-Normal
ICR3_EA	147	0.5125	0.2157	3.0445	12.0261	145.3875	W-Stat = 0.0597 alfa = 0.0500 Not-Normal
ICR4_EA	147	0.2253	0.0644	1.4414	11.9811	144.6449	W-Stat = 0.0585 alfa = 0.0500 Not-Normal
ICR5_EA	147	0.3692	0.1579	1.9980	11.9020	143.3417	W-Stat = 0.0586 alfa = 0.0500 Not-Normal
ICR6_EA	147	0.0820	0.0063	0.4049	10.4680	119.9076	W-Stat = 0.0885 alfa = 0.0500 Not-Normal
ICR7_CFA	160	−30.2396	3.8455	425.9275	−12.6213	159.5172	W-Stat = 0.0953 alfa = 0.0500 Not-Normal
ICR8_CFA	160	−1151.5075	3.3679	13,654.968	−12.5707	158.6128	W-Stat = 0.1079 alfa = 0.0500 Not-Normal
ICR9_CFA	160	−1153.5149	3.0413	13,669.692	−12.5689	158.5796	W-Stat = 0.2282 alfa = 0.0500 Not-Normal
ICR10_CFA	160	0.4862	0.2045	2.8656	12.0262	145.3880	W-Stat = 0.0884 alfa = 0.0500 Not-Normal
ICR11_CFA	147	0.4488	0.1749	3.2678	11.3890	135.2668	W-Stat = 0.1544 alfa = 0.0500 Not-Normal
ICR12_CFA	147	0.3205	0.1542	1.8588	8.2226	80.8334	W-Stat = 0.2939 alfa = 0.0500 Not-Normal
ICR13_CFA	147	0.3429	0.1528	1.8193	11.8860	143.0776	W-Stat = 0.1099 alfa = 0.0500 Not-Normal
ICR14_CFA	147	0.3055	0.1260	2.2499	10.5465	122.5286	W-Stat = 0.2177 alfa = 0.0500 Not-Normal
ICR15_CFA	147	0.1772	0.0927	1.1016	4.4881	37.1519	W-Stat = 0.4797 alfa = 0.0500 Not-Normal

Table 7. Threshold values analysis of ICRs calculated with EA and CFA.

Indicators	Indicator Value ≥ 0 (Absolute Value)	Indicator Value < 0 (Absolute Value)	Indicator Value ≥ 0 (Relative Value)	Indicator Value < 0 (Relative Value)
ICR1_EA	143	17	89.38%	10.63%
ICR2_EA	122	38	76.25%	23.75%
ICR7_CFA	145	15	90.63%	9.38%
ICR8_CFA	119	41	74.38%	25.63%
ICR9_CFA	114	46	71.25%	28.75%

The application of this set of ICRs expresses the ability to repay NFP with EA and CFA margins, without considering, however, as a deduction, the cost of SF, and, therefore, overestimating the firms' NFP repayment potential (RQ2b). The research has 147 useful observations, because there are 13 observations in which NFP < 0, which, therefore, does not need to be reimbursed. For the 147 observations, the median values of the ICRs are 0.2157, 0.0644, 0.2045, 0.1749, and 0.1542 respectively. The result indicates that, in the observations, the repayment capacity from NFP varies from ~21% (ICR3_EA) to ~6% (ICR4_EA) per fiscal year, depending on the calculation method. The repayment capacity is relatively high for all ICRs, despite the following differences: the distribution is asymmetric (g1) and divergent from the normal by the shape of kurtosis (g2), for all the ICRs in question; this result also emerges from Tables A4–A6 and from Figure A2a,b, in Appendix A. In particular, it emerges from Figure A2 that ICR3_EA is the ICR that has the greatest frequency in the low-value classes and is therefore the most restrictive ICR if applied as a debt covenant.

The reading of ICRs expresses the ability to repay the PFN using the EA and CFA margins and, unlike the previous ICRs, the cost of the SFs is considered a deduction (RQ2c); the objective of these ICRs is to more correctly estimate the reimbursement of the NFP. For these ICRs, the research also counts 147 useful observations, because there are 13 observations in which PFN < 0. For the 147 observations, the median values of the ICRs, following the list above, are 0.1579, 0.0063, 0.1528, 0.1260, and 0.0927, respectively. The result indicates that, in the observations, the repayment capacity of the NFP varies from ~16% (ICR5_EA) to ~1% (ICR6_EA) per fiscal year, depending on the calculation method. The ICRs values displayed here appear significantly lower than the five ICRs considered in the previous point; the distribution is confirmed to be asymmetric (g1) and divergent from the normal, even in terms of kurtosis (g2) for all the ICRs in question. This result also emerges from Tables A7–A9 and from Figure A3a,b in Appendix A. It is confirmed that the EBIT-based ICR, in this case ICR5_EA, has the greatest frequency in the low-value classes and is therefore the most restrictive ICR if applied as a debt covenant.

To answer to the next RQ3, it is necessary to establish whether the shape of the distribution of ICRs differs from the normal distribution. The Shapiro–Wilk W test was applied, which responds to the null hypothesis of normality of the distribution of the observations. The results (Table 6) indicate that none of the ICRs has a normal distribution: the W-test rejects the null hypothesis of normality of the distribution for all the ICRs. To answer the RQ, it is therefore necessary to apply a non-parametric approach that does not require that the distribution shape of the ICRs follows the normal distribution.

3.3. Main Result for RQ3

The ICRs were divided into two groups. The first group (ICRs_group_1) included the ICRs that are used to pay the cost of debt (SF), with 160 observations. ICRs included in ICRs_group_1 are frequently applied as debt covenants in the bank contracts in financing operations [132].

First, we test whether the ICRs in ICRs_group_1 are correlated. In Table 8, data highlight that all these ICRs are correlated using the non-parametric approach (Spearman's ρ test). The correlation is significant at the 0.01 level for all correlations.

Table 8. Correlation between ICRs (SF payment), non parametric approach (Spearman's ρ).

		ICR1_EA	ICR2_EA	ICR7_CFA	ICR8_CFA	ICR9_CFA
ICR1_EA	Corr. Spearman ρ Sig. (2-tailed)	1.000 -	- -	- -	- -	- -
ICR2_EA	Corr. Spearman ρ Sig. (2-tailed)	0.656 ** <0.001	1.000 -	- -	- -	- -
ICR7_CFA	Corr. Spearman ρ Sig. (2-tailed)	0.995 ** <0.001	0.628 ** <0.001	1.000 -	- -	- -
ICR8_CFA	Corr. Spearman ρ Sig. (2-tailed)	0.690 ** <0.001	0.668 ** <0.001	0.687 ** <0.001	1.000 -	- -
ICR9_CFA	Corr. Spearman ρ Sig. (2-tailed)	0.598 ** <0.001	0.589 ** <0.001	0.593 ** <0.001	0.886 ** <0.001	1.000 -

** The relation is significant at the 0.01 level (2-tailed). * The relation is significant at the 0.05 level (2-tailed).

In Table 9, we answer another part of RQ3a; ICRs considered here in this second group (ICRs_group_2) are applied to quantify firms' NFP repayment capacity. In Table 9, we have 147 useful observations because, in 13 observations out of 160, NFP has an active cash balance and is not a source of financing. The data highlight a significant result, i.e., that all ICRs in ICRs_group_2 are correlated with each other using the non-parametric approach (Spearman's ρ test). The correlation is significant at the 0.01 level for all correlations.

Table 9. Correlation between ICRs (SF payment and NFP repayment), non parametric approach (Spearman's ρ).

