Profitability of IT companies in the Republic of Croatia in (non)crisis periods: Skillings-Mack test

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Abstract. *Exogenous shocks jolt companies, which is often manifested in realized profitability. The aim of the paper is to determine whether there is a statistically significant difference in the profitability of the Croatian companies operating in the IT sector, before, during and after crisis periods. The paper covers two global crises: financial crisis and COVID-19 pandemic. Based on secondary data from the company's financial statements for the period from 2008 to 2023 and by applying the Skillings-Mack test, it has been proven that there are (in)equalities in the profitability of companies from the analysed industry, and that there is a statistically significant difference in profitability measured by the gross return on assets at a significance level of 1 % in the observed periods.*

Keywords. IT activity, Skillings-Mack test, panel data, crisis

1 Introduction

Without delving into a discussion about the ultimate purpose of the company's operations, Tamminen (2017) states that profitability is the final outcome of the overall management of pricing strategies of all products in relation to the overall cost structure with regard to the competitive environment. However, the question of what determines the profitability of a company is the focus of many researches[1].

Given Marx's theory of economic cycles, Fichtenbaum (1988) states that the participants in the discussion over this theory agree on one point, namely that crises are connected with a drop in the rate of profit. However, they disagree on the factors that caused this drop. This is supported by the fact that, according to Binz (2020) profitability is the result of the interplay between consumption, output and investment, which determine income and expenses, as well as the fact that during times of economic uncertainty, demand falls and income falls, resulting in a decline in profitability.

According to Jermann and Quadrini (2009) the crisis that began in the United States of America (USA) due to subprime loans in the summer of 2007 suggests that the financial sector plays an important role as a source of business cycle fluctuations. The financial shock, or disruption that originated directly from the financial sector, which consequently affected the *global village*, spilled over into the real sector as well. Prasad et al. (2015) in their research find evidence that the financial crisis reduced the profitability of companies from Indonesia, Korea and Thailand included in the sample.

After the recovery, the world was shocked by a new economic shock – the COVID-19 pandemic. The COVID-19 pandemic, as one of the external shocks, accelerated the digitization of various aspects of the company's operations by up to four years in just a few of months. It also increased the level of digital products and services in business portfolios that would otherwise have taken seven years to reach. (McKinsey & Company, 2020) Under pandemic conditions, digital technology has become a pillar for the development and creation of new business models that enable an improvement in relationships with customers and stakeholders as well as an overall improvement of the company. The above implies that the COVID-19 crisis affected the growth of demand for IT industry products and services. Based on the findings of their study of the IT sector in the Republic of Croatia, Zubak et al. (2022) conclude that the IT industry proved to be less sensitive to the negative circumstances of the crisis in 2020 and 2021 than most other industries, especially services.

This provokes the question: is the force of economic destruction damaging the profitability of companies in all sectors? For this reason, this paper aims to determine whether there is a statistically significant difference in the profitability of the Croatian IT industry, specifically companies operating in the IT sector, before, during and after the crisis. In

[1] Goddard et al. (2009) provide a qualitative overview of studies into the factors of firm profitability.d

this context, the goal is to determine (in)equalities in the profitability of business operations of the mentioned companies', not only in the pre-crisis and post-crisis period, but also in the crisis period. Profitability is therefore regarded as one of the indicators of the IT sector's resilience to external shocks.

The time horizon of consideration is the sixteen-year period from 2008 - 2023, whereby the period from 2008 - 2014 defines as the period of financial crisis, the period from 2015 - 2019 as the post-crisis period of the financial crisis, i.e., the pre-crisis period of the COVID-19 crisis, the period 2020 - 2021 as the period of the COVID-19 crisis and 2022 and 2023 as the post-crisis period of the COVID-19 crisis.

2 Literature Review

The aim of many researches is to test the existence of differences in determinants that affect the profitability of companies before and/or during and/or after the economic crisis (for example, Adlina, 2015; Argyrou et al., 2016; Cheong & Hoang, 2021 etc.), and among them there are especially those that investigate the aforementioned on samples of the banking sector (for example, Adelopo et al., 2018; Demirhan, 2013; Dietrich & Wanzenried, 2011; Rossi et al., 2018 etc.). However, there are few studies that empirically investigate whether there is a statistically significant difference between the profitability of companies before, during and/or after the crisis period.

Research that includes companies from the non-financial sector primarily differs in terms of the scope of the company's activities, and the time period or crisis that they examine. For instance, Prasad et al. (2015) investigate the mentioned issue on the example of industrial companies, Spitsin et al. (2020) on manufacturing companies, and Mazliza & Kusumaningdyah Adiati (2023) on listed manufacturing companies, Mulyono (2023) on listed companies but from the technology and telecommunications industry, Migliaccio (2018) and Pavone et al. (2023) on hotels with revenues over 800 thousand euros, and Migliaccio & De Palma (2023) on real estate companies. Apart from the aforementioned, the studies also include companies from various industries, which are listed on the stock exchange (Denčić-Mihajlov, 2014; Maziarczyk, 2020; Paulus Tahu & Yuesti, 2021; Rizaldi et al., 2022; Sulistyorini et al., 2023).

