GLOBAL FINANCIAL CRISES, PROFITABILITY AND OUTSOURCING IN INDUSTRIAL COMPANIES IN POLAND

Anna MAZIARCZYK

Faculty of Economics, Maria Skłodowska-Curie University, Lublin, Poland;
a.maziarczyk@poczta.umcs.lublin.pl, ORCID: 0000-0001-7213-0961

Abstract: The purpose of the article was to determine whether there is a relationship between the use of outsourcing and profitability in industry depending on time. The research sample consisted of 200 enterprises operating on the Polish market. The study covered the years 2000-2018. The study was divided into 2 parts. It turned out that during the financial crisis, profitability is significantly lower in the case of return on assets. During the crisis, industrial companies were on the verge of profitability and deficit. The average level of return on assets during the crisis was significantly lower than before and after the crisis. Given the return on equity and return on sales, the planned contrast turned out to be statistically insignificant. It should be noted that there is a certain limitation in the interpretation of results, because external services also consist of services that are not outsourced, e.g. banking services.
In addition, there is agreement that with the increase in the use of services of external suppliers (leading to an increase in the cost of external services), the profitability of sales decreases. The study does not allow one to draw a conclusion about the existence of a relationship between the use of outsourcing in industrial companies and profitability.

Keywords: financial crisis, profitability, outsourcing, industrial companies.

1. Introduction

Increasingly, companies are deciding to implement outsourcing. Large competition encourages the search for interesting forms of enterprise financial management. Outsourcing is becoming a fashionable management tool. In economics, the term 'outsourcing' is used to show the participation of external sources in the development of a company. This paper refers to a company that used its internal resources (Aalders, 2001). In other words, it is a transfer of managerial responsibility to a third party. The service contract is binding (Lysons, 2003).

The decision to implement outsourcing is dictated by the reduction of costs. This is indicated, among others, by Dunford (2000). He claims that the primary task of outsourcing is to focus the company on its core activities and reduce costs. All activities that the company may delegate should be left to an external expert (Dunford, 2000). In addition, quality is an important

factor that customers pay attention to. Therefore, care for the quality of products and services improves the quality of the entire company. According to Kakabadse (2003), outsourcing is a way to provide the best quality for products and services. Delegating certain activities to experts increases the quality of the product. Outsourcing is one of the important elements of the strategy of companies in Europe and the US (Kakabadse, 2003).

The article consists of five parts. The following section discusses the problem, given the popularity of outsourcing and its impact on the profitability of foreign enterprises. The second part presents the research sample and its short characteristics. The next part is a description of the research methodology with a detailed explanation of the possibility of using statistical tests. The results are then described. The last section draws conclusions for Polish industrial companies.

2. Profitability, outsourcing and financial crisis – literature review

Many scientists have already conducted research on the profitability of companies. There are also many studies on outsourcing and business operations during the financial crisis (2006-2009). Despite this, few researchers combined these two aspects related to a company.

Noah Mwelu did a study on a sample of 80 manufacturing companies in Uganda before the financial crisis. The study determined the level of profitability impacts on outsourcing in Uganda. The author indicates that there is a strong and significant relationship between outsourcing and profitability. Despite this, outsourcing is not yet clear enough to affect the profitability levels of manufacturing companies in this country (Mwelu and Moya, 2014).

Görg and Hanley (2004) investigated the relationship between outsourcing and profitability for the electronics sector in Ireland before the financial crisis. The study concerned manufacturing and service activities – a sample of 215 companies. They stated that large companies use outsourcing of materials and services. For small businesses, outsourcing services is not so straightforward (Görg, and Hanley, 2004).

In turn, Kimura (2002) presents a different approach to the role of outsourcing. He claims that those with weak activities are more likely to use external experts. The study was conducted on a sample of companies from the machine-building sector in Japan before the financial crisis. The author concludes that companies with high profits do not use outsourcing. Weak companies (low surplus in sales and low value added to sales) are more likely to use subcontractors. The author concludes that companies that do not get involved obtain the highest profits (Kimura, 2002).

