# Charles University in Prague

Faculty of Social Sciences
Institute of Economic Studies


BACHELOR THESIS

# Relationships between Corporate Governance and Firm Performance: Effects on Czech Export Oriented and Financial Industries


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# Declaration of Authorship

The author hereby declares that he compiled this thesis independently, using only the listed resources and literature.

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Prague, May 5, 2013

Signature

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# Abstract

The thesis describes effects of corporate governance on firm performance and managerial income of firms from sectors important for Czech GDP: financial sector and export-oriented manufacturing industries. Added value of the work comes mostly from the fact that it concerns Czech firms and especially that it studies the two sectors using econometric method as well as it compares them on graphs and tables. There are two main topics for hypotheses testing. Firstly, the thesis investigates effects on firm performance, measured by proxy variable return on equity, by sizes of executive boards and firms. Secondly, the effects of performance as well as companies and boards sizes on managerial income are studied.



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| **JEL Classification** | G34, L25, M52 |
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# Abstrakt

Téza popisuje účinky corporate governance na firemní výkonnost a příjem manažerů firem ze sektorů důležitých pro české HDP: finančního sektoru a pro-exportně založených výrobních odvětví. Přidaná hodnota práce vychází zejména z faktu, že popisuje právě české firmy a zejména dva zmiňované sektory, přičemž k jejich studiu využívá ekonometrické metody a zároveň je porovnává na tabulkách a grafech. Práce obsahuje dvě hlavné témy. První zkoumá efekty velikostí firem a představenstev na firemní výkonnost měřenou návratností na kapitál. Druhá studuje efekty výkonnosti, velikostí firem, představenstev a dozorčích rad na příjem manažerů.



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| **Klasifikace** | G34, L25, M52 |
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# Acronyms

**BLUE** Best Linear Unbiased Estimator

**CG** Corporate Governance

**ČR** Czech Republic

**EMC** Export-Oriented Manufacturing Companies

**FDI** Foreign Direct Investment

**LSE** London Stock Exchange

**NIE** New Institutional Economics

**OLS** Ordinary Least Squares

**VIF** Variance Inflation Factor

# Bachelor Thesis Proposal

The main purpose of this work is investigation of effects between corporate governance and firm performance of firms functioning in Czech Republic in year 2009 within the financial and export-oriented manufacturing sectors, which means companies of high importance for development of Czech economy. Information about variables needed for the research will be taken from annual reports, a source on basis of which it is possible to analyze structure and performance of a company. The main source of theoretical part concerning corporate governance will be the publication of professor Michal Mejstřík from 1999: "Corporate governance: Theory and the Czech practice" and paper "Corporate Governance" written by Jean Tirole, published in 2001. The work will include several hypotheses testing. The first hypothesis is that size of executive board has zero effect on firm performance when size of the company is fixed whether it is from financial or export-oriented manufacturing sector. Another hypothesis concerning both types of firms says that firm performance, measured by return on equity, has zero effect on income of managers when size of firm, executive board and supervisory board is fixed. The last mutual hypothesis is that the size of company measured by value of sales has no effect on managerial income when value of assets and number of members of both boards is fixed. The difference between the two sectors within relationship of assets on return on equity will be tested when holding for sales and executive board size.

# 1 Introduction

Czech Republic is an open economy. Its GDP is highly dependent on exports which importance is still growing. Therefore when effectivity of companies essential for export of the country is increased then implicitly these positive results display in the whole country's performance. This thesis studies relationships between effects of corporate governance on firm performance as well as executive compensation of financial companies, which provide huge amount of capital to domestic private sector, and export-oriented manufacturing firms. The work also introduces general importance of institutions and corporate governance; it gives a brief introduction to differences between Anglo-Saxon and German model of corporate governance and compares statistics of financial and manufacturing sectors.

The general objective of the thesis is to find possible effects of CG on firm performance and managerial income under the light of the two types of firms in Czech Republic. In the first part of the text based on empirical findings, the goal is to find differences and similarities in firms' and boards sizes, performance and managerial income between financial and manufacturing companies. In the second part of the text based on empirical findings, the goal is to find economic or statistical significance of variables when using econometric methods on the data and testing hypotheses. Based on the previous findings in literature the general hypothesis is that neither board sizes nor value of assets and sales have statistically significant effect on firm performance. Another main hypothesis states that firm performance and size of the firm have positive statistically significant effect on managerial income.

The thesis is structured as follows: Chapter 2 reviews existing literature on the topics of corporate governance and institutions. Chapter 3 includes data description and statistics, description of econometric method used and its application on the data. Chapter 4 states stepbacks in the research. Chapter 5 summarizes the findings in the thesis.

# 2 Literature Review

In order to make the thesis as understandable as possible the author gives an introduction to general theory behind corporate governance (CG). As it is important to comprendiously connect general persperctive with more detailed views there will be firstly given theoretical concepts of institutions and then CG.

## 2.1 Institutions

To determine why institutions are important for the topic, it is fistly needed to define the term correctly. The definition as given by Hogdson (2006, p.18): 'Institutions are systems of established and embedded social rules that structure social interactions.' According to North (1990), institutions and organizations must be separated as the former are rules while the latter are players. Yet Hodgson (2006) defines organizations as special case of institutions as they also include boundaries, they separate members and nonmembers, they have certain principles of souvereignity and they posses structure of members who are creating chains of responsibilities. Decomposing institutions to formal and informal where, according to North (1994), the former are legal laws and the latter is self-controled behavior it is now clear that institutions in their abstract form have been part of society since its very beginning. It is interesting to study how setting of institutions affected development of cultures, nations and also individuals. From economical perspective this field is nowadays mainly represented by NIE which is based mostly on the work of Ronald Coase.

The importance of institutions comes from the definition quite easily. In order to have effective economy the general authority (e.g. EU or government) should pursue as clear and understandable system of rules as possible. Economic subjects then lack the motivation to be speculative and it also reduces e.g. transaction costs to obtain necessary information. According to Coase (1960) under no transaction costs assumption, by setting production factors as rights, economic subjects can trade with these rights which eventually leads to internalizing the existing externalities. Putting all these informations together, the logical conclusion on the micro (enterprise) level is that setting clear relationships within firm should be set as one of primary targets to achieve by the owners in order to maximize transparency and effectiveness of subjects within company. This is supported by Charreaux (2004, p.3): "Most micro

theories of governance come under the perspective of efficiency. The function of a governance mechanism or, more generally, a governance system, is to contribute to the efficiency of the firm. Thus, mechanisms such as the board of directors or hostile takeover bids would, by ensuring a better discipline of the managers, contribute to the increase of efficiency of the firm that creates more value."

## 2.2 Corporate Governance

### 2.2.1 Definition and Importance

There are several conventional definitions of Corporate Governance. According to Shleifer and Vishny (1997, p. 1), CG concerns the concepts of assurance of financial suppliers to companies for their investment return. This definition appears rather restrictive as it seemingly constraints itself to relationships between providers of finance (e.g. shareholders or creditors) and corporations. From the first look, determination of interactions between corporation and public interests (e.g. by labour unions), which is part of Stakeholder model of corporate governance introduced later, is missing. On the other hand, financial providers have to adapt to specific cultural or regional institutional environment and therefore they have to take these differences into account when assuring their investment return. The author finds this definition useful also on the basis of so called principal-agent problem. Principal is reffered to a money provider while agents are executive members of the institution. This concept was dealt with by classical economists for example Berle and Means (1932).

Tirole (2001, p. 1) introduces the principal-agent problem as:

> There is now widespread awareness that managers, say, may take actions that hurt shareholders. They exert insufficient effort when overcommitting themselves to external activities, when finding it convenient to accept overstaffing, or when overlooking internal control. They may collect private benefits by building empires, enjoying perks, or even stealing from the firm by raiding its pension fund, by paying inflated prices to affiliated entities, or by engaging in insider trading.

It is in the interst of principals, in this case shareholders, to restrict such behavior.

Understanding the importance of efficient corporate governance led the London Stock Exchange and Financial Reporting Council to set up the Committee to report financial aspects of corporate governance which eventually created so called *Cadbury report* (1992) on the code of best practise. Nowadays, every listed company on the London Stock Exchange (LSE) must state whether and how much it complies with

the code and state explicit reasons why it does not (LSE 2010). In USA, Sarbanes-Oxley Act from 2002 was integrated into federal law. It consists of 11 parts and its main impact was to be improvement of confidence of investors in financial statements and corporate structure. All over the world it has been a trend of the last 15 years to release national codes of best practice e.g. German Government Commision's German Corporate Governance Code from 2010 or Corporate Governance Code for Slovakia by Central European Corporate Governance Asociation (2008). The interest on CG posed by these institutions implies that corporate governance is the theme of high importance.

### 2.2.2 Models of Corporate Governance

Lazonic and O'Sullivan (2000) distinguish between three perspectives of corporate governance: Managerial, Shareholder Value and Stakeholder Perspective. While they state that managerial approach was dominant after the WWII, its main problem was absence of clear rules for the agents. The other two main models of CG are especially nowadays used in theory[1]. General diferenciation is to Anglosaxon (Shareholder) and German (Stakehholder) model where these approaches were named by Jean Tirole (2001, p. 5, 23) as The Shareholder-Value Perspective and The Stakeholder Society View. Sheridan and Kendall (1992) distinguish between outsider and insider system, however, summing up, these are only various names with the same meaning. After giving basic arguments for the two models, instead of describing each one separately, this chapter will compare the basic differencies between the two models. The focus will be on the comparison of regions, differencies of ownership, financing and how these imply the structure of boards of directors.

Firstly, developing the notion about the difference in the ideas behind the theory, Lazonic and O'Sulluvan (2000, p. 24) summarize the Shareholder model from the perspective of company owners:

> The basic argument underlying the shareholder perspective on corporate governance is that as equity investors shareholders are the only participants in the business corporation whose returns to their productive contributions are "residual". All other groups besides shareholders, such as workers, external suppliers, and creditors, who provide resources to the firm do so on the basis of contracts that specify the relation between their contributions to the productive process and the returns that they receive for those contributions. It is assumed that market forces determine the resources provided and the returns received by these other groups, and that the possessors of these resources will use the market to allocate the resources that they control to their best

[1] see Sheridan and Kendall (1992), Mejstřík (1999), Tirole (2001), Charreaux (2004)

> alternative uses. The returns to shareholders, then, depend upon what, if any, revenues are left over after all other contractual claims have been paid.

On the contrary, the Stakeholder model '[i]s reflecting mostly German and Japanesse microeconomic environment. It assumes that the main function of the firm is wider than maximizing welfare of the shareholder.' Mejstřík (1999, p. 3)[2]. When setting maximizing profit as the main goal companies impose externalities on other stakeholders: employees who are connected with the firm and actually invested their human and off-work related capital into their jobs, clients and suppliers who chose the firm instead of others etc., Tirole (2001, p. 23). Mejstřík (1999, p. 3) analyses this model from game theory perspective on the example of prisoner's dilemma, where in one round game defection remains dominant strategy even if cooperation maximizes the mutual profit, however, in repeated game cooperation might result in competitive advantage as partners of the firm with good reputation will also gain on reputation from signing the contract.

From Shleifer and Vishny's definition stated above, Edwards and Nibler (1999, p. 1) see the distinction of German CG and Anglosaxon (USA, UK) CG in two main points: firstly, role of banks in corporate governance and secondly, ownership concentration.

According to the role of banks, Tirole (2001, p. 3) suggests that in the most of continental Europe banks are active in corporate governance, hovewer:

> In the US, ownership is particularly dispersed; institutions shy away from sitting on boards and mostly act as short-term players (80 percent of the trading of shares is done by institutions, which hold them for an average of 1.9 years, whereas in Japan quasi-permanent holdings make institutions into long-term players).

As to ownership concentration, Edwards and Nibler (1999, p. 1-2) distinct the German system from the Anglo-Saxon one by high concentration of ownership, where the most of the largest firms have significant amount of shares owned by large equity-holders while in the Anglo-Saxon countries it is common for the huge enterprises to have no equity-holding investor.

Berndt (2000, p. 9) states that an equity holder has two basic rights from holding shares: he can use his vote and he can get the residual income; in insider systems there is a controlling shareholder which has enough power to supervise the

[2] Translation by the author

management, however there are problems with low voting power of non-controlling investors[3]; outsider systems have dispersed control resulting in weak control over management while low potential of exploiting shareholders by an individual. According to Keasey, Thompson and Wright (1997) the dominant investors strategy in the outsider system, which has the assumption of efficient capital markets, is to quit while in the insider system the dominant strategy is to vote.

Another assumption for the outsider system is efficient labour market, especially the specific one concerning managers where inappropriate behavior within company reduces managers value on the market and where providing sufficient compensation for managers creates incentives for them to play fair; insider system provides manager control throung supervisory boards usually with members of banks, labour unions and equity-holders, Keasey, Thompson and Wright (1997).

The difference in financing of corporation between the two models lies, according to Berndt (2000, p. 54), in the relying of outsider system on arm's length finance while insider system uses relationship based finance.

Wolf (2011, p. 2) defines the two systems as:

> Ideal-type ALFS treat individual financial transactions as separate decisions, individually structured and priced and provided by the financial institution offering the best transaction-specific service. Long duration and broad ranging relationships between financial firms and customers are rare. Ideal-type RBFS in contrast emphasize long-term relations between customers and a specific financial institution. Individual transactions take place and are priced in the context of this long-term relationship.

[3] see Mejstřík (1999) who describes the problems of such ownership concentration when there is a lack of executable legislation in the country on the case of privatization in Czech Republic

# 3 Empirical Findings

In this chapter the reader will be acknowledged with the author's empirical research. In the first part the author describes reasons for choosing this field of research and possible value added. The second part concerns the data; how they were attained, their description and summary of chosen statistics. The third part starts with theoretical explanation of econometric models and statistical interference used and then describes application of these models on acquired data.

## 3.1 Value Added

Corporate governance is an important topic. There are numerous perspectives on the theme when empirical data are concerned. In this thesis the methodology is based mostly on the work *Board Size, Board Composition and Firm Performance: Empirical Evidence from Germany* of Andreas Bermig and Bernd Frick (2010) who analyzed the effects of corporate governance on firm performance on a sample of German firms. In their work, they were not able to find statistical significance of effects of supervisory board size and composition on firm performance and valuation. This work, however, studies a cross-section of 60 firms with corporate domicil in Czech Republic from which 35 are labeled as manufacture companies and 25 as financial companies. The research is based on revealing possible correlations between supervisory and executive boards, firm performance measured by a proxy variable, firm size represented by value of Assets and Sales and managerial income. Similarly to the research of Bermig and Frick (2010), the data obtained by the author of this thesis proved no significant correlation between supervisory boards' sizes and performance. On the other hand, in this work, statistically significant correlation between executive board and firm size was found, interestingly. Another topic is the compensation of management. As outlined in the theoretical chapter 2.2.2 one of the incentives for the managers to play fair is their wage and bonuses. Within the bigger and more complicated firms the information asymmetry between executives and shareholders grows higher and therefore this thesis tests whether managers in bigger firms have higher income when controlled for firm performance with positive significant correlation as a result.

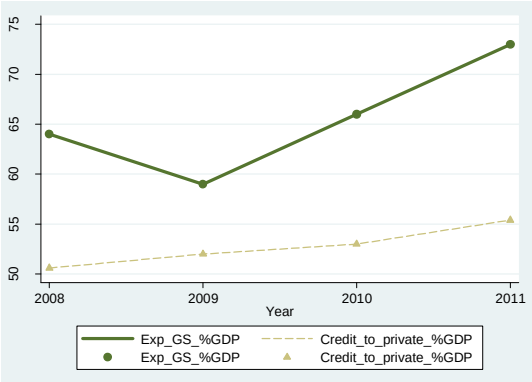
## 3.2 Data

As mentioned above, sample consists of 60 companies divided in two sectors. It is not random sample from all Czech firms, therefore any conclusions stated in this work should not be considered as representative for the whole country or every industry. The reasons for choosing the two segments are that both are extremely valuable for Czech economy:

1) According to The World Bank (n.d. a), Czech exports made 73% of country's GDP in 2011 and they are growing. This means that main export industries of the Czech Republic are not only important for the country but their importance is growing. Therefore, the author finds it interesting to study these enterprises and analyze effects of corporate governance on their performance because the positive impact of these implicitly results in the enhancement of the whole economy.

