EBITDA / EBIT AND CASH FLOW BASED ICRs: A COMPARATIVE APPROACH IN THE AGRO-FOOD SYSTEM IN ITALY

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In the article, even though it presents a joint reflection of the authors, Mattia Iotti wrote the following paragraphs: "Introduction", "Methodology" and "Data Analysis and Empirical Results"; Giuseppe Bonazzi wrote the paragraphs "Literature Review" and "Conclusions". The authors would like to thank arch. Chiara Panini for help in data collecting and analisiaziendale.it for free use of the database.

Abstract: The interest coverage ratios (ICRs) are used to quantify the ability of firms to pay financial debts; ICRs are then considered by banks such as covenants in the financing term sheet, and are used by researchers and the rating agencies to estimate the probability of default of firms. Typically, ICRs calculation is based on profit margins, such as EBITDA and EBIT; EBITDA and EBIT approximate, but do not directly express, cash flows available to pay financial debts. The article aims to evaluate whether there are significant differences in results using ICRs based on EBITDA or EBIT and ICRs based on different definitions of cash flow (CF). The application is made to a sample of firms characterized by high absorption of capital operating in the Italian agro-food sector. The article highlights that there are statistically significant differences using ICRs EBITDA and EBIT based and ICRs based on different CF definitions.

Keywords: EBITDA / EBIT based interest coverage ratios, Italian agro-food firms, debt repayment, operating cash flow

JEL Classification: Q13, Q14, G31, G32

Introduction

Several studies were conducted about the general theme of assessing a firm's capacity to sustain the financial cycle in order to be able to pay the cost of debt and to refund the financial debts borrowed in terms of net financial position (NFP). The firm's ability to support the financial cycle does not reside only in the ability to generate profit, but it is the situation in which the cash flows generated by operations are sufficient to pay the cost of debt and refund the debt; for this purpose interest coverage ratios (ICRs) are applied. These ratios express the firm's ability to pay the cost of debt traditionally using the profit margins generated by operations, such as EBITDA (earnings before interest, taxes, depreciation, and amortization) and EBIT (earnings before interest and taxes). However, EBITDA and EBIT do not express directly cash flow (CF) available to pay the cost of debt, but approximates CF. If ICRs calculated with EBITDA / EBIT based approach are different from ICRs calculated with CF based approach it is possible to state that the use of ICRs EBITDA / EBIT based approach provides distorted information about the firm's ability to sustain the cycle of indebtedness; it could then be useful to modify the traditional approach to ICRs ratios, expressing these with a CF based approach, especially for firms with a high level of capital requirement such as agro-food firms. This type of firms is a part of the agro-food system defined as the set of interdependent elements with the aim to satisfy food needs of the population in a given space and time (Malassis 1979; Malassis and Padilla 1986).

The article is divided into five parts. This part is the introduction of research that explains the reasons and objectives of the work; the second part is the literature review that explains how the work fits within the framework of studies already conducted and what new elements it provides; the third part describes the methodology used to calculate the ratios and sample selection; the fourth part discusses the data analysis and empirical results obtained; and the fifth and final part outlines the conclusions of the work, also expressing the limits and possible future research developments.

Literature review

Financial ratios are used (Barnes, 1987) to evaluate the firm’s capacity to repay its debts, to quantify business and managerial success and even to consider the statutory regulation of a firm's performance. The ratios are applied for an easier comparison between different firms; in fact, they are more significant than absolute values in comparison (Barnes, 1987). Whittington (1980) identified two principal uses of financial ratios. The first is to compare a firm's ratio with a general standard, and the second is in order to estimate empirical relationships also for predictive objectives. The former dates back to the end of the nineteenth century when US banks started to apply the ratio of current assets to current liabilities to evaluate firm’s credit rating (Horrigan, 1968; Dev, 1974; Ohlson, 1980, Hillegeist et al., 2004). In 1919 du Pont Company began to use a ratio system to evaluate its operating results, starting the application of financial ratios for managerial purposes. The bankruptcy prediction literature starts with the seminal work of Altman (1968) that tried to explain corporate bankruptcy status in the United States applying accounting and financial ratios. The importance of these ratios is considered in several research studies (Leland, 1994 and 1998) where it is shown that an interest coverage ratio covenant could reduce asset volatility. The covenants often considered in bank loan agreements (Gray et al., 2006) are leverage and current ratio, interest coverage ratios are also frequently used, expressing as EBIT or EBITDA to interest expense ratio, having an earnings based approach. These are the most important financial covenants in terms of frequency as expressed in different studies (Dichev et al., 2002; Demerjian, 2011).