Juma'h and Wood studied the business results of outsourcing companies. It was concluded that profitability and liquidity decrease over the years with outsourcing. In turn, the increase in profitability and liquidity increases when companies resign from outsourcing services

(Juma'h, and Wood, 2000). Maziarczyk comes to other conclusions (2020). A survey was conducted on a sample of companies from Poland, and the aim of the study was to check the impact of outsourcing on the productivity of companies in the period 2010-2018. It was concluded that as outsourcing increases, the productivity of Polish industrial companies increases. In addition, it has been proven that outsourcing will positively affect the entire country by improving Gross Domestic Product (Maziarczyk, 2020). Performance research in connection with outsourcing was also conducted. Findings show that companies that have distorted their production structure show higher growth, while companies using the verticalisation strategy achieved better results in terms of debt ratio (Calabrese, and Erbetta, 2005).

Agburu, Anza, Iyortsuun (2017) argue that small and medium-sized companies, like large organisations, outsource services. In their research, they list a number of outsourcing factors. These factors led to an increase in the profitability of small and medium enterprises. The study covered the period of both the crisis and after the crisis. However, the authors did not distinguish this factor (Agburu, Anza, Iyortsuun, 2017).

Isaksson and Lantz (2015) studied outsourcing strategies among small manufacturing companies. The authors do not state what period the study covered. It is only known that the data was taken from the annual data from 2011. However, we can guess that the study was about post-crisis data for a sample of 700 small (less than 50 employees) manufacturing companies in Sweden. They mainly studied the relationship between outsourcing and return on investment (ROI) and return on capital (ROE). However, this study did not show the impact of these outsourcing strategies on SME profitability (Isaksson, and Lantz, 2015).

Further studies were conducted by Edvardsson and Teitsdóttir. The purpose of their research was to analyse the use of outsourcing in the services sector after the collapse of banking. They compared the results of Icelandic companies from 2009 and 2013. The authors state that outsourcing has not increased, but some SMEs have begun outsourcing IT and human resource management to a greater extent. It is emphasised that there is little research on SMEs in the aftermath of the financial crisis (Edvardsson, and Teitsdóttir, 2015),

K. Denčić-Mihajlov (2014) examined how companies from Serbia adapt to the conditions of the financial crisis. The sample included 108 non-financial companies. The author states that larger and smoother companies achieve higher profitability. The effectiveness of assets and the possibility of growth proved to be important for determining profitability as a return on assets. The study points to the urgent need to improve business performance during the crisis. The conclusions of the study concern only the period of the financial crisis. The author indicates that it is worth analysing profitability before the crisis, during the crisis and after the crisis (Denčić-Mihajlov, 2014).

Speaking about the benefits of outsourcing, the article seeks to check how outsourcing affects the profitability of industrial companies in Polish conditions during the financial crisis, as well as before and after it. There are studies based on a combination of outsourcing and

profitability, but this is new for Polish conditions. The article brings new information about the relationship between the profitability of Polish industrial companies and outsourcing. A review of literature shows that there is no research on the relationship between outsourcing and the profitability of Polish enterprises during the crisis. It is worth paying attention to research on this subject.

The financial crisis of 2007-2009 occurred as a result of the credit crisis in 2006. Specialists say the beginning took place in the US housing market, and the general decline in property prices caused stress on loans (Benmelech, and Dlugosz, 2009).

The 2007-2009 financial crisis is commonly considered the worst crisis since the Great Depression of the 1930s, which turned out to be a massive shock for enterprises. The crisis caused a sharp fall in share prices and more expensive loans, which largely affected the financial situation of companies. The global financial system was at risk of collapse by rescuing uninsured large financial institutions (Brunnermeier, and Pedersen, 2009).

According to specialists, the economic crisis of 2007-2009 initially bypassed the Polish economy. Dangers were sought in high state debt and a large share of imports in domestic production. As it turned out, Poland was also affected by the effects of the global crisis. The value of the Polish currency (Polish zloty) was significantly reduced as a result of a speculative attack, and enterprises began to have financial problems with currency options. Despite this, Poland was positively assessed when taking into account other economies during the crisis. The largest effect for Poland was the reduction of the deposit interest rate from 4.5% to 2.00%[1].