		ICR3_EA	ICR4_EA	ICR5_EA	ICR6_EA	ICR10_CFA	ICR11_CFA	ICR12_CFA	ICR13_CFA	ICR13_CFA	ICR15_CFA
ICR3_EA	Corr. Spearman ρ	1.000	-	-	-	-	-	-	-	-	-
	Sig. (2-tailed)	-	-	-	-	-	-	-	-	-	-
ICR4_EA	Corr. Spearman ρ	0.659 **	1.000	-	-	-	-	-	-	-	-
	Sig. (2-tailed)	<0.001	-	-	-	-	-	-	-	-	-
ICR5_EA	Corr. Spearman ρ	0.980 **	0.604 **	1.000	-	-	-	-	-	-	-
	Sig. (2-tailed)	<0.001	<0.001	-	-	-	-	-	-	-	-
ICR6_EA	Corr. Spearman ρ	0.617 **	0.890 **	0.629 **	1.000	-	-	-	-	-	-
	Sig. (2-tailed)	<0.001	<0.001	<0.001	-	-	-	-	-	-	-
ICR10_CFA	Corr. Spearman ρ	0.996 **	0.620 **	0.977 **	0.578 **	1.000	-	-	-	-	-
	Sig. (2-tailed)	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-
ICR11_CFA	Corr. Spearman ρ	0.714 **	0.614 **	0.718 **	0.612 **	0.711 **	1.000	-	-	-	-
	Sig. (2-tailed)	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-
ICR12_CFA	Corr. Spearman ρ	0.687 **	0.644 **	0.673 **	0.585 **	0.679 **	0.938 **	1.000	-	-	-
	Sig. (2-tailed)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	-
ICR13_CFA	Corr. Spearman ρ	0.974 **	0.567 **	0.995 **	0.591 *	0.979 **	0.712 **	0.662 **	1.000	-	-
	Sig. (2-tailed)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-
ICR14_CFA	Corr. Spearman ρ	0.691 **	0.584 **	0.710 **	0.615 **	0.687 **	0.993 **	0.924 **	0.703 **	1.000	-
	Sig. (2-tailed)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
ICR15_CFA	Corr. Spearman ρ	0.663 **	0.614 **	0.662 **	0.583 **	0.656 **	0.933 **	0.994 **	0.650 **	0.930 **	1.000
	Sig. (2-tailed)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-

** The relation is significant at the 0.01 level (2-tailed). * The relation is significant at the 0.05 level (2-tailed).

3.4. Main Result for RQ4

RQ4 concerns the difference between ICRs calculated with different approaches. To compare the ICRs, and verify the null hypothesis of equality between pairs of values, we apply the non-parametric approach of the Wilcoxon T statistic (Wilcoxon matched-pairs signed-rank test); 35 comparisons were carried out (Table 10).

Table 10. ICRs comparison, non-parametric approach (T Wilcoxon for paired samples).

Couple of Values	T-Wilcoxon for Paired Sample Stand. Stat.	Observ.	Sig. 2-Tailed
Couple_01: ICR2_EA − ICR1_EA	−10.868 [a]	160 observations ICR2_EA < ICR1_EA; 157 observ. ICR2_EA > ICR1_EA; 0 observ. ICR2_EA = ICR1_EA; 3 observ.	<0.001 **
Couple_02: ICR7_CFA − ICR1_EA	−7.874 [a]	160 observations ICR7_CFA < ICR1_EA; 130 observ. ICR7_CFA > ICR1_EA; 17 observ. ICR7_CFA = ICR1_EA; 13 observ.	<0.001 **
Couple_03: ICR8_CFA − ICR1_EA	−4.028 a	160 observations ICR8_CFA < ICR1_EA; 105 observ. ICR8_CFA > ICR1_EA; 54 observ. ICR8_CFA = ICR1_EA; 1 observ.	<0.001 **
Couple_04: ICR9_CFA − ICR1_EA	−5.055 [a]	160 observations ICR9_ CFA < ICR1_EA; 119 observ. ICR9_CFA > ICR1_EA; 41 observ. ICR9_CFA = ICR1_EA; 0 observ.	<0.001 **
Couple_05: ICR7_CFA − ICR2_EA	−10.313 [b]	160 observations ICR7_CFA < ICR2_EA; 11 observ. ICR7_CFA > ICR2_EA; 148 observ. ICR7_CFA = ICR2_EA; 1 observ.	<0.001 **
Couple_06: ICR8_CFA − ICR2_ EA	−3.557 [b]	160 observations ICR8_CFA < ICR2_EA; 48 observ. ICR8_CFA > ICR2_EA; 112 observ. ICR8_CFA = ICR2_EA; 0 observ.	<0.001 **
Couple_07: ICR9_CFA − ICR2_ EA	−2.679 [b]	160 observations ICR9_CFA < ICR2_EA; 54 observ. ICR9_CFA > ICR2_EA; 105 observ. ICR9_CFA = ICR2_EA; 1 observ.	<0.007 **
Couple_08: ICR8_CFA − ICR7_CFA	−3.344 [a]	160 observations ICR8_CFA < ICR7_CFA; 97 observ. ICR8_CFA > ICR7_CFA; 61 observ. ICR8_CFA = ICR7_CFA; 2 observ.	<0.001 **
Couple_09: ICR9_CFA − ICR7_CFA	−4.705 [a]	160 observations ICR9_CFA < ICR7_CFA; 116 observ. ICR9_CFA > ICR7_CFA; 44 observ. ICR9_CFA = ICR7_CFA; 0 observ.	<0.001 **
Couple_10: ICR9_CFA − ICR8_CFA	−8.893 [a]	160 observations ICR9_CFA < ICR_8; 136 observ. ICR9_CFA > ICR_8; 13 observ. ICR9_CFA = ICR_8; 11 observ.	<0.001 **
Couple_11: ICR4_EA − ICR3_EA	−10.410 [a]	94 observations ICR4_EA < ICR3_EA; 144 observ. ICR4_EA > ICR3_EA; 0 observ. ICR4_EA = ICR3_EA; 3 observ.	<0.001 **

Table 10. *Cont.*

Couple of Values	T-Wilcoxon for Paired Sample Stand. Stat.	Observ.	Sig. 2-Tailed
Couple_12: ICR10_CFA − ICR3_EA	−8.368 [a]	94 observations ICR10_CFA < ICR3_EA; 123 observ. ICR10_CFA > ICR3_EA; 11 observ. ICR10_CFA = ICR3_EA; 13 observ.	<0.001 **
Couple_13: ICR11_CFA − ICR3_EA	−4.456 [a]	94 observations ICR11_CFA < ICR3_EA; 99 observ. ICR11_CFA > ICR3_EA; 47 observ. ICR11_CFA = ICR3_EA; 1 observ.	<0.001 **
Couple_14: ICR12_CFA − ICR3_EA	−6.049 [a]	94 observations ICR12_CFA < ICR3_EA; 114 observ. ICR12_CFA > ICR3_EA; 33 observ. ICR12_CFA = ICR3_EA; 0 observ.	<0.001 **
Couple_15: ICR10_CFA − ICR4_CFA	−10.363 [b]	160 observations ICR10_CFA < ICR_4; 5 observ. ICR10_CFA > ICR_4; 140 observ. ICR10_CFA = ICR_4; 2 observ.	<0.001 **
Couple_16: ICR11_CFA − ICR4_CFA	−3.908 [b]	147 observations ICR11_CFA < ICR_4; 42 observ. ICR11_CFA > ICR_4; 105 observ. ICR11_CFA = ICR_4; 0 observ.	<0.001 **
Couple_17: ICR12_CFA − ICR4_CFA	−2.586 [b]	147 observations ICR12_CFA < ICR_4; 50 observ. ICR12_CFA > ICR_4; 96 observ. ICR12_CFA = ICR_4; 1 observ.	<0.010 *
Couple_18: ICR11_CFA − ICR10_CFA	−3.665 [a]	147 observations ICR11_CFA < ICR10_CFA; 91 observ. ICR11_CFA > ICR10_CFA; 54 observ. ICR11_CFA = ICR10_CFA; 2 observ.	<0.001 **
Couple_19: ICR12_CFA − ICR10_CFA	−5.712 [a]	147 observations ICR12_CFA < ICR10_CFA; 111 observ. ICR12_CFA > ICR10_CFA; 36 observ. ICR12_CFA = ICR10_CFA; 0 observ.	<0.001 **
Couple_20: ICR12_CFA − ICR11_CFA	−9.075 [a]	147 observations ICR12_CFA < ICR11_CFA; 130 observ. ICR12_CFA > ICR11_CFA; 9 observ. ICR12_CFA = ICR11_CFA; 8 observ.	<0.001 **
Couple_21: ICR6_EA − ICR5_EA	−10,410 [a]	147 observations ICR6_EA < ICR5_EA; 144 observ. ICR6_EA > ICR5_EA; 0 observ. ICR6_EA = ICR5_EA; 3 observ.	<0.001 **
Couple_22: ICR13_CFA − ICR5_EA	−8366 [a]	147 observations ICR13_CFA < ICR5_EA; 123 observ. ICR13_CFA > ICR5_EA; 11 observ. ICR13_CFA = ICR5_EA; 13 observ.	<0.001 **
Couple_23: ICR14_CFA − ICR5_EA	−4455 [a]	147 observations ICR14_CFA < ICR5_EA; 99 observ. ICR14_CFA > ICR5_EA; 47 observ. ICR14_CFA = ICR5_EA; 1 observ.	<0.001 **
Couple_24: ICR15_CFA − ICR5_EA	−6048 [a]	147 observations ICR15_CFA < ICR5_EA; 114 observ. ICR15_CFA > ICR5_EA; 33 observ. ICR15_CFA = ICR5_EA; 0 observ.	<0.001 **

