Univerzita Karlova v Praze
Fakulta sociálních věd

Institut ekonomických studií

Diplomová práce

2008 **Petra Hájková**

Univerzita Karlova v Praze
Fakulta sociálních věd

Institut ekonomických studií

DIPLOMOVÁ PRÁCE

Prediction of Stock Returns Using Financial Statement Analysis

Vypracoval: **Bc. Petra Hájková**

Vedoucí: **PhDr. Ing. Petr Jakubík Ph.D.**

Akademický rok: **2007/2008**

Prohlášení

Prohlašuji, že jsem diplomovou práci vypracovala samostatně a použila pouze uvedené prameny a literaturu.

V Praze, 21. května 2008

Petra Hájková

PODĚKOVÁNÍ

Především bych ráda poděkovala svému konzultantovi, Petru Jakubíkovi, za jeho neocenitelné komentáře, připomínky a podporu při vedení mé diplomové práce.

Poděkování patří také mé rodině a přátelům za jejich podporu a pomoc při získávání dat nezbytných k vytvoření této práce, jejich cenné rady a v neposlední řadě textové revize.

Chtěla bych také poděkovat Pražské burze za poskytnutí užitečných informací.

ABSTRACT

This diploma thesis should contribute to research in the area of fundamental analysis. Its aim is to study whether financial statement data of Czech non-financial companies capture information that is not reflected in prices. Therefore, the question is whether investment strategy based on financial statement analysis could earn excess returns. In order to test this hypothesis, a three-step estimation procedure based on a logit model is used to identify financial ratios relevant for prediction of future earnings. The final estimated model includes four financial ratios and is then used to set a one-year investment strategy. Although the performance of the estimated model is not too sound, this investment strategy brings positive abnormal returns during the monitored period of time. Despite the fact that results were influenced by several factors, they could indicate that financial statement analysis of companies listed on the Prague Stock Exchange is able to predict stock returns.

ABSTRAKT

Tato diplomová práce by měla přispět k výzkumu v oblasti fundamentální analýzy. Jejím cílem je zjistit, zda data z finančních výkazů zachycují informace, které nejsou obsaženy v cenách. Otázkou tedy je, zda by mohla investiční strategie založená na analýze finančních výkazů přinést abnormální zisky. Za účelem testování této hypotézy je použit postup založený na logit modelu, jenž je rozdělen do tří kroků s cílem identifikovat finanční ukazatele relevantní pro predikci budoucích zisků. Finální odhad modelu zahrnuje čtyři finanční ukazatele a je použit pro stanovení jednoleté investiční strategie. I přesto, že není úspěšnost predikce budoucích zisků na základě odhadnutého modelu příliš vysoká, tato investiční strategie přináší během sledovaného období značné výnosy. Ačkoliv byly výsledky ovlivněny několika faktory, mohly by naznačovat, že je možné na základě analýzy finančních výkazů společností kótovaných na Pražské burze predikovat výnosnost akcií.

PROJECT OF MASTER THESIS

Author: Bc. Petra Hájková
Consultant of the master thesis: PhDr. Ing. Petr Jakubík, Ph.D.
Term of master examination: Summer semester 2007/2008

Preliminary title:

The Ability of Financial Statement Analysis to Predict Stock Returns

Characteristic of the topic:

Fundamental and technical analyses represent two different approaches to valuation of companies. While a lot of attention has been paid to technical analysis, fundamental analysis research has remained quite narrow. This master thesis focuses on the fundamental approach according to which financial statement analysis is relevant for investment decisions. It is important to know which indicators carry information about future earnings of a company. Once we know it, we will be able to define investment strategy. In this master thesis, we will try to determine investment strategy based on financial statement analysis for the Czech capital market.

Basic outline:

1. Introduction
2. Related studies
3. Value of the company and financial indicators
4. Data sample
5. Estimated model
6. Model implications
7. Conclusion
8. References

Hypotheses:

- Future earnings are predictable from financial data.
- Future earnings influence market share price.
- Financial statement analysis of Czech listed companies may lead to formulation of investment strategy.

Methods of verification:

- Mathematical statistics – univariate and multivariate analysis
- Descriptive statistics
- Logistic regression
- Use of statistical software for model estimation – Excel, EViews, SAS

Main sources:

- *Literature*

Ball, R. and Brown., P (1968): *An Empirical Evaluation of Accounting Income Numbers*, Journal of Accounting Research, Vol 6, No. 2, pp. 159 – 178, Autumn

Beaver, W. H. and Morse, D. (1978): *What Determines Price-Earnings Ratio?*, Financial Analysts Journal, Vol. 34, No. 4, pp. 65-76, July-August

Cohen, J. B.; Zinbarg, E. D. et al. (1982): Investment Analysis and Portfolio Investment, 4th edition, Irwin, Homewood

Copeland, T.; Koller, T. et al. (2000): *Valuation: Measuring and Managing the Value of Companies*, 3rd edition, Viley, New York

Copeland, T.; Weston, J. F. et al. (2005): *Financial Theory and Corporate Policy*, 4th edition, Pearson Addison Wesley, Boston

Elton, E. J. and Gruber, M. J. (1991): *Modern Portfolio Theory and Investment Analysis*, 4th edition, Wiley, New York

Holthausen, R. W. and Larcker, D. F. (1992): *The Prediction of Stock Returns Using Financial Statement Information*, Journal of Accounting and Economics, Elsevier, Vol. 15, No. 2-3, pp. 373-411, August

McKibben, W. (1972): *Econometric forecasting of common stock investment returns: A New Methodology Using Fundamental Operating Data*, Journal of Finance, Vol. 27, No. 2, pp. 371-380, May

Ou, J. A. and Penman, S. H. (1989): *Financial Statement Analysis and the Prediction of Stock Returns*, Journal of Accounting and Economics, Elsevier, Vol. 11, No. 4, pp. 295-329, November

- *Other sources*

Annual reports of companies

http://www.pse.cz

10th October 2007, Prague

Signature of the consultant: Signature of the author:

Table of Contents

1. Introduction

Two basic approaches are usually used to evaluate a company: fundamental approach and technical approach. The former focuses on the analysis of financial and socio-economic data of a company, the latter aims at identifying patterns and trends of historical data in order to predict future direction of security prices. Much research has been already done in both areas. However, especially the fundamental analysis research offers a wide range of unanswered questions. The objective of this thesis is to contribute to the research in this area and identify the relationship between accounting data and stock returns.

Analysis of financial statements is considered to be a major part of the fundamental analysis. A lot of authors have described how this analysis should be done, however, a general consensus is missing. The question is if all information from financial statements is already included in prices or if a correct analysis of this information could predict the way of stock returns. Some studies show that it is possible while others demonstrate the contrary.

The majority of studies have focused on the developed U.S. market offering large amount of data. This is considered to be a challenge for this diploma thesis which aims its research at relatively unexplored Czech capital market. The Prague Stock Exchange is young and relatively small, which makes it different from traditional stock exchanges like the New York or London ones to a great extent. All this thus enables to compare results of this thesis with findings of other authors and make some conclusions on the characteristics of the Czech capital market in comparison to the U.S. capital market.

In this thesis, an effort is made firstly to study the relationship between financial statement information and future earnings on the Czech capital market. The aim is to identify financial indicators which are relevant for prediction of future earnings. Then, the research is extended to the relation between financial statement information and stock returns. Since earnings play a key role in the valuation of companies, the indicators identified in the previous step are used to test whether financial data capture information which is not reflected in prices.

The thesis is divided into two main parts: theoretical and empirical. The theoretical part provides necessary background for the empirical research. It is

structured as follows. Principal studies related to the topic of this thesis are introduced in *Chapter 2*. This chapter indicates the direction of ongoing research and its main findings and results. Then, *Chapter 3* describes a theory behind the fundamental analysis with a main focus on financial statement analysis and basic valuation methods. A special attention is paid to the importance of earnings and their estimation.

The empirical research in *Chapter 4* represents a core part of this thesis. Firstly, the data sample is described deriving its main characteristics. Then, the model which should predict the direction of future earnings is estimated. Finally, after evaluating the performance of the estimated model, the model is applied in order to decide if all information from financial statements is included in prices.

The final *Chapter 5* concludes findings of this thesis and suggests the way of possible further research.

2. Related Studies

In general, stock prices reflect future expectations of earnings, while accounting numbers reflect their past performance. However, a lot of authors studied the relation between accounting data and stock price returns in their papers and they found that accounting statements provide more than a historical perspective on the firm.

The pioneering work in capital markets research is represented by a study of Ball and Brown (1968). They proved that accounting attributes are contemporaneously statistically associated with stock prices. One of their findings was that at least one half of all the information about an individual firm, which becomes available during a year is captured in the year's income numbers. This leads to a conclusion that the information in the annual net income is useful. Nevertheless, their timeliness is questionable. Most of the information contained in the annual income report is anticipated by the market before the earnings announcement as about 85% to 90% of its content is captured by more prompt media[1].

A number of studies have then documented that stock prices lead accounting earnings (for example Beaver et al., 1980; Collins et al., 1987; Freeman, 1987; Kothari and Sloan, 1992; Kothari and Zimmerman, 1995). In other words, that prices provide information about earnings ahead of time and that earnings capture events that affect security prices with a lag. Beaver et al. (1987) or for example Collinset al. (1987) indicated that earnings are poor earnings predictors relative to price-to-earnings comparisons.

Ou and Penman (1989b) then demonstrates that predictors based on financial statement information are also considered to be relatively good predictors of future earnings. Therefore, based on the fact that both financial statement measures and price-to-earnings (P/E) comparisons can predict future earnings, the information about earnings, which can be identified by P/E ratios, is contained in financial statements. One of their key findings was that the information in prices that leads earnings is contained in financial statements.

[1] Ball and Brown do not specify which type of media. This was left for further research. However, interim reports or dividend announcements could be considered.

A number of papers indicated that P/E ratio, the earnings predictor, also predicts stock returns (for example Basu, 1983; Jaffe, Keim and Westerfield, 1989)[2]. Ou and Penman (1989a) focused on the research of the relevance of fundamental analysis to predict stock returns and they found that the accounting numbers, which contain similar information about future earnings as P/E ratio also predict stock returns. Ou and Penman took the market price as a benchmark, against which it is possible to evaluate the information in accounting numbers. They examined the profitability of a trading strategy which they based on a logit model designed to predict the sign of one-year-ahead earnings changes from financial statement analysis. On the basis of this measure, they took positions in stocks during the period 1973–1983. They proved that stock prices do not reflect all the fundamental information; therefore, it is possible to earn excess returns. Ou and Penman (1989b) concluded that although both P/E ratio and the financial statement measure of Ou and Penman (1989a) provide similar predictions of future earnings, their predictions of stock returns are negatively correlated.

Holthausen and Lacker (1992) implemented a similar trading strategy to that of Ou and Penman (1989a) in the 1978–1988 period. The main difference was that their investment strategy was based on a prediction of excess return measure directly and not on a prediction of unexpected earnings as Ou and Penman did. As their trading strategy was able to earn significant abnormal returns in the determined time period, they confirmed Ou and Penman's conclusion. However, they also concluded that Ou and Penman's trading strategy does not work in the period 1983–1988. Furthermore, McKibben (1972) used a simple econometric model and fundamental operating data to predict stock investment returns. The model is different from those of Ou and Penman or Wolthausen and Lacker; nevertheless, he also concluded that it is possible to consistently select groups of stocks, which yield exceptional investment returns.

Another study, which examines the usefulness of financial variables in security valuation, was written by Lev and Thiagarajan (1993). Their findings support the value relevance of most of the identified fundamentals. They found that, for the 1980s, the fundamentals added approximately 70% to the explanatory power of earnings with respect to excess returns. The difference between their analysis and the work of Ou and Penman is in the way how they found financial variables, which were included

[2] After controlling for beta, size and January affects in returns.

in empirical tests. While Ou and Penman (1989a) used a statistical search for the fundamentals, Lev and Thiagarajan identified these fundamentals from written pronouncements of financial analysts. They found 12 fundamental signals, which they tested and they proved that most of the fundamental signals are value relevant.[3] Moreover, they showed that the relation between returns and fundamentals is considerably strengthened when it is conditioned on macroeconomic variables.

The research focusing on the ability of fundamental information to predict stock returns is ongoing and this thesis should extend it by examination whether analyzing fundamental information can be useful to earn excess returns in the Czech capital market. This master thesis will use the findings of Jindrichovska (2001), who investigated whether there is a statistically significant permanent relationship between returns and accounting data in the Czech capital market. Using accounting earnings and stock prices during the period 1993–98, she proved that such a relationship exists. A goal of this thesis will be to determine an investment strategy which would earn abnormal returns.