3. Sample

The purpose of the article was to check whether the use of outsourcing in Polish industrial companies affects their profitability over time. Companies that are listed on the Warsaw Stock Exchange were analysed. Due to the specifics of the study, the research sample covered 200 companies that operate in the industrial sector.

The sample was based on data provided by the Notoria database from 2018. This database contains the financial statements of Polish companies. The choice of the sample that was ultimately analysed was as follows: firstly, from the pool of all companies, industrial companies were chosen, as the study concerns only this sector. This was done on the basis of descriptions of the characteristics of individual companies also available in this database. Due to the need for accurate calculations from the sample, companies were then selected for which all data needed to calculate the profitability ratios and the data needed to determine outsourcing were

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[1] Experts say that the increase in GDP was caused by an increase in net exports and an increase in total consumption [http://nbp.pl/ home.aspx? f = / / daily /, Forsal.pl].

provided. The study concerned the period 2000-2018. In this way, a database consisting of annual data for 200 companies from Poland was optained, which consists of companies from many different industries.

4. Methodology

Data from the study was processed using a statistical program. There are three types of variables throughout the analysis: dependent, independent and grouping variables. A detailed list of all variables is provided in Table 1. The data of the research part and research hypotheses refers to individual variables, which will be listed later.

Table 1
All descriptions of variables used in this analysis

Variables	Description
Dependent variables • Return on assets (ROA) • Return on equity (ROE) • Return on sales (ROS)	Net profit divided by total assets multiplied by 100 Net profit divided by equity capital multiplied by 100 Net profit divided by sales revenues multiplied by 100
Independent variables • outsourcing	external services divide by sales revenues (external services include costs that are not outsourced; therefore, identifying outsourcing as a foreign service is an optimistic approach)

Source: own study.

Three indicators were used to determine the profitability of companies – return on assets, return on equity and return on sales. As it is believed that one indicator does not give an objective picture of the situation, 3 indicators to measure profitability were used. Depending on individual parts of the study, profitability becomes dependent and once independent. The value of outsourcing was determined on the basis of the relationship of external services to sales transactions (external services divided by sales revenues). The value of outsourcing was defined on the basis of the value of external services, which are part of the generic cost system. There is a certain limitation in the interpretation of results, because external services also consist of services that are not outsourced, e.g. banking services. At the beginning, I compared the profitability ratios among (ROA, ROE, ROS) or different indicators give the same result before the crisis, during the crisis and after the crisis. Therefore, the first (preliminary) hypothesis is put forward:

H1 a): the average level of ROA profitability changes over time.

H1 b): the average level of ROE profitability changes over time.

H1 c): the average level of ROS profitability changes over time.

The dependent variables used in this part of the study were data on profitable companies (depending on the hypothesis, this was ROA, ROE, ROS). The variables were divided into three periods. Thus, all variables are: ROA before the crisis, ROA during the crisis, ROA after the crisis, ROE before the crisis, ROE during the crisis, ROE after the crisis and ROS before the crisis, ROS during the crisis, ROS after the crisis. This part of the study did not require independent variables. In order to verify whether the hypotheses (H1a, H1b, H1c) are true and whether it can be stated that the indicators give the same result before the crisis, during the crisis and after the crisis, analysis of variance with repeated measurements was used. Repeated measurement means that the variable has been tested many times. In the study, multiple measurements of the same variables at intervals were made. In this case, time is an intra-object factor. The greatest benefit of the ANOVA test with repeated measurements is the reduction of individual differences, i.e. the variation between variables in different groups (Niewiarowski, 2013). We can use this test, because the assumptions are met. The variables have a distribution close to normal, the variances of the distribution of variables are equal, and the fulfilment of the sphericity assumption (no correlation between successive measurements). In addition, the analysis was supplemented with contrast analysis.

The ratio of external services to sales transactions were then compared. Whether the same result was available before, during and after the crisis was also checked. Therefore, one should hypothesise:

H2: The average level of outsourcing varies over time.