2) In 2011, financial resources provided to the private sector that establish a claim for repayment were more than 55% of GDP and are growing, following the data of The World Bank (n.d. b). From this data it can be seen very clearly that financial institutions are extremely important intermediaries which provide funds for the e.g. manufacturing industries what later reflects to the GDP. Therefore the effectiveness of these companies is also vital for the economy. In this work, similarities as well as differences of these two important sectors in terms of corporate governance and firm performance will be discussed. Figure 1 shows trends in share of exports on % GDP and share of domestic credit to private sector as a % of GDP according to The World Bank (n.d. a,b) data.

Figure 1: *Trends in Exports and Domestic Credit*




### 3.2.1 Description

There are two types of enterprises in the primary sample: Firstly manufacturing companies from traditional Czech export industries as stated by National Trade

Promotion Agency (n.d.) which is working under Czech Ministry of Industry and Trade and secondly financial companies. The only two industries stated as traditional by National Trade Promotion Agency not included in the sample are the *Mechanical engineering* exchanged by *Machinery* (very important sector for the eastern part of Czech Republic) and *The information and communication technologies* sector simply because it is not manufacturing sector and firms in this industry have different asset structure (e.g. no need for inventories) which would possibly cause problems in the models. Most of the companies which were labeled as manufacturing were taken from reports of National Promotion Agency (n.d.) on each sector. Several other important export companies were added to the primary sample from the 20 most exporting companies according to the research of associacion CZECH TOP 100 (n.d.). The rest of companies in primary sample were chosen according to the List of Monetary Financial Institutions according to Czech National Bank (n.d.).

All data used in the work were obtained from annual reports for year 2009 of enterprises from primary sample, however, not every company created annual report for the year. Also, specific informations about income of wider management from each firm were needed for the model. These were the two main reasons for dropping observations. Eventually, the author finished the search by having 64 observations. As the main regression model in this work measures dependence of firm performance on several explanatory factors, the dataset was then cleared for 4 outliers, firms with extraordinary bad performance. Including them in the model positively changed the significance of the results, however, the author assumed that they should be kept out of the model because the rest of the sample is normally distributed so by opting them out the description of population is better.

Figure 2: *Density ROE before adjustment* Figure 3: *Density ROE adjusted*

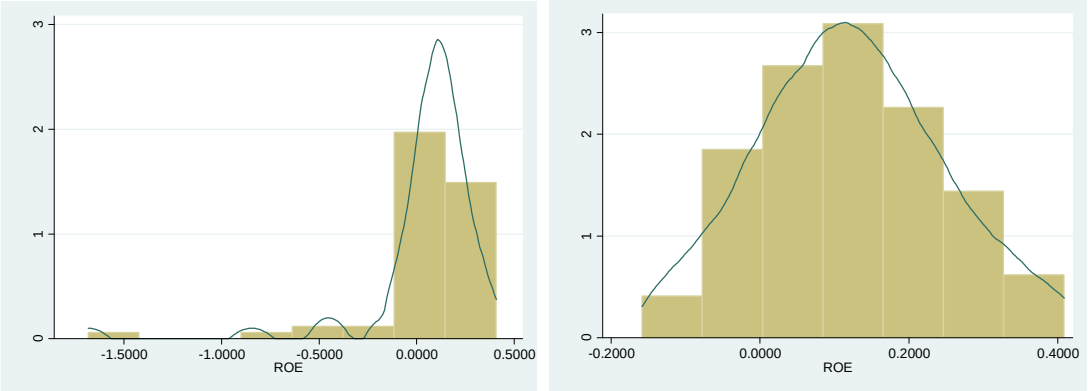



Figure 2 shows density of performance proxy before adjustment for outliers, Figure 3 shows density of performance proxy after adjustment for outliers. The line

in both figures represents kernel density of performance proxy. Histogram is showing frequency distribution, Wooldridge (2002, p. 167). Figure 3 is cleaned for so called "spoiled eggs", a term used in the world of finance for observations with extreme values when compared to the rest of population. According to Ledl (2004), Kernel density is a non-parametric smoothing estimation method. Kernel density estimation was first introduced by Rosenblat (1956) and can be written as:

$$\hat{f}_h(x) = \frac{1}{nh}\sum_{i=1}^{n} K\left(\frac{x - x_i}{h}\right)$$

where K is kernel function and h is width parameter.

These variables were used in the work:

$\boldsymbol{ROE}$ … $Return\ on\ equity;\ ROE = \dfrac{Net\ Income}{Equity}$

$\boldsymbol{eboard}$ … $Number\ of\ members\ of\ executive\ board$

$\boldsymbol{sboard}$ … $Number\ of\ members\ of\ supervisory\ board$

$\boldsymbol{MI}$ … $Income\ per\ manager\ in\ milion\ CZK$

$\boldsymbol{A}$ … $Net\ value\ of\ assets\ in\ milion\ CZK$

$\boldsymbol{S}$ … $Value\ of\ sales\ in\ milion\ CZK$

$\boldsymbol{manuf}$ … $States\ 1\ if\ firm\ is\ from\ manufacturing\ sector, 0\ if\ from\ financial\ sector$

$\boldsymbol{fin}$ … $States\ 1\ if\ firm\ is\ from\ financial\ sector, 0\ if\ from\ manufacturing\ sector$

Variables ROE, sboard, eboard, A and S were used in accordance with Bermig and Frick (2010) where ROE serves as performance proxy, Assets and Sales serve as a measure of size and complexity of a company and sboard/eboard determines supervisory/executive board size. The thesis also contains variable MI on the basis of the work of e.g. Hamill, Ward & Wylie (2011) or Stigler (2011) who were determining effects of CEO compensation, dividend policies and managerial bonuses on performance. Variables manuf and fin serve as dummy variables to discard possible differences between manufacturing and financial companies in the model.

Certain variables, namely Assets, Sales and MI, have skewed distributions as shown in figures 4, 6 and 8. Using logarithmic form of these variables (figures 5, 7, 9) changes their distribution, moves them closer to normal distribution and eventually

results in higher significance of logarithmed variables in the econometric models than their nonlogarithmic counterparts (this conclusion results from testing the goodness of fit of the variables on the dataset used in this work, it is not a general conclusion).

Figure 4: *Density A*

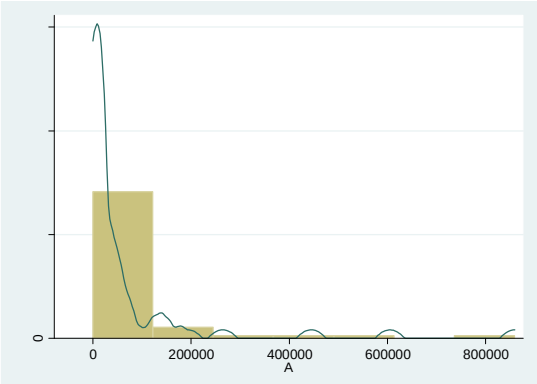
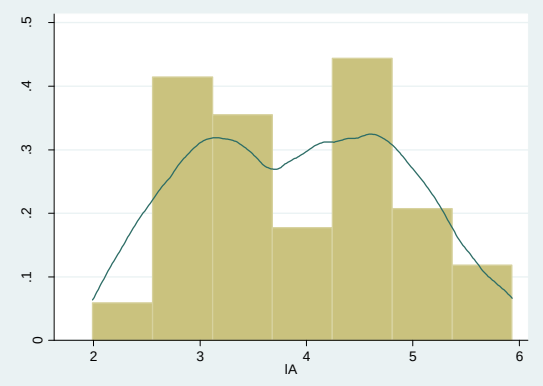



Figure 5: *Density lA*




Assets are distributed mainly around value of 10 bilion CZK with gradual decline after 20 bilion CZK. After using the transformation, observations seem to concentrate much more in the middle values.

Figure 6: *Density S*

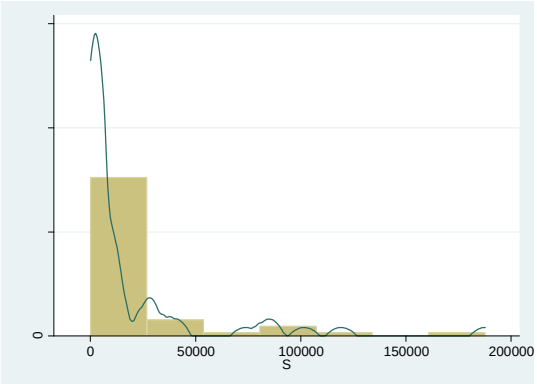
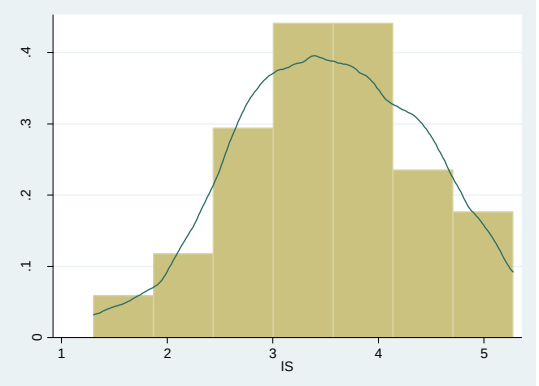



Figure 7: *Density lS*




Sales follow the description of distributions of Assets. These two variables are very highly correlated. Firms with lower value of Assets had lower Sales and vice versa.

Figure 8: *Density MI*

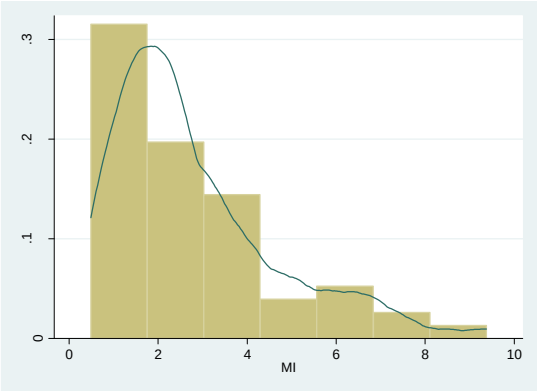
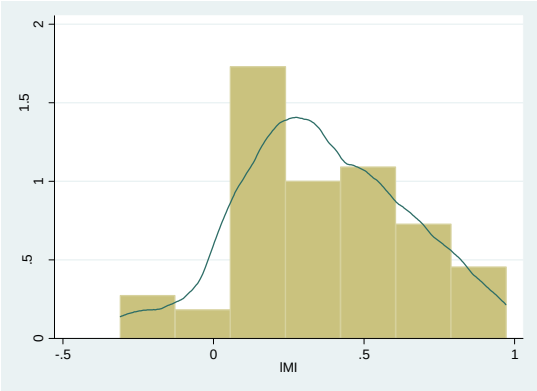



Figure 9: *Density lMI*




Managerial income variable was distributed mainly around 2 milion CZK per manager; however, there was certain decline to the left (lower values). Resulting lMI distribution is not as clearly close to normal as for example distribution of lS, on the other hand, it is still better than MI as it boosted significance of the models used.

A good example of why to use transformation of variables in the models is shown by plotting the observations. Figure 10 shows scatterplot of variables MI and A while Figure 11 shows scatterplot of variables lMI and lA. While in the former, it is hard to find a relationship between variables, the latter shows correlation between variables very clearly. It is important to mention that interpretation of econometric results is different when using logarithms but it changes only from nominal effects to elasticities, Wooldridge (2002, p. 46).

Figure 10: *Plot MI A*

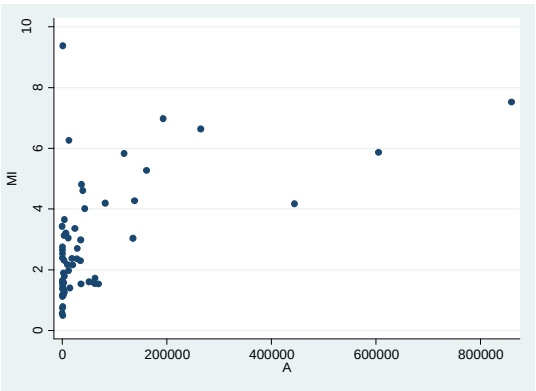
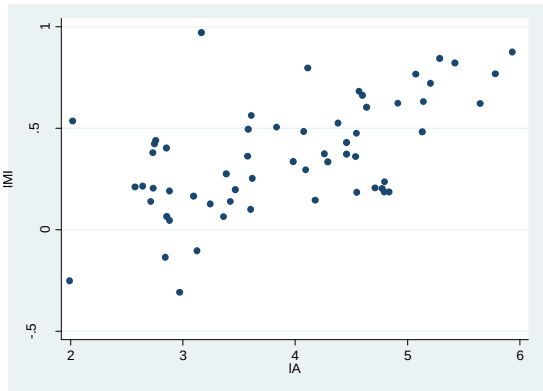


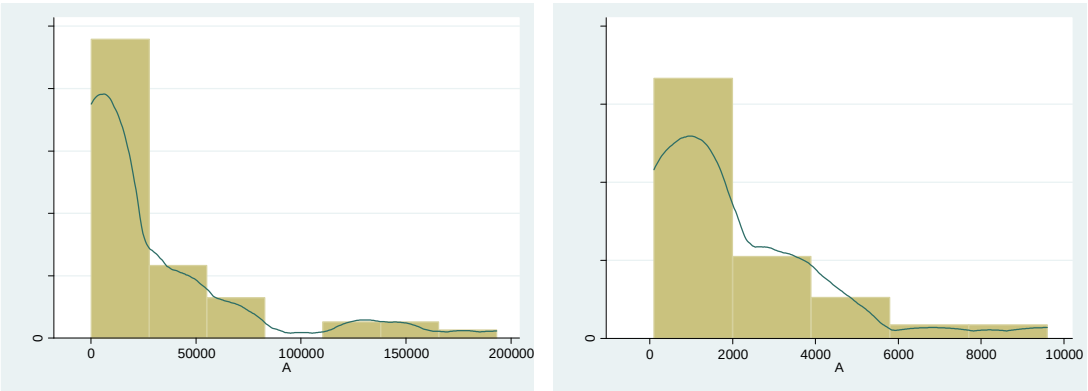

Figure 11: *Plot lMI lA*




Explanation why the author used logarithmic transformation on e.g. Assets and not on ROE, which was adjusted for outliers, comes from 3 reasons. Firstly, ROE contains negative values which are not possible to be used in logarithm. Secondly, even if the author used logarithmisation of the form e.g. log(ROE +1), the result would not be closer to the normal distribution as it was the “left” tail of the variable

which was longer. Possibly, exponential transformation would result in "normalisation", however, the interpretation of results in such case is much more complicated than the one when logarithmic forms are used. The third reason and the one with the highest weight is that Assets (and Sales and MI) are much smoother and follow similar distribution even after adjusting for the highest values, unlike ROE. For example, Figure 12 shows distribution frequency with kernel density of Assets when only observations with Assets of value less than 200 bilion were taken into account and Figure 13 only those with Assets of value less than 10 bilion.

Figure 12: *Density Assets < 200 000 mil* Figure 13: *Density Assets < 10 000 mil*




### 3.2.2 Statistics

*Source of all data are annual reports*. As a measure of mean values arithmetic average, median and, where possible, modus were used. Standard deviation was used as a measure of variation. Table 1 shows statistics before adjustment for outliers of ROE. Table 2 shows statistics after adjustment. Tables 3 and 4 restrict themselves only to manufacturing and financial firms respectively, both after being adjusted for outliers of ROE.