[3] A signal refers to a specific configuration of several fundamental variables. Lev and Thiagarajan then selected one of several alternative configurations of the same fundamental. Based on their search, they identified following signals used in the empirical tests: inventory, account receivable, capital expenditure, R&D, gross margin, sales and administration expenses, provision for doubtful receivables, effective tax, order backlog, labor force, last in first out (LIFO) earnings and audit qualification.

3. Value of Company and Financial Indicators

A general consensus about basic determinants of common stock prices exists; therefore, one would say that once we know that the price of common stocks is a function of the level of company's earnings, dividends, risk, the cost of money and future growth rate, we should be able to find a way how to successfully value stocks and select those, which would bring above average returns. However, the contrary is true and it seems to be very difficult to find such a way. Moreover, the theory of efficient capital markets tells that all the information available is already included in stock prices, thus it is not possible to earn excess returns.

Nevertheless, some authors have already found models, both simple and more complex ones, which prove that the efficient capital market theory does not hold and that it is possible to determine an investment strategy, which will bring abnormal returns. These models have their limitations but the research continues in this area and also this thesis should contribute to it.

In this chapter, the importance of the financial statement analysis, which provides a wide range of information about the company useful for investment decisions, is discussed. Then, basic valuation models are described to gain an important background for a later estimation of the model. A special attention is also paid to earnings and their estimation since they are considered to be one of the most important variables in the valuation process.

3.1. Financial Statement Analysis

3.1.1. Financial Statements

Financial statements provide the framework for forecasting company's future performance. In fact, financial statements reflect the cumulative effects of all management's past decisions. There exist four basic financial statements, which provide financial information about companies that are publicly available (except for privately held companies): balance sheet, income statement, cash flow statement and statement of changes in shareholders' equity. Each of these financial statements is important

for gaining information about the company's performance; however, not until we examine all the financial statements we can get a complete picture of company's finances.

Balance sheet summarizes assets, liabilities and shareholders' equity at a specific point in time. In other words, it describes a capital structure of a company as of date of the preparation of this financial statement. *Income statement*, on the other hand, reflects the effect of management's operating decisions on business performance as it shows the amount of revenue and profit, which was generated by the company over a certain period. The profit or loss calculated in the income statement increases or decreases shareholders' equity in the balance sheet, which gives an important interconnection between the two statements.

Both in the theory of a firm and business practice, two views on the economics of a company exist, the static and the dynamic. The static aspect is reflected in the value of the firm, while the dynamic aspect is reflected in changes of this value over time. In accounting, the static approach is represented by the balance sheet and the dynamic approach by the income statement.

Further, *cash flow statement* offers an overview of the combined cash impact of all management decisions during a certain period of time. It compares balance sheets from the beginning and the end of the period and uses key items of the income statement for the period. Cash flow statement thus provides aggregate data regarding all cash inflows the company has received from both its ongoing operations and external investment sources, as well as all cash outflows, which have been paid for its business activities and investments during a given period. Finally, *statement of changes in shareholders' equity* provides an analysis of main changes in shareholders' equity during a specific period. This information is not always presented in a special statement; it is rather given in footnotes.

3.1.2. Financial Ratios

The ratio analysis is a way how to measure financial and economic consequences of past management decisions to be able to assess the performance of a business. Ratios are computed based on the published financial statements briefly described above and thus summarize large amounts of data contained in them focusing

on the key information for assessing the company's performance. Financial statement analysis is not limited to the calculation of ratios, non-ratio indicators are commonly used as well (e.g. total sales, number of employees). However, the attention is paid to the ratio analysis in this chapter as it represents a key background for our model.

Much research has focused on a question of classification of financial ratios. There exist four basic approaches in the classification. The *first approach* is called by Salmi et al. (1990) a pragmatic or an authoritative approach. In this case, the classification of financial ratios has developed from established business practices and personal views of renowned financial analysts. The classifications and the ratios in different categories can and basically do differ amongst the authors. Nevertheless, following three categories of financial ratios are more or less common: profitability, capital structure (long-term solvency) and liquidity (short-term solvency). This approach is presented in many standard textbooks (e.g. Brealey et al., 2006).

The *second approach* is based on the technical relationships between different ratios which makes it more deductive. The classical example of this approach is the du Pont triangle system from 1919: profits/total sales, profits/sales, sales/total assets. Other examples of this approach include Courtis (1978) or Bayldon et al. (1984). The *third approach* is represented by the empirical classification of financial ratios using statistical techniques (in particular factor analysis). Factor analysis is used to reduce a large number of financial ratios into a smaller number of mutually exclusive categories, which cover the various aspects of the company's activities. This socalled inductive approach is problematic because studies focusing on this approach were not able to agree on a consistent classification of financial ratio factors (e.g. Pinches et al., 1973; Johnson, 1979; Cowen and Hoffer, 1982).

The *fourth approach* can be called a confirmatory approach. Two steps are used to classify the ratios: At first a hypothesis of an a priori classification is set and then it is tested whether this classification is confirmed by empirical evidence or not. The example of this approach can be seen in a work of Laurent (1979) or Pohlman and Hollinger (1981).

Main ratios are now briefly described in the following prevalent classification: accrual ratios, cash flow ratios and market based ratios.[4] Accrual ratios and cash flow

[4] This classification is used for example in the work of Salmi et al. (1990).

ratios represent different categories because different principles of economic theory and accounting are involved. One of the reasons is the distinction between the static and dynamic aspect of the company's finances as referred above. Furthermore, two different valuations can be used in defining firm's performance in terms of profitability: the economist's valuation, which is based on cash flows, and the accountant's valuation based on accrual concepts. Empirical evidence from several research papers have also showed that cash flow ratios involve information, which is uniquely different from accrual ratios (e.g. Gombola and Ketz, 1983).

Accrual Ratios

- **Liquidity**

Liquidity ratios provide information about company's ability to meet its short-term financial obligations. One of the basic liquidity ratios is a *current ratio* defined as a ratio of current assets to current liabilities. A possible disadvantage of this ratio is that it involves inventories, which are not always truly liquid in their nature. Therefore, a *quick ratio* (current assets less inventories to current liabilities) is commonly used to describe the company's liquidity. Besides, *cash ratio* involving just cash and short term securities as the company's most liquid assets in the numerator could be used.

- **Capital Adequacy**

These ratios also called financial leverage ratios provide an indication of the long-term solvency of a company. In comparison to liquidity ratios, which measure the extent, to which a company is able to cope with short-term debt, financial leverage ratios focus on the firm's use of the long term debt. The basic financial leverage ratios are *debt ratio* defined as total debt divided by total assets and *debt-to-equity ratio* defined as total debt divided by total equity. Another important ratio is *interest coverage* (EBIT to interest charges) indicating how well the company can cover interest payments on its debt using earnings.[5]

[5] EBIT represents earnings before interest and taxes

- **Profitability**

Profitability ratios are the most important ratios in the financial statement analysis. Generally, profitability is regarded as earnings generated in relation to resources invested in company's activities and there are two ways of looking at it: shareholders' and managerial view. The former is focused mainly on the return on investment, the latter on the productivity of the firm's capital resources. Therefore, the two basic profitability ratios are *return on equity* (ratio of return after interest and taxes to equity) and *return on assets* (return to total assets). Another ratio which could be stated is for example *profit margin* calculated as a return on sales ratio.

- **Efficiency**

Efficiency ratios are also called asset turnover ratios or activity ratios and they help to identify how efficiently the company utilizes its assets. Commonly used ratio is *receivables turnover* representing annual credit sales to accounts receivables which tells how quickly the company collects its account receivables. Furthermore, *inventory turnover* defined as a cost of sold goods divided by an average inventory is used as well. *Average collection period* (365 to receivables turnover) and *inventory period* (365 to inventory turnover) represent other examples of efficiency ratios that could be used within the financial statement analysis.

- **Operating Leverage**

The total risk of the company can be divided between two components – financial risk and business risk. The former is a function of the financial leverage described above; the latter is a function of firm activities and is closely related to the concept of operating leverage reflecting the production technology of a company. The basic ratios are *variable costs to fixed costs* or *labour intensiveness* defined as personnel expenditures divided by adjusted real-term fixed assets[6].

[6] It is better to use real-term fixed assets rather than the book value because they better reflect the technology which is at the firm's disposal.

Cash Flow Ratios

Cash flow ratios are considered to have different characteristics in comparison to the accrual ratios as described above, they thus represent a different category here. There exist a wide range of cash flow ratios; however, just some of them are chosen to give an idea, what these ratios could tell about the company. *Cash flow from operations to net income ratio* indicates the extent to which net income generates cash in a business. *Cash flow to capital investments to cash based sales ratio* reflects a different aspect of the companies' activities, investment intensity. This ratio is important because capital investments represent a key tool for the firm's success. Another ratio, at this time reflecting financial risk of the company, is for example *cash flow to long term debt ratio* assessing the adequacy of available funds to pay obligations.

Market Based Ratios

- **Firm Ratios**

These ratios are directly connected with financial statements. One of commonly used ratios from this category is a *dividend payout ratio* defined as dividends per share divided by earnings per share. This ratio is considered to be an indicator of the company's dividend policy. Changes in dividend policy represent a signal to investors which indicates a long-term shift in the company's profitability or financial position. Different payout policies also attract different kind of investors, e.g. as there is a difference in the tax treatment of personal capital gains and dividends.

- **Combined Ratios**

This category includes ratios with a numerator coming from financial statements and a denominator from the market based information. The most used ratios are *dividend yield* and *P/E ratio* (price per earnings). P/E ratio is described in more details in the next chapter as it is also used as one of the company's valuation tools.

- **Pure Market Ratios**

These ratios which are market based are mentioned just to complete the list of the types of financial ratios. Commonly used ratio is a *return on security* with two main components – capital gain/loss and dividends. Another ratio very often used to analyze the company is *security beta*, a measure of stock's volatility in relation to the market. Security beta represents a central concept in capital market theory, more specifically in the capital asset pricing model (CAPM).[7]

3.2. Valuation Models

A valuation model is an instrument that enables to formalize the relationship between a set of corporate and economic factors and the market's valuation of these factors. In other words, a valuation model determines the value of a company's stock based on a set of forecasts of company and economic variables. A lot of different approaches to security valuation exist; nevertheless, not all valuation models are presented, some of the more widely used ones are rather described.

3.2.1. Relative Valuation

One of the valuation tools is a relative valuation. This type of valuation is based on a comparison between the value of an asset and the value assessed by the market for similar or comparable assets. Market value of these assets must be standardized because absolute prices cannot be compared. The process of standardizing creates multiples. Prices can be standardized by using a common variable such as earnings, cash flows, book value or revenues. Thus, we can distinguish following multiples:

- Earnings multiples
  - Price/Earnings ratio
  - Value/EBIT
  - Value/EBITDA[8]

[7] For more information about CAPM see for example Brealey et al. (2006)
[8] EBITDA represents earnings before interest, taxes, depreciation and amortization

  - Value/Cash flow

- Book value multiples
  - Price/Book value of equity
  - Value/Book value of assets
  - Value/Replacement cost (Tobin's Q)
- Revenues multiples
  - Price/Sales per share
  - Value/Sales
- Industry specific variable (e.g. Price/km, Price per ton of steel…)

It is important to define the multiple consistently. This means that both the value in numerator and the standardizing value in denominator should be to the same claimholder in the firm. Therefore, equity value should be divided by equity earnings or book value of equity, whereas enterprise value should be divided by firm earnings or book value of assets.[9]

Table 1: *Advantages and Disadvantages of Price/Earnings Ratio*

Price/Earnings Ratio	
Advantages	**Disadvantages**
• Simple to compute • Widely available • Proxy for a number of other characteristics of the firm like risk or growth	• Likely to reflect market moods • Cannot be used for firm with negative earnings • Based on reported earnings which are not a good indicator of actual value creation for shareholders

The commonly used multiple is *Price/Earnings ratio*, which is calculated by dividing the market price per share by earnings per share. This ratio is simple to compute for most of the stocks, it is widely available and thus enables to make comparisons between stocks quite easily. Moreover, several modifications can be done

[9] Equity earnings are represented by net income, while firm earnings are represented by either EBITDA or EBIT.

and we can get more information about the company we are evaluating. We can for example compare P/E to the expected growth rate, which is sometimes used to identify undervalued and overvalued stocks or generally as a measure of relative value. Or we can use the relative P/E ratio, a comparison of the P/E ratio of the company to the P/E of the market. Some of the main advantages and disadvantages of the P/E ratio are shown in the following table.

Another quite often used multiple is *price to book value of equity* (P/BV ratio) where book value of equity represents the difference between the book value of assets and the book value of liabilities. The market value of an asset reflects its earning power and expected cash flow, while the book value of an asset reflects its original cost. The problem with this multiple is that the measurement of book value of assets is largely determined by accounting rules. Pros and cons of this valuation method are summarized in *Table 2*.