The ratios are also applied by rating agencies and banks to assess the rating of companies, in particular (Dothan, 2006) banks use ratios that express the ability to pay debt service (interest coverage ratios and cash flow measures), profitability (return on equity and return on assets) and leverage (debt to assets and debt to equity ratio). The banks usually include the minimum interest coverage ratio (ICR) that the firm must comply with in the term sheet for financing; the text of the covenants by the definition of the minimum ICR could be in terms of earnings before interest and taxes (EBIT) and/or in terms of earnings before interest, taxes, depreciation, and amortization (EBITDA). EBITDA is an accounting measure frequently recommended as a proxy for cash flow; the definitions of accruals versus cash flow were conducted also by Healy (1985) and Sloan (1996); these researchers have been considered the standard in the accounting literature until the introduction of a more comprehensive model by Richardson (2005); this model is considered useful in explaining the financial performance and the relationship between accounting and cash flow data. Some researchers (Esty, 2004) use the cash flow based ICRs approach in analyzing project finance operations. An interesting paper (Trejo-Pech et al., 2006), exploring the relationship between earnings (EBITDA) and the cash flow measure for agro-food firms data in USA, shows that EBITDA differ from CF and should not be used as a CF proxy. We believe that the work of Trejo-Pech has the advantage of making the analysis of comparison between EBITDA and CF in a specific business sector, namely the agro-food firms. In fact, different sectors may have different dynamics of absorption of capital in fixed assets and working capital; in this way it could not be possible to compare sectors that have different characteristics in terms of production, investments, revenues and payments cycle. In Italy, some researchers (such as Dono et al., 2010) have analyzed the role of sustainability indicators of the business cycle, including ICRs, in the case of agricultural firms evaluated by public agencies in order to test the firms' access to state funds. In some other Italian studies (as in Cupo et al., 2008) ICRs were applied to analyze agricultural firms credit standing considering Basel II Accord. We intend to expand the work of Trejo-Pech, also considering the work of these Italian researchers, applying ratios that express the ability to pay financial debts with a methodology considering earnings and financial ratios net of financial charge.

Methodology

The economic approach quantifies the result of the management cycle in terms of profit considering the moment in which the value is generated by the firm's activity; this is in fact an accounting approach; the financial approach considers the management result in terms of cash inflow and outflow, as streams of money (Kwon, 1989; Copeland et al., 2000). The economic approach uses an analysis of positive and negative voices of income to calculate profit. We can express the economic approach, defining the value of production, for a generic time t, in the income statement, as follows:

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

where S_t are sales at time t, I_t and I_{t-1} are inventories at time t and t-1, respectively; $\Delta_{It,t-1}$ is the variation of inventories between time t-1 and time t. The value of production (VP) is a stream value (Dechow et al., 2002). The operative monetary costs are raw material costs (M_t), costs for services (S_t), rent and leasing costs (R_t), labor costs (L_t), others operative costs (O_t). In the income statement we summarize non-monetary operating costs as amortization of tangible and intangible fixed assets (D_t) and depreciation and risk provisions (A_t). The balance of financial operations, in terms of interest income and interest expenses is expressed as follows:

(2) $$SF_t = I_t^a - I_t^p$$

where I_t^a are interest incomes at time t, I_t^p are interest expenses at time t. The balance of extraordinary voices of income (SX_t), at time t, is given by:

(3) $$SX_t = X_t^a - X_t^p$$

where X_t^a is an extraordinary income while X_t^p is an extraordinary expense. We can then express the income statement as follows:

(4) $$VP_t - (M_t + S_t + R_t + L_t + O_t) = EBITDA_t \quad ; \quad EBITDA_t - (D_t + A_t) = EBIT_t \quad ;$$
$$EBIT_t + SF_t + SZ_t = \Pi_t^{aT}$$

where *EBITDA* approximates the creation of liquidity about the costs, such as net of non-monetary costs ($D_t + A_t$); *EBIT* is the operating income margin expressing an intermediate operative current income; Π_t^{aT} is profit before taxes while profit after taxes (Π_t^{pT}) is given as follows:

(5) $$\Pi_t^{aT} - T_t^Y = \Pi_t^{pT}$$

where Π_t^{pT} expresses the remuneration, at a given time t, of the equity capital given by equityholders while T_t^Y are income taxes.