The dependent variables used in this part of the study were the data on outsourcing companies, i.e. the ratio of external services to sales revenues. The variables were divided into three periods. Thus, all variables are: outsourcing before the crisis, outsourcing during the crisis and outsourcing after the crisis. This part of the study did not require independent variables. In order to verify whether the H2 hypothesis is true and whether it can be stated that the indicators give the same result before the crisis, during the crisis and after the crisis, analysis of variance with repeated measurements was used. The possibility of using the test confirms the fulfilment of the assumptions for this test, i.e. the variables have a distribution similar to normal, the variances of the distribution of variables are equal, the fulfilment of the assumption of sphericity.

The next step was to check whether outsourcing before, during and after the crisis is related to profitability in these periods. Profitability was defined using three indicators: ROA, ROE, ROS. The following hypotheses were checked:

H3: a) there is a relationship between pre-crisis ROA and outsourcing.

H3: b) there is a relationship between ROA during a crisis and outsourcing.

H3: c) there is a relationship between post-crisis ROA and outsourcing.

H4: a) there is a relationship between pre-crisis ROE and outsourcing.

H4: b) there is a relationship between ROE during a crisis and outsourcing.

H4: c) there is a relationship between ROE after crisis and outsourcing.

H5: a) there is a relationship between pre-crisis ROS and outsourcing.

H5: b) there is a relationship between ROS during a crisis and outsourcing.

H5: c) there is a relationship between post-crisis ROS and outsourcing.

The dependent variables used in this part of the study were data on profitable companies (depending on the hypothesis, this was ROA, ROE, ROS). The independent variable was the use of outsourcing, which was defined as the value of external services. In order to verify whether the hypotheses (H3, H4, H5) are true and whether it can be concluded that there is a significant relationship between outsourcing and the profitability of industry before the crisis, during the crisis and after the crisis, the Pearson correlation test was used. The possibility of using the test is confirmed by the fact that the variables have a distribution close to normal (sample greater than 100 observations).

After analysing the correlation, a regression analysis was then performed. This study was done to determine the degree of impact of outsourcing of certain activities in a company on the level of profitability in industrial companies in Poland. Whether it is possible to predict the level of profitability based on outsourcing was also checked. A general straight line regression model was created:

$$Y = \beta_0 + \beta_1 X + \epsilon$$

Where:

Y – dependent variable (profitability).

X – independent variable (outsourcing).

β_0, β_1 – structural parameters of the model.

ϵ - random component.

We accept this mathematical formula. It contains relationships between variables and the assumption of random processes affecting the results of individual measurements. We use the least squares method to determine a line (y = b_0 + b_1 * x) that fits to our linear regression model.

5. Result and their analysis

When analysing the use of outsourcing by Polish industrial companies, one can expect differentiation. The share of funds allocated by entities to the services of external suppliers differ depending on the industry sector. Therefore, the value of external services for the entire sample of 200 industrial enterprises was averaged over a given period. (copy) Before the 2000-2005 crisis, the 2006-2009 crisis and after the crisis 2010-2018. The study led to such results:

Table 2.
Basic descriptive

	Mean	Median	Minimum	Maximum	St. dev.
ROA before the crisis	9.3%	7.9%	1.8%	9.9%	4.7%
ROA crisis	7.7%	4.2%	0.4%	13.7%	2.2%
ROA after the crisis	8.0%	5.1%	1.2%	14.4%	3.5%
ROE before the crisis	19.1%	15.4%	4.0%	20.6%	5.8%
ROE crisis	16.0%	13.1%	1.5%	15.1%	4.4%
ROE after the crisis	14.3%	9.5%	2.6%	16.9%	4.8%
ROS before the crisis	8.6%	5.2%	1.0%	20.0%	6.0%
ROS crisis	7.2%	6.1%	0.3%	16.7%	6.2%
ROS after the crisis	7.4%	4.8%	1.0%	16.7%	6.2%
Outsourcing before the crisis	15.0%	17.5%	4.4%	15.3%	7.8%
Outsourcing crisis	12.2%	12.5%	3.2%	12.6%	6.4%
Outsourcing after the crisis	10.9%	9.5%	5.2%	15.1%	5.7%

Source: own study.