Table 10. *Cont.*

Couple of Values	T-Wilcoxon for Paired Sample Stand. Stat.	Observ.	Sig. 2-Tailed
Couple_25: ICR13_CFA − ICR6_EA	−10,363 [b]	147 observations ICR13_CFA < ICR6_EA; 5 observ. ICR13_CFA > ICR6_EA; 140 observ. ICR13_CFA = ICR6_EA; 2 observ.	<0.001 **
Couple_26: ICR14_CFA − ICR6_EA	−3907 [b]	147 observations ICR14_CFA < ICR6_EA; 42 observ. ICR14_CFA > ICR6_EA; 105 observ. ICR14_CFA = ICR6_EA; 0 observ.	<0.001 **
Couple_27: ICR15_CFA − ICR6_EA	−2586 [b]	147 observations ICR15_CFA < ICR6_EA; 50 observ. ICR15_CFA > ICR6_EA; 96 observ. ICR15_CFA = ICR6_EA; 1 observ.	<0.010 *
Couple_28: ICR14_CFA − ICR13_CFA	−3663 [a]	147 observations ICR14_CFA < ICR13_CFA; 91 observ. ICR14_CFA > ICR13_CFA; 54 observ. ICR14_CFA = ICR13_CFA; 2 observ.	<0.001 **
Couple_29: ICR15_CFA − ICR13_CFA	−5711 [a]	147 observations ICR15_CFA < ICR13_CFA; 111 observ. ICR15_CFA > ICR13_CFA; 36 observ. ICR15_CFA = ICR13_CFA; 0 observ.	<0.001 **
Couple_30: ICR15_CFA − ICR14_CFA	−9.075 [a]	147 observations ICR15_CFA < ICR14_CFA; 130 observ. ICR15_CFA > ICR14_CFA; 9 observ. ICR15_CFA = ICR14_CFA; 8 observ	<0.001 **
Couple_31: ICR5_EA − ICR3_EA	−10.410 [a]	147 observations ICR15_CFA < ICR14_CFA; 144 observ. ICR15_CFA > ICR14_CFA; 0 observ. ICR15_CFA = ICR14_CFA; 3 observ	<0.001 **
Couple_32: ICR6_EA − ICR3_EA	−10.446 [a]	147 observations ICR15_CFA < ICR14_CFA; 145 observ. ICR15_CFA > ICR14_CFA; 0 observ. ICR15_CFA = ICR14_CFA; 2 observ	<0.001 **
Couple_33: ICR13_CFA − ICR10_CFA	−10.410 [a]	147 observations ICR15_CFA < ICR14_CFA; 144 observ. ICR15_CFA > ICR14_CFA; 0 observ. ICR15_CFA = ICR14_CFA; 3 observ	<0.001 **
Couple_34: ICR14_CFA − ICR11_CFA	−10.410 [a]	147 observations ICR15_CFA < ICR14_CFA; 144 observ. ICR15_CFA > ICR14_CFA; 0 observ. ICR15_CFA = ICR14_CFA; 3 observ	<0.001 **
Couple_35: ICR15_CFA − ICR12_CFA	−10.446 [a]	147 observations ICR15_CFA < ICR14_CFA; 148 observ. ICR15_CFA > ICR14_CFA; 0 observ. ICR15_CFA = ICR14_CFA; 2 observ	<0.001 **

** The relation is significant at the 0.01 level (2-tailed). * The relation is significant at the 0.05 level (2-tailed). "[a]" expresses positive rank sign. "[b]" expresses negative rank sign.

Pairwise comparisons from 1 to 10, ICRs_group_1, have the aim of verifying whether there are significant pairwise differences between the ICRs that are aimed at paying SF; these are the ICRs for which the correlation was calculated in Table 8. The result highlights that, for all pairwise comparisons, it is possible to reject the null hypothesis of equality between median values. In particular, it is important to observe the following: (a) ICR1_EA has higher values in terms of ranks compared to the other four ICRs considered and is therefore a non-restrictive and non-prudential debt covenant for banks; (b) ICR2_EA has lower values in terms of ranks compared to the other three ICRs calculated with the CFA considered, and is therefore a restrictive, prudential debt covenant for banks; (c) among the ICRs calculated with CFA, ICR7_CFA is the ICR with the highest rank value, and is therefore a non-restrictive and non-prudential debt covenant for banks; and (d) ICR8_CFA has a higher rank value than ICR9_CFA and, therefore, it appears that ICR9_CFA is the most restrictive and prudential debt covenant in application by banks.

Pairwise comparisons from 11 to 20 to verify whether there are significant pairwise differences between the ICRs that are aimed at NFP repayment. The result highlights that, for all pairwise comparisons, it is possible to reject the null hypothesis of equality between median values. In particular, it is important to observe the following: (a) ICR3_EA, as previously shown for ICR1_EA, has higher values in terms of ranks compared to the other four ICRs considered and is therefore a non-restrictive and non-prudential debt covenant for banks; (b) ICR4_EA has lower values in terms of ranks compared to the other three ICRs calculated with CFA; it is therefore confirmed for EBIT that it is a prudent margin for the calculation of ICRs; (c) among the ICRs calculated with CFA, ICR10_CFA is the ICR with the highest rank value, and is therefore a non-restrictive and non-prudential debt covenant for banks; and (d) ICR11_CFA has a higher rank value than ICR12_CFA and, therefore, it appears that ICR12_CFA is the most restrictive and prudential debt covenant in application by banks.

Pairwise comparisons from 21 to 35, ICRs_group_2, have the aim of verifying whether there are significant pairwise differences between the ICRs that are aimed at NFP repayment also considering the payment of SF. These ICRs are rarely applied among debt covenants, but the results are interesting: (a) comparisons from 21 to 30 confirm what emerged in comparisons from 1 to 20, i.e., that the null hypothesis of equality between the medians of the compared ICRs is no longer rejected and therefore the indices have statistically different values; EBIT is confirmed to be the most restrictive margin among EAs, like OCF and UFCF among CFA margins (Figure A4a,b, Table A10, Table A11, Table A12, Appendix A); and (b) comparisons from 31 to 35 highlight that, in the ICRs used to calculate the payment of NFP, those calculated taking into account the cost of SF have lower values, and this is statistically significant. ICR3_EA, ICR4_EA, ICR10_CFA, ICR11_CFA, and ICR12_CFA therefore overestimate the ability of the firms in the sample to repay the NPF.