***Table 2**: Advantages and Disadvantages of Price/Book Value of Equity Ratio*

Price/Book Value of Equity Ratio	
Advantages	**Disadvantages**
• Relatively stable measure of the value • Enables valuing firm with negative earnings (not if a firm reports permanently negative earnings, in this case the P/BV ratio becomes negative)	• Book values are affected by accounting decisions (like decisions on depreciation) • In case that accounting standards vary across firms, P/BV cannot be use as a tool for comparison of different firms

Price to sales multiple (P/S ratio) represents another possibility how to value the company which is quite popular. The biggest advantage of this multiple is that it can be used even if the company is unprofitable several consecutive years. Generally, if the P/S ratio is low, the investment into the company is considered to be more advantageous as the investor is paying less for each unit of sales. Nevertheless, sales do not reveal the whole picture of the company if the company is not profitable. This indicates that when we use the P/S ratio it is also important to look at other company indicators to be able to make a decision. *Table 3* describes advantages and disadvantages or the P/S ratio.

***Table 3**: Advantages and Disadvantages of Price/Sales Ratio*

Price/Sales Ratio	
Advantages	**Disadvantages**
• Relatively difficult to manipulate • Available even for the most troubled firms • Less volatile than the P/E ratio	• Limited in its use – expenses or debt not taken into account • Substantially vary across industries (not a good comparative tool for companies from different sectors)

In conclusion, each of the multiples has its advantages and disadvantages and is more appropriate in some cases than the other. However, it is important not to rely only on one multiple when valuing a company. We need to use it as one of the valuation tools and not as a tool, which has a deterministic value.

3.2.2. Discounted Cash Flow Models

Discounted cash flow models (DCF) represent a key valuation tool. They are much more flexible than any individual ratio, which could be used for the valuation of the company. The flexibility is given by the investor's possibility to incorporate assumptions about such factors as a company's capacity to generate cash flows from assets, growth prospects of these cash flows, the length of time it will take for the company to reach stable growth and the cost of capital representing the riskiness of company's cash flows. The concept of DCF models is that the value of a share is equal to the present value of the cash flow that the shareholder expects to receive from it.

There are two basic approaches to DCF valuation. The first is to value just the company's equity[10], whereas the second is to value the entire company when we value the claims of all the investors, which includes besides shareholders of common stocks also bondholders and debt holders or for example shareholders of preferred stocks. Therefore, we need to decide whether we will discount:

[10] The value of equity of publicly traded company is represented by the value of the common stocks in the company.

- Cash flow to equity
  - dividends
  - free cash flows to equity (FCFE)
- Free cash flows to firm (FCFF)

We should discount cash flow to equity when we value companies that have stable leverage, no matter if it is high or low.[11] On the other hand, we should use firm valuation for companies, which have high leverage but expect to lower the leverage over the time (for example because debt payments do not have to be factored in the cash flows or the discount rate does not change significantly over time) or for firms for which we do not have complete information on leverage (this can happen for example when interest expenses are missing). The decision whether to use equity or firm valuation then indicates if we will use the cost of equity or the cost of capital as a discount rate. If we discount cash flow to equity, we should use the cost of equity as a discount rate, whereas if we discount cash flow to firm, we should use the cost of capital.

Once we decide for the equity valuation, the question is also whether to discount dividends or free cash flow to equity. Dividends usually provide the most conservative estimate of the company's equity value. The reason is that most firms pay less in dividends than they could afford. In fact, free cash flow to equity represents the cash flow left after meeting all the investment needs and making debt payments, which means that free cash flow to equity represents the amount, which could be paid out by the company in a form of dividends. Therefore, FCFE should represent a more realistic estimate of the equity value than dividends. However, despite the fact that dividend discount model (DDM) is the oldest type of discounted cash flow models and could be seen as old-fashioned, it is still useful in a wide range of circumstances such as for valuing firms, which pay dividends that are close to FCFE over an extended period or firms for which FCFE is difficult to estimate (like financial institutions). The FCFE model is then generally used when companies do not pay dividends (e.g. private companies or IPOs) or when firms pay dividends that are significantly higher or lower

[11] Leverage represents a degree to which the company uses borrowed money. It is measured by debt/equity ratio.

than the FCFE.[12] The basic advantages and disadvantages are summarized in *Table 4* and *Table 5*.

***Table 4**: Advantages and Disadvantages of Price/Sales Ratio*

Dividend Discount Model	
Advantages	**Disadvantages**
• Easy concept – dividends represent what shareholders get • Dividends are usually quite stable in the short run, therefore they are easy to forecast	• Dividend payout is not related to value – dividend forecasts ignore the capital gain component of payoffs • Shorter period forecasts are difficult to calculate with any reliability

***Table 5**: Advantages and Disadvantages of Price/Sales Ratio*

Discounted Cash Flow Model	
Advantages	**Disadvantages**
• Cash flows are not affected by accounting rules • Cash flows represent a straight application of familiar net present value techniques	• Free cash flow does not measure value added in the short run • Investment is treated as a loss • Long forecast horizons are required to recognize cash inflows from investments • Hard to validate free cash flow forecasts

In fact, there could be a third cash flow measure that could be used and that represents commonly available metric, earnings. The reason why earnings are not amongst dividends and free cash flow is that over time they represent both free cash flow and the amount paid out in a form of dividends. In general, earnings can be used for two purposes: they can be paid out to shareholders as dividends or they can be reinvested in the company. In this case, they should result in increased future earnings, and consequently to increased future dividends. Moreover, reported earnings can be quite easily manipulated, therefore, we can conclude that dividends or free cash flow represent much better measure for our valuation purposes.

[12] Damodaran uses a rule that if dividends are less than 80% or greater than 110% of FCFE, FCFE model should be used (V. Beyond Inputs: Choosing and Using the Right Model, available at http://pages.stern.nyu.edu/~adamodar)

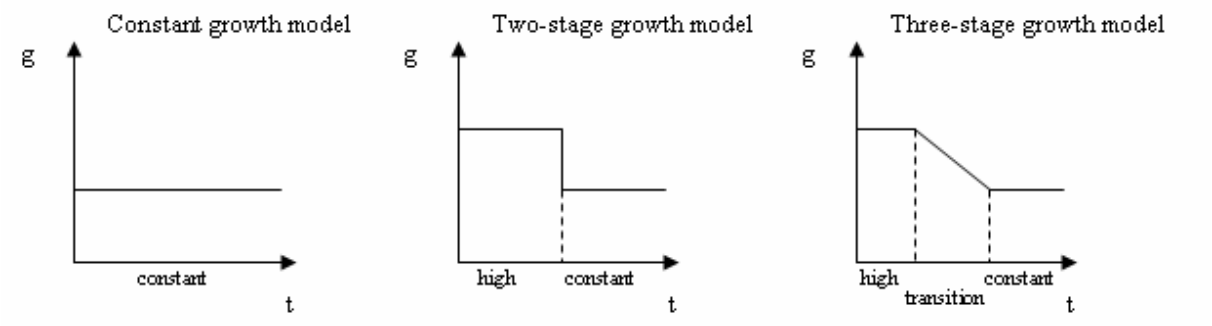
One of the most important assumptions for the valuation is the estimate of cash flows in the future years. We need to estimate the expected growth rate in net income or earnings when forecasting cash flows to equity, or an expected growth rate in operating earnings when forecasting cash flows to the firm. This represents the main step in the valuation that can largely influence results of the valuation.

The last assumption to be made is to define the growth patterns of the firm. Despite its simplicity, there exist three basic models:

- Constant growth model
- Two-stage growth model
- Three-stage growth model

Constant growth model assumes that the company is already in a stable growth. The dividend discount form of this constant growth model is called the Gordon growth model. The two-stage model is used when we expect that the company will be at first highly growing and then the growth will become stable. In contrast to this model, the three-stage model will be used when the first stage of a high growth period is expected to be replaced by a transition period, finally stabilizing on a certain growth level at a certain point in time in the future. The difference between these models is shown in *Figure 1*.

***Figure 1**: Three Basic Types of Growth Models*



Once all the necessary assumptions have been made, we can use one of the following formulas for the valuation:

Constant growth model

$$V_0 = \frac{CF_1}{r-g} \tag{3.1}$$

Two-stage growth model

$$V_0 = \frac{CF_0 * (1+g) * \left(1 - \frac{(1+g)^n}{(1+r)^n}\right)}{r-g} + \frac{CF_{n+1}}{(r-g_n)(1+r)^n} \tag{3.2}$$

Three-stage growth model

$$V_0 = \sum_{t=1}^{n_1} \frac{CF_0 * (1+g_1)^t}{(1+r)^t} + \sum_{t=n_1+1}^{n_2} \frac{CF_t}{(1+r)^t} + \frac{CF_{n_2+1}}{(r-g_2)(1+r)^n} \tag{3.3}$$

where V_0.....value of equity or firm

CF_t.....cash flow in period t

r.....cost of equity/cost of capital

g .....expected growth rate in cash flow

g_1 .....expected growth rate in cash flow in the first stage of three-stage model

g_2 .....expected growth in cash flow in a period with constant growth

n .....length of the high growth period in two-stage model

n_1 .....length of the high growth period in three-stage model

$n_2 - n_1$.....length of the transition period in three-stage model

3.3. Earnings and Their Estimation

Earnings and growth in earnings play a key role in valuation models. For this reason we will examine earnings and their behaviour in a greater detail. The value of an asset is not determined by its cost in the past but rather by its future earnings power. The problem is that earnings can be defined in alternative ways. For some people, earnings are represented by cash flow plus a change in the market value of the asset, for others, it is a mixture of the income earned and an attempt to measure some part of a change in the value of the asset. Earnings can differ substantially because companies

choose different accounting methods in reporting income and cost. Moreover, due to the fact that earnings are considered to be important for the valuation process, accountants and management may try to manage the level and growth of earnings.

Despite the problems linked to accounting earnings mentioned above, they are still considered to be one of the important variables used in the process of company valuation. Elton, Gruber and Gultekin (1978) examined if an investor could make an excess return by buying and selling stocks on the basis of an estimate of future earnings. At first, they divided stocks into deciles based on the consensus forecast of earnings growth. In this case, there was no difference in excess returns between the deciles. The results changed when they divided firms into deciles by the error in the forecast of earnings growth. An investor who could forecast earnings better than the average could earn abnormal returns. Their third test was to divide firms into deciles by the change in the expectation about future earnings, which led to even higher returns. These findings just confirm the importance of earnings and the estimation of their growth for the valuation process.

One of the earnings characteristics is that they are strongly influenced by changes in aggregate earnings for the economy and they can be also influenced by changes in the earnings of the particular industry. Elton and Gruber (1991) tested this influence and they proved that such effects of market and industry factors exist. Another important issue linked with earnings is the relation between past earnings and future earnings. The first question to be answered is whether past earnings can be useful for predicting future earnings. A lot of studies focused on the examination of time series behavior of earnings based on previous earnings realizations. For example Brealey (1986) analyzed the growth of 610 industrial companies from 1950–1964 and each year he determined 305 companies with the highest growth and the same number of companies with the lowest growth. If past growth was helpful for predicting future growth, we would expect that companies would tend to have long periods when they were in groups with low growth and vice versa. However, the opposite was proved and a good year followed a bad year frequently.

Several papers (for example Ball and Watts, 1972; or Albrecht et al., 1977) have suggested that annual earnings per share are well approximated as a random walk with a drift. This is based upon a time series extrapolation of previous earnings. Nevertheless, further research showed that earnings could be a more complex process

than had been previously modeled. Beaver et al. (1980) were the first who took into consideration additional data to describe earnings expectations. In particular, they used prices as a source of additional information available to market participants. They characterized earnings as a mixture of two processes. The first process is linked to prices and appears to exhibit a lagged response to the information reflected in prices, while the second process is independent of prices (the transitory error component). One of their major conclusions was that future expected earnings differ significantly from those implied by a simple extrapolation of past earnings.

Beaver et al. (1980) proposed following reasons why prices may convey information about future earnings:

- Annual earnings can be viewed as an aggregation of earnings for shorter time intervals (quarterly, monthly etc.). Prices can be used to extract information about pre-aggregated earnings series, which has been lost in temporal aggregation.
- Events, which affect future earnings may not be reflected in current earnings (e.g. information regarding future capital expenditures) while prices reflect such information.
- Generally, when earnings are a compound process consisting of more than one stochastic variable, prices can convey information about future earnings.