The financial approach differs from the economic approach; the economic approach quantifies intermediate income margins while the financial approach expresses different types of cash flow available. The cash flow statement is the table used to quantify the cash flow generation (Wallace et al., 1997; Krolick, 1998; Penman, 2004):

(6) $$\Pi_t^{pT} + (D_t + A_t) - (I_t^a - I_t^p) = CF_t \quad ; \quad CF_t - (NWC_t - NWC_{t-1}) = OCF_t \quad ;$$
$$OCF_t - (FA_t - FA_{t-1}) - (D_t + A_t) = UFCF_t \quad ; \quad UFCF_t + (I_t^a - I_t^p) = FCFE_t$$

where CF_t is cash flow at time t, OCF_t is the operating cash flow at time t, $UFCF_t$ is the unlevered free cash flow at time t, $FCFE_t$ is free cash flow to equity at time t, *NWC* is net working capital. We have $\Delta^+ NWC_{t,t-1} => \Delta^- OCF_{t,t-1}$ expressing that an increase in net working capital implies an increase in absorption of liquidity that reduces operating cash flow and vice versa in the case of negative variation ($\Delta^- NWC_{t,t-1} => \Delta^+ OCF_{t,t-1}$). An increase in inventories ($\Delta^+ I_{t,t-1}$), that is a positive income voice, implies a reduction in the operating cash flow: $\Delta^{\pm} I_{t,t-1} \Rightarrow \Delta^{\mp} OCF_{t,t-1}$ with $|\Delta^{\pm} I_{t,t-1}| = |\Delta^{\mp} OCF_{t,t-1}|$. Given OCF_t, the liquidity absorption due the fixed asset investment has an effect on $UFCF_t$, having that $[(FA_t - FA_{t-1}) - (D_t + A_t)] > 0 => \Delta^- UFCF_{t,t-1}$, and vice versa. $UFCF_t$ is therefore the cash flow available, given the investments in fixed assets, at time t, to remunerate the financial debt and equity capital.

Given the income statement and cash flow statement structure, we would propose in the article a panel of 12 ratios that are applied to the firm's sample date, also considering comparisons between different ratio's results. The ratios are divided into 2 categories; the ratios from S1 to S6 are marked with "ea" letters expressing an earning approach and assume the denomination from S1ea to S6ea; the ratios from S7 to S12 are marked with "cfa" letters expressing a cash flow approach and assume the denomination from S7cfa to S12cfa. The traditionally formulated ratios are expressed with an asterisk (S1ea*, S2ea*, S3ea*, S4ea*), where we consider S1ea* and S2ea* as ICR with economic approach (respectively EBITDA and EBIT based ICR); the ratios suggested in the article, if characterized by innovation considering a financial value in the evaluation of sustainability, are marked with two asterisks (S7cfa**, S8cfa**, S9cfa**, S10cfa**), where S7cfa** and S8cfa** are ICRs with the financial approach (respectively OCF and UFCF based ICR). We use OCF and UFCF because we do not consider CF adequately expressive of cash flow available to pay the cost of debt as it does not consider the absorption of financial resources due to the cycle of working capital. The ratios that we consider innovative because of the expression of ability to pay NFP with a value net of the interest charge are indicated with three asterisks (S5ea***, S6ea***, S11cfa***, S12cfa***), where S5ea*** and S8cfa*** have the earning approach while S11cfa*** and S12cfa*** concern the financial approach.