4. Discussion

Regarding RQ1, the first discussion point that emerges from the results is that observations of the firms in the sample are of a capital intensive nature (NIC and TA greater than VP), thus confirming that biogas firms require high investments which, in the case of the research, are in FAI. NWC is negative in the majority of observations (109 out of 160) and, therefore, is a source of financing in the average of the observations. This finding confirms the results of other authors [133,134]. The point is of crucial importance because of the following points: (a) as demonstrated by various studies, firms that have negative NWC have higher default rates and are more risky [135–138], and this finding must be considered by the banks when granting loans, and by the policy maker when financing firms in the sector; and (b) the use of NWC as a source of financing (cases where NWC < 0) represents an element of reduction in E among the financing sources. This determines a further element of risk to be considered by banks and policy makers. The direct evidence shows that E is a negligible source of financing, on average, in the sample observations, and this entails a greater risk of default, which is reflected in debt constraints or increased interest rates. Consequently, an increase in NFP as a primary source of capital, as highlighted in the research, has the effect of shifting the majority of the risk onto financial creditors and suppliers; equity holders maintain the right of control and the right of ownership of the firm. Firms in the sector use financial debt (NFP) as a primary source of capital and this result is in line with recent trends observed in the market and highlighted by European Union [139]. This finding poses a moral hazard problem [140–142], which is particularly relevant considering the public support for the renewable energy sector. The research findings confirm that firms operating in the biogas sector can be considered highly capital-intensive firms, thus confirming the findings of other research [15,73,143]. The research highlights the aggressive use of WCM to finance the operating cycle (NWC < 0). NWC is negative in 109 out of 160 observations and, therefore, constitutes a source of financing. ICRs based on EBITDA and CF are above the threshold value of "1" in 143 and 145 observations, respectively, while ICRs based on EBIT, OCF, and UFCF are above the threshold value of "1" in 132, 133, and 122 observations, respectively. The high incidence of SF in relation to EBIT observed in the research highlights the following: (a) biogas firms need, and are able to acquire on the market, a high level of indebtedness, which generates SF; (b) SF almost entirely erodes EBIT; (c) it is therefore necessary to proceed with the calculation of the ICRs to calculate the firms' capacity to cover the cost of SF. The percentage of EBITDA on VP is, on average, equal to 25.22%; this finding helps to explain why the firms in the sample are able to attract high financing, in terms of the relationship between NFP and E, even if other profit and/or financial margins have relevance in performance evaluation, such as CF, or EBIT and $^{aT}\Pi$ profit margins.

As regards RQ2, the vast majority of observations confirm the results of other research [144,145]. The research highlights that firms in the sample generate value for equity holders and are able to pay the cost of debt; however, some profit margins, in particular EBITDA and CF, if used for the calculation of ICRs, overestimate the real performance of firms. For this reason, these margins are not to be used by managers, banks, or policy makers in the calculation of ICRs. This result has already been highlighted in general studies, but it is a new result in the biogas sector and in the renewable energy sector in general [146].

The results of the research regarding the pairwise comparison of ICRs_group_1 allow some further observations about RQ3. Firms in the biogas sector have significantly different ICRs and, even if these ICRs are correlated with each other, they are statistically different. The more traditionally applied ICRs, such as ICR1_EA and ICR2_EA, have significant differences between them and, for lenders, ICR1_EA is the least conservative ICR, while ICR2_EA is the most conservative.

The research highlights that, for biogas firms, it is preferable to apply the ICRs calculated with CFA because they directly express the CFs available for the payment of SF; these ICRs are statistically different and cannot be approximated with the ICRs calculated with the EA.

The research shows that the EBITDA margin, employed in calculating the ICRs, is the least restrictive profit margin in this calculation. Consequently, it is less conservative for financiers if included in debt covenants. Using EBITDA to estimate cash flows (CFs) by firms is inaccurate as it leads to overestimation of CFs. This finding is particularly relevant in addressing RQ4. This result can be considered relevant because the analysis of financial sustainability, calculated through ICRs, is conducted for the first time for the biogas sector, and this brings an element of novelty to our field of research.

5. Conclusions

The results of RQ1 highlight that firms in the sector show a high use of NFP and a low use of E. Furthermore, the use of NWC as a source of financing is notable, indicating an aggressive WCM policy among the firms included in the research sample. These results of RQ1 confirm the importance of calculating ICRs, since the majority of biogas firms in the sample rely on financial debt, resulting in interest charges. The evaluation of ICRs also allows the calculation of compliance with the debt covenants outlined in the financing contracts, which often include the ICR requirement.

In relation to RQ2, the research shows that firms in the biogas sector included in the sample demonstrate their ability to repay financial debt, as shown by the results of ICR calculation. Regarding this matter, for ICRs having the purpose of evaluating the annual repayment capacity of NFP, ICRs that do not consider SF in the numerator should not be applied. Using such ratios could overestimate the repayment capacity of NFP, potentially providing managers, banks, and policy makers with misleading information.

Regarding RQ3, the research has highlighted that the ICRs are correlated with each other in a statistically significant way. Statistically significant differences in median values have been highlighted between many ICRs calculated with the economic approach (EA) compared to the ICRs calculated with the cash flow approach (CFA). This finding is relevant to answering RQ4.

These research findings can be useful for managers, entrepreneurs, banks, and policy makers because the research answered the questions and highlighted the typical elements of the capital structure of biogas companies in some Italian regions. The results highlighted the need to proceed with the calculation of the ICRs, indicating the ICRs that are calculated in the most correct and useful way to represent the sustainability of the debt service of the firms in the sector. Thanks to these results, it will be possible to transfer the results to operators in the sector.

The research has some limitations, as follows: (1) The analyzed data pertain to only 16 firms situated in northern Italy, rendering the sample size small and precluding the derivation of general conclusions. (2) The sampling methodology employed in this study is dependent on data accessibility rather than random selection. (3) The sample exclusively consists of capital firms, as they provide public annual reports. Consequently, sole proprietorships and partnerships are excluded from the sample, as they are not required to produce public annual reports. (4) Data from firms' annual reports cannot be critically verified for accuracy, and the mandatory minimum content in these reports may lack specific details.

The research highlights new insights that could be further developed by broadening the study to include other sectors within renewable energy and beyond.

Author Contributions: The study is a result of the full collaboration of all the authors. However, M.I. and G.B. wrote the section titled "Introduction" with equal contributions from the authors; M.I. wrote the sections titled "Material and methods" and "Discussion"; M.I. and E.M. wrote the section titled "Results", with equal contributions from the authors; M.I. and G.B. wrote the section titled "Conclusions" with equal contributions from the authors. All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to [AIDA database is available free of charge for research purposes only for the members of the University of Parma].