Furthermore, previously listed studies studies are primarily focused on the time period of a single crisis. For example, Maziarczyk (2020), Migliaccio (2018) and Pavone et al. (2023) investigate the existence of statistically significant differences in the profitability of companies due to the global crisis of 2008, which affected most countries of the world. The main findings of the aforementioned studies show that there is a statistically significant difference in profitability indicators in the non-crisis period versus the period of the global economic crisis. In particular, the results of this investigations reveal a decrease in the profitability of companies due to the global crisis.

The most recent external shock that jolted the world related to the COVID-19 pandemic is also considered by scientists as a crisis that affected the profitability of companies. Therefore, Mazliza & Kusumaningdyah Adiati (2023), Migliaccio & De Palma (2023), Mulyono (2023) and Paulus Tahu & Yuesti (2021) investigate the difference in company profitability due to the COVID-19 pandemic. The results of the mentioned research are not unambiguous. First, the main results of some of these studies show that there is a difference in the profitability indicator before the pandemic and during the COVID-19 pandemic. This is confirmed by the research results conducted by Mazliza & Kusumaningdyah Adiati (2023) and Mulyono (2023). Thay agree that the pandemic has reduced the profitability of companies. Second, some of these studies only partially confirm that there is a difference in profitability in pandemic versus non-pandemic periods, such as research conducted by Migliaccio & De Palma (2023). The main findings of that research can only to a limited extent confirm the difference in profitability before and during the pandemic, since the profitability of companies fell slightly and only in certain geographical areas. Finally, the main results of some studies shows that there isn`t statistically significant difference in the profitability of companies in the non-pandemic period versus the pandemic period. This is confirmed by the study results conducted by Paulus Tahu & Yuesti (2021). They didn`t find empirical evidence, i.e., there is no significant difference in profitability ratios before and after the announcement of the first case of Covid-19.

According to the author's knowledge, no research on IT activities has been conducted at this point, and unlike the aforementioned studies, which considered only one crisis, the subject research includes two exogenous shocks: the 2008 global crisis and the COVID-19 pandemic.

3 Methodological Framework

3.1 Sample

The research sample consists of 80,490 company-year observations, that is, quantitative secondary data on companies registered in the Republic of Croatia in the period from 2008 to 2023. The sample is based on the approach used by the Croatian Chamber of Economy (CCE) in its research of the Croatian IT sector (Zubak et al., 2022), and it includes companies registered in the classes of activities that comprise the IT industry according to the National Classification of Activities 2007 (Vlada Republike Hrvatske, 2007). First, the analysis includes companies/trades that are in the corporate income tax system and have submitted

annual financial reports to the Financial Agency (FINA); second, companies are classified according to how they registered their core activity; and third, the IT industry is defined as the following classes of the National Classification of Activities i.e., Statistical classification of economic activities in the European Community (NACE Rev. 2) (Eurostat, 2008; Vlada Republike Hrvatske, 2007):

- C 26.11 Manufacture of electronic components
- C 26.12 Manufacture of loaded electronic boards
- C 26.20 Manufacture of computers and peripheral equipment
- C 26.30 Manufacture of communication equipment
- G 46.51 Wholesale of computers, computer peripheral equipment and software
- G 46.52 Wholesale of electronic and telecommunications equipment and parts
- G 47.41 Retail sale of computers, peripheral units and software in specialised stores
- G 47.42 Retail sale of telecommunications equipment in specialised stores
- J 58.21 Publishing of computer games
- J 58.29 Other software publishing
- J 62.01 Computer programming activities
- J 62.02 Computer consultancy activities
- J 62.03 Computer facilities management activities
- J 62.09 Other information technology and computer service activities
- J 63.11 Data processing, hosting and related activities
- S 95.11 Repair of computers and peripheral equipment
- S 95.12 Repair of communication equipment.

The time period of the analysis covers the sixteen-year period from 2008 to 2023, with the period from 2008 to 2014 defined as the period of the financial crisis, the period from 2015 to 2019. as the post-crisis period of the financial crisis, i.e., the pre-crisis period of the COVID-19 crisis, the period 2020 - 2021 as the period of the COVID-19 crisis and the period of 2022 - 2023 as the post-crisis period of the COVID-19 crisis. The selection of the mentioned period is primarily the result of the defined problem and research objective.

Table 2., attached to Appendix 1, demonstrates the distribution of the number of companies in the defined time period by the covered classes of IT sector activities. Companies in activity class 62.01 Computer programming hold the largest share of the Croatian IT industry. In 2008, the number of companies in class 62.01 covered 34.81 % of the total IT industry, however by 2023, the share has climbed to 60.74 %. While the total number of companies in the IT industry expanded by 167.57 % between 2023 and 2008, the number of companies in class 62.01 increased for 3,816 companies, or 366.92 %.