Table 1: *Sample before adjustment*

| Full | manuf | sboard | eboard | MI | A | S | ROE | lMI | lA | lS | Eq | NI | Lia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| min | 0 | 0 | 1 | 0.49 | 97.86 | 20.14 | -1.68 | -0.31 | 1.99 | 1.30 | 28.64 | -3,261.64 | 38.18 |
| average | 0.59 | 3.61 | 3.92 | 2.88 | 59,149.92 | 16,657.94 | 0.06 | 0.37 | 3.90 | 3.52 | 12,303.31 | 1,700.05 | 47,245.83 |
| median | 1 | 3 | 3 | 2.30 | 8,213.69 | 2,939.45 | 0.11 | 0.36 | 3.91 | 3.47 | 1,438.07 | 41.98 | 3,863.85 |
| max | 1 | 12 | 9 | 9.37 | 858,972.00 | 187,858.00 | 0.41 | 0.97 | 5.93 | 5.27 | 177,460.00 | 45,427.00 | 790,021.00 |
| st.dev | 0.50 | 3.08 | 1.84 | 2.00 | 143,675.73 | 33,542.77 | 0.30 | 0.29 | 0.97 | 0.88 | 28,629.27 | 6,491.60 | 126,667.99 |
| modus | 1 | 3 | 3 | | | | | | | | | | |

According to the Table 1, companies from the sample before the adjustment mostly had supervisory board of size 3 and executive board of size 3. Also, this was the most common combination of boards – 3 members of supervisory board and 3 members of executive board (not in the table). Also, only two firms were led by a single executive officer without supervisory board. Income per manager varied from around half million to 10 million CZK a year. Average as well as median was

approximately 2.5 million CZK with standard deviation of 2 million crowns. This means that in the sample, most managers' income was between 0.5 and 4.5 million crowns per year. It can be seen that in the sample there was variety of companies from the perspective of their size. Starting with companies with value of Assets less than 100 million and Sales at around 20 million CZK and ending with companies with revenues and Assets counting hundreds of billion crowns. Average in these two variables is far beyond median which suggests lower amount of much bigger companies. As was shown in chapter 4.2.1., these asimilarities were dealt with by using logarithmic transformation of variables. When taking a closer look at statistics of lMI, lA and lS and comparing them to MI, A, S a reader can notice that medians and averages of logarithmized counterparts are much closer not only in nominal but also in relative terms. Taking e.g. ratio of median divided by average, Assets ratio changed from 0.14 to lAssets ratio approximately 1. Using the same scheme on Sales the ratio changed from approximately 0.19 to 0.99 and MI from around 0.8 to 0.99. Even more importandly, ratios of standard deviation over average reduced significantly for Assets from 2.43 to 0.25 and for Sales from 2.01 to 0.25, rounded for 2 decimals. When applying this ratio on MI and lMI a minor growth can be seen from 0.69 to 0.79. This suggests that observations are concentrated more symetrically around the middle value for lMI but are not as much concentrated around average. On the other hand, transformed variables of Assets and Sales show a major improvement of data allocation according to both ratios. Equity (Eq), Liabilities (Lia) and Net Income (NI) can also be found in the table as they are important indicators of basic company structure and the reader is therefore better able to understand the sample. It can be seen that sample is on average profitable as Net Income is on average positive, most firms actually accounted profit as the middle value is positive. Another possibly interesting fact is that firms had averagely quite high leverage, average Liabilities beign almost four times the size of Equity. Important variable ROE before the adjustment had its minimum value of around -1.68 while maximum was a little more than 40% and average 0.06. Table 2 shows the statistics of variables after adjustment for only 4 observations.

Table 2: *Adjusted sample*

| Adjusted | manuf | sboard | eboard | MI | A | S | ROE | lMI | lA | lS | Eq | NI | Lia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| min | 0 | 0 | 1 | 0.49 | 97.86 | 20.14 | -0.16 | -0.31 | 1.99 | 1.30 | 28.64 | -1,768.50 | 38.18 |
| average | 0.58 | 3.65 | 3.98 | 2.83 | 62,715.73 | 17,607.43 | 0.12 | 0.37 | 3.92 | 3.54 | 12,996.45 | 1,901.18 | 50,145.12 |
| median | 1 | 3 | 3.5 | 2.30 | 10,747.61 | 2,939.45 | 0.11 | 0.36 | 4.03 | 3.47 | 1,438.07 | 66.54 | 4,781.51 |
| max | 1 | 12 | 9 | 9.37 | 858,972.00 | 187,858.00 | 0.41 | 0.97 | 5.93 | 5.27 | 177,460.00 | 45,427.00 | 790,021.00 |
| st.dev | 0.50 | 3.13 | 1.82 | 1.89 | 147,763.47 | 34,446.12 | 0.13 | 0.28 | 0.99 | 0.89 | 29,449.39 | 6,652.18 | 130,365.49 |
| modus | 1 | 3 | 3 | | | | | | | | | | |

All findings according to Table 1 are consistent with Table 2 except those of ROE. Only 4 adjusted observations resulted in moving the ratio of median divided by

average from value 1.8 to 0.95 and ratio standard deviation divided by average from 5.07 to 1.05. Therefore the author decided to work with the adjusted data from this point to the end of the work as he finds them more consistent.

Table 3: *Manufacturing firms*

| Manuf | manuf | sboard | eboard | MI | A | S | ROE | IMI | IA | IS | Eq | NI | Lia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| min | 1 | 0 | 1 | 0.56 | 97.86 | 28.58 | -0.16 | -0.25 | 1.99 | 1.46 | 28.64 | -1,768.50 | 38.18 |
| average | 1.00 | 2.43 | 3.77 | 2.53 | 31,879.14 | 25,511.64 | 0.11 | 0.33 | 3.68 | 3.71 | 15,512.78 | 2,000.27 | 16,344.35 |
| median | 1 | 2 | 3 | 1.97 | 3,764.98 | 7,559.33 | 0.11 | 0.30 | 3.58 | 3.88 | 1,399.06 | 30.34 | 2,620.72 |
| max | 1 | 12 | 9 | 9.37 | 444,698.00 | 187,858.00 | 0.37 | 0.97 | 5.65 | 5.27 | 177,460.00 | 45,427.00 | 267,238.00 |
| st.dev | 0.00 | 3.05 | 2.14 | 1.73 | 79,059.46 | 42,670.98 | 0.13 | 0.24 | 0.92 | 0.93 | 35,347.23 | 8,081.93 | 45,704.58 |
| modus | 1 | 0 | 3 | | | | | | | | | | |

Table 3 shows statistics of manufacturing firms only. Table 4 shows statistics of financial firms only. The main difference when compared to Table 2 is the leverage. For manufacturing firms, on average, Assets are funded from internal sources at approximately the same amount as from external sources. On the contrary, it can be seen that financial firms require higher ratio of liabilities to equity which comes probably mainly from their structure. As the definition of financial companies in the sample provided by Czech National Bank: “"Monetary Financial Institutions" (MFIs) are central bank, resident banks, and other resident financial institutions whose business is to receive deposits and/or close substitutes for deposits from entities other than MFIs and, for their own account (at least in economic terms), to grant credits and/or make investments in securities.”[4] Obviously, deposits these institutions are regarded as liabilities and therefore the leverages are higher. Also, manufacturing firms seem to preffer smaller supervisory as well as executive boards with middle value of supervisory board beign 4 members less than middle value of financial sboard. Median of executive boards of manufacturing companies is lower by 2 members compared to financial companies. Also modus differs where manufacturing firms actually had no supervisory boad most often and eboard of 3 people. On the contrary, financial sector reported mostly 3 members of supervisory board and 5 executives. The most frequent combination of eboard and sboard is also different for each sector as well as for total. Manufacturing firms mostly used 3 executives without any supervisory board while the total of 5 financial companies reported the same amount of boards’ members, more precisely 3 to 3 and 9 supervisors for 5 executives.

[4] Source: http://www.cnb.cz/en/statistics/money_and_banking_stat/lists_mbs/mfi_list/index.html

Figure 14: *Plot fitci Eq A f/m*

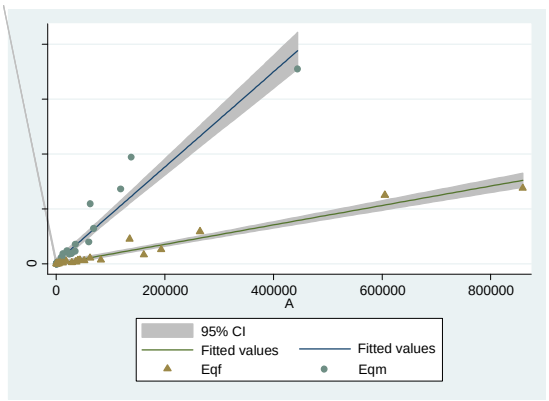
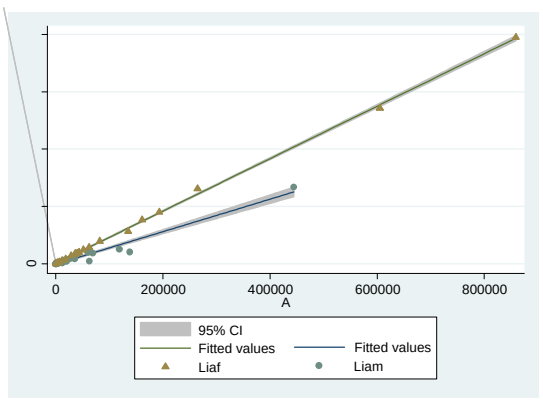



Figure 15: *Plot fitci Lia A f/m*




Figures 14 and 15 show estimated lines from the given data which minimize the squared residuals (how far above or below the line the actual observation is to the power of two). The grey fields show the area with 95% probability of location of mean value of variable from the y axis for the given value on x axis. A clear linear relationships can be seen when separated into financial (Eqf, Liaf) and manufacturing (Eqm, Liam) companies. It is not so surprising for the financial companies as these have to meet capital requirements stated e.g. in BASEL II but more interestingly, according to the figures, manufacturing companies also tend to follow a certain ratio of Equity and Liabilities which is averagely close to 1 (Table 3).

Financial firms had on average approximately 4% better performance measured by ROE. On the other hand, those companies were also averagely bigger in terms of Assets and Sales. Also managers were generally paid better by financial companies with middle value more than a million crowns higher while standard deviation was only slightly higher for manufacturing companies.

Table 4: *Financial firms*

| Fin | manuf | sboard | eboard | MI | A | S | ROE | lMI | lA | lS | Eq | NI | Lia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| min | 0 | 3 | 2 | 0.49 | 438.84 | 20.14 | -0.08 | -0.31 | 2.64 | 1.30 | 120.92 | -71.97 | 123.06 |
| average | 0.00 | 5.36 | 4.28 | 3.24 | 105,886.96 | 6,541.54 | 0.14 | 0.41 | 4.26 | 3.29 | 9,473.60 | 1,762.45 | 97,466.20 |
| median | 0 | 6 | 5 | 3.04 | 35,486.19 | 2,002.26 | 0.15 | 0.48 | 4.55 | 3.30 | 2,030.85 | 349.50 | 33,455.34 |
| max | 0 | 9 | 7 | 7.51 | 858,972.00 | 40,684.00 | 0.41 | 0.88 | 5.93 | 4.61 | 68,951.00 | 17,368.00 | 790,021.00 |
| st.dev | 0.00 | 2.40 | 1.21 | 2.06 | 203,697.06 | 10,897.10 | 0.13 | 0.33 | 0.99 | 0.78 | 18,434.95 | 4,027.06 | 186,605.89 |
| modus | 0 | 3 | 5 | | | | | | | | | | |

Other information from tables 3 and 4 considering the ratios mentioned in the text above are consistent with Table 2. Figure 16 shows relationship between ROE and leverage according to the company beign financial or manufacturing. Figure 17 compares ROE density for financial and manufacturing firms.

Figure 16: *Plot fit ROE lev f/m*

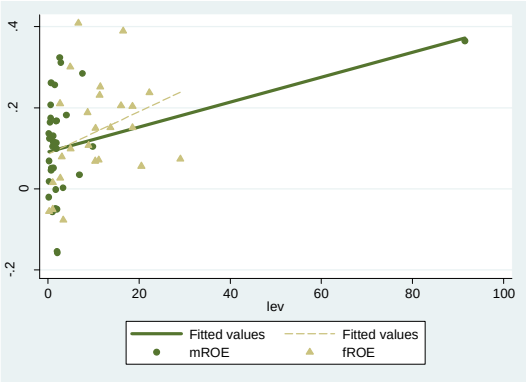
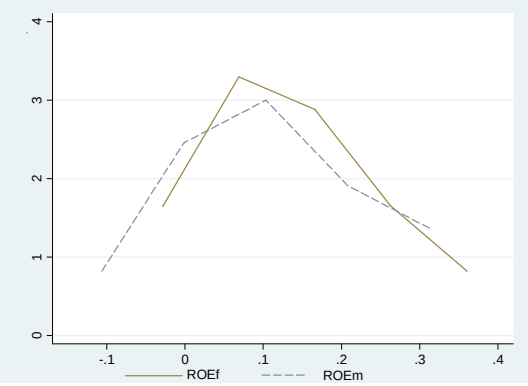



Figure 17: *Density ROE f/m*




According to the findings from tables including statistics, the author decided to investigate the relationship between ROE and leverage separately (and comparably) for financial and manufacturing firms. There is neither statistically significant, nor visible trend and therefore the author does not consider leverage as an important variable in terms of difference between ROE ofmanufacturing and financial firms and leaves this dependence out for the rest of the text. Also the fact that financial companies are highly leveraged does not change the frequency distribution of ROE as shown in Figure 17.

## 3.3 Method

According to the fact that only one time period was used, the author used simple OLS for cross-sectional data. Chapter 4.3.1 concerns with the theory behind OLS, its assumptions, interpretation of the results while using transformation of variables, describes statistics used to measure significance of results and introduces tests of assumptions. Chapter 4.3.2 concerns with the search for statistically significant relationships between corporate governance and firm performance, which is the main part of the work.

### 3.3.1 Theory

Least squares method has been used for a long time. According to Plackett (1949), the main contribution was made by Carl Friedrich Gauss, although as he states that in nineteenth century the credit for introducing the method of least squares was given mostly to Laplace, ignoring the contribution of Gauss, hovewer these views later changed giving credit to Markoff. In his later work, Plackett (1972) states that the discovery was made independently by Adrien-Marie Legendre and Gauss.

In this work, ordinary least squares and weighted least squares methods are used. Firstly, the author introduces multiple linear regression model with n observations and k independent variables in accordance with Wooldridge (2002):

$\boldsymbol{y} = \beta_0 + \beta_1 \boldsymbol{x_1} + \cdots + \beta_k \boldsymbol{x_k} + \boldsymbol{u}$, where

$x_1 \dots x_k$ are independent(explanatory) variables

$\boldsymbol{y}$ is dependent variable, $\boldsymbol{y} = [y_1, \dots, y_n]^T$

$\beta_0$ is interncept parameter

$\beta_1 \dots \beta_k$ are estimation slope parameters

$\boldsymbol{\beta} = [\beta_0, \beta_1 \dots, \beta_k]^T$

$\boldsymbol{u}$ is error term which "represents factors other than x that affect y",$\boldsymbol{u} = [u_1, \dots, u_n]^T$

$$\boldsymbol{X} = [\boldsymbol{x_0}, \dots, \boldsymbol{x_k}];\ \boldsymbol{x_0} = \begin{bmatrix} 1 \\ \vdots \\ 1 \end{bmatrix};\ [\boldsymbol{x_1}, \dots, \boldsymbol{x_k}] = \begin{pmatrix} x_{11} & \dots & x_{1k} \\ \vdots & \ddots & \vdots \\ x_{n1} & \dots & x_{nk} \end{pmatrix}$$

There are two main assumptions about an error term in the model:

$E(u) = 0$,

$E(u|X) = 0$, meaning the error term does not depend on any explanatory variables

Then, population regression function can be written as:

$E(y|X) = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k$

This means that increasing $x_1$ for one unit results in change of expected value of $y$ for $\beta_1$.