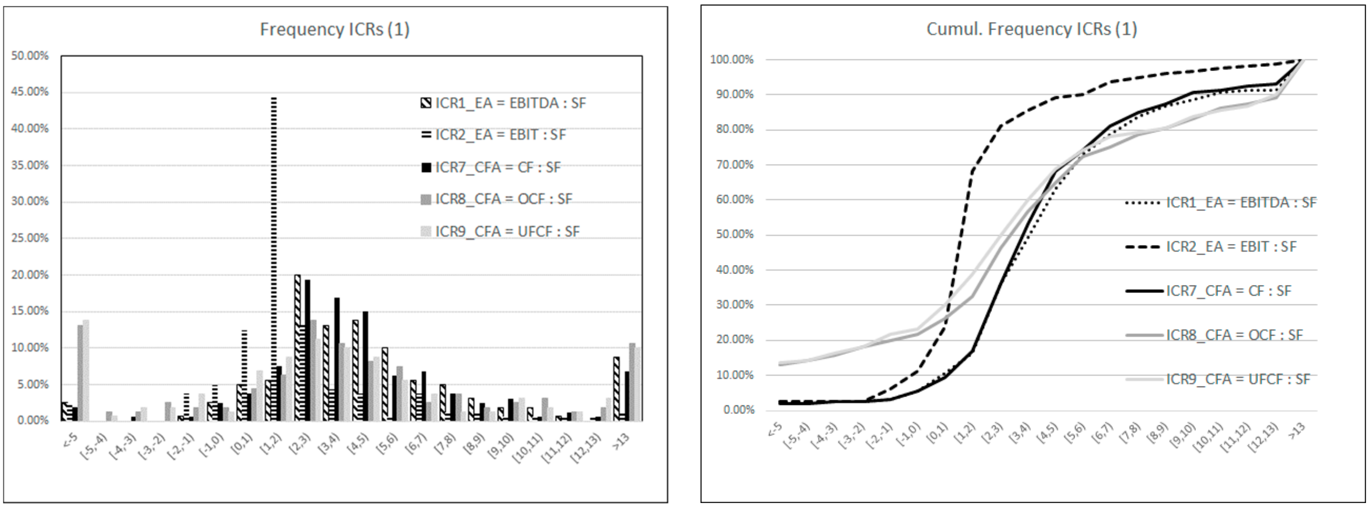
Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

AP	accounts payable
AR	accounts receivable
${}^{aT}\Pi_t$	profit after taxes
${}^{bT}\Pi_t$	profit before taxes
CCC	cash conversion cycle
CF	cash flow
current ratio	total current asset divided by total current liabilities
EBIT	earnings before interest and taxes
EBITDA	earnings before interest, tax, depreciation and amortization
FAI	investment in fixed asset
FCFE	free cash flow to equity
AR	total company debt divided by total shareholders' equity
INV	value of inventories stock
L	labor costs

M	cost for raw materials
MC	monetary cost (MC = M + S + R +L + O)
NWC	net working capital (NWC = AR + INV − AP)
O	others operative costs
OCF	operating cash flow
UFCF	unlevered free cash flow
R	cost for rent and leasing
S	costs for services
T	turnover (sales)
T_m	income tax

Appendix A



(**a**) (**b**)

Figure A1. (**a**) ICR1_EA, ICR2_EA, ICR7_CFA, ICR7_CFA, ICR9_CFA: group of ICRs (1), frequency; (**b**) ICR1_EA, ICR2_EA, ICR7_CFA, ICR7_CFA, ICR9_CFA: group of ICRs (1), cumulative frequency.

Table A1. ICR (1) frequency (n. observations).

Range	ICR1_EA = EBITDA : SF	ICR2_EA = EBIT : SF	ICR7_CFA = CF : SF	ICR8_CFA = OCF : SF	ICR9_CFA = UFCF : SF
<−5	4	4	3	21	22
[5, −4)	0	0	0	2	1
[−4, −3)	0	0	1	2	3
[−3, −2)	0	0	0	4	3
[−2, −1)	1	6	1	3	6
[−1, 0)	4	8	4	3	2
[0, 1)	8	20	6	7	11
[1, 2)	9	71	12	10	14
[2, 3)	32	21	31	22	18
[3, 4)	21	7	27	17	16
[4, 5)	22	6	24	13	14
[5, 6)	16	1	10	12	9
[6, 7)	9	6	11	4	6
[7, 8)	8	2	6	6	2
[8, 9)	5	2	4	3	2
[9, 10)	3	1	5	4	5
[10, 11)	3	1	1	5	3
[11, 12)	1	1	2	2	2
[12, 13)	0	1	1	3	5
>13	14	2	11	17	16
Tot.	**160**	**160**	**160**	**160**	**160**

Table A2. ICR (1) frequency (% observations).

Range	ICR1_EA = EBITDA : SF	ICR2_EA = EBIT : SF	ICR7_CFA = CF : SF	ICR8_CFA = OCF : SF	ICR9_CFA = UFCF : SF
<−5	2.50%	2.50%	1.88%	13.13%	13.75%
[5, −4)	0.00%	0.00%	0.00%	1.25%	0.63%
[−4, −3)	0.00%	0.00%	0.63%	1.25%	1.88%
[−3, −2)	0.00%	0.00%	0.00%	2.50%	1.88%
[−2, −1)	0.63%	3.75%	0.63%	1.88%	3.75%
[−1, 0)	2.50%	5.00%	2.50%	1.88%	1.25%
[0, 1)	5.00%	12.50%	3.75%	4.38%	6.88%
[1, 2)	5.63%	44.38%	7.50%	6.25%	8.75%
[2, 3)	20.00%	13.13%	19.38%	13.75%	11.25%
[3, 4)	13.13%	4.38%	16.88%	10.63%	10.00%
[4, 5)	13.75%	3.75%	15.00%	8.13%	8.75%
[5, 6)	10.00%	0.63%	6.25%	7.50%	5.63%
[6, 7)	5.63%	3.75%	6.88%	2.50%	3.75%
[7, 8)	5.00%	1.25%	3.75%	3.75%	1.25%
[8, 9)	3.13%	1.25%	2.50%	1.88%	1.25%
[9, 10)	1.88%	0.63%	3.13%	2.50%	3.13%
[10, 11)	1.88%	0.63%	0.63%	3.13%	1.88%
[11, 12)	0.63%	0.63%	1.25%	1.25%	1.25%
[12, 13)	0.00%	0.63%	0.63%	1.88%	3.13%
>13	8.75%	1.25%	6.88%	10.63%	10.00%
Tot.	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Table A3. ICR (1) cumulative frequency (% observations).

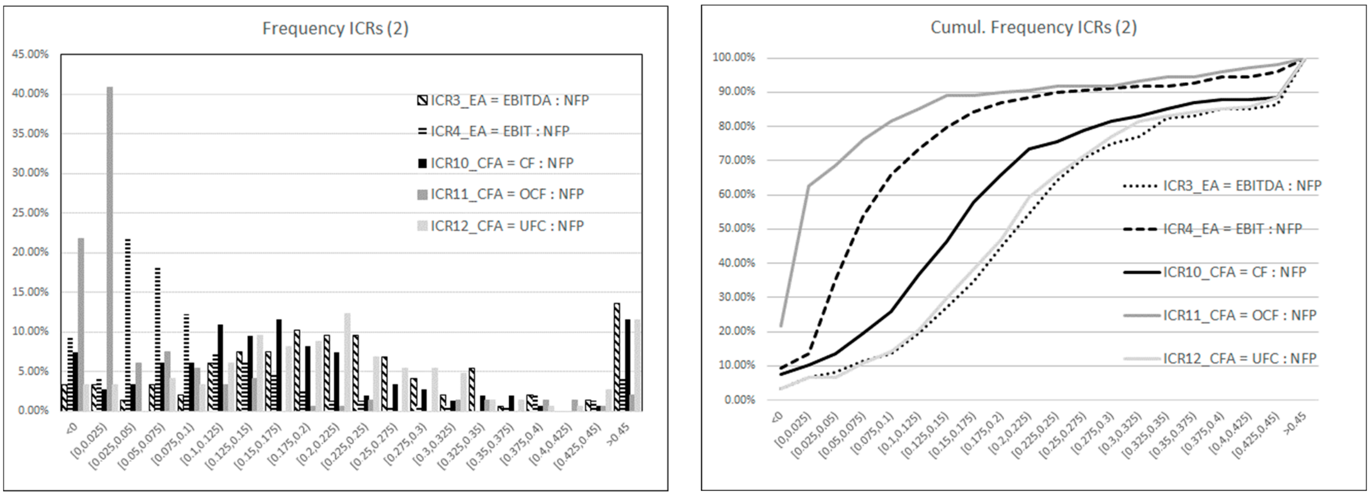
Range	ICR1_EA = EBITDA : SF	ICR2_EA = EBIT : SF	ICR7_CFA = CF : SF	ICR8_CFA = OCF : SF	ICR9_CFA = UFCF : SF
<−5	2.50%	2.50%	1.88%	13.13%	13.75%
[5, −4)	2.50%	2.50%	1.88%	14.38%	14.38%
[−4, −3)	2.50%	2.50%	2.50%	15.63%	16.25%
[−3, −2)	2.50%	2.50%	2.50%	18.13%	18.13%
[−2, −1)	3.13%	6.25%	3.13%	20.00%	21.88%
[−1, 0)	5.63%	11.25%	5.63%	21.88%	23.13%
[0, 1)	10.63%	23.75%	9.38%	26.25%	30.00%
[1, 2)	16.25%	68.13%	16.88%	32.50%	38.75%
[2, 3)	36.25%	81.25%	36.25%	46.25%	50.00%
[3, 4)	49.38%	85.63%	53.13%	56.88%	60.00%
[4, 5)	63.13%	89.38%	68.13%	65.00%	68.75%
[5, 6)	73.13%	90.00%	74.38%	72.50%	74.38%
[6, 7)	78.75%	93.75%	81.25%	75.00%	78.13%
[7, 8)	83.75%	95.00%	85.00%	78.75%	79.38%
[8, 9)	86.88%	96.25%	87.50%	80.63%	80.63%
[9, 10)	88.75%	96.88%	90.63%	83.13%	83.75%
[10, 11)	90.63%	97.50%	91.25%	86.25%	85.63%
[11, 12)	91.25%	98.13%	92.50%	87.50%	86.88%
[12, 13)	91.25%	98.75%	93.13%	89.38%	90.00%
>13	100.00%	100.00%	100.00%	100.00%	100.00%