3.2 Data and variables

The data used for research purposes are secondary in nature and includes data on the companies that make up the defined sample. The data about the companies in question includes both basic and quantitative (financial and non-financial) data. Primarily, quantitative data are mostly used to calculate indicators of variable at the company level, which are organized into a panel data structure. Basic data on companies, as well as data required to construct variable indicator at the company level, were obtained from the Financial Agency's databases (FINA, 2023). Based on the data obtained using the MS Excel software package, a profitability indicator was generated. The profitability indicator is chosen as a primary interest variable based on its theoretical basis, significance in current studies, and availability of the data needed for calculation. As an indicator of profitability, the gross profitability of assets (ROA) was chosen, which relates profit / loss before taxation and total assets, and is expressed as a percentage, which is often used in current studies (Maziarczyk, 2020; Mazliza & Kusumaningdyah Adiati, 2023; Migliaccio, 2018).

In the case of companies who in the reference year are obliged to submit both non-consolidated and consolidated financial statements, data from consolidated financial statements were used[2]. As the Republic of Croatia replaced the Croatian kuna as the official currency on January 1, 2023, and financial results in 2023 were expressed in euros, data from previous years' financial statements were converted into euros using the official exchange rate.

Considering business demographics, births, deaths, entry and exit of companies from a particular class of activity, the data was formed into an unbalanced panel structure. Regardless of the sample's imbalance, companies that survive from period to period imply sample dependency.

Appendix 2 provides a Table 3. of descriptive data for the variables used (total assets, gross profit / loss, and asset profitability) for the analysed period. The results confirm the imbalanced panel structure that is common in economic research while also showing the asymmetry of the distribution of the variable of primary interest. Therefore, the median is used as a representative measure of the mean value. Fig. 1. illustrates an estimate of the median gross return on assets for the IT industry in the Republic of Croatia from 2008 to 2023. The statistics results indicate a fall

[2] With the exception of 2023, where at the time of data availability, only data from non-consolidated financial statements were available.

in asset profitability during the global financial crisis beginning in 2008, with the first hints of recovery (% ROA higher than 2008) showing in 2014.

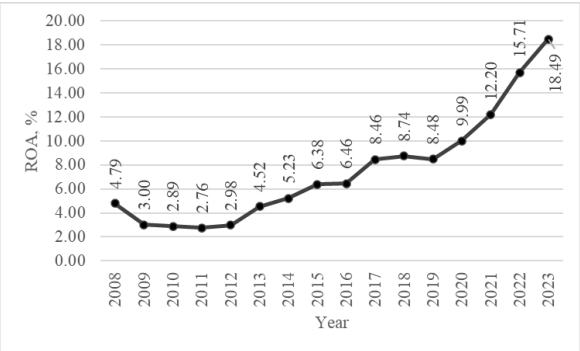

Figure 1. Median ROA of IT companies in the period from 2008 to 2023 [Author's work based on Stata output]

3.3 Methods

In addition to the standard techniques of traditional financial analysis for calculating indicators of the variable of primary interest and descriptive statistical methods, the paper used inferential statistics. Descriptive statistics were used to describe the sample in the previous chapter. Among the methods of inferential statistics, the Skillings-Mack test is a non-parametric pairwise multiple comparison of dependent groups that estimate the existence of statistically significant inequalities between indicators of the profitability variable (ROA) in specific years between 2008 and 2023. In previous studies, the ANOVA test with repeated measurements (Maziarczyk, 2020), or the paired sample t-test (Sulistyorini et al., 2023) were often used, where the aforementioned was attainable due to the use of balanced samples. In this research, the Skillings-Mack test is an appropriate method because it is a generalization of the Friedman test that can be used to an unbalanced panel data structure (Chatfleld & Mander, 2009). It is suitable for asymmetrical data distributions and dependent samples.[3]. With the aim of investigating (in)equality in the profitability of IT companies during and after the financial crisis, as well as before, during and after the crisis caused by the COVID-19 pandemic, in the first step, the Skillings-Mack test is used to test the existence of general statistically significant differences in ranks of the investigated indicator between certain periods, that is, between the years of interest. Then, in the spirit of post-hoc analysis and an effort to reveal differences more precisely, the Skillings-Mack test is used to assess the existence of specific statistically significant differences between all 120 pairs of years.

[3]For more on the Skillings-Mack test, see Chatfleld & Mander (2009).

4 Results and discussion

Table 1 displays the findings of the study on the existence of general statistically significant differences in the ranks of asset profitability or the years of interest. Based on the results, it is evident that in the observed period from 2008 to 2023 in the IT industry in the Republic of Croatia, there is a statistically significant difference in profitability measured by the gross return on assets at a significance level of 1 %.