With model defined and assumptions about errors still valid it is now possible to introduce matrix algebra behind OLS which is again in accordance with Wooldridge (2002):

$$\boldsymbol{y} = \boldsymbol{X\beta} + \boldsymbol{u} \rightarrow \boldsymbol{u} = \boldsymbol{y} - \boldsymbol{X\beta} \rightarrow \boldsymbol{u^2} = (\boldsymbol{y} - \boldsymbol{X\beta})^{\boldsymbol{2}}$$

What is obvious already from the name of OLS, this squared error is to be minimized which is done by findind proper estimated parameters $\widehat{\boldsymbol{\beta}}$.

$\frac{\partial(\boldsymbol{y}-\boldsymbol{X\beta})^2}{\partial \boldsymbol{\beta}} = 2\boldsymbol{X^T}\left(\boldsymbol{y} - \boldsymbol{X}\widehat{\boldsymbol{\beta}}\right) = \boldsymbol{0}$, which can be written by using sums as:

$$\sum_{i=1}^{n}\left(y_i - \hat{\beta}_0 + \hat{\beta}_1 x_{i1} + \cdots + \hat{\beta}_k x_{ik}\right) = 0$$

$$\sum_{i=1}^{n} x_{i1}\left(y_i - \hat{\beta}_0 + \hat{\beta}_1 x_{i1} + \cdots + \hat{\beta}_k x_{ik}\right) = 0$$

$$\vdots$$

$$\sum_{i=1}^{n} x_{ik}\left(y_i - \hat{\beta}_0 + \hat{\beta}_1 x_{i1} + \cdots + \hat{\beta}_k x_{ik}\right) = 0$$

and the estimated betas are computed as:

$$\boldsymbol{X^T\left(y - X\hat{\beta}\right) = 0 \rightarrow (X^T X)^{-1} X y = \hat{\beta}^{(OLS,n)}}$$

After using estimated betas in the model we get:

$\hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1 x_{i1} + \cdots + \hat{\beta}_k x_{ik} + \hat{u}_i$, where

$\hat{\beta}_0$ is estimated interncept parameter

$\hat{\beta}_1 \ldots \hat{\beta}_k$ are estimated slope parameters

$\hat{y}_i$ are fitted values

$\hat{u}_i$ are disturbances.

The OLS has a set of assumptions for the finite sample. These assumptions of the OLS are as follows according to the Wooldridge (2002):

**Assumption 1: Linear in Parameters**

The model can be written as: $\boldsymbol{y = X\beta + u}$, where $\boldsymbol{y}$ is observed $n\ x\ 1$ vector, $\boldsymbol{X}$ is observed $n\ x\ k$ matrix and $\boldsymbol{u}$ is $n\ x\ 1$ vector of disturbances or errors.

**Assumption 2: Random Sampling**

We have a random sample of $n$ observations $\{(x_{i1}, x_{i2}, \ldots, x_{ik}, y_i); i = 1,2, \ldots, n\}$ from population model described in Assumption 1.

**Assumption 3: Zero Conditional Mean**

Conditional on $\boldsymbol{X}$, $u_i$'s have zero means. $E(u_i|\boldsymbol{X}) = \boldsymbol{0}$.

**Assumption 4: No Perfect Collinearity**

The matrix $\boldsymbol{X}$ has rank k.

**Assumption 5: Homoskedasticity**

$Var(\boldsymbol{u}|\boldsymbol{X}) = \sigma^2\boldsymbol{I}_n$, where $\boldsymbol{I}_n$ is identity $n\,x\,n$ matrix with interpretation beign constant variance of errors conditional on $\boldsymbol{X}$.

**Assumption 6: Normality of Errors**

Conditional on $\boldsymbol{X}$, the $u_i$ are independent and identically distributed as $N(0, \sigma^2)$.

From the assumptions several theorems can be implied. Again, according to the Wooldridge (2002):

**Theorem 1: Unbiasedness of OLS**

Under Assumptions 1, 2, 3 and 4 the OLS estimator $\widehat{\boldsymbol{\beta}}$ is unbiased for $\boldsymbol{\beta}$. It means that $E(\widehat{\boldsymbol{\beta}}) = \boldsymbol{\beta}$.

**Theorem 2: Variance – Covariance Matrix of the OLS Estimator**

Under Assumptions 1 through 5, $Var(\widehat{\boldsymbol{\beta}}|\boldsymbol{X}) = \sigma^2(\boldsymbol{X}^T\boldsymbol{X})^{-1}$.

**Theorem 3: Gauss – Markov Theorem**

Under Assumptions 1 through 5, $\widehat{\boldsymbol{\beta}}$ is the best linear unbiased estimator. The best means that parameter estimates of any other estimator have higher variance.

**Theorem 4: Unbiasedness of $\boldsymbol{\sigma^2}$**

Under Assumptions 1 through 5, $\hat{\sigma}^2$ is unbiased for $\sigma^2$. $E(\hat{\sigma}^2|\boldsymbol{X}) = \sigma^2$ for all $\sigma^2 > 0$.

**Theorem 5: Normality of $\widehat{\boldsymbol{\beta}}$**

Under the classical linear model Assumptions 1 through 6, $\widehat{\boldsymbol{\beta}}$ conditional on $\boldsymbol{X}$ is distributed as multivariate normal with mean $\boldsymbol{\beta}$ and variance - covariance matrix $\sigma^2(\boldsymbol{X}^T\boldsymbol{X})^{-1}$.

**Theorem 6**

Under Assumptions 1 through 6, $(\hat{\beta}_j - \beta_j)/se(\hat{\beta}_j) \sim t_{n-k}, j = 1,2, \ldots k$.

An important thing in any empirical project is hypotheses testing. To make a proper test of a hypothesis about significance of a variable or more variables the author of this work uses t test and F test respectively. To find the roots of the exploration of t distribution the search must focus back on the beginning of previous century. Student's t distribution was first introduced by William Sealy Gosset who published his work under nickname Student. In his work, Gosset (1908) concludes that he found curves which represent the frequency distribution of standard deviations of samples from normally distributed population, the frequency distribution of means of samples from normally distributed population, showed that the facts where represented good enough even when population was not strictly normally distributed and constructed tables which gave the probability of location of the mean. He illustrated the method on effects of drugs on patients' sleep. The method consists of firstly calculating the value of mean divided by standard deviation (creating value *z*) of the sample. Secondly, the corresponding z value in the tables he created is found. Lastly, according to the value in tables, the probability of population mean, laying within area of z-times the standard deviation around the sample mean, is extrapolated from the tables.

The application of finding of Gosset in this work is according to the Wooldridge (2002) and the author uses t test to possibly reject the hypotheses that a population mean of a variable is zero. Wooldridge (2002, p. 117) describes the methodology of t test:

> The statistic we use to test $H_0: \beta_j = 0$ against any alternative is called "the" **t statistic** or "the" **t ratio** of $\hat{\beta}_j$ and is defined as $t_{\hat{\beta}_j} = \hat{\beta}_j / se(\hat{\beta}_j)$. We have to put "the" in quotation marks because, as we will see shortly, a more general form of the *t* statistic is needed for testing other hypotheses about $\beta_j$.

As the author tests only that parameters are zero against two-sided alternatioves (either less than or more than zero), the explanation of application restricts only to this approach. According to the Wooldridge (2002, p. 118), firstly the significance level $\alpha$ (measured in percentages) must be chosen – a level at which the hypothesis is rejected with the knowledge that probably $\alpha$ of population is true to be 0. Secondly, he defines the rejection rule of $H_0 = 0$ against $H_1 \neq 0$ at $\alpha$ level of significance when $\left| t_{\hat{\beta}_j} \right| > c$, where $c$ is critical value which depends on a chosen significance level. If the inequality holds, $H_0$ can be rejected at $\alpha$ significance level. If it does not, $H_0$ cannot rejected at $\alpha$ significance level.

Another important instrument regarding the hypotheses is p-value. According to Wooldridge (2002, p. 129) the p-value for the test against two-sided alternative of $H_0 = 0$ is calculated as $P\left(|T| > \left|t_{\hat{\beta}_j}\right|\right)$ where T is a random variable with student's distribution. The usefulness of p-value comes from the fact that small p-values automatically call for rejection of the null hypothesis whereas higher values for inability of rejection. Wooldridge (2002, p. 129) defines p-value as: '… the probability of observing a *t* statistic as extreme as we did *if the null hypothesis is true*.'

For testing the joint significance of variables the author uses F test. This test is based on the findings of George Waddel Snedecor and Ronald Aylmer Fisher who developed the Fisher-Snedecor distribution. According to Wooldridge (2002, p. 142), the testing comes from hypothesis that $H_0: \beta_{k-q+1} = 0, \dots \beta_k = 0$ where k is number of slope estimators and q is number of exlcluded variables which significance is tested. Then F statistic is calculated as $F = \frac{SSR_r - SSR_{ur}}{SSR_{ur}} * \frac{q}{n-k-1}$ where $SSR_r$ means sum of squared residuals ($SSR_r = \sum_{i=1}^{n} \hat{u}_i^2$) from restricted model without q variables and $SSR_{ur}$ is sum of squared residuals from complete unrestricted model. Then again, the rejection rule is defined as $F > c$, where c is critical value depending on $\alpha$, n, k and q. If the inequality holds, $H_0$ can be rejected at $\alpha$ significance level. If it does not, $H_0$ cannot rejected at $\alpha$ significance level. P-value is defined as $p = P(\varphi > F)$ where $\varphi$ follows $F(q, n-k-1)$ and F is value of statistic.

Another important instrument is testing for the Assumptions given in the text above. Given that these Assumptions can be effectively tested, the author can compare and improve models by e.g. adding more variables, correcting heteroskedasticity etc. For testing the Assumptions of the models Variance Inflation Factor was used as a multicolinearity test, White's test was used as a heteroskedasticity tests. RESET test was used for possible functional form misspecification and omitted variables and Shapiro-Wilk test as a test for normality.

The first Assumption that has to be checked is random sampling. According to Bartoszyński and Niewiadomska-Bugaj (2008, p. 240): 'If $X_1, \dots, X_n$ are independent, with the same distribution, then in statistics we call them a ***random sample***.' The author was not able to find any specific test for random sampling as also according to Wooldridge (2002, p. 700): 'Whether or not it is appropriate to assume the sample came from a random sampling scheme requires knowledge about the actual sampling process.'

Why is multicollinearity a case is explained by Wooldridge (2002, p. 96): '…, one thing is clear: everything else beign equal, for estimating $\beta_j$ it is better to have less correlation between $x_j$ and other independent variables.'

Roso, Schenkel, Miller and Schaeffer (2005) suggest that multicollinearity causing estimation problems is when Variance Inflation Factor (VIF) is over 10 and specify:

> The variance inflation factor is the most common measure of multicollinearity. If $R_i^2$ is the coefficient of determination resulting when the predictor variable $X_i$ is regressed on all the remaining predictor variables, the variance inflation factor for $X_i$ ($VIF_i$) is given by: $VIF_i = \frac{1}{(1-R_i^2)}$.

Following the Gauss – Markov Theorem, when hetteroskedasticity is present, the estimators are no longer best linear unbiased ones. Therefore, in the work White's test is used. It was first introduced by Halbert White (1980), in his article published by Econometrica *A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity*. According to Wooldridge (2002), the application of special White's test is divided into three steps: Firstly, the model is estimated by OLS, residuals together with fitted values are obtained and their squared forms are computed. Secondly, the squared residuals are regressed on fitted values and their squared forms. Lastly, F statistic is formed and p-value computed where the null hypothesis is that there is homoskedasticity present. The econometric software used for the purposes of this work uses rather sophisticated method in the second step where it takes not only fitted values and squared fitted values as explanatory variables but as well all independent variables from original regression, their squares and cross products.

RESET means regression specification error test introduced by Ramsey (1969). It is useful test to specify possible functional form misspecifications. When there is omitted variable in the model which is correlated with independent variables, then Assumption 3 does not hold. Therefore, estimators are no longer unbiased according to Theorem 1. The idea of the test is basically adding polynomials of fitted values from the original regression to the regression and testing their significance, Baltagi (2008 , p. 194).

In the work *An analysis of variance test for normality (complete samples)*, Shapiro and Wilk (1965, p. 1):

> [a] new statistical procedure for testing a complete sample for normality. The test statistic is obtained by dividing the square of an appropriate linear combination of the sample order statistics by the usual symmetric estimate of variance. This ratio is both scale and origin invariant and hence the statistic is appropriate for a test of the composite hypothesis of normality.

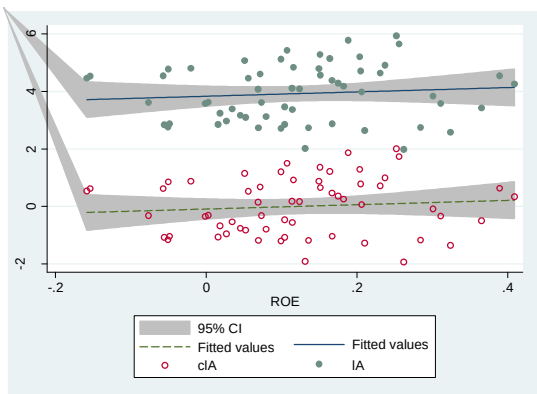
The null hypothesis is that residuals come from a normal population.

Goodness-of-Fit measure used is R-squared, which is, according to Wooldridge (2002), defined as $R^2 = 1 - SSR/SST$, where SSR is sum of squared residuals and SST is the total sum of squares. $SST = \sum_{i=1}^{n}(y_i - \bar{y})^2$. $R^2$ can also be written as $SSE/SST$, where $SSE = \sum_{i=1}^{n}(\hat{y}_i - \bar{y})^2$. Usefulness of R-squared comes with its interpretation. Wooldridge (2002, p. 40) puts interpretation as: 'Fraction of the sample variation in y that is explained by x.' When rewriting the equation as $R^2 = 1 - \frac{(SSR/n)}{(SST/n)} = 1 - \frac{\sigma_u^2}{\sigma_y^2}$ the logic behind interpretation is clearer. Another possibility for a Goodness-of-Fit measure which will be used is adjusted R-squared: $\bar{R}^2 = 1 - \frac{(SSR/n-k-1)}{(SST/n-1)}$ which replaces representative sigmas with their unbiased estimates and penalizes the model for including additional variables in the model, Wooldridge (2002, p. 192-193).

Interpretation is different when the dependent variable or independent variables are logarithmized. According to Wooldridge (2002), when both dependent and independent variables are in their "log" form (log-log model), it gives interpretation of constant elasticity and goes like this: if the value of independent variable *j* rises for 1%, the dependent variable rises for $\hat{\beta}_j$%; when only dependent variable is logarithmed (log-level model) then 1 point rise in the independent variable causes $\hat{\beta}_j$% rise of dependent variable; when we have level-log model the 1% growth of independent variable results in $\hat{\beta}_j/100$ unit increase of dependent variable; in the level-level model, unit growth of explanatory variable results in $\hat{\beta}_j$ unit growth of dependent variable. Using dummy variables such as $fin$ or $manuf$ in a model results in moving the intercept of the population (financial companies for fin) specified by the dummy variable for $\hat{\beta}_{dummy}$ units from $\hat{\beta}_0$ which settles the intercept for the other population (manufacturing companies for fin); using interaction variables which are defined as multiplication of two variables (in this work, one is always continuous and the other dummy) helps to separate the slope estimators for e.g. two populations so that the slope parameter of the population with interaction variable is $\hat{\beta}_{interaction}$ units higher than the slope parameter of the other population, Wooldridge (2002).