Data analysis was conducted on a sample of 250 firms of the agro-food sector operating in 4 northern regions of Italy (Piemonte, Lombardia, Emilia-Romagna and Veneto). The data was made available free of charge by the analisiaziendale.it company and it was randomly drawn from the financial statements in the AMADEUS database considering 2005 as the extraction year; the data extraction covers the 5-year period from 2006 to 2010 and uses the financial statements filed by corporations and cooperatives each year at the Registrar of Companies. In the sample, 87 firms operate in the meat sector (ATECO-ISTAT code 15.1), 4 operate in the fish transformation industry (ATECO-ISTAT code 15.2), 51 operate in the vegetables preserving industry (ATECO-ISTAT code 15.3), 8 operate in the oils and fats processing industry (ATECO-ISTAT code 15.4), 67 operate in the milk and dairy industry (ATECO-ISTAT code 15.5), 33 operate in the pasta and bakery products industry (ATECO-ISTAT code 15.8). These types of firms are interesting because several studies (Iotti et al., 2011) have shown that in agro-food there is a high capital absorption in the cycle of fixed assets and in the working capital cycle; this is due to processing of agricultural raw materials that often requires high investments in plant and machinery and also determines the absorption of capital due to the aging cycle of production, especially for cured meats and hard matured cheeses.

The 2005 data were used to provide availability of the 2006 cash flow statements. The random extraction from the AIDA database of the 250 firms in the sample took into account the following extraction parameters:

1. The extracted firms are limited liability companies (società a responsabilità limitata, società per azioni, società in accomandita per azioni) as defined in the Italian Civil Code; in the sample cooperative firms are not included.
2. The extracted firms are classified as agro-food firms in accordance with the classification of the Italian National Institute of Statistics (ISTAT).
3. The extracted firms have all data available for the years from 2006 to 2010 (except for firms that failed or ceased the activity during the period 2006 / 2010); during the 5-year period 2 companies were declared bankrupt (1 in 2006 and 1 in 2009) and 13 firms closed for voluntary liquidation (2 in 2006, 3 in 2007, 1 in 2008, 4 in 2009, 3 in 2010).
4. The turnover of the extracted firms is between 2 and 50 million Euros, in compliance with the EU definition for small and medium-sized enterprises (SMEs).

A total of 1,207 year-firms have been considered. The analysis tests the following 8 null hypotheses:

H_1: the S_{1ea*} and S_{7cfa**} ratios have equal means (medians) in the firm's sample;
H_2: the S_{2ea*} and S_{8cfa**} ratios have equal means (medians) in the firm's sample;
H_3: the S_{3ea*} and S_{9cfa**} ratios have equal means (medians) in the firm's sample;
H_4: the S_{4ea*} and $S_{10cfa**}$ ratios have equal means (medians) in the firm's sample;
H_5: the S_{3ea*} and S_{5ea***} ratios have equal means (medians) in the firm's sample;
H_6: the S_{4ea*} and S_{6ea***} ratios have equal means (medians) in the firm's sample;
H_7: the $S_{9cfa***}$ and $S_{11cfa***}$ ratios have equal means (medians) in the firm's sample;
H_8: the S_{10ea**} and $S_{12cfa***}$ ratios have equal means (medians) in the firm's sample.

In order to verify the different hypotheses we first applied an approach with parametric statistics (paired sample Student's t-test); if the D statistic of Kolmogorov-Smirnov shows that the distribution of 1 or 2 ratios considered in testing the different hypothesis is not normally distributed, we also apply a non-parametric statistic (Wilcoxon paired sample t-test) to verify the hypothesis; in fact, t-Student statistics could be correctly applied only in the case of a sample with normal distribution. The data analysis were performed using the statistical package SPSS, issue 19.

Data analysis and empirical results

Data analysis was carried out by verifying the assumptions made in 8 equal means for couples of financial ratios. The analysis was conducted with the parametric approach (paired sample Student's t-test). The results of the analysis show that the null hypotheses (equality of means) must be rejected at 95% level of significance for all couples of ratios analyzed using the parametric approach.

The Kolmogorov-Smirnov D statistic shows that all distributions of the ratios do not follow the normal distribution; in past years, several researchers have shown the non normality of the financial ratios distribution in their analysis (McLeav, 1982; Barnes, 1982; Ezzamel et al., 1987).