Table 1. Results of the Skillings-Mack test for the period 2008 - 2023

Year	N	Wsum CRank	SE	Wsum / SE
2008	2,832	2070.49	173.69	11.92
2009	3,249	732.38	184.75	3.96
2010	3,455	-91.78	192.73	-0.48
2011	3,648	-247.74	199.64	-1.24
2012	3,766	-728.74	205.03	-3.55
2013	4,080	510.21	212.85	2.4
2014	4,338	0.27	218.86	0
2015	4,591	43.67	223.56	0.2
2016	4,868	-2.01	227.44	-0.01
2017	5,171	769.58	230.97	3.33
2018	5,549	84.02	234.28	0.36
2019	5,854	-776.86	235.59	-3.3
2020	6,161	-918.48	236.39	-3.89
2021	6,707	-805.44	236.39	-3.41
2022	7,490	-508.03	234.01	-2.17
2023	7,161	-131.53	229.7	-0.57
Skillings Mack = 230.938 ***				
P-value (No ties) = 0.0000				
Empirical P-value (Ties) ~ 0.0000				

* 10 %; ** 5 %; *** 1 %
[Author's work based on Stata output]

Following the spirit of post-hoc analysis, Appendix 3 in Table 4 provides estimates of specific statistically significant differences between all 120 pairs of years of the analysed period. Due to the results' comprehensiveness, the most noteworthy ones are interpreted. The results indicate that there are statistically significant differences in the gross profitability of assets in all observed years compared to 2008, with the exception of 2023. When the global financial crisis hit in 2008, it affected almost every nation on Earth, and numerous companies suffered a sharp decline in their profitability. In the conducted

analysis, this is evident on the graph of the median ROA (Fig.1), which demonstrates a notable decline in the profitability of Croatian IT companies during the period of the global financial crisis. The above highlighted agrees with the research of Migliaccio (2018) who likewise use ROA as an indicator of profitability but on a sample of large Italian hotels. If we look more closely at the results of the Skillings-Mack test in 2023 versus 2008, where no statistically significant difference was found in profitability measured by gross return on assets, the data show that only 1.4781 companies survived in 2023 compared to 2008[4]. The reported surviving companies' median return on assets (ROA) was 8.78 % in 2008 and 8.83 % in 2023, according to available data.

It is interesting to observe the differences in profitability between the years of the period analysed (e.g. 2009 versus 2008, 2010 versus 2009, 2011 versus 2010, etc.). A statistically significant difference in the ranks of asset profitability can be seen in 2009 compared to 2008 and between 2010 and 2009. A look at the weighted sums of the centered ranks of the compared years, as well as the medians of both the entire sample and the medians of companies that persist from year to year, indicates a decrease in the profitability of companies in the IT industry during the global economic crisis. As stated by Ergović & Gambiraža (2023), during the global crisis there was a decline in Croatian purchasing power, which was partly a consequence of high indebtedness, which consequently reduced consumption and imports, and led to a global decline in domestic demand. The general decline in stimulus and consumption may have also affected the profitability of IT activities. The test results confirm that there is no statistically significant difference in ROA in 2011 versus 2010. The aforementioned is also evident based on the median profitability, both of the entire cause of companies in the mentioned years, as well as of only persistent companies. The gross profitability of assets was low in the observed years, and in 2011 compared to 2010 it suffered a slight decline. In 2012 versus 2011, the results of weighted sums of the centered ranks show that there was a decrease in profitability, at the level of statistical significance of 5%. If we look at the median ROA of companies that persisted in 2011 and 2012, it decreased by 0.34 percentage points (2011: 3.38 %, 2012: 3.04 %). From the foregoing, it can be concluded that in the aforementioned years of the financial crisis, the profitability of the Croatian IT industry continued to decline. Although the results of both the weighted sums of the centered ranks and the median show that there was a slight increase in the company's profitability in 2013 compared to 2012, it was still not statistically significant. In the next couple of years, 2014 ─ 2013, 2015 ─ 2014, and 2016 – 2015, there are statistically significant differences in the profitability of the analysed activity, as well as the appearance of an interesting phenomenon. Namely, despite profitability generally records growth, the results of the Skillings-Mack test, as well as the medians of persistent companies between pairs of years, show its decrease. For example, in 2014 compared to 2013, based on the Fig. 1, the growth of the median ROA is evident. Nonetheless, when looking at the weighted sums of the centered ranks of the years mentioned, as well as the medians of persistent companies in those years (2013: 5.43 %, 2014: 5.12 %), a decline in profitability is obvious. The aforementioned provokes the thesis that new companies entering the market compensate for the decline in profitability of companies that persist in their activities and may react to the crisis with more conservative business management. Even no empirically significant difference in profitability was found in 2017 compared to 2016, the results of the Skillings-Mack test as well as the median ROA confirm its growth. Pairs of years of the pre-pandemic period 2018 – 2017, 2019 – 2018, and 2020 – 2019 (pandemic versus pre-pandemic period) indicate that there are empirically significant differences in the gross profitability of assets. A similar phenomenon appears again as in the previously described case, in the periods 2018 – 2017 and 2019 – 2018, profitability is increasing globally, however, among companies that persist in pairs of periods, profitability is declining. In 2020 ─ 2019, the pandemic and pre-pandemic year, the results are not unambiguous. While the weighted sums of the centered ranks indicate a slight decline, the median ROA of all companies in the observed years, as well as the companies that persisted in those years, indicate an increase in the profitability of IT companies[5]. The results of the Skillings-Mack test indicate that there is no statistically significant difference between the pairs 2021 ─ 2020, although the growth of the median gross ROA is again noticeable. Among the persistent companies of the aforementioned years, there was an increase in profitability, but the number of companies that achieved a higher gross ROA in 2021 compared to 2020 is smaller than those whose gross ROA in 2020 was higher than in 2021. These findings during the pandemic period are consistent with those of Mulyono (2023), who also found that the profitability of more companies in the technology and telecommunications sectors listed on the Indonesia Stock Exchange decreased rather than increased. In 2022 versus 2021, the situation is similar