The problem which was encountered mostly in the practical part of this work was multicollinearity. When interaction terms were created and added to model, very high VIF were reported by econometric software. A tool used for minimizing this problem was centering of variables. This reduces multicollinearity while it keeps the slope parameters unchained as can be seen in Figure 18. In the rest of the text centered variables will be labeled as *c** where * is the name of centered variable. Interaction terms will be labeled as *finc** where * is the name of centered variable. Appendix E shows changes in the models when variables are centered. Using centered variable clA as well as finclA shows exactly the same results as using lA with finclA. These two models differ from the basic model in intercept which is moved accordingly to moving the expected value of $lA$ beign zero to $clA$ beign zero i.e. from $lA = 0$ to $lA = mean(lA)$.

Figure 18: *Centering variable lA*

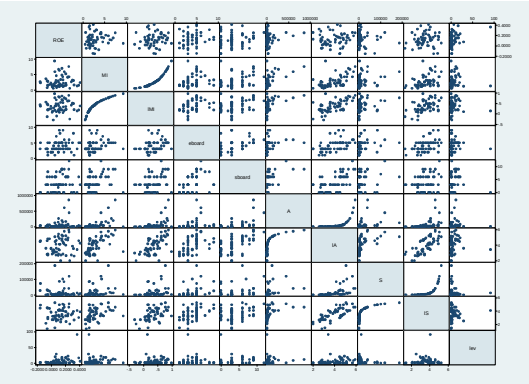



## 3.3.2 Models

Variables used were introduced in chapter 4.2.1 and this chapter will show the outcome when the theory from chapter 4.3.1 is applied. The first and main problem which is investigated in this thesis is the effect of corporate governance on firm performance. From the dataset that the author of this text mustered, other interesting correlations were found. Another model is concerning effects on Managerial income.

Figure 19 shows matrix of variables described in the chapter 4.2.1, their functional forms as well as variable leverage. The graphs to the right side of the diagonal containing variable names are the same as on the left side but reversed. Figures 20 and 21 divide companies to manufacturing and financial.

Figure 19: *Dependence Matrix*



According to Figure 19, it can be seen what happens after logarithmization of variables. The function allocates negative values when the argument is from (0,1), 0 if argument is 1 and positive values for $(0, infinity)$. Also, function y = log($x$) is growing faster than $y = x$ for $x$ less than 1 and slower for $x$ higher than 1. Therefore, logarighmic function allocates significantly lower value to observation with extremely high outcome. At this point, several trends can be seen. Especially lA and lS effect on MI and lMI. Also eboard and sboard seem to be growing with lA and lS. There is high correlation between lA and lS which are used as company size proxies. Eboard and sboard also show certain correlation. Also, leverage as well as ROE seem to be random and not dependent on any of variables. Figure 20 considers only manufacturing firms. Again, Managerial income and its transformed functional form seem to be correlated with logarithmed Assets and logarithmed Sales. Also executive boards seem to rise with supervisory boards, logarithmed Assets and logarighmed Sales as well as supervisory boards with lA and lS. Leverage does not seem to be correlated with any variable. Figure 21 shows basically the same results plus eboard seems to be correlated with leverage and ROE.

Figure 20: *Dependence Matrix manuf*

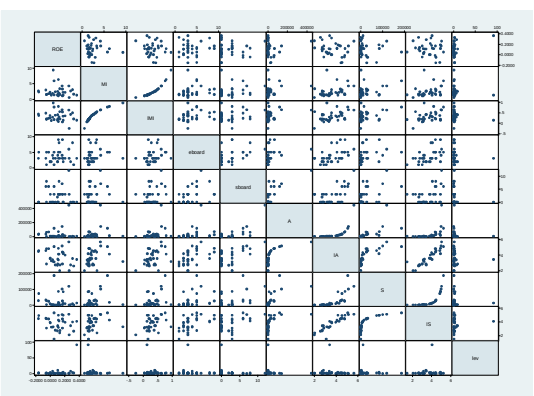
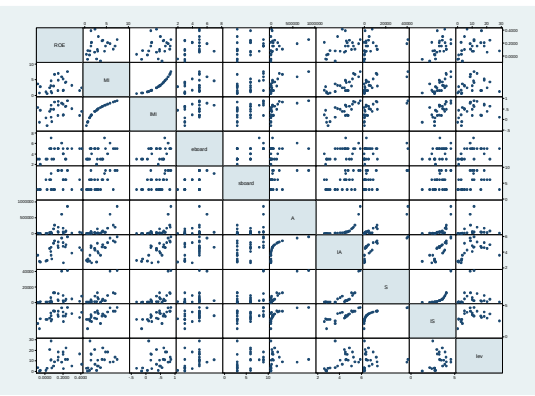


Figure 21: *Dependence Matrix fin*



Given the fact that data sample is quite small it is very important to specify each model correctly. Lower number of degrees of freedom will be encountered in the computations of models' statistics, adjusted R-squared etc. and therefore the author introduces framework which he used to include only important variables from the point of statistical and economic significance. Dependence of ROE and lMI on other variables will be investigated and the following steps will be considerated:

1) Stating an economic problem which is to be tested.

2) Determination of intercept dummy: Depending upon whether there is difference in middle value of the response variable between financial and manufacturing firms. Also densities of financial and manufacturing firms are compared in Appendix A.

3) Determination of interaction variables with dummies: Depending upon whether there is difference in slope of regressands (manufacturing and financial firms separately) conditional on regressor. Scatterplots with linear regression lines are shown in Appendix A.

4) After running the regression, careful exclusion of variables (under the thread of omitted variable bias) from the model which results in higher adjusted R-squared, higher joint significance of all independent variables; exlusion of variables from the model which imply violation of the Assumptions.

5) Estimation of the final model, its description and tests of the Assumptions.

The author considers the data as a random sample. Also, there is no perfect collinearity between any two variables.

Following the work of Bermig and Frick (2010) the first main hypothesis concerns determinants of companies' performance. The basic intuitive idea is that bigger boards imply better performance, however, because of the fact that on the sample of German companies they were not able to find consistent effect of board size on firm performance and also firms'size effect on performance was statistically insignificcant, the hypothesis is that also within population of types of Czech firms from the sample (pro-export and financial) these effects are not statistically significant.

The first regression is estimating the effects on ROE. According to the data, mean values of mROE (manufacturing ROE) and fROE (financial ROE) are approximately the same. Also their densities are very similar which can be seen in Appendix A. Following the ROE interactions from Appendix A there is a dissimilar

trend between ROE and lMI for the two types of firms, however, this trends seem to be very weak in point of flat slope estimates and as well as in fact that lMI seems to be uncorrelated with the performance proxy in any form, specificly, the observations seem to be randomly distributed in the graph. The same holds for ROE and sboard. On the other hand, executive boards seem to be correlated with ROE for financial companies while not for manufacturing. lA and lS once again show very similar results with opposing clear trends for financial and manufacturing companies. When the two sectors are taken together, there is no clear evidence of correlation between ROE and lA or lS. Therefore after centering variables lA, lS and eboard to clA, clS and ceboard; interaction terms are added, namely finclA, finclS and finceboard so:

*Equation*:

$$ROE = \beta_0 + \beta_1 lMI + \beta_2 eboard + \beta_3 finceboard + \beta_4 sboard + \beta_5 lA + \beta_6 finclA + \beta_7 lS + \beta_8 finclS + \alpha_0 fin \qquad (1)$$

resulting in:

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .2393723 | 9 | .026596922 | Number of obs | = 60 |
| Residual | .705284627 | 50 | .014105693 | F( 9, 50) | = 1.89 |
| Total | .944656926 | 59 | .016011134 | Prob > F | = 0.0759 |
| | | | | R-squared | = 0.2534 |
| | | | | Adj R-squared | = 0.1190 |
| | | | | Root MSE | = .11877 |

| ROE | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| lMI | -.0666434 | .0734524 | -0.91 | 0.369 | -.2141769 | .0808901 |
| eboard | .0159138 | .0114474 | 1.39 | 0.171 | -.007079 | .0389065 |
| finceboard | .0011286 | .0264459 | 0.04 | 0.966 | -.0519895 | .0542466 |
| sboard | .0059089 | .0072682 | 0.81 | 0.420 | -.0086897 | .0205075 |
| lA | -.1147618 | .0576011 | -1.99 | 0.052 | -.2304571 | .0009335 |
| finclA | .1160769 | .0737881 | 1.57 | 0.122 | -.0321308 | .2642846 |
| lS | .0627387 | .0536929 | 1.17 | 0.248 | -.0451065 | .170584 |
| finclS | .0221633 | .0779032 | 0.28 | 0.777 | -.1343098 | .1786365 |
| fin | .0726895 | .0475383 | 1.53 | 0.133 | -.0227939 | .1681729 |
| _cons | .2427417 | .0899531 | 2.70 | 0.009 | .0620655 | .4234179 |

*Equation (1)* shows effects of logarithmized Managerial income, executive board, interaction term of executive board, supervisory board, logarithmized Assets, interaction term of logarithmized Assets, logarithmized Sales, interaction term of logarithmized Sales and dummy variable determining the sector of company on ROE. This model includes probably too many variables. Also VIF test for lA showed value of 13.47 even after the centering for finclA. This was caused mainly because of correlation between lS and lA. Another interesting finding is that 1% growth in Managerial income results in only -0.06 percentage point growth of ROE and is not even statistically significant. Also finceboard and sboard show similar results. Neither sboard nor lMI as well as interaction term of eboard proved to be correlated

with ROE even when regressed on its own and therefore excluding these variables does not cause the error term of restricted model to bear important information about dependent variable while beign correlated with independent variables i.e. this exclusion does not cause omitted variable bias. Also, finclS bear information similar to finclA which causes another big multicollinearity problem. Excluding finclS did not significantly affect coefficient parameters, however boosted significance of the model as well as adjusted R-squared. Therefore the author decided to restrict the model to:

*Equation*:

$$ROE = \beta_0 + \beta_1 eboard + \beta_2 lA + \beta_3 finclA + \beta_4 lS + \alpha_0 fin \qquad (2)$$

resulting in:

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .217029566 | 5 | .043405913 | | |
| Residual | .727627361 | 54 | .013474581 | | |
| Total | .944656926 | 59 | .016011134 | | |

| | | | | | |
|---|---|---|---|---|---|
| Number of obs | = | 60 | | | |
| F( 5, 54) | = | 3.22 | | | |
| Prob > F | = | 0.0129 | | | |
| R-squared | = | 0.2297 | | | |
| Adj R-squared | = | 0.1584 | | | |
| Root MSE | = | .11608 | | | |

| ROE | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| eboard | .0178312 | .0099143 | 1.80 | 0.078 | -.0020458 | .0377082 |
| lA | -.1080694 | .0409145 | -2.64 | 0.011 | -.190098 | -.0260408 |
| finclA | .1178434 | .0338886 | 3.48 | 0.001 | .0499008 | .185786 |
| lS | .057704 | .0369397 | 1.56 | 0.124 | -.0163557 | .1317636 |
| fin | .0722862 | .0450922 | 1.60 | 0.115 | -.0181183 | .1626907 |
| _cons | .2216969 | .0833566 | 2.66 | 0.010 | .054577 | .3888168 |

*Equation (2)* concerns effects of executive board, lA, finclA, lS and fin on ROE. Still, this model has relatively small R-squared but higher adjusted R-squared, joint significance of independent variables and also high significance of explanatory variables. The results show that additional executive board member results in approximately 1.8 percentage points higher ROE and hypothesis that eboard has no effect on ROE can be rejected at 10% level of significance. Economically, the explanation of this finding is rather intuitive. For example, more people introduce more ideas or decomposing a company into more executive units can lead to higher effectivity of each and eventually to higher effectivity of the whole company. Also, when Assets rise 1%, the ROE falls by around 0.11 percentage points for manufacturing and grows by around 0.01 percentage points for financial companies. Hypothesis about zero effect of both of variables concerning Assets can be rejected, for lA at 5% significance level and for finclA at even 1% level of significance. Therefore it cannot be rejected that financial companies have, when holding for lS, fin and eboard, opposite effect on performance than export-oriented manufacturing

firms. Estimated difference between a unit growth of financial companies Assets and manufacturing companies Assets is almost 0.12 percentage points in growth of ROE. The author suggests following possible economic reasoning: financial companies fall under higher regulation resulting in more transparent structures which can result in more effective performance when companies' sizes are taken into consideration. *Hypothesis that residuals are not from normal population can be rejected at 5% significance level as shown in Appendix B.* This violates the last Assumption 6 which can lead to imprecise inference but otherwise *the model went through tests for multicollinearity, heteroskedasticity and misspecification problems and none of these was found as can be seen in Appendix B.* On the other hand, small R-squared show that possibly some variables were omitted as the variance explained is only around 23%. Also when plotting the residuals on fitted values a dispersion can be seen.

Figure 22: *Residuals vs. fitted plot ROE*

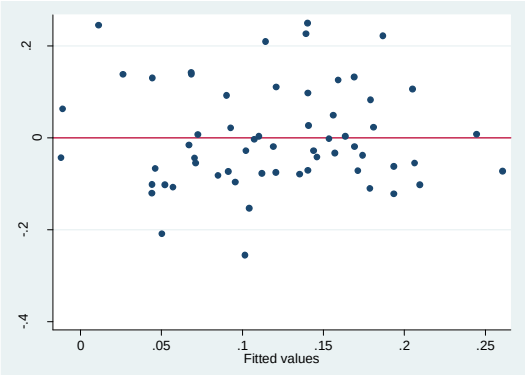
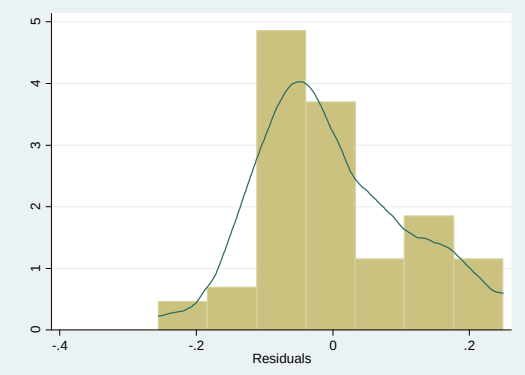



Figure 23: *Density uhat, ROE*




According to the theory in Chapter 2.2.2, Anglo-Saxon model compensates managers according to agency costs. An effective system of income and bonuses should motivate a manager not to behave deceptively. Bigger firms have usually more complicated structure and therefore managers have certain information advantage against owners. However, according to the sample, these Czech companies fit better to the German model of CG following the high ownership concentration and existence of supervisory boards which should result in reducing this information asymmetry. Also, a widely discussed problem of compensation according to the performance is examined. According to Sigler (2011), return on equity is statistically significant when describing total CEO compensation when firm size; measured by amount of employees, market beta and number years in the position are fixed. Therefore the main hypothesis is that executive compensation is not significantly affected by firm size, although it is positively correlated with performance on a high statistical significance level.

The second model therefore concerns effects on lMI. From the data, financial and manufacturing firms have different means. From Appendix A, they also have different distributions and densities. Probably because of these differences in densities, all interaction terms seem needed except ROE where the discussion from previous model holds. The observations seem to be randomly dispersed over the graph for both financial and manufacturing companies. This variable is needed in the model because of testing the hypothesis about effects of performance on income of managers. For the rest of variables, financial sector seems to raise the income of managers according to sizes of companies and boards faster than manufacturing sector. On the other hand, compared to the previous model, all effects of interaction terms seem to have the same direction except for ROE.