Table A4. ICR (2) frequency (n. observations).

Range	ICR3_EA = EBITDA : NFP	ICR4_EA = EBIT : NFP	ICR10_CFA = CF : NFP	ICR11_CFA = OCF : NFP	ICR12_CFA = UFC : NFP
<0	5	14	11	32	5
[0.0, 0.025)	5	6	4	60	5
[0.025, 0.05)	2	32	5	9	0
[0.05, 0.075)	5	27	9	11	6
[0.075, 0.1)	3	18	9	8	5
[0.1, 0.125)	9	11	16	5	9
[0.125, 0.15)	11	9	14	6	14
[0.15, 0.175)	11	7	17	0	12
[0.175, 0.2)	15	4	12	1	13
[0.2, 0.225)	14	2	11	1	18
[0.225, 0.25)	14	2	3	2	10
[0.25, 0.275)	10	1	5	0	8
[0.275, 0.3)	6	1	4	0	8
[0.3, 0.325)	3	1	2	2	7

Table A4. *Cont.*

Range	ICR3_EA = EBITDA : NFP	ICR4_EA = EBIT : NFP	ICR10_CFA = CF : NFP	ICR11_CFA = OCF : NFP	ICR12_CFA = UFC : NFP
[0.325, 0.35)	8	0	3	2	2
[0.35, 0.375)	1	1	3	0	2
[0.375, 0.4)	3	3	1	2	1
[0.4, 0.425)	0	0	0	2	1
[0.425, 0.45)	2	2	1	1	4
>0.45	20	6	17	3	17
Tot.	**147**	**147**	**147**	**147**	**147**



(**a**) (**b**)

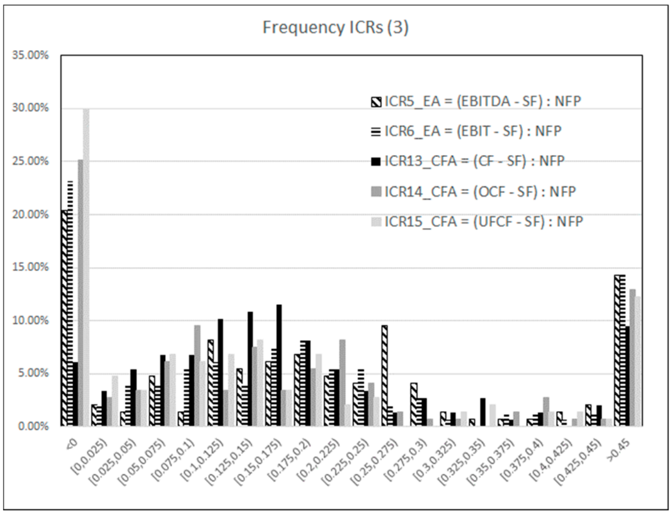
Figure A2. (**a**) ICR3_EA, ICR4_EA, ICR10_CFA, ICR11_CFA, ICR12_CFA: group of ICRs (2), frequency; (**b**) ICR3_EA, ICR4_EA, ICR10_CFA, ICR11_CFA, ICR12_CFA: group of ICRs (2), cumulative frequency.

Table A5. ICR (2) frequency (% observations).

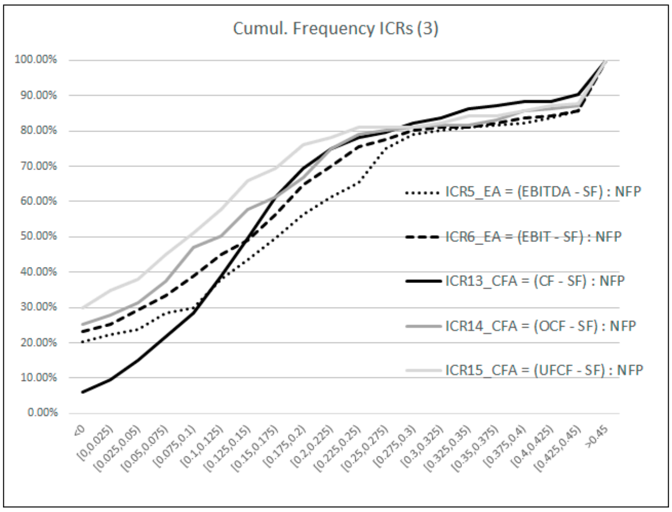
Range	ICR3_EA = EBITDA : NFP	ICR4_EA = EBIT : NFP	ICR10_CFA = CF : NFP	ICR11_CFA = OCF : NFP	ICR12_CFA = UFC : NFP
<0	3.40%	9.52%	7.48%	21.77%	3.40%
[0.0, 0.025)	3.40%	4.08%	2.72%	40.82%	3.40%
[0.025, 0.05)	1.36%	21.77%	3.40%	6.12%	0.00%
[0.05, 0.075)	3.40%	18.37%	6.12%	7.48%	4.08%
[0.075, 0.1)	2.04%	12.24%	6.12%	5.44%	3.40%
[0.1, 0.125)	6.12%	7.48%	10.88%	3.40%	6.12%
[0.125, 0.15)	7.48%	6.12%	9.52%	4.08%	9.52%
[0.15, 0.175)	7.48%	4.76%	11.56%	0.00%	8.16%
[0.175, 0.2)	10.20%	2.72%	8.16%	0.68%	8.84%
[0.2, 0.225)	9.52%	1.36%	7.48%	0.68%	12.24%
[0.225, 0.25)	9.52%	1.36%	2.04%	1.36%	6.80%
[0.25, 0.275)	6.80%	0.68%	3.40%	0.00%	5.44%
[0.275, 0.3)	4.08%	0.68%	2.72%	0.00%	5.44%
[0.3, 0.325)	2.04%	0.68%	1.36%	1.36%	4.76%
[0.325, 0.35)	5.44%	0.00%	2.04%	1.36%	1.36%
[0.35, 0.375)	0.68%	0.68%	2.04%	0.00%	1.36%
[0.375, 0.4)	2.04%	2.04%	0.68%	1.36%	0.68%
[0.4, 0.425)	0.00%	0.00%	0.00%	1.36%	0.68%
[0.425, 0.45)	1.36%	1.36%	0.68%	0.68%	2.72%
>0.45	13.61%	4.08%	11.56%	2.04%	11.56%
Tot.	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Table A6. ICR (2) cumulative frequency (% observations).