The explanation of the finding that prices tend to lead earnings (alternatively, price changes anticipate earnings changes), which give Kothari and Sloan (1992) is that historical cost accounting measurement process is not designed to fully reflect expectations of future net cash flows on timely basis. The reason is that, while price changes over a period reflect revision in the market's expectation of future earnings as well as realized earnings over the period, accounting earnings over a period primarily summarize:

- the effect of sales transactions during a fiscal period which have generated cash (e.g. cash sales) or will generate cash almost certainly (e.g. net change in receivables),
- the effect of past period's activities (e.g. depreciation expense or cost of sales),

- cash expenditures for investments generating uncertain future benefits (e.g. R&D or advertising expenses).

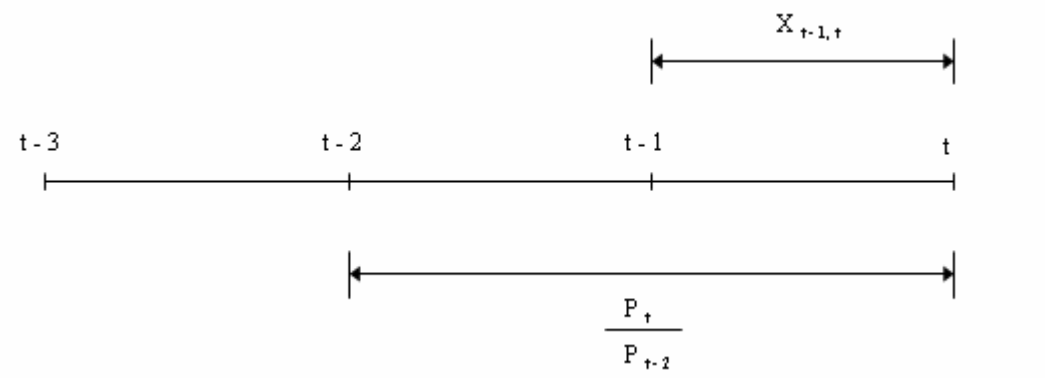
Therefore, we can see that earnings have a limited ability to contemporaneously reflect the market's revised expectations of future earnings compared to stock prices.

Collins et al. (1986) extended the work of Beaver et al. (1980). They focused on a firm size and its relation to the predictive accuracy of price-based earnings forecasts in comparison to univariate time series models over one-year forecast horizon. In their work, firm size represents the amount of available information in addition to that reflected in the past time series of earnings and the number of traders and professional analysts processing the available information about a company. They also came to the conclusion that price-based models outperform both random walk and random walk with a drift models, however, only for larger firms. The difference between the price-based model and the univariate time series models for small firms was minor. We can conclude that according to these findings, price changes tend to anticipate earnings changes, particularly for larger firms.

Compared to the research of Beaver et al. (1980) and other authors (e.g. Collins and Kothari, 1989) who documented that return over one leading year is related to the annual earnings change, Kothari and Sloan (1992) provided the evidence that even returns measured over three leading years contain information about an annual earnings change. The explanation of leading-year returns is given by the following *Figure 2*.

Further, their findings contrast with the interpretation of transitory earnings component of Beaver et al. (1980) as an error component that does not capture the information in prices about future earnings. They found that financial statements provide information, which distinguishes transitory earnings components from "permanent" earnings. These transitory components also affect prices; therefore, they are not value irrelevant measurement error as Beaver, Lambert and Morse indicated. They also found that although earnings capture information in prices with a lag, other aspects of financial statements reveal some of this information contemporaneously with prices. They conclude that because price changes contemporaneous with earnings reflect transitory earnings, price changes are poor predictors of future earnings relative to financial statement information.

***Figure 2**: Earnings and Returns Measurement Intervals in Lead-lag Price-earnings Regression*



Note: Generally, X_t represents accounting earnings over the period t and P_t / P_{t-i} represent one plus the buy-and-hold return over the period from the end of t – i to the end of t, where i > 1. Return measurement interval in the figure above consists of contemporaneous and one leading year (i = 2). Kothari and Sloan proved that returns over three leading years (i = 4) contain information about an annual earnings change.

Although the study of Ou and Penman (1989b) has already been criticized on several grounds (see for example Larcker, 1989), their work contributed to the accounting research to a great extent. On the other hand, the question of the most appropriate tool for forecasting future earnings is still not answered and the research in this area continues.

4. Empirical Part

This chapter focuses on estimation of the model. By applying this model, we should be able to answer to our question raised at the beginning of this master thesis: Do financial statement data provide information about future earnings and are thus able to predict future stock returns in the Czech capital market?

Firstly, the data sample and its basic characteristics are described. Then, model assumptions are set with the main focus on the identification of financial ratios used in the model. The model is described in the following part of this chapter, finally leading to its testing on the data, which were collected.

4.1. Data Sample

4.1.1. Background

This chapter provides a certain background important for understanding the environment, in which the model is estimated and then tested. Since this study is focused on the Czech capital market, it is essential to be familiar with the circumstances of the Prague Stock Exchange (PSE) creation and the extent to which the stock exchange has evolved since 1994. Furthermore, the knowledge of development of the Czech macroeconomic situation during the whole monitored period of time is useful for interpretation of the results. Therefore, a brief economic review from the macroeconomic point of view is given.

Establishment of Prague Stock Exchange

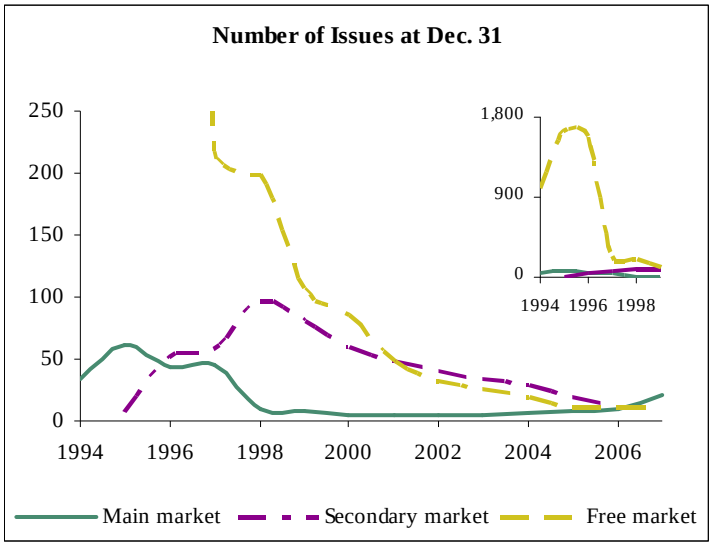
The PSE was officially established on November 24, 1992 after the first of two waves of Czech Voucher Privatization. Its main purpose was to provide a market for shares, which were distributed to the public through vouchers.[13] The first seven share

[13] Vouchers were in fact one-purpose money which could be exchanged only for shares. Vouchers themselves were not tradable.

issues started to be traded on the PSE nearly a half of a year after the stock exchange creation.

The first wave of the Voucher Privatization brought 955 share issues on the PSE within June and July 1993. Other 674 share issues started to be traded after the second wave in 1995. The Voucher Privatization "played a role of temporary but very costly intermediary that opened the space for finding out the new ownership structure" (Mejstřík, 1999, p. 13). These circumstances, under which the PSE was created, caused that a lot of very small companies went public, which led to the relative illiquidity of the whole marketplace.

Figure 3: *Number of Issues on the PSE between 1994 and 2007*



Source: Fact Books of Prague Stock Exchange

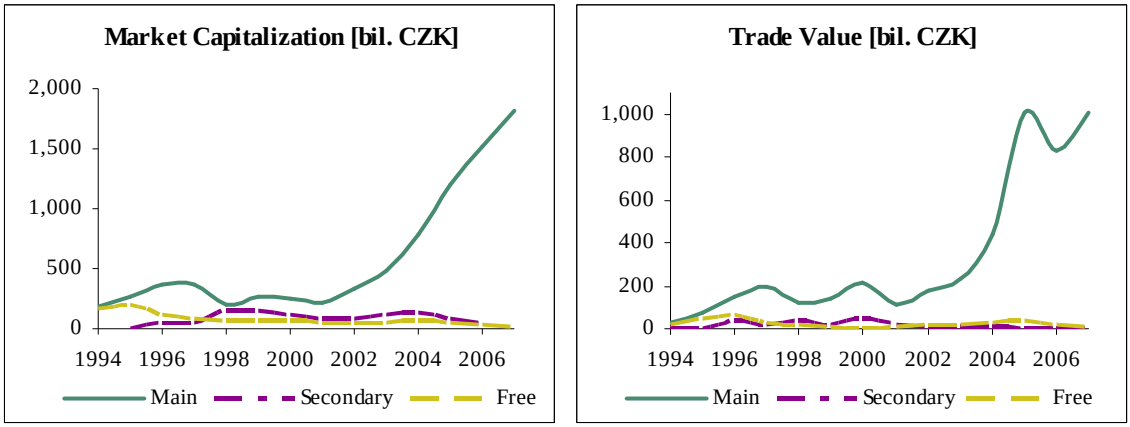
In a nutshell, nearly 1,800 new share issues started to be traded on the PSE in very short time, which imposed substantial transaction costs. Moreover, imperfect legal framework made efficient functioning of capital market more difficult. The way in which the state ownership was changed into private one in combination with the absence of independent regulatory body, the limited transparency, the lack of protection of minority investors and last but not least the absence of a takeover regulation led to inefficient corporate governance.[14]

[14] For more information about Czech privatization and corporate governance see for example Mejstřík (1999).

Most of the small companies which were privatized through vouchers were not suitable for public trading on the emerging capital market and their shares were illiquid as described above. Therefore, nearly 80% of de-listed companies in 1997 can be seen as a natural evolution of the situation on the marketplace (see *Figure 3*). Since that time, strong regulatory and supervisory environment has been demanded. The establishment of the Securities Commission in 1998 as an independent body supervising capital market can be seen as one of the most important steps.[15]

The PSE has slowly become a respected marketplace, which can be declared for example by the fact that the PSE was affiliated as the Associate member of the Federation of the European Securities Exchanges (FESE) in June 2001 and since May 2004 it has become the full member of FESE. Moreover, the PSE received the "Designated Offshore Market" status in 2004. The U.S. Securities Commission uses this status to confirm that the market is transparent and safe. Another proof that the PSE has become a dynamically developing market attracting more and more investors is the increasing number of initial public offerings (IPOs).[16]

Figure 4: *Market Capitalization and Trade Values on the PSE between 1994 and 2007*



Source: Fact Books of Prague Stock Exchange

The rising quality of the PSE can be seen in *Figure 4*. The market capitalization of companies listed on the main market has an increasing tendency.[17] Furthermore, the

[15] Since 2006, the activities of the Securities Commission were taken over by the Czech National Bank.
[16] The IPO Zentiva in 2004 was the first IPO on the PSE. Shares of ECM REAL ESTATE INVESTMENTS and PEGAS NONWENS were initially publicly offered in 2006, followed by AAA Auto Group and VGP in 2007 and NWR in May 2008.
[17] The market was divided into main, secondary and free in 1995. The main market has always been the most prestigious one with the most liquid shares. The secondary market was also supposed to be of high

volume of shares traded on the main market has risen significantly in the last three years. [18]

Czech Macroeconomic Development

The macroeconomic review covers the time period since 1996 until April 2008. During this period, the country faced both a severe recession and an unexpected long lasting boom. More detailed explanation of the economic cycles described in the following text is accompanied by *Figure 5*, which shows the development of main economic indicators during the whole period.[19]

The year 1996 was one of the years when the economy was seemingly recovering from the transitional recession; however, the Czech Republic had to face the consequences of not too successful privatization. Years 1997–1999 were thus characterized by a new recession, which reached its bottom in 1998. The direct cause of the recession was tightening of fiscal and monetary policies as a response to widening internal and external imbalances and currency crisis at the beginning of 1997. Nevertheless, serious structural deficiencies played a key role in the development. Weak corporate governance both in state controlled banks and in companies leading to excessive credit growth, misguided investments and many other factors can be seen as roots of significant decline in domestic demand (especially fixed investment), external current account deficit, increase of the unemployment rate etc.