[4] Specifically, 1,479 survived, however, one company had no recorded assets, which made the ROA invalid and recorded as missing. As a result, the Skillings-Mack test did not consider this company. Note N= 8,017 not included as only had one observation.

[5] Companies that persisted in 2019 and 2020, and in both cases had a valid gross ROA indicator, indicate that 2,669 companies had higher ROA rates in 2020 compared to 2019, and 2,887 companies had lower ROA rates. For this reason, the Skillings-Mack test shows a decline, although the companies generally achieved an increase in the gross return on assets measured by the median of this indicator.

to that of a couple of years before, only that it is statistically significant. In the final few years of the observed period, using the weighted sums of the centered ranks results, a slight decrease in profitability was detected, although not statistically significant, accompanied by a decrease in the median ROA of persistent companies in the mentioned years, in same time a global increase in profitability when all companies are included of the observed period is evident. Ergović & Gambiraža (2023) state that the COVI-19 pandemic has certainly changed consumer habits. The ban on leaving the place of residence, the closing of borders and social distancing have led many consumers to shop from the comfort of their homes, i.e. many have started shopping online. Changing consumer preferences required business entities to adapt to online shopping. The COVID-19 crisis has introduced new global trends in business. (Ergović & Gambiraža, 2023) The aforementioned has certainly stimulated the increase in demand for IT services. On the one hand, many business entities had to offer an online way of shopping and thus introduce some form of IT business solution, while on the other hand, the population in order to buy goods and services had to have access to the Internet, they began to use more online forms of communication, as well as other IT solutions to adapt your life to numerous limitations. The aforementioned may have been reflected in the global increase in the median profitability indicators of Croatian IT companies.

5 Conclusion, contribution and limitation

By conducting empirical research, the main goal of the study was achieved, i.e. (in)equality was determined in the profitability of IT companies, not only in the pre-crisis and post-crisis period, but also in the crisis period. The research does not cover the period of one, but two major global crises: the 2008 financial crisis and the COVID-19 crisis. The main findings of the conducted research show that in the observed period from 2008 to 2023 in the IT industry in the Republic of Croatia, there is a statistically significant difference in profitability measured by the gross return on assets at a significance level of 1%. Also, the findings show that there is (in)equality in the profitability of these companies between pairs of years. These results are important both for policymakers and business leaders. Policymakers have to make decisions at the time of a certain crisis, which are primarily reflected in changes in fiscal and monetary policy. Therefore, it is important that they know how the measures they adopted in a particular period affected certain activities, in this case the IT activity, which is becoming increasingly important in the Croatian economy. On the other hand, it is important for business leaders to know whether the profitability of their company moves in accordance with the activity in which they operate, and how exogenous shocks affect its profitability globally.

The scientific contribution of the paper is manifested in the time span of a sixteen-year period, i.e. in a long term which, compared to many other studies that span the period of one crisis, spans the time period of two global crises. In contrast to existing studies mainly oriented towards non-financial companies that are listed on the stock exchange, as well as studies that often includes the banking sector, the research in question covers IT activity and not only large companies but companies of all sizes. Unlike many studies that test differences in the determinants of profitability before and/or during and/or after the crisis, the subject study examines the existence of statistically significant differences in profitability using a statistical test that is not common in existing studies. In addition to the above, the contribution is also evident in the number of tests of pairs of years, which estimated a total of 120 pairs of years, with the aim of drawing more detailed conclusions about the differences in the profitability of the companies from the sample between the years of interest.

The limitation of the study can be seen in the selection of only one profitability indicator compared to some studies that consider several profitability indicators. Therefore, other profitability indicators should also be considered in future studies. Although the topic of research covers various classes from different fields of activity, it focuses on research in the IT sector. As the instrument mentioned was not used in the previous studies and other activities were examined, comparability with these studies is limited. In this context, future research should also focus on other activities in order to compare the results and come to more comprehensive conclusions about the profitability of the Croatian economy in times of crisis and non-crisis. Furthermore, it would be a valuable extension of research to conduct comparative studies with companies from different countries. Finally, the observed phenomenon of global growth in the profitability of the companies observed after the financial crisis, while at the same time the profitability of the companies that persisted in that period became more modest, leaves open the question of whether the global crisis conditioned their more cautious, i.e. more conservative business management.