The study and verification of research hypotheses gave such results:

1) The average value of return on assets during the crisis for the sample was the lowest. During the crisis, it was 7.7% and was 1.6 percentage points lower than before the crisis. In turn, after the crisis, the return on assets improved to 8%, which is a slight increase of 0.03 percentage point. The median also confirms that profitability fell significantly during the crisis (4.2%), where before the crisis, the median was 7.9%. There are not many outliers on the sample. This is confirmed by similar values of the average and median return on assets. The lowest return on assets was during the crisis at 0.4%.

2) The average value of return on equity was the largest before the crisis (19%). During the crisis, it was lower by 3 percentage points and accounts for 16%. After the crisis, this value increased to 14% (which is smaller than before the crisis). This means that after the crisis, industrial companies did not managed to improve the return on equity enough to match the value before the crisis. The effects of the financial crisis had an impact on companies' results, worsening their situation. As you can see, there was a slight difference in the median. Before the crisis, the median was 15%, while after the crisis, there was a decline to 10%. The lowest index value reached 4% during the crisis.

3) The average value of the sales profitability index during the crisis turned out to be lower by only 1.4 percentage point than before the crisis. Based on the median, a significant improvement in profitability can be seen over the period considered. After the crisis period, the median return on sales was 4.8%, while during the crisis, this was 6.1%. The observations deviate from the mean value by 6% in each time interval.

4) The largest amplitude of the minimum and maximum value is seen in the ROS indicator. The sample is quite diverse. The observations deviate from the mean value by about 6%.

5) Analysing external services for the pre-crisis sample, during the crisis and after the crisis, there was no big difference between the average value and the median. The average value of the ratio of external services to sales revenues was the largest before the crisis. This proves its use during this period. In the crisis, this value fell, after which growth was again noted after the crisis.

From the above statistics, it can be concluded that the sample of 200 industrial enterprises is diversified in terms of profitability measured by various indicators and outsourcing depending on the period. The nature of the operations of the companies in the sample has a large impact on this, which shall be verified in the hypotheses.

5.1. Verification of hypothesis 1

At the beginning it is worth saying that the assumptions for the analysis of variance with repeated measurements have been met. The variables have a normal distribution because the sample includes more than 100 observations. Another assumption about equal variance also proved to be fulfilled. Levene's test did not detect significant differences between variances. The assumption of equal variance is met for $p > 0,05$ ($p = 0,061$). The third assumption of sphericity was also met (the assumption of sphericity is met for results not statistically significant $p > 0,05$). According to the Mauchley test, the sphericity assumption is seriously violated and detects significant deviations from the sphericity assumption $p = 0,00$ ($p < 0,05$) I applied the Huynh-Feldt correction ($p > 0,05$). This is a high-powered fix. Corrective factors take into account the deviation of the covariance matrix from combined symmetry and are designed to change the degrees of freedom that are associated with the F test (Stanisz, 2007). The data obtained from tests is presented in Table 3.

Table 3.
Test results of sphericity

	W	p	
		Mauchley's test	**Huynh-Feldt corrections**
ROA	0.41	0.00	0.762
ROE	0.58	0.00	0.445
ROS	0.53	0.00	0.36

* results are significant with $p < 0.05$.

Source: own study.

Based on the table, it can be concluded that the Huynh-Feldt tests do not detect significant deviations from the assumption of sphericity for ROA: $p = 0.762$ ($p > 0.05$); ROE: $p = 0.445$ ($p > 0.05$) and ROS: $p = 0.36$ ($p > 0.05$). Thus, the assumption of sphericity is fulfilled.

Based on the statistical test (ANOVA analysis of variance with repeated measurements), the results can be considered statistically significant with $p < 0.05$. We can therefore reject the hypothesis of equality of average profitability before, during and after the crisis. There are statistically significant differences between the means. This data is shown in Table 4.

Table 4.
Results of the one-dimensional ANOVA analysis test with repeated measurements

	F	p
ROA	33.23	0.000
ROE	5.41	0.005
ROS	4.19	0.016

* results are significant with $p < 0.05$.

Source: own study.

Based on the results obtained from the one-dimensional test of repeated measurements, it can be concluded that the average level of return on assets changes over time. This means that the profitability of Polish enterprises has changed over time. It was described as "before the crisis", "crisis" and "after the crisis". A similar situation was found in the case of return on equity and return on sales. The average level of ROE and ROS profitability is different before, during and after the crisis.