The Czech Government took significant measures to enhance the economic climate. The government continued with important domestic reforms and encouraged further trade and investment liberalization, which brought foreign direct investment and increased exports. All this resulted in economic recovery in 2000. The real GDP growth increased in 2000 reaching the value of 3.6% and also other macroeconomic indicators improved. The recovery was accompanied by the increase in labour productivity,

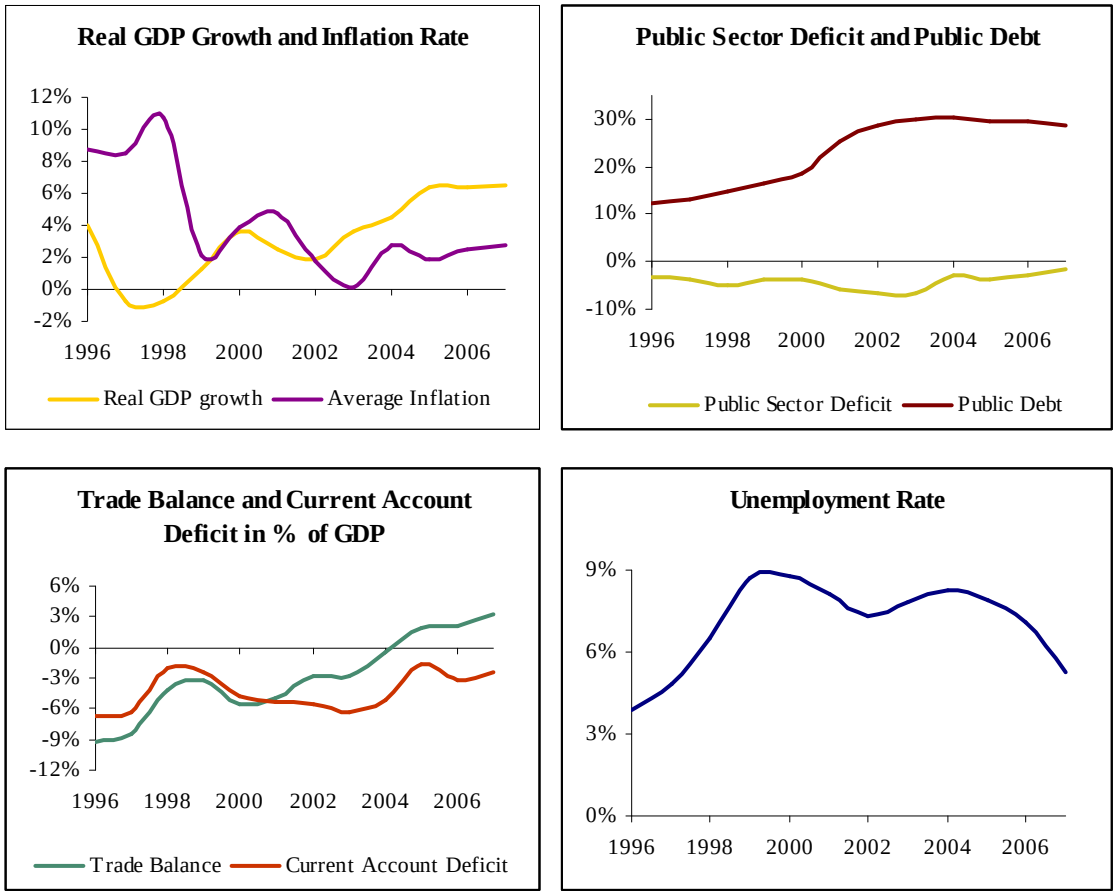
quality, the only difference was the strictness of requirements on companies, which wanted to be listed there. In 2007, these two markets were merged. The free market is intended to be a market for share issues of companies which either do not want to provide a wide range of information as it is necessary on he other two markets or pay higher fees or do not meet the criteria to be listed on the other markets.

[18] For more information about PSE see the website of Prague Stock Exchange, http://www.pse.cz/.

[19] You can find more information on the Czech macroeconomic development for example on websites of Czech National Bank, Ministry of Finance or Ministry of Industry and Trade.

investment demand, decrease in unemployment rate and inflation under control. On the other hand, government and trade deficit increased.

Figure 5: *Macroeconomic Review*



Source: Czech Statistical Office, author's calculations

Increasing GDP, massive inflow of foreign direct investment, increasing domestic demand, decreasing average inflation and unemployment rate characterised the year 2001 as well. However, the economic growth slightly slowed down in 2002. The main causes were global economic growth deceleration and some exceptional influences, in particular fast strengthening of Czech koruna and extensive floods which affected substantial part of the country.

Czech economy has been expanding since 2003. Especially the year 2004 can be considered as a breakthrough as the majority of macroeconomic indicators started to ameliorate. The GDP growth reached a level of 4.5% in 2004, even exceeded 6% in 2005 and remained around 6.5% both in 2006 and 2007. Trade balance has been in surplus since 2005, the unemployment rate has decreased from 8.3% in 2004 to 5.3% in

2007 and also the public deficit had a decreasing tendency. The level of public debt has remained approximately stable around 30% of GDP, which is higher than the average of 15% during the period between 1996 and 2000. Although 30% of GDP still represent a relatively low figure in European comparison, almost stable level of public debt could be perceived as a negative signal. The reason is that the government has not efficiently taken advantage of the extraordinary economic growth during last three years and has not implemented all necessary reforms, which would lead to the improvement of public finances.

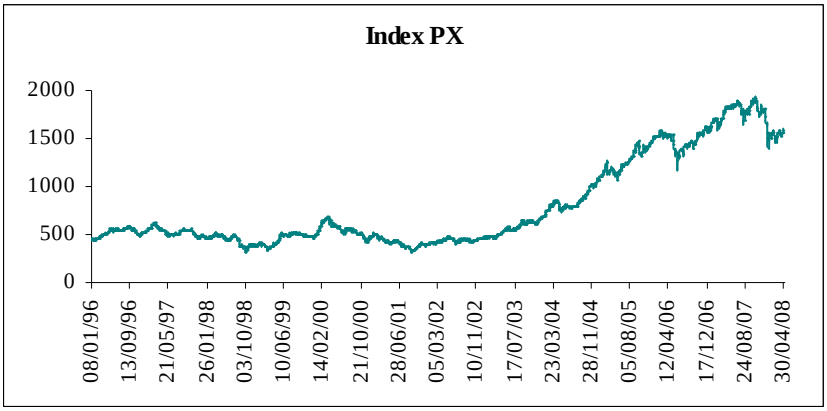
With regard to the sector of non-financial companies, the raise of economic growth in 2003 and 2004 led to improvement in almost all their indicators. Large profitability increase was used by companies to restructure their balance sheets. The improvement on the asset side could be seen particularly in higher liquidity of companies, while a reduction of indebtedness represented the improvement on the liability side. However, the Czech National Bank (2005) pointed out the unresolved structural problems persisting in the Czech industry in parallel with the noticeably positive development of some corporations, mainly the foreign ones, resulting from higher foreign direct investment in the past. On the other hand, the profitability improved in both foreign private corporations and domestic private corporations.

The corporate sector dynamically grew also in the period of 2005–2007. Czech National Bank (2007) attributes the increasing productivity and corporate profitability to past investments, restructurings, foreign direct investment and a related increase in know-how resulted in. Nevertheless, some risks for further financial growth exist. The development of non-financial corporations is most affected by interest rates, exchange rate, domestic economic growth and the economic growth in major trading partners. The examples of current risks are increasing commodity prices and appreciation of the Czech currency. Although prices of oil and metals have been rising since 2004, the profitability of large Czech enterprises has not been much affected. However, long-lasting appreciation of Czech koruna could have a negative impact on corporate financial results since the competitiveness of Czech companies is lowered.

In conclusion, domestic macroeconomic environment with a special focus on non-financial sector has been very favourable during the last years. Nevertheless, the global economic development influenced by the mortgage crisis in the United States

could have certain impact also on the Czech economy.[20] On the other hand, the impact should not be as significant as in countries from the Eurozone. According to predictions of the Ministry of Finance from April 2008, more serious barrier for continuing pace of the economic growth is lack of labour force. Moreover, an increase in consumer prices should reduce household consumption. The predictions of the Ministry of Finance for 2008 are 4.9% for the real GDP growth rate, average inflation rate being at 6%.

Figure 6: *Prague Stock Exchange Equity Index*



Source: Prague Stock Exchange

The development on the PSE is in line with the development of the economic situation. *Figure 6* shows that stock prices were significantly increasing since 2004. The drop in prices at the beginning of 2008 was caused by the market reaction on the extending global slowdown, which started by the mortgage crisis in the U.S. Nevertheless, prices started to rise again in March 2008.

[20] The mortgage crisis was triggered by extending problems of the mortgage market with bad debts. High degree of competitiveness and already big amount of provided credit led to providing subprime mortgages as a way how to extend the sale of credit products. These mortgages were targeted at clients who could not afford it under normal circumstances, which caused much higher credit risk. This risk was not correctly assessed and securitized subprime mortgages were mispriced. These were the main causes of the crisis which influenced the whole U.S. economy. Since the U.S. is among the main world economic players and world financial markets are inter-connected, the impact of the crisis is worldwide.

4.1.2. Structure of Data Sample

Our data sample for model estimation in *Chapter 4.2.3* consists of companies which were listed on the main or secondary market of Prague Stock Exchange at least two consecutive years since 1995 until 2005. All financial institutions (e.g. banks or investment funds) were excluded from the data sample because the valuation methods of these institutions are different from those of non-financial companies. Although the first share issues started to be traded on the PSE in 1994, this year is not included since there are no data available. The data sample used for observation of the model implications in *Chapter 4.3* consists of companies, which were listed on the main market of PSE in 2006, 2007 and at least the first quarter of 2008.

Table 6: *Number of Companies in Data Sample*

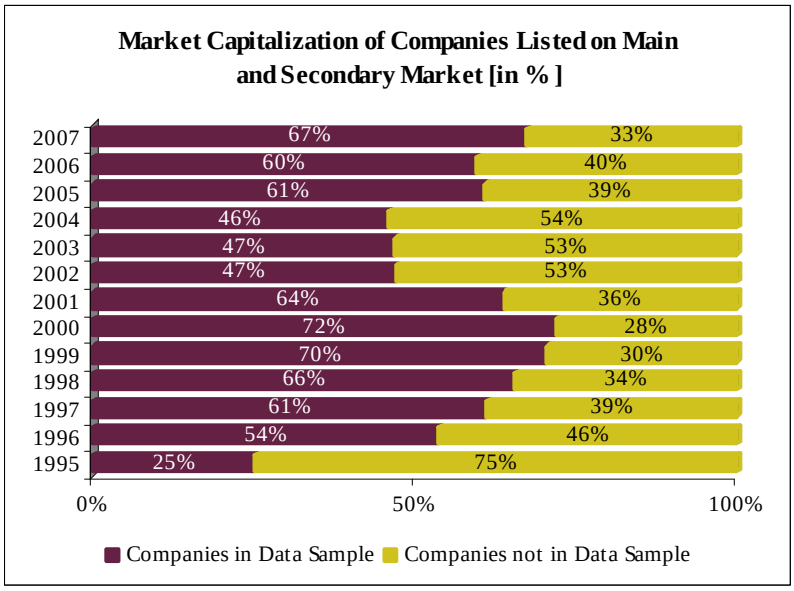
Year	Number of Companies Listed on PSE	Number of Companies in the Data Sample	
		Number	% of Total Number of Companies Listed on PSE
1995	68	10	15 %
1996	96	34	35 %
1997	103	38	37 %
1998	106	36	34 %
1999	89	35	39 %
2000	65	33	51 %
2001	53	33	62 %
2002	46	32	70 %
2003	39	28	72 %
2004	35	22	63 %
2005	27	17	63 %
2006	21	14	67 %
Total	**748**	**332**	**44 %**

Source: Fact Books of Prague Stock Exchange, author's calculations

Two sources of the financial data from annual reports were used: databases Thomson ONE Banker and Bloomberg. Other sources of information for this chapter were Fact Books of the PSE, the Czech Statistical Office and Financial Stability Reports of the Czech National Bank. Our sample was created from companies which had at least one data item available at one of the two databases. The total number of companies

in our data sample for each year is shown in *Table 6*. The observations from years 1995–2005 were used for model estimation, the data from 2006 were used in order to test the model. The average number of companies in the data sample was 28 per year. The total number of observations, for which financial statement information from the databases mentioned above were used, was 332. 318 observations were used for the estimation of the model and 14 observations for testing the model.