Range	ICR3_EA = EBITDA : NFP	ICR4_EA = EBIT : NFP	ICR10_CFA = CF : NFP	ICR11_CFA = OCF : NFP	ICR12_CFA = UFC : NFP
<0	3.40%	9.52%	7.48%	21.77%	3.40%
[0.0, 0.025)	6.80%	13.61%	10.20%	62.59%	6.80%
[0.025, 0.05)	8.16%	35.37%	13.61%	68.71%	6.80%
[0.05, 0.075)	11.56%	53.74%	19.73%	76.19%	10.88%
[0.075, 0.1)	13.61%	65.99%	25.85%	81.63%	14.29%
[0.1, 0.125)	19.73%	73.47%	36.73%	85.03%	20.41%
[0.125, 0.15)	27.21%	79.59%	46.26%	89.12%	29.93%
[0.15, 0.175)	34.69%	84.35%	57.82%	89.12%	38.10%
[0.175, 0.2)	44.90%	87.07%	65.99%	89.80%	46.94%
[0.2, 0.225)	54.42%	88.44%	73.47%	90.48%	59.18%
[0.225, 0.25)	63.95%	89.80%	75.51%	91.84%	65.99%
[0.25, 0.275)	70.75%	90.48%	78.91%	91.84%	71.43%
[0.275, 0.3)	74.83%	91.16%	81.63%	91.84%	76.87%
[0.3, 0.325)	76.87%	91.84%	82.99%	93.20%	81.63%
[0.325, 0.35)	82.31%	91.84%	85.03%	94.56%	82.99%
[0.35, 0.375)	82.99%	92.52%	87.07%	94.56%	84.35%
[0.375, 0.4)	85.03%	94.56%	87.76%	95.92%	85.03%
[0.4, 0.425)	85.03%	94.56%	87.76%	97.28%	85.71%
[0.425, 0.45)	86.39%	95.92%	88.44%	97.96%	88.44%
>0.45	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**



(**a**)



(**b**)

Figure A3. (**a**) ICR5_EA, ICR6_EA, ICR13_CFA, ICR14_CFA, ICR15_CFA: group of ICRs (3), frequency; (**b**) ICR5_EA, ICR6_EA, ICR13_CFA, ICR14_CFA, ICR15_CFA: group of ICRs (3), cumulative frequency.

Table A7. ICR (3) frequency (n. observations).

Range	ICR5_EA = (EBITDA − SF) : NFP	ICR6_EA = (EBIT − SF) : NFP	ICR13_CFA = (CF − SF) : NFP	ICR14_CFA = (OCF − SF) : NFP	ICR15_CFA = (UFCF − SF) : NFP
<0	30	34	9	37	44
[0.0, 0.025)	3	3	5	4	7
[0.025, 0.05)	2	6	8	5	5
[0.05, 0.075)	7	6	10	9	10
[0.075, 0.1)	2	8	10	14	9
[0.1, 0.125)	12	9	15	5	10
[0.125, 0.15)	8	6	16	11	12
[0.15, 0.175)	9	11	17	5	5
[0.175, 0.2)	10	12	12	8	10

Table A7. *Cont.*

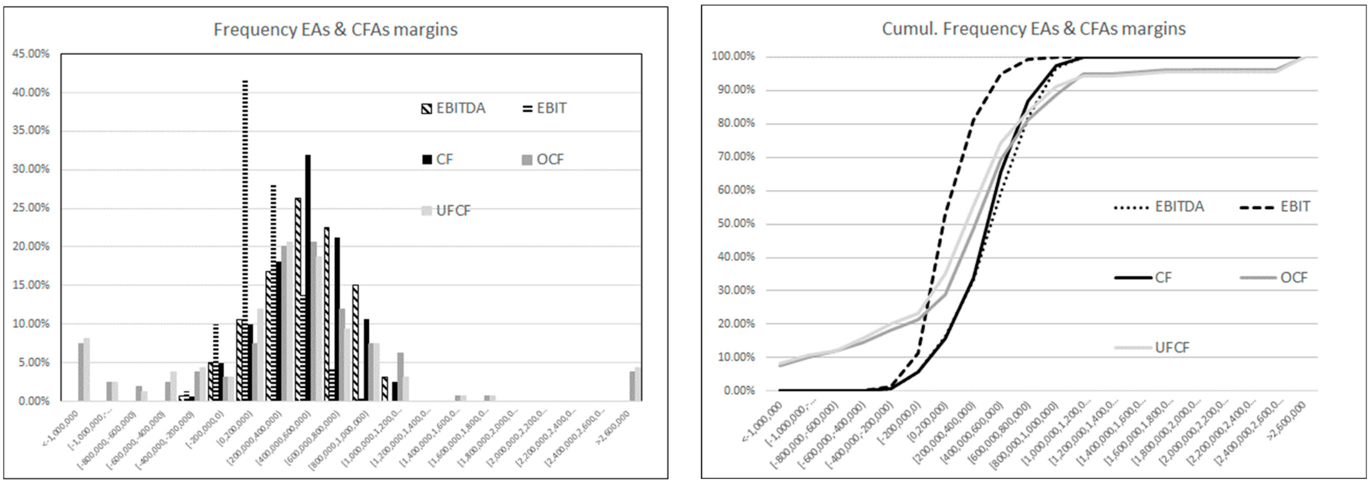
Range	ICR5_EA = (EBITDA − SF) : NFP	ICR6_EA = (EBIT − SF) : NFP	ICR13_CFA = (CF − SF) : NFP	ICR14_CFA = (OCF − SF) : NFP	ICR15_CFA = (UFCF − SF) : NFP
[0.2, 0.225)	7	8	8	12	3
[0.225, 0.25)	6	8	5	6	4
[0.25, 0.275)	14	3	2	2	0
[0.275, 0.3)	6	4	4	1	0
[0.3, 0.325)	2	1	2	1	2
[0.325, 0.35)	1	0	4	0	3
[0.35, 0.375)	1	2	1	2	0
[0.375, 0.4)	1	2	2	4	2
[0.4, 0.425)	2	1	0	1	2
[0.425, 0.45)	3	2	3	1	1
>0.45	21	21	14	19	18
Tot.	147	147	147	147	147

Table A8. ICR (3) frequency (% observations).

Range	ICR5_EA = (EBITDA − SF) : NFP	ICR6_EA = (EBIT − SF) : NFP	ICR13_CFA = (CF − SF) : NFP	ICR14_CFA = (OCF − SF) : NFP	ICR15_CFA = (UFCF − SF) : NFP
<0	20.41%	23.13%	6.12%	25.17%	29.93%
[0.0, 0.025)	2.04%	2.04%	3.40%	2.72%	4.76%
[0.025, 0.05)	1.36%	4.08%	5.44%	3.40%	3.40%
[0.05, 0.075)	4.76%	4.08%	6.80%	6.12%	6.80%
[0.075, 0.1)	1.36%	5.44%	6.80%	9.52%	6.12%
[0.1, 0.125)	8.16%	6.12%	10.20%	3.40%	6.80%
[0.125, 0.15)	5.44%	4.08%	10.88%	7.48%	8.16%
[0.15, 0.175)	6.12%	7.48%	11.56%	3.40%	3.40%
[0.175, 0.2)	6.80%	8.16%	8.16%	5.44%	6.80%
[0.2, 0.225)	4.76%	5.44%	5.44%	8.16%	2.04%
[0.225, 0.25)	4.08%	5.44%	3.40%	4.08%	2.72%
[0.25, 0.275)	9.52%	2.04%	1.36%	1.36%	0.00%
[0.275, 0.3)	4.08%	2.72%	2.72%	0.68%	0.00%
[0.3, 0.325)	1.36%	0.68%	1.36%	0.68%	1.36%
[0.325, 0.35)	0.68%	0.00%	2.72%	0.00%	2.04%
[0.35, 0.375)	0.68%	1.36%	0.68%	1.36%	0.00%
[0.375, 0.4)	0.68%	1.36%	1.36%	2.72%	1.36%
[0.4, 0.425)	1.36%	0.68%	0.00%	0.68%	1.36%
[0.425, 0.45)	2.04%	1.36%	2.04%	0.68%	0.68%
>0.45	14.29%	14.29%	9.52%	12.93%	12.24%
Tot.	100.00%	100.00%	100.00%	100.00%	100.00%

Table A9. ICR (3) cumulative frequency (% observations).