Therefore, a non-parametric approach was applied for paired data (Wilcoxon paired sample t-test) to test the null hypotheses (in this case equality of medians). We can then reject the null hypotheses for all pairs of ratios having 95% level of significance with the parametric approach.

The research can then show some remarkable results in terms of application:

1. The ICRs EBITDA and EBIT based (S_{1ea*} and S_{2ea*}), with the earnings based approach, are significantly different compared to ICRs OCF and UFCF based (S_{7cfa**} and S_{8cfa**}), with the cash flow based approach; we then suggest to apply the cash flow based ratios; therefore, the application of ICRs earnings based, both in the quantification of bank covenants for credit operations and the analysis of the ratings, leads to a distorted result; this result is significantly different than the real result that could be calculated with the ICRs cash flow based.

2. The ratios expressing the firm's capacity to repay financial debts, EBITDA and EBIT based (S_{3ea*} and S_{4ea*}), with the earnings based approach, are statistically different if compared with OCF and UFCF based ratios (S_{8cfa**} and S_{9cfa**}), with the cash flow based approach. We then suggest to apply the cash flow based ratios; the S_{3ea*} and S_{4ea*} application, in order to quantify covenants in financing operations and to quantify the firm's rating causes a distorted result; this result is significantly different than the real result that is calculated with the S_{8cfa**} and S_{9cfa**} cash flow based ratios.

3. The ratios applied to express the firm's capacity to repay financial debts EBITDA and EBIT based (S_{3ea*} and S_{4ea*}) and OCF and UFCF based (S_{8cfa**} and S_{9cfa**}), do not express this attitude in a correct way; in fact, the analyzed couple of ratios (S_{3ea*} and S_{5ea***}, S_{4ea*} and S_{6ea***}, $S_{9cfa***}$ and $S_{11cfa***}$, S_{10ea**} and $S_{12cfa***}$) show that the ratios not considering the interest charge, as traditionally applied (S_{3ea*}, S_{4ea*}, $S_{9cfa***}$, S_{10ea**}), are significantly different than the suggested ratios that are calculated considering the cost of debt (S_{5ea***}, S_{6ea***}, $S_{11cfa***}$, $S_{12cfa***}$); if we apply traditional ratios we could overestimate the firm's ability to repay its debts and, therefore, provide distorted information on the sustainability of debt service.

Conclusion

The evaluation of the cost of debt payment, carried out applying ICRs, and the analysis of the ability to repay financial debts, are essential to quantify: a) the sustainability of the business cycle, b) the calculation of the firm's rating, c) the covenants in bank financing operations, d) the managerial assessment of sustainability of the business cycle. This importance is higher in firms where the economic and the financial cycle have a time lag, due to the absorption of capital in the cycle of investments in fixed assets and in working capital, as in the case of agro-food firms. Firms with a greatest mismatch between the economic and the financial cycles often operate in the aging of meat and dairy products, such as cured meats and hard cheeses; in this sector of the agro-food system it would be useful to perform future studies.

The article proposes the use of ICRs expressing directly the financial ability to pay the cost of debt (ICRs cash flow based), and ratios that express the repayment of financial debt with cash flows net of the cost of interest charge. All the suggested ratios are statistically different compared to the traditional ratios used in banking covenants and, often, for the calculation of the firm's rating. The analysis thus shows that it is preferable to use the suggested ratios rather than the traditional ones; the former are able to express the sustainability of the business cycle more correctly.

The analysis is based, however, on a sample of only 1.207 observations of Italian data, and for some agro-food segments. It may therefore be important, even for the work of other researchers, that research proceeds to test the suggested ratios in other sectors and in other states to get a more reliable evaluation of the correctness of the suggested ratios.