Figure 7: *Share of Capitalization of Companies Included in Data Sample on Total Capitalization of Companies Listed on Main and Secondary Market of PSE (in %)*

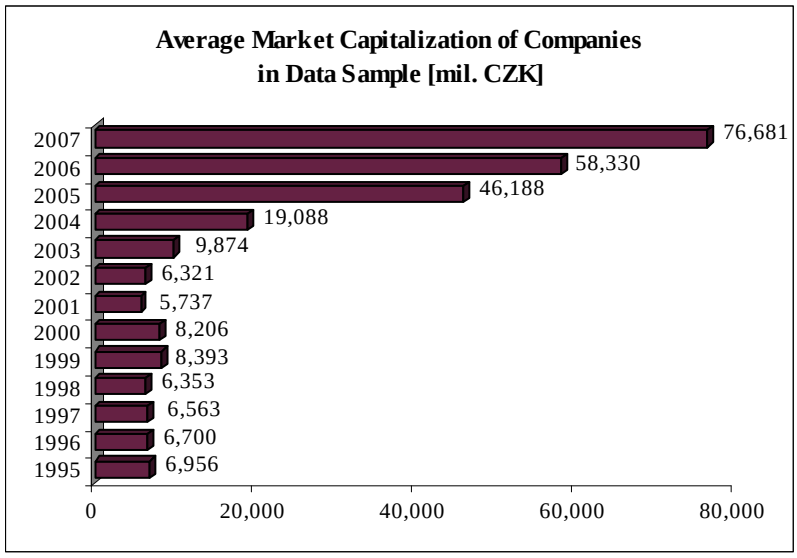


Source: Fact Books of Prague Stock Exchange, author's calculations

As shown in *Figure 7*, the total capitalization of companies in our data sample was more than 50% of the total capitalization of companies listed on the main and secondary market in 9 from 13 years. This fact should ensure the representativeness of our data sample in relation to the PSE; however, the sample representativeness in relation to Czech economy is discussed later in this chapter.

Figure 8 shows the average capitalization of companies in the data sample in each year. We can see that the average capitalization has significantly increased mainly during the last four years. This could be explained in particular by economic expansion in the Czech Republic during recent years associated and by much better reputation of the PSE. The interest of big companies to get listed there has thus significantly increased.

Figure 8: *Average Capitalization of Companies Included in Data Sample*

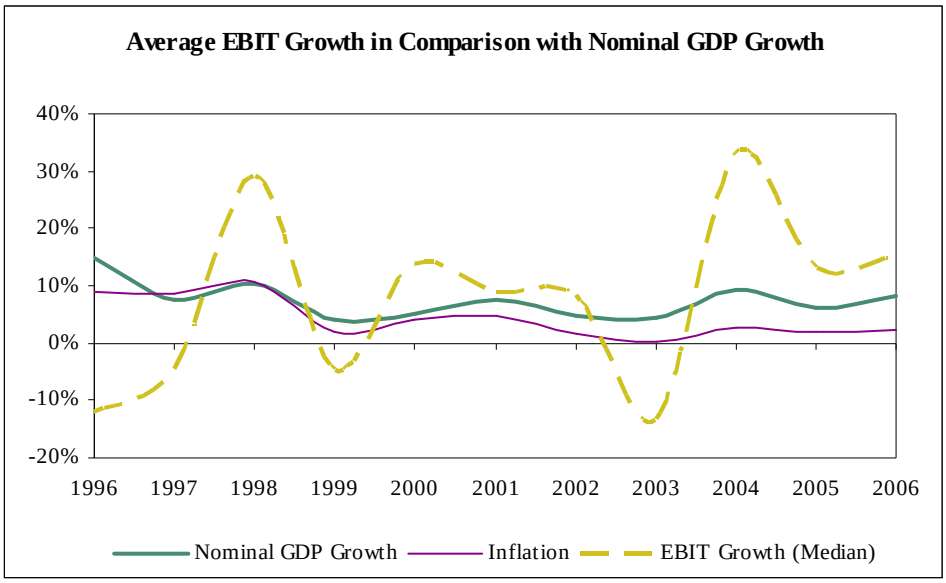


Source: Fact Books of Prague Stock Exchange, author's calculations

Financial health of an average firm in our data sample is briefly described using the following figures. A median of values was used rather than an average in order to avoid the bias given by existence of extreme values. Observations for the year 2007 were not included because they are not employed in our estimations either. It is important to keep in mind that the sample does not consist of the same number of companies each year.

We can see the comparison between an average EBIT growth in our data sample with nominal GDP growth in *Figure 9*. Basically, both indicators follow a similar trend, the EBIT growth being more volatile. The trend difference between 1996 and 1997 could be explained by the structure of our data sample. During these years, very small illiquid companies were listed on the PSE and the majority of them were de-listed in 1997 how it was described above. Thus, these companies cannot be considered as a representative sample for the Czech economy. This has changed mainly during the last few years when the number of companies on the main and secondary market has stabilized and their market capitalization has considerably increased. The trend in annual average inflation which has radically dropped after 1998 provides an idea about real values of both indicators.

Figure 9: *Comparison of EBIT Growth of Average Company in Data Sample with GDP Growth*



Source: Czech Statistical Office, Thomson ONE Banker, Bloomberg, author's calculations

Table 7: *Number of Companies According to Increase or Decrease of Earnings*

Year	Earnings Increase		Earnings Decrease	
	Number	%	Number	%
1996	2	20 %	8	80 %
1997	15	44 %	19	56 %
1998	21	55 %	17	45 %
1999	23	64 %	13	36 %
2000	19	54 %	16	46 %
2001	21	64 %	12	36 %
2002	19	58 %	14	42 %
2003	21	66 %	11	34 %
2004	18	64 %	10	36 %
2005	14	64 %	8	36 %
2006	11	65 %	6	35 %
Total	**185**	**58 %**	**133**	**42 %**

Source: Author's calculations

When the frequency of earnings increases and earnings decreases in individual firms from the data sample is observed for each year, we can see in *Table 7* that

earnings increase dominated in 9 from 11 years.[21] On average, earnings increased in 58% of cases.

Table 8 shows minimal, maximal and average values of all financial ratios which were used for the model estimation. Definitions of the ratios are given in *Table 9*. Minimal and maximal values of some of the ratios significantly differ, which shows the heterogeneity of companies.

Table 8: *Minimum, Maximum and Median of Ratios Used in Model*

Financial Ratio	Minimum[22]	Maximum[23]	Median
Current ratio	0.46	3.44	1.02
Quick ratio	0.10	2.27	0.56
Cash ratio	0.01	1.37	0.16
Debt ratio	0.23	0.77	0.48
Debt-to-equity ratio	0.29	3.12	0.94
Capitalization ratio	0.00	0.42	0.09
LT debt to equity ratio	0.00	0.74	0.09
Interest coverage ratio	- 2.54	90.80	4.57
Equity to fixed assets ratio	0.42	1.59	0.83
Net profit margin	- 0.12	0.15	0.04
Operating income margin	- 0.13	0.21	0.05
Return on assets	- 0.12	0.11	0.04
Return on equity	- 0.22	0.15	0.06
Receivables turnover	2.70	39.82	8.36
Inventory turnover	3.33	706.73	32.10
Accounts payable to sales ratio	0.04	0.49	0.12
Asset turnover	0.29	1.59	0.84
Sales to working capital ratio	- 52.98	54.38	1.86
Fixed assets turnover	0.36	5.28	1.47
Cash flow to long-term debt ratio	0.02	82.48	2.49
Operating cash flow ratio	- 0.02	1.78	0.34
Operating cash flow to net income	- 3.08	13.39	2.49

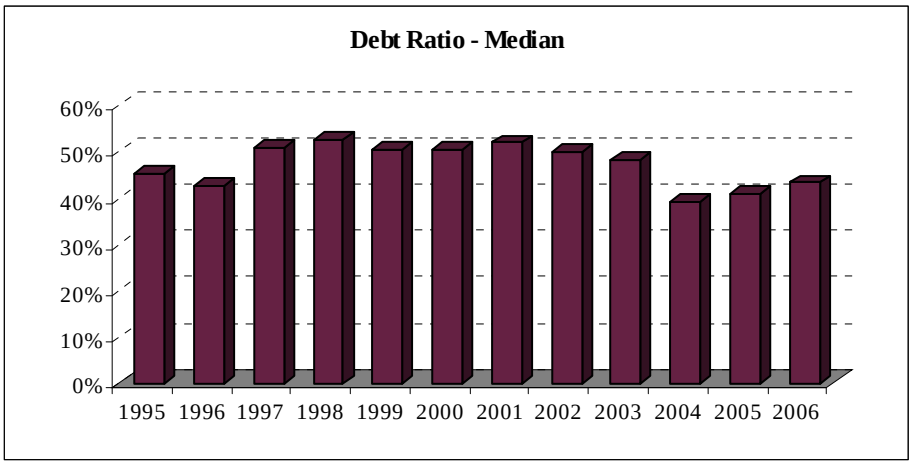
Source: Author's calculations

The median of debt ratio, which was defined as total liabilities divided by total assets, in the data sample can be seen in *Figure 10*. The debt ratio has stayed between

[21] Earnings increase/decrease was calculated using equation 4.2.
[22] Minimum was calculated as a median of 0.10-quantile.
[23] Maximum was calculated as a median of 0.90-quantile.

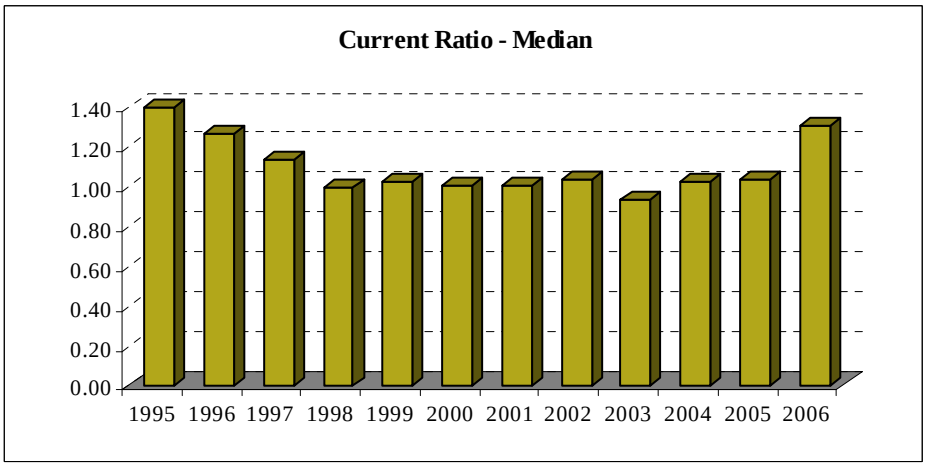
38% and 52% for the whole period. Between 1997 and 2002, the share of debt and equity on total assets stayed approximately equal. Since that time the debt ratio has decreased and remained around 40%. This means that equity financing is used slightly more than debt financing. The development of this ratio corresponds quite well to the macroeconomic situation. The share of debt increased in 1997 and reached the highest value in 1998 when the country was facing the bottom of the recession. On the other hand, the debt considerably decreased in 2004, the first year of extraordinary economic growth, and increased only slowly until 2006.

Figure 10: *Debt Ratio of Average Company in Data Sample (Median)*



Source: Thomson ONE Banker, Bloomberg, author's calculations

Figure 11: *Current Ratio of Average Company in Data Sample (Median)*



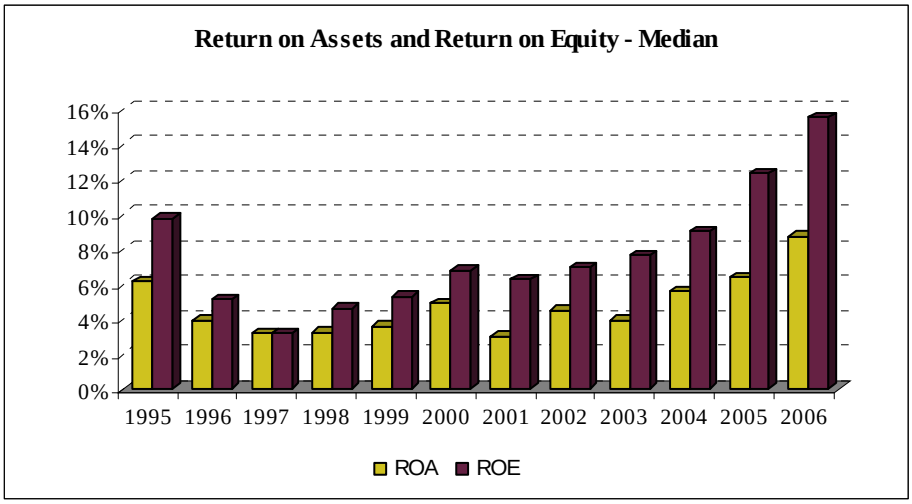
Source: Thomson ONE Banker, Bloomberg, author's calculations

Also values of current ratio defined as current assets divided by current liabilities basically reflect the macroeconomic evolution described above. *Figure 11*

shows that the ratio stayed around one during eight years (since 1997 until 2005) getting under the threshold of one in 1998 and 2003. This lack of liquidity can be related to the recession, which started in 1997 and economic slowdown in 2002. The average liquidity has not reached a satisfactory value until 2006. Nevertheless, it is supposed to stay high since the economic growth persists.

Figure 12 describes an average profitability of our data sample. Both return on assets and return on equity follow the development of main macroeconomic indicators. A significant growth of both indicators since 2004 is a positive sign and indicates the expansion of the economy, particularly of non-financial sector.