Range	ICR3_EA = EBITDA : NFP	ICR4_EA = EBIT : NFP	ICR10_CFA = CF : NFP	ICR11_CFA = OCF : NFP	ICR12_CFA = UFC : NFP
<0	20.41%	23.13%	6.12%	25.17%	29.93%
[0.0, 0.025)	22.45%	25.17%	9.52%	27.89%	34.69%
[0.025, 0.05)	23.81%	29.25%	14.97%	31.29%	38.10%
[0.05, 0.075)	28.57%	33.33%	21.77%	37.41%	44.90%
[0.075, 0.1)	29.93%	38.78%	28.57%	46.94%	51.02%
[0.1, 0.125)	38.10%	44.90%	38.78%	50.34%	57.82%
[0.125, 0.15)	43.54%	48.98%	49.66%	57.82%	65.99%
[0.15, 0.175)	49.66%	56.46%	61.22%	61.22%	69.39%
[0.175, 0.2)	56.46%	64.63%	69.39%	66.67%	76.19%
[0.2, 0.225)	61.22%	70.07%	74.83%	74.83%	78.23%
[0.225, 0.25)	65.31%	75.51%	78.23%	78.91%	80.95%
[0.25, 0.275)	74.83%	77.55%	79.59%	80.27%	80.95%
[0.275, 0.3)	78.91%	80.27%	82.31%	80.95%	80.95%
[0.3, 0.325)	80.27%	80.95%	83.67%	81.63%	82.31%
[0.325, 0.35)	80.95%	80.95%	86.39%	81.63%	84.35%
[0.35, 0.375)	81.63%	82.31%	87.07%	82.99%	84.35%
[0.375, 0.4)	82.31%	83.67%	88.44%	85.71%	85.71%
[0.4, 0.425)	83.67%	84.35%	88.44%	86.39%	87.07%
[0.425, 0.45)	85.71%	85.71%	90.48%	87.07%	87.76%
>0.45	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**



(**a**) (**b**)

Figure A4. (**a**) EBITDA, EBIT, CF, OCF, UFCF: frequency; (**b**) EBITDA, EBIT, CF, OCF, UFCF: cumulative frequency.

Table A10. EA and CFA frequency (n. observations).

Range	EBITDA	EBIT	CF	OCF	UFCF
<−1,000,000	0	0	0	12	13
[−1,000,000, 800,000)	0	0	0	4	4
[−800,000, −600,000)	0	0	0	3	2
[−600,000, −400,000)	0	0	0	4	6
[−400,000, −200,000)	01	2	1	6	7
[−200,000, 0)	8	16	8	5	5
[0, 200,000)	17	67	16	12	19
[200,000, 400,000)	27	45	29	32	33
[400,000, 600,000)	42	22	51	33	30
[600,000, 800,000)	36	7	34	19	15
[800,000, 1,000,000)	24	1	17	12	12
[1,000,000, 1,200,000)	5	0	4	10	5
[1,200,000, 1,400,000)	0	0	0	0	0
[1,400,000, 1,600,000)	0	0	0	1	1
[1,600,000, 1,800,000)	0	0	0	1	1
[1,800,000, 2,000,000)	0	0	0	0	0
[2,000,000, 2,200,000)	0	0	0	0	0
[2,200,000, 2,400,000)	0	0	0	0	0
[2,400,000, 2,600,000)	0	0	0	0	0
>2,600,000	0	0	0	6	7

Table A11. EA and CFA frequency (% observations).

Range	EBITDA	EBIT	CF	OCF	UFCF
<−1,000,000	0.00%	0.00%	0.00%	7.50%	8.13%
[−1,000,000, 800,000)	0.00%	0.00%	0.00%	2.50%	2.50%
[−800,000, −600,000)	0.00%	0.00%	0.00%	1.88%	1.25%
[−600,000, −400,000)	0.00%	0.00%	0.00%	2.50%	3.75%
[−400,000, −200,000)	0.63%	1.25%	0.63%	3.75%	4.38%
[−200,000, 0)	5.00%	10.00%	5.00%	3.13%	3.13%
[0, 200,000)	10.63%	41.88%	10.00%	7.50%	11.88%
[200,000, 400,000)	16.88%	28.13%	18.13%	20.00%	20.63%
[400,000, 600,000)	26.25%	13.75%	31.88%	20.63%	18.75%
[600,000, 800,000)	22.50%	4.38%	21.25%	11.88%	9.38%
[800,000, 1,000,000)	15.00%	0.63%	10.63%	7.50%	7.50%

Table A11. *Cont.*

Range	EBITDA	EBIT	CF	OCF	UFCF
[1,000,000, 1,200,000)	3.13%	0.00%	2.50%	6.25%	3.13%
[1,200,000, 1,400,000)	0.00%	0.00%	0.00%	0.00%	0.00%
[1,400,000, 1,600,000)	0.00%	0.00%	0.00%	0.63%	0.63%
[1,600,000, 1,800,000)	0.00%	0.00%	0.00%	0.63%	0.63%
[1,800,000, 2,000,000)	0.00%	0.00%	0.00%	0.00%	0.00%
[2,000,000, 2,200,000)	0.00%	0.00%	0.00%	0.00%	0.00%
[2,200,000, 2,400,000)	0.00%	0.00%	0.00%	0.00%	0.00%
[2,400,000, 2,600,000)	0.00%	0.00%	0.00%	0.00%	0.00%
>2,600,000	0.00%	0.00%	0.00%	3.75%	4.38%
Tot.	100.00%	100.00%	100.00%	100.00%	100.0%

Table A12. EA and CFA cumulative frequency (% observations).

Range	EBITDA	EBIT	CF	OCF	UFCF
<−1,000,000	0.00%	0.00%	0.00%	7.50%	8.13%
[−1,000,000, 800,000)	0.00%	0.00%	0.00%	10.00%	10.63%
[−800,000, −600,000)	0.00%	0.00%	0.00%	11.88%	11.88%
[−600,000, −400,000)	0.00%	0.00%	0.00%	14.38%	15.63%
[−400,000, −200,000)	0.63%	1.25%	0.63%	18.13%	20.00%
[−200,000, 0)	5.63%	11.25%	5.63%	21.25%	23.13%
[0, 200,000)	16.25%	53.13%	15.63%	28.75%	35.00%
[200,000, 400,000)	33.13%	81.25%	33.75%	48.75%	55.63%
[400,000, 600,000)	59.38%	95.00%	65.63%	69.38%	74.38%
[600,000, 800,000)	81.88%	99.38%	86.88%	81.25%	83.75%
[800,000, 1,000,000)	96.88%	100.00%	97.50%	88.75%	91.25%
[1,000,000, 1,200,000)	100.00%	100.00%	100.00%	95.00%	94.38%
[1,200,000, 1,400,000)	100.00%	100.00%	100.00%	95.00%	94.38%
[1,400,000, 1,600,000)	100.00%	100.00%	100.00%	95.63%	95.00%
[1,600,000, 1,800,000)	100.00%	100.00%	100.00%	96.25%	95.63%
[1,800,000, 2,000,000)	100.00%	100.00%	100.00%	96.25%	95.63%
[2,000,000, 2,200,000)	100.00%	100.00%	100.00%	96.25%	95.63%
[2,200,000, 2,400,000)	100.00%	100.00%	100.00%	96.25%	95.63%
[2,400,000, 2,600,000)	100.00%	100.00%	100.00%	96.25%	95.63%
Tot.	100.00%	100.00%	100.00%	100.00%	100.0%

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