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DOI: 10.5817/FAI2012-2-2

Appendix

Fig. 1 Ratios applied in the research on the firm's sample data

Ratio	Formula	Meaning
S_{1ea*}	EBITDA / I	Expresses the firm's capacity to pay interest on financial debts using an earning measure such as EBITDA as a proxy of CF.
S_{2ea*}	EBIT / I	Expresses the firm's capacity to pay interest on financial debts using an earning measure such as EBIT as a proxy of CF.
$S_{3ea\ *}$	EBITDA / NFP	Expresses the firm's capacity to repay NFP using an earning measure such as EBITDA as a proxy of CF.
S_{4ea*}	EBIT / NFP	Expresses the firm's capacity to repay NFP using an earning measure such as EBIT as a proxy of CF.
S_{5ea***}	(EBITDA – I) / NFP	Expresses the firm's capacity to repay NFP using an earning measure such as EBITDA as a proxy of CF net of the interest charge I.
S_{6ea***}	(EBIT – I) / NFP	Expresses the firm's capacity to repay NFP using an earning measure such as EBIT as a proxy of CF net of the interest charge I.
S_{7cfa**}	OCF / I	Expresses the firm's capacity to pay interest on financial debts using a financial measure such as OCF.
S_{8cfa**}	UCFC / I	Expresses the firm's capacity to pay interest on financial debts using a financial measure such as UFCF.
S_{9cfa**}	OCF / NFP	Expresses the firm's capacity to repay NFP using a financial measure such as OCF.
$S_{10cfa**}$	UFCF / NFP	Expresses the firm's capacity to repay NFP using a financial measure such as UFCF.
$S_{11cfa***}$	(OCF – I) / NFP	Expresses the firm's capacity to repay NFP using a financial measure such as OCF net of the interest charge I.
$S_{12cfa***}$	(UFCF – I) / NFP	Expresses the firm's capacity to repay NFP using a financial measure such as UFCF net of the interest charge I.

Source: Authors' calculation.

Fig. 2 Descriptive statistics

	N	Min	Max	Mean		Dev std.	Asymmetry		Kurtosis	
	Stat	Stat	Stat	Stat	Standard dev	Stat	Stat	Stat	Stat	Standard dev
S_{1ea*}	1207	-19.4783	4644.6753	102.0290	17.3214	601.7792	7.184	.07000	51.169	.141
S_{2ea*}	1207	-40.2643	677.8350	17.6106	2.5600	88.9417	6.841	.07000	47.687	.141
S_{3ea*}	1207	-271.2103	.6081	-9.3428	1.2665	44.0032	-5.167	.07000	25.643	.141
S_{4ea*}	1207	-33.6988	112.4473	.6571	.4428	15.3838	6.146	.07000	43.932	.141
S_{5ea***}	1207	-268.4176	.5433	-8.6917	1.1829	41.0993	-5.356	.07000	28.358	.141
S_{6ea***}	1207	-33.1619	115.2400	1.3082	.4493	15.6111	6.285	.07000	44.692	.141
S_{7cfa**}	1207	-66.6192	14188.4805	252.0930	52.2130	1813.9810	7.531	.07000	55.058	.141
S_{8cfa**}	1207	-11081.8052	922.7290	-171.3491	40.9255	1421.8320	-7.496	.07000	54.784	.141
S_{9cfa**}	1207	-128.2280	92.6552	-1.3146	.5993	20.8225	-2.269	.07000	26.955	.141
$S_{10cfa**}$	1207	-36.0901	141.1224	1.7976	.5459	18.9671	6.447	.07000	45.799	.141
$S_{11cfa***}$	1207	-92.3714	95.4479	-.6635	.5081	17.6545	.294	.07000	23.863	.141
$S_{12cfa***}$	1207	-14.5495	143.9152	2.4481	.5374	18.6726	7.217	.07000	51.919	.141

Source: Authors' calculation.

Fig. 3 Paired-sample statistics – parametric approach – t-Student statistic

Cfr. between couple of ratios (H$_0$: Ratio1 mean = Ratio2 mean in the couple)		Confidence interval 95%		t-Sudent stat.	D.F.	Sig. (2-tailed)	§: Sign. 0.05 (2-sided test)
		Min.	Max.				
Ratios Couple 1	S_{1ea*} - S_{7cfa**}	-218.9614	-81.1665	-4.273	1206	.000	§
Ratios Couple 2	S_{2ea*} - S_{8cfa**}	107.9492	269.9702	4.576	1206	.000	§
Ratios Couple 3	S_{3ea*} - S_{9cfa**}	-10.7174	-5.3390	-5.857	1206	.000	§
Ratios Couple 4	S_{4ea*} - $S_{10cfa**}$	-1.5846	-.6951	-5.029	1206	.000	§
Ratios Couple 5	S_{3ea*} - S_{5ea***}	-.9102	-.3920	-4.931	1206	.000	§
Ratios Couple 6	S_{4ea*} - S_{6ea***}	-.9101	-.3920	-4.931	1206	.000	§
Ratios Couple 7	S_{9cfa**} - $S_{11cfa***}$	-.9101	-.3920	-4.931	1206	.000	§
Ratios Couple 8	$S_{10cfa**}$- $S_{12cfa***}$	-.9101	-.3920	-4.931	1206	.000	§