Based on the analysis, a large variation in average profitability (ROA, ROE, ROS) can be seen before, during and after the crisis. The greatest amplitude of value occurred at the return on assets. In addition, the average post-crisis value is much higher than even the pre-crisis profitability. Industrial enterprises achieved much lower profitability during the crisis. A slightly smaller variation occurred in the return on equity. Despite this, the profitability of ROA and ROE and ROS is clearly improving after the crisis. Still, using a priori contrast analysis, whether the average ROA/ROE/ROS level is significantly lower during the crisis compared to the period before and after the crisis will be examined. A priori analysis of contrasts is done after determining the significance of a given factor. Here, we examine the influence of a controlled factor at three levels and check whether the first group differs from the others. The null hypothesis has the form H0: $u1 = \frac{u2+u3}{2}$, which we write as $u1 - \frac{1}{2}u2 - \frac{1}{2}u3 = 0$, i.e. $2u1 - u2 - u3 = 0$ (Bedyńska, Cypryańska, 2013). To test the hypothesis, we assign weights (c1=2, c2=-1, c3=-1). In this study, we examine the effect of factor $u2 = \frac{u1+u3}{2}$, meaning that $-u1 + 2u2 - u3 = 0$. Thus, in this study, we assign weights c1=-1, c2=2, c3=-1. We study the contrast, and the coefficients adopted in this analysis are: (-1, 2, -1). Table 5 presents the received data.

Table 5.
A priori contrast analysis

	F	Standard error	p
ROA	43.6	0.010	0.001
ROE	2.94	0.023	0.087
ROS	2.16	0.015	0.141

Source: own study.

Examining the results obtained from the contrast analysis a priori, it can be seen that the planned ROA contrast proved significant with $p < 0.05$ ($p = 0.001$). The average level of return on assets during the crisis is significantly lower than before and after the crisis. Taking into account the return on equity and return on sales, the planned contrast turned out to be statistically insignificant with $p > 0.05$ (ROE $p = 0.87$, ROS $p = 0.141$). Thus, the average level of ROE and ROS during the crisis is not significantly lower than in the other periods examined.

5.2. Verification of hypothesis 2

The assumptions for the analysis of variance with repeated measurements have been met. The variables have a normal distribution, because the sample includes more than 100 observations. Another assumption about equal variance also proved to be fulfilled. Levene's test did not detect significant differences between variances. The assumption of equal variance is met for $p > 0.05$ ($p = 0.078$). The third assumption of sphericity was also met (the assumption of sphericity is met for results not statistically significant with $p > 0.05$). The Mauchley test does not detect significant deviations from the assumption of sphericity with $p > 0.05$ ($p = 0.73$). The test requires no corrections. The data obtained from tests is presented in Table 6.

Table 6.
Test results on Mauchley's sphericity

	W	**p**
Outsourcing	0.81	0.73

* results are significant with $p < 0.05$.

Source: own study.

Based on the statistical test (ANOVA analysis of variance with repeated measurements), the results can be considered statistically significant with $p<0.05$. We can therefore reject the hypothesis about the equality of average profitability before, during and after the crisis. There are statistically significant differences between the means. This data is shown in Table 7.

Table 7.
Results of the one-dimensional ANOVA analysis test with repeated measurements

	F	**p**
Outsourcing	2.37	0.15

* results are significant with $p < 0.05$.

Source: own study.

Based on the results obtained from the one-dimensional test of repeated measurements, it can be concluded that the average level of outsourcing changes over time. The coefficient was not statistically significant with $p > 0.05$ ($p = 0.15$). This means that outsourcing has not changed over time. It was described as "before the crisis", "crisis" and "after the crisis". Further analysis does not require contrast analysis.

5.3. Verification of hypothesis 3

Due to the fact that the average ROA profitability level is significantly lower in the crisis, we will check the correlation with outsourcing for this profitability. The next step was to examine whether outsourcing before, during and after the crisis is significantly related to the development of the industrial sector. To this end, we examined the relationship between outsourcing and profitability. Based on the statistical test (application of the Pearson correlation

test), it can be concluded that there is a positive possible relationship between profitability measures, outsourcing and global financial crises. However, not all correlation coefficients marked are relevant for the study (p < 0.05). In Table 8, we presented the correlation values according to the test. Therefore, hypothesis 3 can be accepted.