*Equation*:

$$lMI = \beta_0 + \beta_1 ROE + \beta_2 eboard + \beta_3 finceboard + \beta_4 sboard + \beta_5 fincsboard + \beta_6 lA + \beta_7 finclA + \beta_8 lS + \beta_9 finclS + \alpha_0 fin \qquad (3)$$

resulting in:

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | 2.00355027 | 10 | .200355027 | | |
| Residual | 2.55947508 | 49 | .052234185 | | |
| Total | 4.56302536 | 59 | .077339413 | | |

| | | | | | |
|---|---|---|---|---|---|
| Number of obs | = | 60 | | | |
| F( 10, 49) | = | 3.84 | | | |
| Prob > F | = | 0.0007 | | | |
| R-squared | = | 0.4391 | | | |
| Adj R-squared | = | 0.3246 | | | |
| Root MSE | = | .22855 | | | |

| lMI | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| ROE | -.2252345 | .2723456 | -0.83 | 0.412 | -.7725334 | .3220644 |
| eboard | .0067944 | .0225725 | 0.30 | 0.765 | -.0385668 | .0521556 |
| finceboard | -.0227363 | .0529901 | -0.43 | 0.670 | -.1292239 | .0837512 |
| sboard | .0052643 | .0173513 | 0.30 | 0.763 | -.0296045 | .0401331 |
| fincsboard | .0146077 | .0296949 | 0.49 | 0.625 | -.0450665 | .0742818 |
| lA | -.0304038 | .1217459 | -0.25 | 0.804 | -.2750613 | .2142537 |
| finclA | .1847478 | .153335 | 1.20 | 0.234 | -.1233904 | .4928861 |
| lS | .1156188 | .1060692 | 1.09 | 0.281 | -.0975352 | .3287729 |
| finclS | .0228371 | .1516984 | 0.15 | 0.881 | -.2820122 | .3276863 |
| fin | .0558341 | .0970891 | 0.58 | 0.568 | -.1392738 | .2509419 |
| _cons | .0012593 | .1903885 | 0.01 | 0.995 | -.3813408 | .3838594 |

*Equation (3)* shows effects of performance, boards with their interaction terms and logarithmized size proxies with their interaction terms together with dummy fin on logarithmized Managerial income. Again, high multicollinearity is present, especially for lA with VIF beign 16.25. Boards with their specific forms proved to be of low economical and statistical significance. However, when regressing eboard on lMI a very high statistical significance of eboard is found. Also, eboard is correlated with ROE so omitting this variable would cause error term to be correlated with independent variable causing bias. On the other hand, when regressing lMI on eboard, finceboard and fin; the interaction variable was insignificant resulting in its

exclusion from the Equation (4). Also finclS and finclA were partly responsible for multicollinearity without having any major statistical significance. Considering that both are performance proxies and both follow similar trends finclS was canceled out from the model.

*Equation*:

$$lMI = \beta_0 + \beta_1 ROE + \beta_2 eboard + \beta_3 sboard + \beta_4 fincsboard + \beta_5 lA + \beta_6 finclA + \beta_7 lS + \alpha_0 fin \qquad (4)$$

resulting in:

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | 1.99058808 | 8 | .24882351 | Number of obs | = 60 |
| Residual | 2.57243727 | 51 | .050439946 | F( 8, 51) | = 4.93 |
| | | | | Prob > F | = 0.0001 |
| Total | 4.56302536 | 59 | .077339413 | R-squared | = 0.4362 |
| | | | | Adj R-squared | = 0.3478 |
| | | | | Root MSE | = .22459 |

| lMI | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| ROE | -.2422144 | .2650495 | -0.91 | 0.365 | -.7743234 | .2898946 |
| eboard | .00537 | .0218963 | 0.25 | 0.807 | -.0385886 | .0493286 |
| sboard | .0105291 | .0134717 | 0.78 | 0.438 | -.0165165 | .0375746 |
| finceboard | -.0152556 | .0499336 | -0.31 | 0.761 | -.1155014 | .0849903 |
| lA | -.0552102 | .0935241 | -0.59 | 0.558 | -.2429677 | .1325472 |
| finclA | .221871 | .0830741 | 2.67 | 0.010 | .0550929 | .3886492 |
| lS | .1332205 | .0755225 | 1.76 | 0.084 | -.0183973 | .2848383 |
| fin | .0680922 | .0899004 | 0.76 | 0.452 | -.1123903 | .2485748 |
| _cons | .0215988 | .1813357 | 0.12 | 0.906 | -.3424478 | .3856454 |

*Equation (4)* describes effects of performance, boards sizes, interaction term of supervisory board, logarithmized size proxies with interaction term for lA and fin on logarithmized Managerial income. R-squared dropped only slightly while adjusted R-squared grew by around 2.5 percentage points. Also joint significance of all variables is much higher. As can be seen, ROE is not statistically significant. It cannot be rejected that ROE has zero effect on lMI at even 36% significance level. On one hand, one would expect managers to be rewarded for their work according to the performance, on the other hand, the working agreements are signed for a longer time period and therefore the year's income is not the result of only the year's performance. Still, better managers' work should be consistent and therefore lead to better outcomes than competition even in crisis year. Variables lA and lS are jointly significant at 10% significance level (Appendix B) and because these serve as size proxies the ceteris paribus effect of firm size on Managerial income is most likely positive. This is especially true for financial firms which have ceteris paribus almost 22% higher effect of unit growth in Assets on Managerial income which can be possibly described by on average higher social responsibility of managers in banks as

these institutions do not only provide employment in regions and national accounts with high tax provisions, their decisions also implicitly affect other industries and huge number of individuals as suggested by the author. Also interesting economic interpretation is that 1% growth in Sales results in approximately 0.13% growth in Managerial income holding other factors fixed. There is neither economically nor statistically significant effect of boards sizes on executive compensation. As the presence of supervisory board should increase effectivity of monitoring the managers, the theoretical concept of outsider model expected the presence of bigger supervisory board, when firm size factor was fixed, to cause decline in executive compensation as managers' motivation not to act fraudently was no longer needed to be compensated by money but the presence of supervisors. However, it is not possible to reject the hypothesis that supervisory board size has no effect on managerial income at 43% level of significance. *Tests from Appendix B show even better results compared to the previous model. Hypotheses about "Homoskedasticity" and "No omitted variables" cannot be rejected, VIF shows acceptable (although close to 10) results and moreover, it cannot be rejected that residuals come from normally distributed population*. The author therefore concludes that the model is estimated well with over 43% variation in dependent variable explained by its predictors.

Figure 24: *Residuals vs fitted plot lMI*

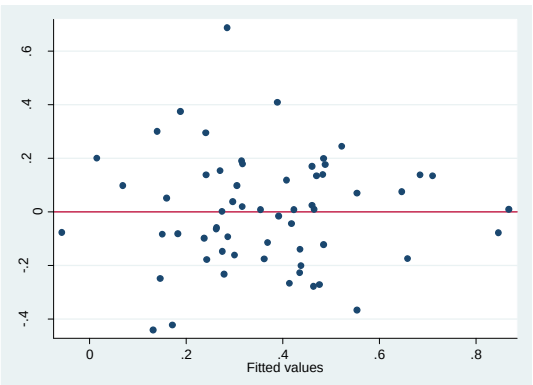
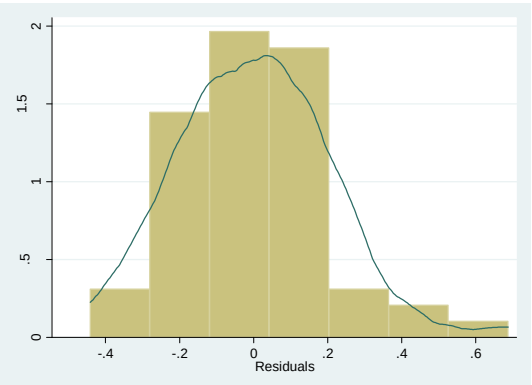



Figure 25: *Density uhat, lMI*



# 4 Stepbacks

Before making conclusions, the author considers it vital to state important facts which might cause the results to be imprecise. As the main part of the work concerns the analysis of effects between corporate governance and firm performance of pro-export manufacturing and financial sector companies using econometric modeling, certain properties might be violated or improved.

## 4.1 Data

The first issue with the data is random sampling. This is one of OLS assumptions. A question rises whether the firms used in this work are representative. The author is confident that financial companies used are representative sample as annual reports of almost all banks, insurance companies, pension companies and buildings societies with legal form of Joint Stock Company were researched. Some of those did not report managerial income and were cut from the sample; however, most of these companies remained. As for manufacturing firms, the vast majority was taken from the research of Czech government institution added for several other well known local or national businesses.

A possible improvement might be a panel regression. A lack of dynamics in the models might be an issue especially when 2009 was a cricis year. Other years might have produced different results. Also, very low correlation of ROE and lMI could possibly be changed if the performance proxy was moved one or two years back as firm performance is affected also by decision made in the past by possibly different management.

## 4.2 Models

The main problems are possible omitted variables which can cause models to be biased. According to Ramsey's test, there are no functional form misspecifications in the two models, however, the author cannot reject that there are not any other variables which he did not use at all that could affect the models while beign correlated with independent variables.

High multicollinearity is still present in the models, although VIF is less than 10. Different authors specify different levels of VIF to detect collinearity. In the

models, the VIF for lA is over 7 and 9 caused by relationship between logarithmized Sales and Assets.

Non-normality of residuals in the ROE model also raises an issue regarding inference. Therefore there is not sufficient information to regard the distribution of test statistics as standard normal.

Penalization for including too many variables seems high too, 8 percentage points drop in R-squared when adjusted seems to be legitimate in the second model, especially when taken into consideration that there are 8 independent variables for 60 observations.

# 5 Conclusion

Growing importance of exports and financial intermediaries for Czech economy was shown in the text. Studying the drivers of this growth from the perspective of corporate governance the work displays interesting results.

With return on equity serving as a performance proxy, assets and sales as measures of company size, executive and supervisory boards sizes and managerial income as variables, the thesis shows interesting results. On the sample of 25 financial and 35 export-oriented manufacturing firms with domicile in Czech Republic from year 2009, ordinary least squares estimation was used.

Negative relationship between performance and company size was found for export-oriented manufacturing companies as well as better performance by financial companies compared to EMC according to their size when fixing for number of executive board members. The results are different to those of Bermig and Frick (2011) whose work served as a primar reference as they were not able to find statistical significance of the effect of size on performance. The owners' decision about employing additional executive member of a board should be based on the conviction that he or she can ceteris paribus raise the effectivity of a company in such way that benefits of his/her work have higher value than what his costs are to the enterprise. Following the findings of this work, executive board size positively affects performance when fixing for a company size and each additional executive brings approximately 1.8 percentage points growth in ROE. According to these findings, the author suggests that as a part of its export policy, Czech Republic should concentrate on enhancement of more effective small and medium businesses from traditional export industries possibly by supporting start-up companies in this sector.

Also Stigler (2011) found different results when effects of performance on executive compensation were taken into account. Within the population of companies used in this work, there is no statistically significant imidiate effect of performance on managers' rewards. On the other hand, bigger company size implies higher executive compensation when performance and boards sizes factors are fixed. Therefore the author concludes that on Czech labour market concerning financial companies and EMC, the potential executives should primarly search for bigger enterprises without looking at prosperity of a company.

# Bibliography

Autner, R., Kotlárik, M., Lazárová, B., Mako, R. & Patarák, O. 2008, *Corporate governance code for Slovakia*, CEGGA, Bratislava.

Baltagi, Badi H. 2008, *Econometrics*, 5th edition, Springer-Verlag, Berlin.

Bartoszyński, R. & Niewiadomska-Bugaj, M. 2008, *Probability and statistical inference*, 2nd edition, John Wiley & Sons, Hoboken, New Jersey.

Berle, A., & G. Means 1932, *The Modern corporation and private property*, Commerce Clearing House, Chicago.

Bermig, A., & B. Frick 2010, 'Board size, board composition and firm performance: empirical evidence from germany', *Social Science Research Network*, Rochester (May 2010).

Bernt, M. 2000: 'Global differences in corporate governance systems theory and implications for reforms', *Social Science Research Network*, Rochester (Jan 2006).

Charreaux, G. 2004: 'Corporate governance theories: from micro theories to national systems theories', *Social Science Research Network*, Rochester (Dec 2004)

Coase, Ronald H. 1960: 'The Problem of social cost', *Journal of Law and Economics*, Vol. 3 (Oct., 1960), pp. 1-44.

Czech National Bank, n.d., *List of Monetary Financial Institutions*, viewed May 13 2013,http://www.cnb.cz/en/statistics/money_and_banking_stat/lists_mbs/mfi_list/index.html

Gosset, William S. (Student) 1908, 'The Probable error of a mean', *Biometrika*, Vol. 6, no.1 (1908): 1-25.

Government Comission 2006, *German corporate governance – code*, Federal Ministry of Justice, Berlin.

Hamil, P., Ward, Anne M., Wylie, J. 2011, 'Corporate governance agency and executive compensation', *Accountancy Ireland*, Vol.43., No.2 (Apr. 2011): 68-70.

Hodgson, Geoffrey M. 2006, 'What are institutions?', *Journal of Economic Issues*, vol. XL, No.1 (March 2006): 1-25.

Keasey, K., Thompson S. & Wright, M. 1997, 'Introduction: the corporate governance problem – competing diagnoses and solutions', in: *Corporate Governance: Economic, Management and Financial Issues*, Keasey, K. Thompson, S, and Wright, M. (editors); Oxford University Press, USA.

Lazonic W. & Mary O'Sullivan 2000, 'Perspectives on corporate governance, innovations and economic performance', INSEAD, Fontainebleau (June 2000).

Ledl, T. 2004, 'Kernel density estimation: theory and application in discriminant analysis', *Austrian Journal of Statistics*, Vol. 33, no.3 (2004): 267-279.

London Stock Exchange (LSE) 2010, *Guide to listing on the London Stock Exchange*, White Page, London.

Mejstrik, M. 1999, 'Corporate governance: Theory and the Czech practice', Occasional Paper IES No.1, Prague 1999.

National Trade Promotion Agency, n.d., *Traditional Czech export sectors*, viewed 13 May 2013, http://www.czechtradeoffices.com/about-czech-republic/export-sectors/.

North, Douglas C. 1990, *Institutions, institutional change and economic performance (Political economy of institutions and decisions)*, Cambridge University Press.

North, Douglas C. 1994, 'Economic performance through time', *The American Economic Review*, Vol. 84, no. 3 (June 1994): 359–67.

Plackett, Robin L. 1949, 'A historical note on the method of least squares', *Biometrika*, Vol. 36, no.3/4 (Dec., 1949): 458-460.

Plackett, Robin L. 1972, 'Studies in the history of probability and statistics. XXIX The discovery of the method of least squares', *Biometrika*, Vol. 59, no.2 (Aug., 1972): 239-251.

Ramsey, J.B. 1969, 'Tests for specification errors in classical linear least-squares analysis', *Journal of the Royal Statistical Association*, Series B, 71, Vol. 31, No.2 (1969): 350-371.

Rosenblatt, M. 1956, 'Remarks on some nonparametric estimates of a density function', *Annals of Mathematical Statistics*, Vol. 27, Iss.3 (Sep., 1956), 832-837.

Roso, V.M., Schenkel, F.S., Miller, S.P. and Schaeffer, L.R. 2005, 'Estimation of genetic effects in the presence of multicollinearity in multibreed beef cattle evaluation', *Journal of Animal Science*, vol. 83, no.8 (Aug., 2005): 788-800.

Shapiro, Samuel S. & Wilk Martin, B. 1965, 'An Analysis of variance test for normality (complete samples)', *Biometrika*, Vol. 52, No. ¾ (Dec., 1965): 591-611.

Shleeifer, A. & Vishny, Robert W. 1997, 'A Survey of Corporate Governance', *The Journal Of Finance*, Vol. LII, no.2 (June 1997): 737-783.

Sheridan, T. and Kendall, N. 1992, *Corporate governance, an action plan for profitability and business success*, Financial Times/Pitman Publishing, London.

Stigler, Kevin J. 2011, 'CEO compensation and company performance', *Business and Economics Journal*, Vol. 2011: BEJ -31 (April 2011): 1 – 8.

The World Bank, n.d., *Domestic credit to private sector (% of GDP)*, viewed 13 May 2013, http://data.worldbank.org/indicator/FS.AST.PRVT.GD.ZS.