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Appendix

Appendix 1

Table 2. Distribution of the number of companies with regard to classes of IT activities in the period from 2008 to 2023 in the Republic of Croatia

NACE Rev. 2 Classes	Year							
	2008	2009	2010	2011	2012	2013	2014	2015
26.11	46	47	54	52	53	54	54	54
26.12	1	5	7	6	7	6	7	10
26.20	241	268	253	245	237	235	232	226
26.30	57	61	55	63	60	62	55	54
46.51	231	221	231	238	228	234	225	225
46.52	64	49	70	82	83	92	92	96
47.41	133	147	145	154	152	136	126	123
47.42	15	9	18	19	23	28	35	42
58.21	1			1	2	3	6	8
58.29	147	150	138	141	128	124	125	119
62.01	1,040	1,320	1,312	1,421	1,539	1,737	1,959	2,128
62.02	246	261	311	315	326	346	351	378
62.03	41	34	68	72	89	107	129	139
62.09	320	286	373	390	390	431	447	456
63.11	180	202	194	208	211	226	238	253
95.11	218	262	247	257	256	259	269	275
95.12	7	6	14	16	18	23	33	38
NACE Rev. 2 Classes	Year							
	2016	2017	2018	2019	2020	2021	2022	2023
26.11	56	59	66	66	68	69	72	72
26.12	14	17	17	17	20	21	22	22
26.20	221	215	216	207	210	204	208	195
26.30	54	55	56	57	56	51	50	50
46.51	222	223	216	222	222	214	209	199
46.52	96	98	108	113	109	118	122	122
47.41	123	118	118	126	121	125	119	112
47.42	48	48	44	42	40	38	40	39
58.21	9	10	11	15	18	26	29	26
58.29	125	121	119	124	126	129	140	141
62.01	2,382	2,632	2,931	3,166	3,403	3,820	4,503	4,856
62.02	387	399	428	449	474	501	531	573
62.03	148	162	171	179	192	216	232	256
62.09	463	468	491	486	518	580	631	695
63.11	259	260	269	282	289	302	317	327
95.11	265	273	274	274	270	275	263	249
95.12	42	49	56	62	61	61	63	61

[Author's work based on Stata output based on data from the Financial Agency (FINA, 2023)]

Appendix 2

Table 3. Descriptive statistics of research variables

Year		Gross profit / loss	Total assets	ROA
2008	M	44729.30	477781.80	6.48
	Me	1998.61	42761.76	4.79
	SD	578171.40	4842489.00	51.90
	N	2988.00	2988.00	2988.00
	Skw	39.85	33.06	-7.21
	Krt	1886.75	1247.04	195.07
2009	M	25527.08	443414.00	-65.22
	Me	1215.94	40508.79	3.00
	SD	479935.90	4599329.00	3929.06
	N	3328.00	3328.00	3328.00
	Skw	3.14	34.65	-57.62
	Krt	797.43	1402.21	3322.48
2010	M	25282.52	402458.10	-19823.31
	Me	1095.23	34969.87	2.89
	SD	231918.10	4340174.00	999574.90
	N	3490.00	3490.00	3490.00
	Skw	7.30	34.36	-57.04
	Krt	301.64	1344.40	3314.16
2011	M	26127.56	378314.50	-3908.71
	Me	1117.26	31907.69	2.76
	SD	187822.40	3824713.00	178116.60
	N	3680.00	3680.00	3679.00
	Skw	2.76	34.04	-49.57
	Krt	176.53	1310.05	2584.17
2012	M	27982.02	385269.60	-3214.68
	Me	1150.51	29489.22	2.98
	SD	387583.60	3746154.00	193212.20
	N	3802.00	3802.00	3802.00
	Skw	29.09	33.09	-61.63
	Krt	1486.38	1265.12	3799.22
2013	M	32207.25	368590.50	-316.96
	Me	1405.27	26122.37	4.52
	SD	357527.10	3502833.00	745770.90
	N	4103.00	4103.00	4101.00
	Skw	37.81	32.61	26.60
	Krt	2014.17	1246.71	2188.98
2014	M	34635.03	363149.60	-7409.35
	Me	1420.93	24691.62	5.23
	SD	273182.90	3120205.00	309587.80
	N	4383.00	4383.00	4381.00
	Skw	22.66	32.39	-58.93
	Krt	839.83	1338.20	3688.60
2015	M	35571.39	377223.80	-11610.70
	Me	1628.04	26767.01	6.38
	SD	337657.60	3261276.00	646307.90
	N	4624.00	4624.00	4623.00
	Skw	11.83	32.04	-66.96
	Krt	567.99	1320.08	4526.63
2016	M	38607.36	381280.80	-2601.06
	Me	1951.95	27154.22	6.46
	SD	356464.30	3198270.00	427634.60
	N	4914.00	4914.00	4914.00
	Skw	23.75	28.25	-2.75
	Krt	930.42	1015.26	2347.16
2017	M	44735.63	388727.00	-5143.32
	Me	2577.88	31509.99	8.46
	SD	377696.30	3092753.00	205640.40
	N	5207.00	5207.00	5206.00
	Skw	17.12	26.18	-45.32
	Krt	528.38	892.38	2138.49
2018	M	49740.83	390544.60	-1352.78
	Me	3016.39	33960.98	8.74
	SD	413779.50	3083861.00	49397.71
	N	5591.00	5591.00	5589.00
	Skw	28.09	27.29	-50.16
	Krt	1065.81	971.00	2632.01
2019	M	50855.08	431452.50	-58668.08
	Me	3146.73	38920.96	8.48
	SD	494817.30	3381768.00	4769072.00
	N	5887.00	5887.00	5885.00
	Skw	14.71	25.66	-74.90
	Krt	719.72	861.37	5712.19