Table 8
Correlation results

Variable	Outsourcing		
	Before the crisis	**Crisis**	**After the crisis**
ROA before the crisis	-0.14 p = 0.82	-	-
ROA crisis	-	-0.22 p = 0.72	-
ROA after the crisis	-	-	**-0.93 p = 0.022**
ROE before the crisis	0.16 p = 0.80	-	-
ROE crisis	-	-0.14 p = 0.81	-
ROE after the crisis	-	-	-0.78 p = 0.12
ROS before the crisis	-0.3 p = 0.62	-	-
ROS crisis	-	-0.29 p = 0.64	-
ROS after the crisis	-	-	0.60 p = 0.19

* results are significant with p < 0.05.
** the correlation is negative in each case, but only in one is this relationship statistically significant.

Source: own study.

The test used shows that there is a positive possible relationship between profitability measures, outsourcing and global financial crises. Only the return on assets after the crisis period (p = 0.022) is statistically significant (p < 0.05). Other indicators are not statistically significant in this model (p>0.05). Analysing the ROA correlation coefficient r = -0.93, it can be concluded that there is a negative correlation between outsourcing after the crisis period measured by the amount of costs of external services and profitability measured by the ROA index. This means that as outsourcing increases after the crisis, the profitability of industrial enterprises decreases. In turn, the more outsourcing, the higher the cost utilisation of external services. This relationship can be considered very large, because the value of statistics is in the range | r | > 0.9. Assuming hypothesis 2, it can be stated that the use of outsourcing significantly reduces the profitability of Polish industrial companies measured by the return on assets after the crisis.

After analysing the correlation, a regression analysis was then performed. The dependent variable is only the return on assets after the crisis period because, as was previously proven, it is not related to the return on sales and the return on equity in any period. The results obtained can be seen in Table 9.

Table 9

Results of the regression analysis

Dependent variable	Parameter	R	R^2	β	F	df model	df the rest	$p < 0.05$
ROA after the crisis	-0.53	0.93	0.87	-0.93	19.4	1	3	0.022

** independent variable – outsourcing.

Source: own study.

Based on the data received, it can be said that there is a linear relationship between outsourcing and the return on assets of industrial companies after the crisis in Poland. Based on the least squares method, we make a straight line pattern. The resulting straight from the analysis has the formula y = -0.53 + 0.05. Along with the increase in the independent variable (outsourcing) by one point, a decrease in the dependent variable (profitability) by 0.53 points can be observed. The independent variable explained about 87% (R^2) of the variability of the dependent variable. The remaining part concerns other variables not included in this model. The beta parameter (-0.93) is consistent with the value achieved in the correlation test. There is a consensus here that along with the increase in the use of services of external suppliers (leading to an increase in the cost of external services), the return on assets is falling.

6. Conclusions

As a result of the ANOVA analysis carried out for repeated measurements, a significant statistical relationship between profitability ratio and time was revealed. It turned out that during the financial crisis, profitability is significantly lower in the case of return on assets. During the crisis, industrial companies were on the verge of profitability and deficit. The average level of return on assets during the crisis is significantly lower than before and after the crisis. Given the return on equity and return on sales, the planned contrast turned out to be statistically insignificant.

Based on the data obtained from the r-Pearson correlation test, we can then say that there is a linear relationship between outsourcing and the return on assets of industrial companies in Poland after the crisis. It can therefore be concluded that there is a positive possible relationship between profitability measures, outsourcing and global financial crises. There is a consensus here that with the increase in the use of services of external suppliers (leading to an increase in the cost of external services), the return on assets decreases. The study does not allow conclusions to be drawn about the existence of a relationship between the use of outsourcing in industrial companies and the profitability measured by ROE and ROS ratios both before and after the crisis. There is a certain limitation in the interpretation of results, because external services also consist of services that are not outsourced, e.g. banking services.