§: Sign. 0.05 (2-sided test)

Source: Authors' calculation.

Fig. 4 Kolmogorov-Smirnov D statistic on normality of distribution

Null hypothesis (H_0)	Test	Sign,	Decision
S_{1ea*} distribution is normal with mean 102.03 and standard deviation 601.78	Kolmogorov-Smirnov D statistic	.000	§Reject null hypothesis
S_{2ea*} distribution is normal with mean 17.61 and standard deviation 88.94	Kolmogorov-Smirnov D statistic	.000	§Reject null hypothesis
S_{3ea*} distribution is normal with mean -9.34 and standard deviation 44.00	Kolmogorov-Smirnov D statistic	.000	§Reject null hypothesis
S_{4ea*} distribution is normal with mean 0.66 and standard deviation 15.38	Kolmogorov-Smirnov D statistic	.000	§Reject null hypothesis
S_{5ea***} distribution is normal with mean -8.69 and standard deviation 41.10	Kolmogorov-Smirnov D statistic	.000	§Reject null hypothesis
S_{6ea***} distribution is normal with mean 1.31 and standard deviation 15.61	Kolmogorov-Smirnov D statistic	.002	§Reject null hypothesis
S_{7cfa**} distribution is normal with mean 252.09 and standard deviation 1,813.98	Kolmogorov-Smirnov D statistic	.003	§Reject null hypothesis
S_{8cfa**} distribution is normal with mean -171.35 and standard deviation 1,421.83	Kolmogorov-Smirnov D statistic	.000	§Reject null hypothesis
S_{9cfa**} distribution is normal with mean -1.31 and standard deviation 20.82	Kolmogorov-Smirnov D statistic	.000	§Reject null hypothesis
$S_{10cfa**}$ distribution is normal with mean 1.80 and standard deviation 18.97	Kolmogorov-Smirnov D statistic	.000	§Reject null hypothesis
$S_{11cfa***}$ distribution is normal with mean 0.66 and standard deviation 17.65	Kolmogorov-Smirnov D statistic	.000	§Reject null hypothesis
$S_{12cfa***}$ distribution is normal with mean 2.45 and standard deviation 18.67	Kolmogorov-Smirnov D statistic	.000	§Reject null hypothesis

§: Sign. 0.05 (2-sided test)

Source: Authors' calculation.

Fig. 5 Paired-sample statistics - non parametric approach – T-Wilcoxon paired sample test

Cfr. between couple of ratios (H₀: Ratio1 median = Ratio2 median in the couple)		T-Wilcoxon paired sample test	T-Wilcoxon paired sample test (standardized value)	Sig. (2-tailed)	§: Sign. 0.05 (2-sided test)
Ratios Couple 1	S_{1ea*} - S_{7cfa**}	193,689.000	-14.103	.000	§
Ratios Couple 2	S_{2ea*} - S_{8cfa**}	233,197.000	-10.842	.000	§
Ratios Couple 3	S_{3ea*} - S_{9cfa**}	308,067.000	-4.660	.000	§
Ratios Couple 4	S_{4ea*} - $S_{10cfa**}$	335,953.000	-2.358	.018	§
Ratios Couple 5	S_{3ea*} - S_{5ea***}	216,672.000	-12.206	.000	§
Ratios Couple 6	S_{4ea*} - S_{6ea***}	216,660.000	-12.184	.000	§
Ratios Couple 7	S_{9cfa**} - $S_{11cfa***}$	216,672.000	-12.206	.000	§
Ratios Couple 8	$S_{10cfa**}$- $S_{12cfa***}$	216,082.000	-11.890	.000	§

§: Sign. 0.05 (2-sided test)

Source: Authors' calculation.