The World Bank, n.d., *Exports of goods and services (% of GDP)*, viewed 13 May 2013, http://data.worldbank.org/indicator/NE.EXP.GNFS.ZS.

Tirole, J. 2001, 'Corporate governance', *Econometrica*, Vol. 69, No.1. (Jan., 2001): 1-35.

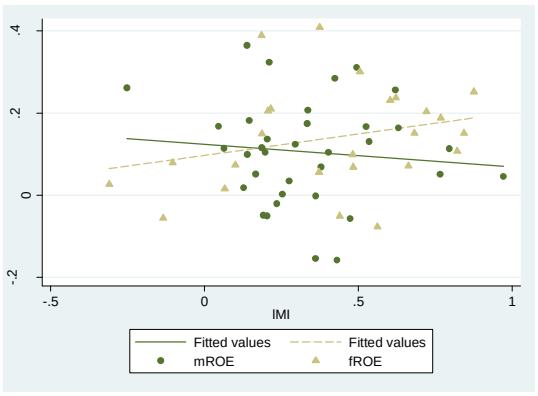
White, H. 1980, 'A Heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity', *Econometrica*, Vol. 48, No.4. (May 1980): 817-838.

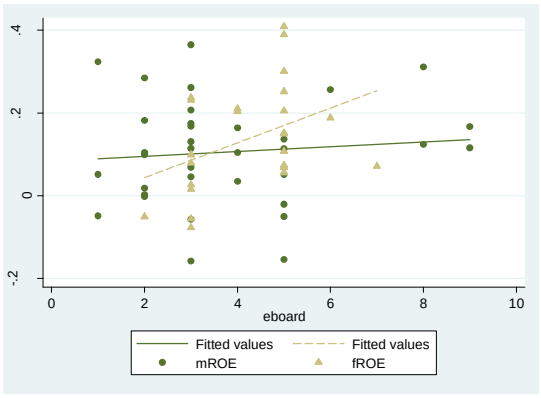
Wolf, H. 2011, 'Relationship-based and arms-length financial systems-a european perspective', The World Bank Policy Research Working Paper no.5833 (Oct. 2011): 1-14.

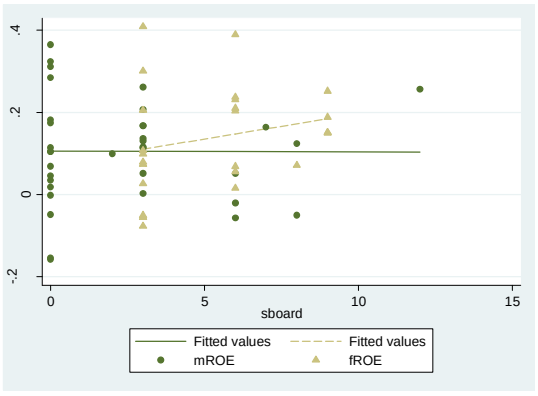
Wooldridge, Jeffrey M. 2002, *Introductory econometrics – a modern aproach*, 2nd edition, South-Western College Pub.

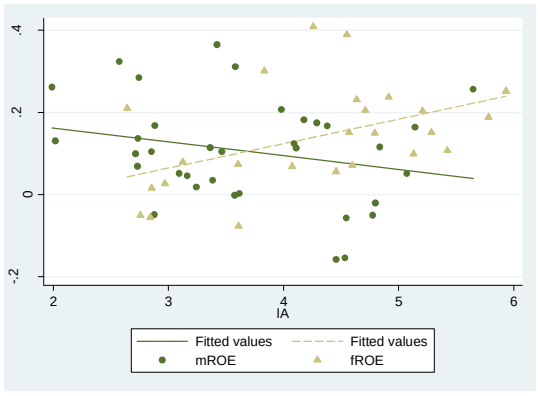
# Appendix A: Sector Dummies and Interaction Terms in Regressions

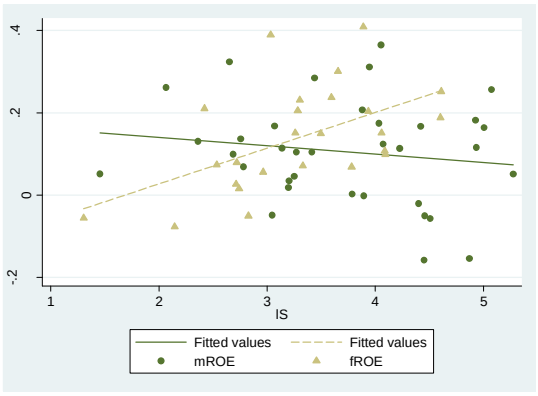
ROE interactions



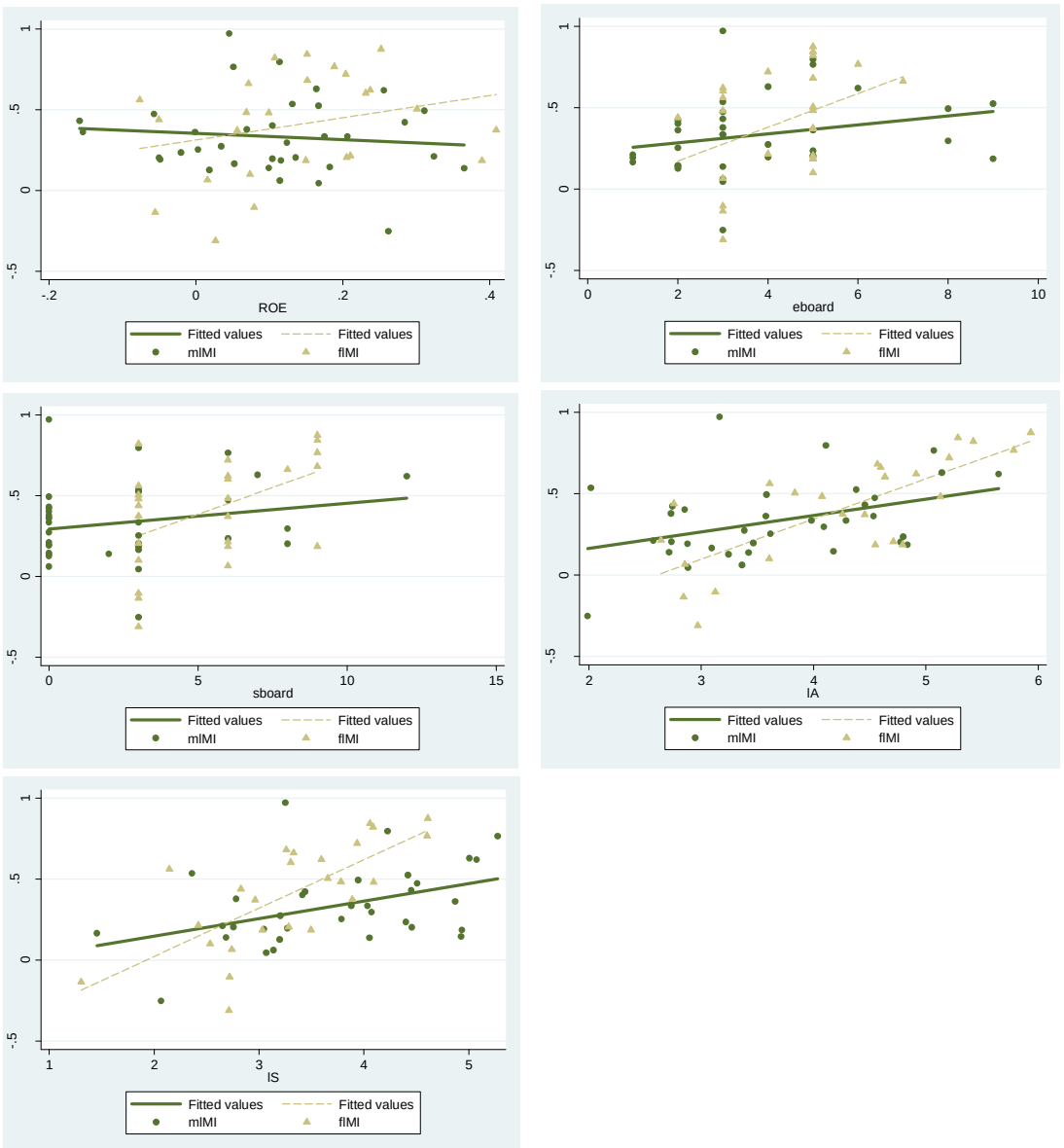



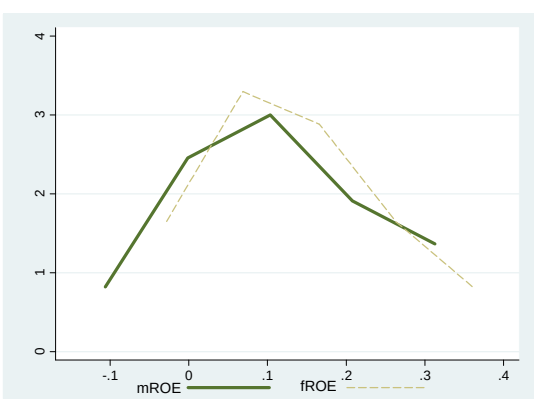



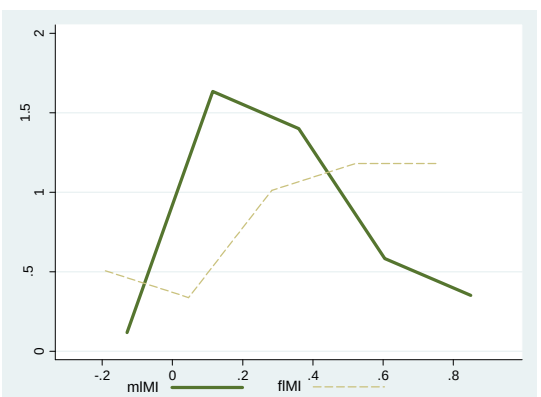
lMI interactions




ROE densities




lMI densities



# Appendix B: Assumptions Tests

Equation: $ROE = \beta_0 + \beta_1 eboard + \beta_2 lA + \beta_3 finclA + \alpha_0 fin$ (2)

| Variable | VIF | 1/VIF |
|---|---|---|
| lA | 7.12 | 0.140544 |
| lS | 4.73 | 0.211403 |
| fin | 2.20 | 0.454417 |
| finclA | 2.14 | 0.467130 |
| eboard | 1.42 | 0.703061 |
| Mean VIF | 3.52 | |

White's test for Ho: homoskedasticity
against Ha: unrestricted heteroskedasticity

chi2(16) = 15.87
Prob > chi2 = 0.4622

Ramsey RESET test using powers of the fitted values of ROE
Ho: model has no omitted variables
F(3, 51) = 1.13
Prob > F = 0.3453

Shapiro-Wilk W test for normal data

| Variable | Obs | W | V | z | Prob>z |
|---|---|---|---|---|---|
| uhat | 60 | 0.95549 | 2.420 | 1.905 | 0.02841 |

Equation: $lMI = \beta_0 + \beta_1 ROE + \beta_2 eboard + \beta_3 sboard + \beta_4 fincsboard + \beta_5 lA + \beta_6 finclA + \beta_7 lS + \alpha_0 fin$ (4)

| Variable | VIF | 1/VIF |
|---|---|---|
| lA | 9.93 | 0.100688 |
| lS | 5.28 | 0.189324 |
| finclA | 3.44 | 0.290987 |
| fin | 2.34 | 0.427952 |
| sboard | 2.09 | 0.479473 |
| eboard | 1.85 | 0.539555 |
| fincsboard | 1.80 | 0.556932 |
| ROE | 1.32 | 0.760058 |
| Mean VIF | 3.50 | |

White's test for Ho: homoskedasticity
against Ha: unrestricted heteroskedasticity

chi2(35) = 19.52
Prob > chi2 = 0.9839

Ramsey RESET test using powers of the fitted values of lMI
Ho: model has no omitted variables
F(3, 48) = 0.00
Prob > F = 0.9996

Shapiro-Wilk W test for normal data

| Variable | Obs | W | V | z | Prob>z |
|---|---|---|---|---|---|
| uhat | 60 | 0.98095 | 1.036 | 0.076 | 0.46990 |

test lA lS

( 1) lA = 0
( 2) lS = 0

F( 2, 51) = 2.53
Prob > F = 0.0895

# Appendix C: List of Companies

| | |
|---|---|
| | *Financial Companies* |
| *Banks* | **Banco Popolare Česká republika, a.s.** |
| | **Českomoravská záruční a rozvojová banka, a.s.** |
| | **Československá obchodní banka, a.s .** |
| | **Evropsko-Ruská Banka, a.s.** |
| | **GE Money Bank, a.s.** |
| | **J&T BANKA, a. s.** |
| | **Komerční banka, a.s.** |
| | **PPF banka, a.s.** |
| | **Raiffeisenbank, a.s.** |
| | **UniCredit Bank Czech Republic, a.s.** |
| *Building Societies* | **Českomoravská stavební spořitelna, a.s.** |
| | **Raiffeisen stavební spořitelna, a.s.** |
| | **Wüstenrot, stavební spořitelna, a.s.** |
| *Insurance* | **AEGON Pojišťovna, a. s.** |
| | **D.A.S. pojišťovna právní ochrany, a.s.** |
| | **Generali Pojišťovna a.s.** |
| | **Hasičská Vzájemná Pojišťovna, a.s.** |
| | **Komerční pojišťovna, a.s.** |
| | **Triglav Pojišťovna, a.s.** |
| | **UNIQA pojišťovna, a.s.** |
| | **Victoria Volksbanken Pojišťovna, a.s.** |
| | **Wüstenrot, životní pojišťovna, a.s.** |
| *Pension Funds* | **AXA penzijní fond a.s.** |
| | **Penzijní fond České pojišťovny, a.s.** |
| | **Penzijní fond Komerční banky, a.s.** |
| | |
| | *Export-Oriented Manufacturing Companies* |
| *Automotive* | **Citroen Česká Republika, s.r.o.** |
| | **Hyundai Motor Manufacturing Czech, s.r.o.** |
| | **Iveco Czech Republic, a.s.** |
| | **Peugeot Česká Republika, s.r.o.** |
| | **Škoda Auto, a.s.** |
| *Building* | **Hochtief CZ, a.s.** |
| | **OHL Central Europe, a.s.** |
| | **Skanska, a.s.** |
| | **Strabag, a.s.** |
| | **Tondach Česká republika, s.r.o.** |
| *Electrical Engineering and Electronics* | **Bang & Olufsen, s.r.o.** |
| | **Honeywell International, s.r.o.** |
| | **FOXCONN® CZ, s.r.o.** |

| | |
|---|---|
| | **Inventec (Czech), s.r.o.** |
| | **ON Semiconductor Czech Republic, s.r.o.** |
| | **Tesla, a.s.** |
| *Energy* | **ČEZ, a.s.** |
| | **E.ON AG** |
| | **Pražská energetika, a.s.** |
| | **RWE Transgas, a.s.** |
| *Glass, Pottery and Ceramics* | **Ideal Standard, s.r.o.** |
| | **Laufen CZ, s.r.o.** |
| *Medical Equipment* | **BTL zdravotnická technika, a.s.** |
| | **Linet spol. s.r.o.** |
| *Chemicals and Pharmaceuticals* | **Agrofert Holding, a.s.** |
| | **Barum Continental, spol. s.r.o.** |
| | **Robert Bosch, spol. s.r.o.** |
| | **Unipetrol RPA, s.r.o.** |
| *Machinery* | **ArcelorMittal Ostrava, a.s.** |
| | **České dráhy, a.s.** |
| | **Moravia Steel, a.s.** |
| *Wood Processing* | **Huhtamaki Česká republika, a.s.** |
| | **Mondi Bags Štětí, a.s.** |
| | **Mondi Coating Štětí a.s.** |
| | **Smurfit Kappa Czech, s.r.o.** |