*Mean (M), median (Me), standard deviation (sd), count (N), skewness (Skw), kurtosis (Krt)

[Author's work based on Stata output]

*Mean (M), median (Me), standard deviation (sd), count (N), skewness (Skw), kurtosis (Krt)

[Author's work based on Stata output]

Continued **Table 3.** Descriptive statistics of research variables

Year		Gross profit / loss	Total assets	ROA
2020	M	56632.06	446206.90	-12697.39
	Me	4109.63	42551.99	9.99
	SD	415889.10	3342378.00	602966.50
	N	6197.00	6197.00	6191.00
	Skw	9.96	24.34	-61.86
	Krt	502.24	776.52	4294.69
2021	M	73922.94	485838.40	-2940.47
	Me	6007.10	46638.26	12.20
	SD	497512.80	3812588.00	277596.90
	N	6750.00	6750.00	6741.00
	Skw	27.05	26.41	-33.14
	Krt	1163.30	908.81	2231.55
2022	M	80122.94	510412.50	-3892.42
	Me	8935.56	52501.82	15.71
	SD	543534.90	4143179.00	317887.00
	N	7551.00	7551.00	7545.00
	Skw	15.74	26.78	-49.28
	Krt	509.65	911.33	3540.20
2023	M	83721.20	551214.10	2635.68
	Me	12427.25	58359.63	18.49
	SD	560701.90	6341141.00	2205466.00
	N	7995.00	7995.00	7985.00
	Skw	24.15	49.76	55.57
	Krt	867.37	3143.93	5206.36
Total	M	50717.36	434091.20	-8484.41
	Me	2838.28	38050.30	7.69
	SD	436205.40	4010588.00	1519403.00
	N	80490.00	80490.00	80448.00
	Skw	23.09	40.70	-153.84
	Krt	1115.63	2712.86	42914.03

*Mean (M), median (Me), standard deviation (sd), count (N), skewness (Skw), kurtosis (Krt)

[Author's work based on Stata output]

Appendix 3

Table 4. Skillings-Mack Test for years pairs

	2008	2009	2010	2011	2012
2009	**50.548*** **				
	0.0000 (0.0000)				
2010	**110.513*** **	**32.834*** **			
	0.0000 (0.0000)	**0.0000 (0.0000)**			
2011	**102.081*** **	**19.868*** **	0.679		
	0.0000 (0.0000)	**0.0000 (0.0000)**	0.4099 (0.4550)		
2012	**104.054*** **	**37.883*** **	**20.425*** **	**6.014** **	
	0.0000 (0.0000)	**0.0000 (0.0000)**	**0.0000 (0.0000)**	**0.0142 (0.0170)**	
2013	**41.253*** **	**5.252** **	**6.992*** **	0.015	1.738
	0.0000 (0.0000)	**0.0219 (0.0240)**	**0.0082 (0.0030)**	0.9025 (0.9050)	0.1874 (0.1630)
2014	**52.14*** **	**14.672*** **	**3.631***	1.544	0.088
	0.0000 (0.0000)	**0.0001 (0.0000)**	**0.0567 (0.0570)**	0.214 (0.2190)	0.7667 (0.7670)
2015	**39.206*** **	**10.464*** **	**4.632** **	3.514	1.710
	0.0000 (0.0000)	**0.0012 (0.0000)**	**0.0314 (0.0370)**	0.0609 (0.0580)	0.1910 (0.1950)
2016	**25.98*** **	**4.151***	2.267	1.209	0.136
	0.0000 (0.0000)	**0.0416 (0.0530)**	0.1322 (0.1160)	0.2715 (0.2740)	0.7123 (0.6910)
2017	**6.514** **	0.031	0.248	0.000	0.569
	0.0107 (0.0030)	0.8602 (0.8310)	0.6185 (0.6290)	1.0000 (1.0000)	0.4507 (0.4260)
2018	**15.694*** **	**4.892** **	0.374	0.232	0.288
	0.0001 (0.0000)	**0.027 (0.0330)**	0.5408 (0.5700)	0.6300 (0.6260)	0.5915 (0.6010)
2019	**31.081*** **	**6.167** **	1.564	0.380	0.087
	0.0000 (0.0000)	**0.0130 (0.0110)**	0.2111 (0.2190)	0.5376 (0.5580)	0.7680 (0.7760)
2020	**27.88*** **	**6.441** **	1.608	0.000	0.380
	0.0000 (0.0000)	**0.0112 (0.0110)**	0.2048 (0.2180)	1.0000 (1.0000)	0.5376 (0.5600)
2021	**17.629*** **	2.433	0.542	1.085	0.799
	0.0000 (0.0000)	0.1188 (0.1100)	0.4616 (0.4530)	0.2976 (0.2410)	0.3714 (0.3720)
2022	**8.516*** **	0.02	0.354	1.600	3.285
	0.0035 (0.0020)	0.8875 (0.9020)	0.5519 (0.5480)	0.2059 (0.1920)	0.0699 (0.0750)
2023	2.122	0.021	**5.843** **	**5.524** **	**11.215*** **
	0.1452	0.8848	**0.0156 (0.0170)**	**0.0188**	**0.0008**