Fig. 6 Ratios correlation (Pearson's approach)

		S_{1ea*}	S_{2ea*}	S_{3ea*}	S_{4ea*}	S_{5ea***}	S_{6ea***}	S_{7cfa**}	S_{8cfa**}	S_{9cfa**}	$S_{10cfa**}$	$S_{11cfa***}$	$S_{12cfa***}$
S_{1ea*}	Pearson correl.	1	,381**	,014	,004	,013	-,002	,991**	-,961**	,014	,007	,011	,002
	Sig. (2-sided test)		,000	,621	,885	,653	,945	,000	,000	,623	,819	,695	,956
	N	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207
S_{2ea*}	Pearson correl.	,381**	1	,069*	-,101**	,071*	-,108**	,260**	-,112**	-,044	-,071*	-,059*	-,079**
	Sig. (2-sided test)	,000		,016	,000	,014	,000	,000	,000	,131	,014	,040	,006
	N	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207
S_{3ea*}	Pearson correl.	,014	,069*	1	-,591**	,997**	-,778**	,030	-,021	,056	-,598**	-,107**	-,770**
	Sig. (2-sided test)	,621	,016		,000	,000	,000	,297	,456	,053	,000	,000	,000
	N	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207
S_{4ea*}	Pearson correl.	,004	-,101**	-,591**	1	-,644**	,956**	-,010	,001	,721**	,916**	,825**	,906**
	Sig. (2-sided test)	,885	,000	,000		,000	,000	,737	,969	,000	,000	,000	,000
	N	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207
S_{5ea***}	Pearson correl.	,013	,071*	,997**	-,644**	1	-,811**	,030	-,021	-,024	-,661**	-,184**	-,818**
	Sig. (2-sided test)	,653	,014	,000	,000		,000	,298	,464	,409	,000	,000	,000
	N	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207
S_{6ea***}	Pearson correl.	-,002	-,108**	-,778**	,956**	-,811**	1	-,015	,006	,491**	,848**	,630**	,910**
	Sig. (2-sided test)	,945	,000	,000	,000	,000		,596	,833	,000	,000	,000	,000
	N	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207
S_{7cfa**}	Pearson correl.	,991**	,260**	,030	-,010	,030	-,015	1	-,988**	,003	-,013	-,001	-,018
	Sig. (2-sided test)	,000	,000	,297	,737	,298	,596		,000	,908	,642	,968	,523
	N	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207
S_{8cfa**}	Pearson correl.	-,961**	-,112**	-,021	,001	-,021	,006	-,988**	1	-,008	,004	-,005	,008
	Sig. (2-sided test)	,000	,000	,456	,969	,464	,833	,000		,785	,896	,865	,782
	N	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207
S_{9cfa**}	Pearson correl.	,014	-,044	,056	,721**	-,024	,491**	,003	-,008	1	,754**	,985**	,583**
	Sig. (2-sided test)	,623	,131	,053	,000	,409	,000	,908	,785		,000	,000	,000
	N	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207
$S_{10cfa**}$	Pearson correl.	,007	-,071*	-,598**	,916**	-,661**	,848**	-,013	,004	,754**	1	,842**	,970**
	Sig. (2-sided test)	,819	,014	,000	,000	,000	,000	,642	,896	,000		,000	,000
	N	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207
$S_{11cfa***}$	Pearson correl.	,011	-,059*	-,107**	,825**	-,184**	,630**	-,001	-,005	,985**	,842**	1	,702**
	Sig. (2-sided test)	,695	,040	,000	,000	,000	,000	,968	,865	,000	,000		,000
	N	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207
$S_{12cfa***}$	Pearson correl.	,002	-,079**	-,770**	,906**	-,818**	,910**	-,018	,008	,583**	,970**	,702**	1
	Sig. (2-sided test)	,956	,006	,000	,000	,000	,000	,523	,782	,000	,000	,000	
	N	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207	1207

**. Corr. with sign. 0.01 (2-sided test), *. Corr. with sign. 0.05 (2-sided test). *Source: Authors' calculation.*