Figure 12: *Average Return on Assets and Return on Equity in Data Sample (Median)*



Source: Thomson ONE Banker, Bloomberg, author's calculations

Concluding all the information from the figures shown above, we can say that the average financial health of companies in the data sample has improved. Companies are less indebted but still taking advantage of financial leverage, liquidity has raised and profitability ratios have an increasing tendency, too.

4.2. Model Estimation

As was already described in *Chapter 3.1*, financial statement analysis is widely used as a tool for evaluation of companies. A lot of textbooks aiming at describing the calculation of financial ratios can be found; nevertheless, the way how to analyze them is not clear. Therefore, we tried to find a measure summarizing information in financial statements, which is important for prediction of future earnings. The way how the measure was estimated is described in this chapter. The following *Chapter 4.3* then shows how the measure was used for setting an investment strategy and returns from this strategy are observed.

4.2.1. Model Methodology

Our model stems from the work of Ou and Penman (1989a) and follows their main steps in determining the measure. This enables us to compare our results focusing on the Czech capital market with results of Ou and Penman, who used data from the U.S. capital market.

A simple valuation model is considered:

$$V_0 = \frac{D_1}{r}, \tag{4.1}$$

which is a special case of equation (3.1) using dividends as the cash flow and assuming that r represents cost of equity and g is equal to zero. Both expected future dividends (D_1) and discount rate (r) could be an object of our interest. Either we could focus on the numerator of (4.1) and seek for accounting attributes, which indicate positive-value expected payoffs or we could focus on the denominator of (4) and try to find its negative-value risk characteristics as r reflects security risk.

We use the first approach, therefore, our aim is to identify financial statement attributes, which are correlated with future dividend payoffs.[24] Using this approach we face a risk that our measure will reflect the security risk. However, we will assume that this possibility is very low based on findings of Ou and Penman (1989a).

[24] The second approach was used for example by Lintner (1965) or Beaver et al. (1970).

Now the task is to identify the payoff indicators in financial statements. The problem is that we cannot consider their correlation with future dividends directly because we are not able to observe the full set of dividend payouts. Moreover, not all the companies have paid out dividends during the period under the consideration, which would misrepresent our results. The possible way how to overcome this problem seems to be the use of earnings instead of dividends.

The importance of earnings and their correlation with stock returns was already described in *Chapter 3.3*; furthermore, we assume that future dividends are "paid out of earnings" (Ou and Penman, 1989a, p. 298). Therefore, we consider future earnings to be a good substitute for future dividends and we use them as a dependent variable in our model. Based on our assumption of the value-relevance of future earnings, we identify financial descriptors that are able to predict earnings. In our model, just one-year-ahead earnings are considered; we thus use a conservative approach.

Our dependent variable is defined as a binary outcome – earnings increase (indicated as 1) and earnings decrease (indicated as 0). The change in earnings is given by a difference between deflated earnings per share in year t +1 (EPS_{t+1}) and earnings per share in year t (EPS_t). The dependent variable is represented by following formula:

$$y_{i,t} = 1 \qquad \text{if} \quad y^*_{i,t} = \frac{EPS_{i,t+1}}{1+\pi} - EPS_{i,t} > 0\,, \tag{4.2}$$

$$y_{i,t} = 0 \qquad \text{if} \quad y^*_{i,t} = \frac{EPS_{i,t+1}}{1+\pi} - EPS_{i,t} \leq 0\,,\ i = 1,...,N\,;\ \ t = 1,...,T$$

with i denoting firms in out data sample, t denoting time and π denoting the level of inflation.

If the level of inflation remained stable during the period it would not be necessary to consider it when defining the dependent variable. However, as can be seen in *Figure 9*, the inflation in the Czech Republic was significantly moving in the range between 0.1 and 10.7 during the period, which had a large impact on the real values of earnings. Furthermore, we could subtract a drift from the difference between earnings in order to take out the firm specific trend. One way how to define a drift could be to compute a mean EPS change over a specific number of years prior to year t + 1. For example Ou and Penman (1989a) use a 4-year period. We do not consider any drift because of a limited number of observations given by the character and history of the

PSE described above. However, research in this area could go further in the following years, when more data will be available, and extend our work.

Having binary dependent variable, we use a logit model for our estimations. Using logistic regression, it is assumed that the explanatory variables, which are multiplied by the relevant coefficients, are linearly related to the natural logarithm of the probability of earnings increase divided by the probability of earnings decrease:

$$\ln\frac{P}{1-P} = \alpha + X_i^T\beta\,,\quad i = 1,...,N\,, \tag{4.3}$$

$$X_i = \left(X_{i,1},...,X_{i,K}\right)^T,\ \beta = \left(\beta_1,...,\beta_K\right),$$

with P denoting the probability of one-year-ahead earnings increase, i denoting firms in our data sample, α denoting a constant, which reflects the effects not involved by explanatory variables, β denoting the coefficients of individual explanatory variables and X_i denoting the ith observation on K explanatory variables.

Equation (4.3) can be used to derive the relationship for the probability of earnings increase:

$$P_i = P\left(y_i = 1\right) = F\left(X_i^T\beta\right) = \frac{1}{1+\exp\left(-\alpha - X_i^T\beta\right)},\ i = 1,...,N \tag{4.4}$$

Explanatory variables are represented by individual financial ratios described in *Chapter 4.2.2*. Using this model we will estimate the probability P_i of earnings increase in the subsequent years. In other words, P_i will be the tool for assessment of the relative ability of different firms to generate earnings in the future. Data used in the logit model are pooled over firms and time in order to gain more information to the estimates of the parameters from a limited number of observations.

The selection of relevant financial ratios leading to determination of the P_i measure is done in three steps:

A) Univariate regression

B) Multivariate regression

C) Likelihood ratio test (LR test)

A) Each financial descriptor is included in the logit model as a sole explanatory variable (K = 1). We look at the significance of coefficient estimates at the 10% significance level. We exclude those explanatory variables, whose coefficient estimates are insignificant.

B) All financial ratios, which were not dropped in step A are included in the multivariate LOGIT model. We drop variables, for which coefficient estimates are not significant at the 10% significance level.

C) Each of the remaining variables is investigated step-wise using LR test. We test the hypothesis that the coefficient estimate is significant. If we reject the null hypothesis, the variable is excluded.

Two different approaches are taken when estimating the model, which leads to two parallel lines of the three steps A-C described above:

I. We follow the motto of Ou and Penman (1989a, p. 300): "Let the data speak". No assumptions about the relationship between future earnings and individual financial ratios are made in the model.

II. We identify the theoretical impact of individual financial ratios on future earnings (positive or negative). If the dependency of the future earnings on a financial ratio is not monotonous, we transform the data using a created function in order to uniquely determine the impact. These modified data are then used in the model.

4.2.2. Explanatory Variables

The problem of non existence of a general consensus on the ideal method for analysing financial statement information has been already mentioned in *Chapter 3.1.2.* Different authors present various approaches to analysis of financial indicators in Czech literature and foreign one as well. However, in order to include all the important financial ratios for the purpose of our study, we compared the breakdown of relative indicators presented both in theoretical books (especially Damodaran, 2001; Brealey et al., 2006; Bláha and Jindřichovská, 2006; Kislingerova, 2001) and in empirical studies (especially Ou and Penman, 1989a, focusing on the estimation of probability of earnings increase, or Jakubík and Teplý, 2008, focusing on the estimation of the probability of default) and we finally chose 20 financial ratios. These financial ratios are divided into 5 groups: liquidity ratios, financial leverage ratios, profitability ratios, efficiency ratios and cash flow ratios. All ratios including their definition and the theoretical impact on future earnings are shown in the following table.

Table 9: *Financial Ratios Used as Explanatory Variables in Model*

Name	Definition	Symbol	Exp. Impact
Liquidity ratios			
Current ratio	$\frac{\text{Current assets}}{\text{Current liabilities}}$	r_1	+
Quick ratio	$\frac{\text{Cash} + \text{Marketable securities} + \text{Accounts receivable}}{\text{Current liabilities}}$	r_2	+
Cash ratio	$\frac{\text{Cash} + \text{Marketable securities}}{\text{Current liabilities}}$	r_3	+
Financial leverage ratios			
Debt ratio	$\frac{\text{Total liabilities}}{\text{Total assets}}$	r_4	+
Debt-to-equity ratio	$\frac{\text{Total liabilities}}{\text{Total equity}}$	r_5	+
Interest coverage ratio	$\frac{\text{EBIT}}{\text{Interest expense}}$	r_6	+
Equity to fixed assets ratio	$\frac{\text{Total equity}}{\text{Fixed assets}}$	r_7	+
Profitability ratios			
Net profit margin	$\frac{\text{Net income}}{\text{Net sales}}$	r_8	+
Operating income margin	$\frac{\text{Operating income}}{\text{Net Sales}}$	r_9	+
Return on assets	$\frac{\text{Operating income}}{\text{Total assets}}$	r_{10}	+
Return on equity	$\frac{\text{Net income}}{\text{Total equity}}$	r_{11}	+
Efficiency ratios			
Receivables turnover	$\frac{\text{Net sales}}{\text{Accounts receivable}}$	r_{12}	+
Inventory turnover	$\frac{\text{Net sales}}{\text{Average inventory}}$	r_{13}	+
Accounts payable to sales ratio	$\frac{\text{Accounts payables}}{\text{Net sales}}$	r_{14}	+
Asset turnover	$\frac{\text{Net sales}}{\text{Total assets}}$	r_{15}	+
Sales to working capital ratio	$\frac{\text{Net sales}}{\text{Working capital}}$	r_{16}	+
Fixed assets turnover	$\frac{\text{Net sales}}{\text{Fixed assets}}$	r_{17}	+

Cash flow ratios			
Cash flow to long-term debt ratio	$\frac{\text{Cash flow from operations}}{\text{Long - term debt}}$	r_{18}	+
Operating cash flow ratio	$\frac{\text{Cash flow from operations}}{\text{Current liabilities}}$	r_{19}	+
Operating cash flow to net income ratio	$\frac{\text{Cash flow from operations}}{\text{Net income}}$	r_{20}	+

Based on empirical evidence, we cannot assume that earnings are monotonously dependent on all types of ratios. Therefore, we tried to identify the hypothetical ideal value in relation to future earnings in case those ratios which are not monotonously dependent on future earnings and we determined functions $y = f(x)$, so that each value of the ratio was transformed into a number from an interval $[0,1]$. These transformation functions were constructed regarding our data. Therefore, if the functions were used for a different data sample, extreme values should not be transformed using these functions but should be assumed to be zero.

We are aware that the analysis of financial ratios depends to a certain extent on a particularity of a given sector and company itself. However, we believe that we are able to identify general dependencies of future earnings and individual financial ratios using empirical evidence. By comparing results from logit regressions between the model using the approach I and II, we will be able to answer a question if the use of transformation functions improves the model results or not.

Liquidity Ratios

Generally, liquidity (r_1, r_2 and r_3) is supposed to have a positive impact on future earnings. The reason is that they evaluate the company's ability to pay off its short-term debt obligations and the better the ability, the better the prospects of the company. Nevertheless, the relation between liquidity and earnings is not monotonous. If the company’s liquidity is too high, it could be a signal that the company does not use

its cash effectively or that a poor collection program for accounts receivable is implemented.[25]

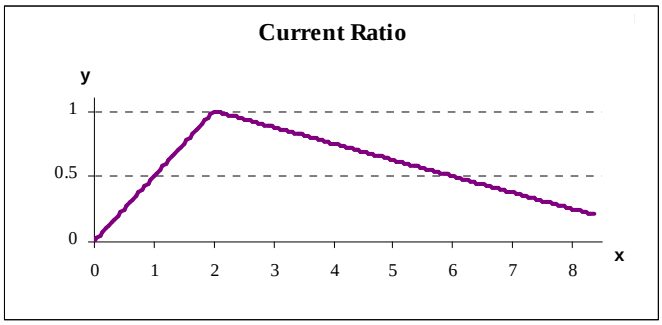
Current ratio (r_1) should be at least one, which means that current assets should cover current liabilities by at least 100%. However, the ideal value is supposed to be two. This provides a shield to the inventory. Therefore, we transformed the values of this ratio using following simple functions:

$$y = \frac{x}{2} \qquad \text{if } 0 \le x \le 2 \tag{4.5}$$

$$y = -\frac{(x - 2)}{8} + 1 \qquad \text{if } x \ge 2$$

The course of the transformation function is shown in *Figure 13*.