# Appendix D: Adjusted Dataset

| manuf | sboard | eboard | MI | A | S | ROE | lMI | lA | lS | Eq | NI | Lia | fin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 3 | 2.69719 | 28687.33 | 28358.896 | -15.84% | 0.430912 | 4.45769 | 4.452689 | 9404.634 | -1490.05 | 19136.17 | 0 |
| 1 | 0 | 5 | 2.295519 | 34375.33 | 73941.235 | -15.40% | 0.360881 | 4.536247 | 4.868887 | 11485.03 | -1768.5 | 22890.3 | 0 |
| 0 | 3 | 3 | 3.651083 | 4065.4 | 139.666 | -7.68% | 0.562422 | 3.609103 | 2.145091 | 937.104 | -71.974 | 3128.296 | 1 |
| 1 | 6 | 3 | 2.981748 | 35081.63 | 32337.925 | -5.73% | 0.474471 | 4.54508 | 4.509712 | 17942.62 | -1027.44 | 17139.01 | 0 |
| 0 | 3 | 3 | 0.733667 | 696.445 | 20.142 | -5.58% | -0.1345 | 2.842887 | 1.304103 | 573.384 | -31.97 | 123.061 | 1 |
| 0 | 3 | 2 | 2.7538 | 571.624 | 671.362 | -5.06% | 0.439932 | 2.75711 | 2.826957 | 286.127 | -14.48 | 285.497 | 1 |
| 1 | 8 | 5 | 1.596713 | 59529.08 | 28770.885 | -5.02% | 0.203227 | 4.774729 | 4.458953 | 20000 | -1003.08 | 39529.08 | 0 |
| 1 | 0 | 1 | 1.554556 | 757.959 | 1118.608 | -4.87% | 0.191606 | 2.879646 | 3.048678 | 288.335 | -14.042 | 469.624 | 0 |
| 1 | 6 | 5 | 1.721077 | 62717.55 | 25141.877 | -2.05% | 0.2358 | 4.797389 | 4.400398 | 54696.34 | -1121.69 | 8021.215 | 0 |
| 1 | 0 | 2 | 2.301694 | 3764.977 | 7823.229 | -0.13% | 0.362048 | 3.575762 | 3.893386 | 1399.061 | -1.883 | 2365.916 | 0 |
| 1 | 3 | 2 | 1.7925 | 4142.874 | 6141.91 | 0.26% | 0.253459 | 3.617302 | 3.788303 | 960.28 | 2.48 | 3182.594 | 0 |
| 0 | 6 | 3 | 1.16325 | 715.87 | 550.252 | 1.55% | 0.065673 | 2.854834 | 2.740562 | 353.745 | 5.494 | 362.125 | 1 |
| 1 | 0 | 2 | 1.3405 | 1753.442 | 1575.511 | 1.83% | 0.127267 | 3.243891 | 3.197421 | 1441.131 | 26.36 | 312.311 | 0 |
| 0 | 3 | 3 | 0.490111 | 931.016 | 515.848 | 2.64% | -0.30971 | 2.968957 | 2.712522 | 252.795 | 6.686 | 678.221 | 1 |
| 1 | 0 | 4 | 1.885857 | 2424.15 | 1592.125 | 3.44% | 0.275509 | 3.384559 | 3.201977 | 307.782 | 10.585 | 2111.974 | 0 |
| 1 | 0 | 3 | 9.373333 | 1459.933 | 1773.868 | 4.54% | 0.971894 | 3.164333 | 3.248921 | 894.974 | 40.599 | 564.959 | 0 |
| 1 | 6 | 5 | 5.829787 | 118376 | 187858 | 5.08% | 0.765653 | 5.073264 | 5.27383 | 68180 | 3462 | 50196 | 0 |
| 1 | 3 | 1 | 1.467636 | 1244.589 | 28.581 | 5.19% | 0.166618 | 3.095026 | 1.456077 | 575.195 | 29.849 | 669.394 | 0 |
| 0 | 6 | 5 | 2.3572 | 28610.68 | 918.934 | 5.60% | 0.372396 | 4.456528 | 2.963284 | 1331.413 | 74.606 | 27279.27 | 1 |
| 0 | 6 | 5 | 3.0472 | 11896.05 | 6043.925 | 6.85% | 0.483901 | 4.075403 | 3.781319 | 1047.543 | 71.736 | 10848.5 | 1 |
| 1 | 0 | 3 | 2.391667 | 538.913 | 605.352 | 6.91% | 0.378701 | 2.731519 | 2.782008 | 439.141 | 30.336 | 99.772 | 0 |
| 0 | 8 | 7 | 4.605714 | 39644.37 | 2137.017 | 7.14% | 0.663297 | 4.598182 | 3.329808 | 3275.971 | 234.066 | 36368.4 | 1 |
| 0 | 3 | 5 | 1.26 | 4030.399 | 341.688 | 7.35% | 0.100371 | 3.605348 | 2.53363 | 134.12 | 9.852 | 3896.279 | 1 |
| 0 | 3 | 3 | 0.788 | 1334.284 | 524.394 | 7.91% | -0.10347 | 3.125248 | 2.719658 | 332.381 | 26.285 | 1001.903 | 1 |
| 0 | 3 | 3 | 3.035333 | 134945.1 | 12380.03 | 9.91% | 0.482206 | 5.130157 | 4.092722 | 22732.64 | 2253.802 | 112212.4 | 1 |
| 1 | 2 | 2 | 1.3774 | 518.072 | 485.835 | 9.94% | 0.13906 | 2.71439 | 2.686489 | 180.552 | 17.941 | 337.52 | 0 |
| 1 | 0 | 2 | 2.526 | 712.18 | 2601.876 | 10.39% | 0.402433 | 2.85259 | 3.415287 | 64.622 | 6.715 | 634.246 | 0 |
| 1 | 0 | 4 | 1.575389 | 2916.408 | 1871.253 | 10.40% | 0.197388 | 3.464848 | 3.272133 | 1435 | 149.292 | 1481.408 | 0 |
| 0 | 3 | 5 | 6.634375 | 264627 | 12237 | 10.72% | 0.8218 | 5.422634 | 4.087675 | 29482 | 3161 | 235145 | 1 |
| 1 | 3 | 5 | 6.253727 | 12921.29 | 16745.134 | 11.36% | 0.796139 | 4.111306 | 4.223889 | 4547.799 | 516.486 | 8373.488 | 0 |
| 1 | 0 | 3 | 1.156944 | 2305.97 | 1374.916 | 11.41% | 0.063313 | 3.362854 | 3.138276 | 955.015 | 109 | 1350.955 | 0 |
| 1 | 3 | 9 | 1.534133 | 68910.21 | 85897.442 | 11.56% | 0.185863 | 4.838284 | 4.93398 | 32253.15 | 3729.512 | 36657.06 | 0 |
| 1 | 8 | 8 | 1.973273 | 12405.79 | 11872.529 | 12.37% | 0.295187 | 4.093624 | 4.074543 | 9334.281 | 1154.211 | 3071.506 | 0 |
| 1 | 3 | 3 | 3.4305 | 103.958 | 229.222 | 13.10% | 0.535357 | 2.016858 | 2.360256 | 50.181 | 6.574 | 53.777 | 0 |
| 1 | 3 | 5 | 1.6006 | 543.536 | 568.803 | 13.59% | 0.204283 | 2.735228 | 2.754962 | 451.358 | 61.342 | 92.178 | 0 |
| 0 | 9 | 5 | 1.53787 | 62134.94 | 3131.171 | 14.95% | 0.18692 | 4.793336 | 3.495707 | 5448.621 | 814.632 | 56686.32 | 1 |
| 0 | 9 | 5 | 6.979609 | 193213.5 | 11402.782 | 15.11% | 0.843831 | 5.286037 | 4.057011 | 13159 | 1988.306 | 180054.5 | 1 |
| 0 | 9 | 5 | 4.814333 | 37078.55 | 1819.413 | 15.14% | 0.682536 | 4.569123 | 3.259931 | 1897.383 | 287.282 | 35181.17 | 1 |
| 1 | 7 | 4 | 4.271714 | 138464.3 | 101640.697 | 16.39% | 0.630602 | 5.141338 | 5.007068 | 96971.98 | 15891.09 | 41492.28 | 0 |
| 1 | 3 | 9 | 3.353385 | 24142.53 | 26198.527 | 16.66% | 0.525483 | 4.382783 | 4.418277 | 8738.414 | 1455.787 | 15404.12 | 0 |
| 1 | 3 | 3 | 1.1115 | 759.891 | 1167.423 | 16.73% | 0.045909 | 2.880751 | 3.067228 | 259.282 | 43.367 | 500.609 | 0 |
| 1 | 0 | 3 | 2.158304 | 19426.66 | 10823.891 | 17.49% | 0.334113 | 4.288398 | 4.034383 | 12000.01 | 2098.773 | 7426.647 | 0 |
| 1 | 0 | 2 | 1.398828 | 15002.86 | 84154.26 | 18.21% | 0.145764 | 4.176174 | 4.925076 | 2891.021 | 526.443 | 11671.04 | 0 |
| 0 | 9 | 6 | 5.864583 | 605047 | 39949 | 18.83% | 0.768237 | 5.781789 | 4.601506 | 62651 | 11795 | 542396 | 1 |
| 0 | 6 | 4 | 5.266558 | 161157.2 | 8621.568 | 20.37% | 0.721527 | 5.20725 | 3.935586 | 8249.644 | 1680.748 | 152907.6 | 1 |
| 0 | 3 | 5 | 1.6076 | 51366.24 | 1917.872 | 20.51% | 0.206178 | 4.710678 | 3.28282 | 3018.005 | 619.011 | 48348.23 | 1 |
| 1 | 3 | 3 | 2.1652 | 9599.165 | 7559.331 | 20.64% | 0.335498 | 3.982233 | 3.878483 | 6128.674 | 1265.009 | 3470.491 | 0 |
| 0 | 6 | 4 | 1.6426 | 438.843 | 263.335 | 21.02% | 0.215532 | 2.642309 | 2.420509 | 120.921 | 25.414 | 317.922 | 1 |
| 0 | 6 | 3 | 4.016417 | 43256.04 | 2002.263 | 23.09% | 0.603839 | 4.636047 | 3.301521 | 3512.457 | 811.181 | 39743.58 | 1 |
| 0 | 6 | 3 | 4.191342 | 81946.95 | 3925.055 | 23.71% | 0.622353 | 4.913533 | 3.593846 | 3524.086 | 835.615 | 78422.87 | 1 |
| 0 | 9 | 5 | 7.514317 | 858972 | 40684 | 25.19% | 0.875889 | 5.933979 | 4.609424 | 68951 | 17368 | 790021 | 1 |
| 1 | 12 | 6 | 4.177419 | 444698 | 119205 | 25.60% | 0.620908 | 5.648065 | 5.076294 | 177460 | 45427 | 267238 | 0 |
| 1 | 3 | 3 | 0.559897 | 97.861 | 116.479 | 26.19% | -0.25189 | 1.99061 | 2.066248 | 59.677 | 15.629 | 38.179 | 0 |
| 1 | 0 | 2 | 2.6518 | 555.9 | 2747.731 | 28.46% | 0.423541 | 2.744997 | 3.438974 | 64.127 | 18.248 | 485.478 | 0 |
| 0 | 3 | 5 | 3.201705 | 6828.21 | 4516.332 | 30.09% | 0.505381 | 3.834307 | 3.654786 | 1161.479 | 349.5 | 5666.731 | 1 |
| 1 | 0 | 8 | 3.125366 | 3808.427 | 8813.08 | 31.13% | 0.494901 | 3.580746 | 3.945128 | 953.886 | 296.94 | 2695.269 | 0 |
| 1 | 0 | 1 | 1.623077 | 373.918 | 446.887 | 32.37% | 0.210339 | 2.572776 | 2.650198 | 104.976 | 33.983 | 268.942 | 0 |
| 1 | 0 | 3 | 1.374222 | 2649.362 | 11319.183 | 36.52% | 0.138057 | 3.423141 | 4.053815 | 28.643 | 10.459 | 2620.719 | 0 |
| 0 | 6 | 5 | 1.533143 | 35486.19 | 1077.073 | 38.92% | 0.185583 | 4.550059 | 3.032245 | 2030.854 | 790.469 | 33455.34 | 1 |
| 0 | 3 | 5 | 2.369333 | 18180.24 | 7748.423 | 40.86% | 0.374626 | 4.259599 | 3.889213 | 2376.335 | 970.961 | 15803.9 | 1 |

# Appendix E: Centering Variables

| Source | SS | df | MS | Number of obs = | 60 |
|---|---|---|---|---|---|
| | | | | F( 3, 56) = | 3.07 |
| Model | .133468901 | 3 | .044489634 | Prob > F = | 0.0350 |
| Residual | .811188026 | 56 | .0144855 | R-squared = | 0.1413 |
| | | | | Adj R-squared = | 0.0953 |
| Total | .944656926 | 59 | .016011134 | Root MSE = | .12036 |

| ROE | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| lA | -.0337859 | .0223822 | -1.51 | 0.137 | -.0786228 | .0110511 |
| finlA | .0933847 | .0334483 | 2.79 | 0.007 | .0263796 | .1603897 |
| fin | -.3441272 | .137882 | -2.50 | 0.016 | -.6203381 | -.0679162 |
| _cons | .2297487 | .0848903 | 2.71 | 0.009 | .0596929 | .3998045 |

| Variable | VIF | 1/VIF |
|---|---|---|
| finlA | 22.28 | 0.044891 |
| fin | 19.14 | 0.052247 |
| lA | 1.98 | 0.504871 |
| Mean VIF | 14.47 | |

| Source | SS | df | MS | Number of obs = | 60 |
|---|---|---|---|---|---|
| | | | | F( 3, 56) = | 3.07 |
| Model | .133468898 | 3 | .044489633 | Prob > F = | 0.0350 |
| Residual | .811188029 | 56 | .014485501 | R-squared = | 0.1413 |
| | | | | Adj R-squared = | 0.0953 |
| Total | .944656926 | 59 | .016011134 | Root MSE = | .12036 |

| ROE | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| lA | -.0337859 | .0223822 | -1.51 | 0.137 | -.0786228 | .0110511 |
| finclA | .0933847 | .0334483 | 2.79 | 0.007 | .0263796 | .1603897 |
| fin | .0223188 | .0330664 | 0.67 | 0.502 | -.0439211 | .0885588 |
| _cons | .2297487 | .0848903 | 2.71 | 0.009 | .0596929 | .3998045 |

| Variable | VIF | 1/VIF |
|---|---|---|
| lA | 1.98 | 0.504871 |
| finclA | 1.94 | 0.515484 |
| fin | 1.10 | 0.908453 |
| Mean VIF | 1.67 | |

| Source | SS | df | MS | Number of obs = | 60 |
|---|---|---|---|---|---|
| | | | | F( 3, 56) = | 3.07 |
| Model | .133468898 | 3 | .044489633 | Prob > F = | 0.0350 |
| Residual | .811188028 | 56 | .014485501 | R-squared = | 0.1413 |
| | | | | Adj R-squared = | 0.0953 |
| Total | .944656926 | 59 | .016011134 | Root MSE = | .12036 |

| ROE | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| clA | -.0337859 | .0223822 | -1.51 | 0.137 | -.0786228 | .0110511 |
| finclA | .0933847 | .0334483 | 2.79 | 0.007 | .0263796 | .1603897 |
| fin | .0223188 | .0330664 | 0.67 | 0.502 | -.0439211 | .0885588 |
| _cons | .0971714 | .0210514 | 4.62 | 0.000 | .0550003 | .1393425 |

| Variable | VIF | 1/VIF |
|---|---|---|
| clA | 1.98 | 0.504871 |
| finclA | 1.94 | 0.515484 |
| fin | 1.10 | 0.908453 |
| Mean VIF | 1.67 | |