Year	Skillings Mack
	P-value (No ties) (Empirical P-value (Ties))

* 10 %; ** 5 %; *** 1 %

[Author's work based on Stata output]

Continued **Table 4.** Skillings-Mack Test for years pairs

	2013	2014	2015	2016	2017
2009					
2010					
2011					
2012					
2013					
2014	**12.201***** **0.0005 (0.0000)**				
2015	**18.700***** **0.0000 (0.0000)**	**5.508**** **0.0189 (0.0150)**			
2016	**14.626***** **0.0001 (0.0000)**	**9.59***** **0.0020 (0.0020)**	**5.591**** **0.0181 (0.0130)**		
2017	**6.618**** **0.0101 (0.0130)**	1.308 0.2528 (0.2550)	1.998 0.1575 (0.1570)	0.333 0.5639 (0.5640)	
2018	**11.376***** **0.0007 (0.0010)**	0.391 0.5318 (0.5010)	**10.998***** **0.0009 (0.0000)**	**18.04***** **0.0000 (0.0000)**	**20.549***** **0.0000 (0.0000)**
2019	**10.935***** **0.0009 (0.0000)**	**7.38***** **0.0066 (0.0090)**	**10.035***** **0.0015 (0.0020)**	**16.067***** **0.0001 (0.0000)**	**40.533***** **0.0000 (0.0000)**
2020	**8.383***** **0.0038 (0.0040)**	**5.157**** **0.0232 (0.0220)**	**13.759***** **0.0002 (0.0000)**	**15.279***** **0.0001 (0.0000)**	**33.58***** **0.0000 (0.0000)**
2021	**12.53***** **0.0004 (0.0000)**	3.675 0.0552 (0.0630)	**11.924***** **0.0006 (0.0000)**	**4.130*** **0.0421 (0.0540)**	**24.972***** **0.0000 (0.0000)**
2022	**4.779**** **0.0288 (0.0230)**	0.540 0.4624 (0.4710)	0.078 0.7800 (0.7880)	0.215 0.6429 (0.6550)	**15.883***** **0.0001 (0.0000)**
2023	0.542 0.4616	0.382 0.5365 (0.5120)	0.167 0.6828 (0.6840)	0.179 0.6722 (0.6620)	2.04 0.1532 (0.1340)

Year	Skillings Mack
	P-value (No ties) (Empirical P-value (Ties))

* 10 %; ** 5 %; *** 1 %

[Author's work based on Stata output]

Continued **Table 4.** Skillings-Mack Test for years pairs

	2018	2019	2020	2021	2022
2009					
2010					
2011					
2012					
2013					
2014					
2015					
2016					
2017					
2018					
2019	**26.971***** **0.0000 (0.0000)**				
2020	**29.889***** **0.0000 (0.0000)**	**5.263**** **0.0218 (0.0240)**			
2021	**22.408***** **0.0000 (0.0000)**	**11.12***** **0.0009 (0.0000)**	2.750 0.0973 (0.1090)		
2022	**7.564***** **0.0060 (0.0070)**	3.154 0.0757 (0.0700)	2.337 0.1263 (0.1370)	**3.837*** **0.0501 (0.0480)**	
2023	3.119 0.0774 (0.0670)	0.000 1.0000 (1.0000)	0.019 0.8904 (0.9040)	1.113 0.2914 (0.2990)	0.948 0.3302 (0.3060)

Year	Skillings Mack
	P-value (No ties) (Empirical P-value (Ties))

* 10 %; ** 5 %; *** 1 %

[Author's work based on Stata output]