As part of the study, there were other issues worth considering. Since we already know what the relationship between the profitability of industrial companies and outsourcing is, it is worth checking how outsourcing affects other financial issues of enterprises, including the liquidity and indebtedness of Polish enterprises during and after the crisis. According to research, the Polish industry uses outsourcing to a lesser extent than services. The question is whether outsourcing is a solution for modern industrial enterprises? This question is left to the researchers, as it is worth conducting research not only in Poland, but also in other countries. We note a significant impact of outsourcing on the profitability of service companies and recommend conducting an in-depth analysis of outsourcing in this sector.

References

1. Aalders, R. (2001). *The IT Outsourcing Guide.* Chichester: Wiley, 37.

2. Agburu, J.I., Anza, N.C., Iyortsuun, A.S. (2017). Effect of outsourcing strategies on the performance of small and medium scale enterprises (SMEs). *Journal of Global Entrepreneurship Research*, DOI: 10.1186/s40497-017-0084-0.

3. Bedyńska, S., Niewiarowski, J., Cypryańska, M. (2013). *Analiza wariancji-integracja zagadnień.* S. Bedyńska, M. Cypryańka (eds.). Warszawa: SEDNO, 227.

4. Benmelech, E., Dlugosz, J. (2009). The credit rating crisis. *NBER Macroeconomics Annual*, *24,* 161-207.

5. Brunnermeier, M., Pedersen, L. (2009). Market liquidity and funding liquidity. *Review of Financial Studies*, *22,* 2201-2238.

6. Calabrese, G., Erbetta, F. (2005). Outsourcing and firm performance: Evidence from Italian automotive suppliers. *International Journal of Automotive Technology and Management*, *5, 4,* DOI: 10.1504/IJATM.2005.008585.

7. Denčić-Mihajlo, K. (2014). Profitability during the financial crisis evidence from the regulated capital market in Serbia. *South-Eastern Europe Journal of Economics*, 7-33.

8. Dunford, R. (2000). Key challenges in the search for the effective management of knowledge in management consulting firms. *Journal of Knowledge Management, 4, 4,* 295-300.

9. Edvardsson, I., and Teitsdóttir, U. (2015). Outsourcing and financial crisis: evidence from Icelandic service SMEs. *Employee Relations, 37, 1,* 30-47. DOI: 10.1108/ER-11-2013-0168.

10. Görg, H., Hanley, A. (2004). Does Outsourcing Increase Profitability? *Discussion Paper series.* IZA DP, 1372.

11. Juma'h, A., Wood, D. (2000). Outsourcing implications on companies profitability and liquidity: a sample of UK companies. *Work Study*, *49, 7,* 265-275. DOI:10.1108/ 00438020010350220.

12. Kakabadse, A., Kakabadse, N. (2003). Outsourcing best practice: transformational and transactional considerations. *Journal of Corporate Transformation, 10, 1*.

13. Kimura, F. (2002). Subcontracting and the performance of small and medium firms in Japan. *Small Business Economics, 18,* 163-175.

14. Lantz, I.A. (2015). Outsourcing strategies and their impact on financial performance in small manufacturing firms in Sweden. *International Journal of Business and Finance Research, 9, 4*.

15. Lysons, K., Gillinham, M. (2003). Purchasing and Supply Chain Management. *Prentice Hall*, 351.

16. Maziarczyk, A. (2020). Impact of outsourcing on the productivity of Polish industrial enterprises. *The Małopolska School of Economics in Tarnów Research Papers Collection*, *45, 1,* 41-52. DOI: 10.25944/znmwse.2020.01.4152.

17. Mwelu, N., Moya, M.B. (2014). Outsourcing practices and profitability levels of manufacturing firms in Uganda. *European Journal of Business and Management, 6,* 19.

18. Niewiarowski, J. (2013), *Schematy wewnątrzgrupowe. Statystyczny drogowskaz. Praktyczne wprowadzenie do wariancji*. S. Bedyńska, M. Cypryańska (eds.). Warszawa: SEDNO, 107-108.

19. Notoria Serwis, https://ir.notoria.pl/.

20. Stanisz, A. (2007). *Przystępny kurs statystyki II*, Kraków: StatSoft, 41.