Figure 13: *Transformation Function for Values of Current Ratio*



Source: Author's calculations

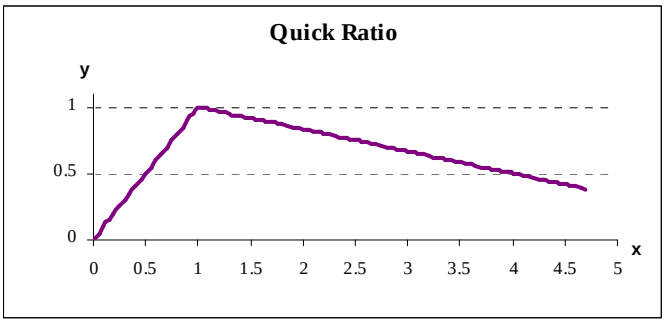
Quick ratio (r_2) is similar to current ratio with a difference that inventories are not taken into account and thus the value, which is considered to be a norm is lower than in case of current ratio – generally referred is 1. In this case the company does not have to rely on sale of inventory to pay the short-term debts. The transformation function is as follows:

$$y = x \qquad \text{if } 0 \le x \le 1 \tag{4.6}$$

$$y = -\frac{(x - 1)}{6} + 1 \qquad \text{if } x \ge 1$$

[25] The ideal values of liquidity ratios used in the transformation functions are in conformity with a practical experience of several institutions – see for example Missouri Small Business Development Centers, http://www.missouribusiness.net or Bizwiz Consulting, http://www.bizwiz.ca. We keep in mind that an industry average may be a better standard. However, the industry average cannot be used because companies listed on the PSE come from different sectors and we need to have one universal rule.

Figure 14: *Transformation Function for Values of Quick Ratio*



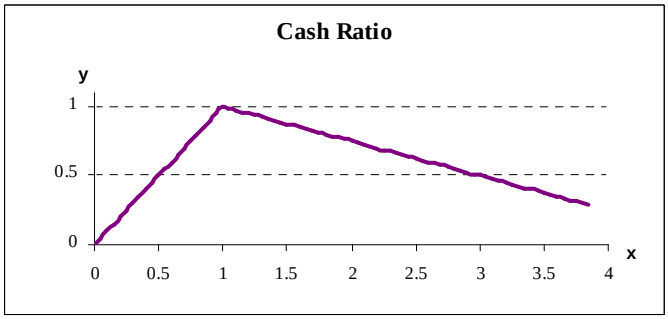
Source: Author's calculations

There does not exist any theoretical ideal value, which would help to assess the value of cash ratio (r_3) as in case of the two previous liquidity ratios. Nevertheless, we assume that the transformation could be similar to that of quick ratio, the optimal value being one which means that cash and marketable securities cover all current liabilities. The transformation function for values of cash ratio is shown below:

$$y = x \qquad \text{if } 0 \le x \le 1 \tag{4.7}$$

$$y = -\frac{(x-1)}{4} + 1 \qquad \text{if } x \ge 1$$

Figure 15: *Transformation Function for Values of Cash Ratio*



Source: Author's calculations

Financial Leverage Ratios

Financial leverage is one of the most complicated topics, which are discussed when analyzing companies' financial statements. Already Modigliani and Miller (1958) were studying the importance of capital structure in relation to the market value of a company in the middle of the last century. They came into conclusion that the company's value is independent of its capital structure. They agreed that borrowing

increases an expected rate of return of company's shareholders; however, this increase in expected return is compensated by an increase of a risk of shares. All this holds under the assumption of perfect capital markets.

This assumption was criticized by opponents of Modigliani and Miller, who pointed out that imperfections of capital market make borrowing more expensive and riskier, which creates a clientele, who offers a premium for such shares. The company should borrow to gain this premium. The problem of this theory is that this clientele must be unsatisfied, which is not true.

We stem from the theory of Modigliani and Miller but we add more factors: taxes and cost of financial distress. These factors ensure that capital structure becomes relevant for the company's value. The advantage of debt financing is represented by a tax shield.[26] On the other hand, the cost of financial distress must be also considered, which has a negative impact on the company's value.[27] There is no easy way how to find an optimal capital structure; nevertheless, a general way how to identify the relation between capital structure and future earnings can be determined.

We assume in our model that neither no debt nor too much debt is good for the company. The reason is that if company uses only equity financing, it does not take an advantage of the tax shield. On the other hand, if company uses only debt financing, the cost of financial distress is too high.

Therefore, a theoretical optimal value of debt ratio (r_4) is assumed to be 0.5.[28] The transformation function is following:

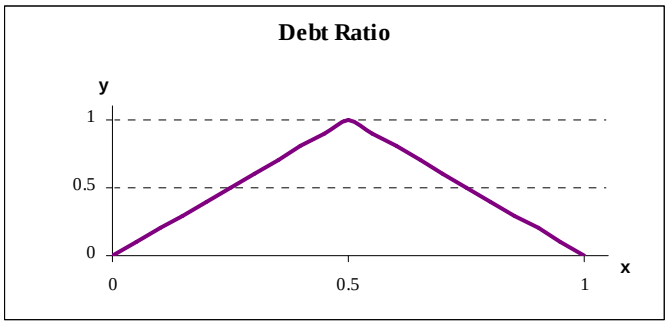
$$\begin{aligned} y &= x && \text{if } 0 \le x \le 0.5 \\ y &= -2x + 2 && \text{if } 0.5 \le x \le 1 \end{aligned} \qquad (4.8)$$

[26] A tax shield is a reduction in income taxes which results from taking an interest on debt as a tax deductible expense from taxable income.

[27] Financial distress is a situation when a company does not meet its obligations to creditors or meet them with difficulties. The costs of financial distress can be for example conflicts of interest between company's bondholders and shareholders, costs of reorganization, court charges in case a bankruptcy etc.

[28] Kislingerová (2001, p. 73): "It is commonly recommended to maintain the proportion between liabilities and equity in a rate of 1:1, in disregard of a business line."

Figure 16: *Transformation Function for Values of Debt Ratio*

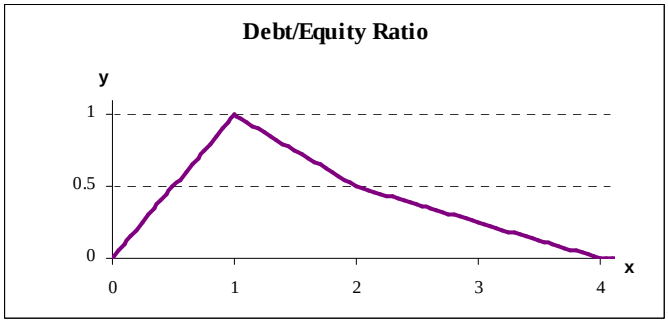


Source: Author's calculations

Debt to equity ratio (r_5) is similar to debt ratio. Both ratios increase with raising amount of debt in the capital structure. The difference is that debt ratio can reach values between 0 and 1, while debt to equity ratio increases exponentially with a limit in infinity. In relation to the transformation function for debt ratio, we assume that the value of debt to equity ratio should remain between 0.5 and 2 depending on a type of the sector. We use the following function to transform the values of this ratio:

$$\begin{aligned} y &= x && \text{if } 0 \le x \le 1 \\ y &= -\frac{1}{2}(x-1)+1 && \text{if } 1 \le x \le 2 \\ y &= -\frac{x}{4}+1 && \text{if } 2 \le x \le 4 \\ y &= 0 && \text{if } y > 4 \end{aligned} \qquad (4.9)$$

Figure 17: *Transformation Function for Values of Debt/Equity Ratio*



Source: Author's calculations

Interest coverage ratio (r_6) is supposed to be monotonously correlated with future earnings. The higher the ratio, more secure the lenders are because the company generates sufficient revenues to satisfy interest expenses. The same is assumed to hold

for equity to fixed assets ratio (r_{10}). The increasing ratio shows that more fixed assets are covered by equity and not by debt (if the ratio is below one) or that all fixed assets are covered by equity by higher rate (if the ratio is higher than one).

Profitability Ratios

Profitability is generally supposed to have a positive impact on future earnings. Higher profitability implies higher probability that a company will generate positive earnings also in the future. We assume that the dependence between profitability ratios ($r_8 - r_{11}$) and future earnings is approximately monotonous.

Efficiency Ratios

We can say, in general, that lower efficiency implies lower probability of high future earnings because from the financial point of view, a company should generate earnings using a minimum amount of sources. Efficiency ratios in our model are supposed to be positively dependent on future earnings. Both efficient collection of accounts receivables (increasing r_{12}), efficient use of total assets or more specifically fixed assets in generating sales or revenue (increasing r_{15} and r_{17}), small amount of redundant illiquid inventories (increasing r_{13}), the ability to obtain cost-free short-term credit (increasing r_{14}) and a minimal amount of cash required to maintain a certain level of sales (increasing r_{16}) are assumed to imply higher future earnings. We assume that the relation between values of efficiency ratios and future earnings is monotonous.

Although we assume the monotonous relation between efficiency ratios and future earnings, such dependency is not always ambiguous. We can take as an example sales to working capital ratio (r_{16}). A very high turnover could indicate a sign of over-trading and could have a negative influence on potential creditors. However, we are not able to determine either the ideal value of this indicator or the threshold, where the level could become a negative sign for future earnings.[29] As this problem concerns only extreme values, we will assume it to be insignificant for our model.

[29] In practice, it is mostly done by comparing the value with an average of the sector.

Cash Flow Ratios

All three cash flow ratios, which were chosen, have a similar impact on future earnings: increasing ratios should indicate a positive change in future earning. The ability of available funds to pay obligations (increasing r_{18}), net income to generate cash in a business (increasing r_{20}) or cash flow to cover current liabilities (increasing r_{19}) is assumed to be monotonously dependent on development of future earnings.

4.2.3. Model Calibration

In this chapter, the probability P_i from equation (4.4) is estimated, which is then used as a tool for examination if financial statement indicators capture information, which is not reflected in prices in environment of the Czech capital market. The final probability of future earnings increase is estimated in three steps as was already described in *Chapter 4.2.1*. Firstly, univariate regression is done, multivariate regression represents a step B and finally, LR test is used to decide if all ratios, whose coefficient estimates were significant in step B are really significant.

All logit model estimations were calculated using Statistics/Data Analysis software (STATA), version 8.0.

Step A: Univariate Regression

In this step, each financial indicator is included as a sole explanatory variable in a logit model. This means that K from equation (4.4) representing the number of explanatory variables is equal to 1. The number of companies, N, differs depending on a concrete financial ratio (represented by *number of groups* in *Table 10*). The reason is that data from databases, which were used to collect financial information from annual reports are not complete for all companies in all years. The number of companies differs from 46 to 55, while the number of observations varies from 205 to 317.

Table 10: *Results from Univariate Regression Using Approach I*

Explanatory Variable		N° of Groups	N° of Obs.	Coeff.	Standard Error	P-value
Current ratio	**r_1**	**55**	**314**	**- 0.3909114**	**0.1261900**	**0.002**
Quick ratio	**r_2**	**55**	**314**	**- 0.4002387**	**0.1591843**	**0.012**
Cash ratio	r_3	55	314	- 0.3324880	0.2048418	0.105
Debt ratio	r_4	55	315	0.4127722	0.6848432	0.547
Debt-to-equity ratio	r_5	55	315	0.0150957	0.0505761	0.765
Interest coverage ratio	r_6	53	271	-0.0012919	0.0022684	0.569
Equity to fixed assets ratio	**r_7**	**55**	**315**	**-0.8446065**	**0.3305090**	**0.011**
Net profit margin	r_8	55	317	0.0466686	0.4337425	0.914
Operating income margin	r_9	53	295	-0.7353629	1.0303480	0.475
Return on assets	r_{10}	53	295	0.1317845	0.9660667	0.891
Return on equity	**r_{11}**	**55**	**315**	**-1.7441900**	**0.8440015**	**0.039**
Receivables turnover	**r_{12}**	**55**	**317**	**0.0258197**	**0.0102273**	**0.012**
Inventory turnover	r_{13}	54	306	0.0003493	0.0007012	0.618
Accounts payable to sales ratio	r_{14}	51	282	-1.2725260	0.7977095	0.111
Asset turnover	r_{15}	55	317	0.1549205	0.2850343	0.587
Sales to working capital ratio	**r_{16}**	**55**	**309**	**-0.0029850**	**0.0017771**	**0.093**
Fixed assets turnover	**r_{17}**	**55**	**317**	**-0.0464341**	**0.0258528**	**0.072**
Cash flow to long-term debt ratio	r_{18}	46	205	0.0011817	0.0014982	0.430
Operating cash flow ratio	r_{19}	50	257	-0.2970133	0.1972550	0.132
Operating cash flow to net income ratio	r_{20}	50	259	-0.0067186	0.0079413	0.398

Source: Author's calculations

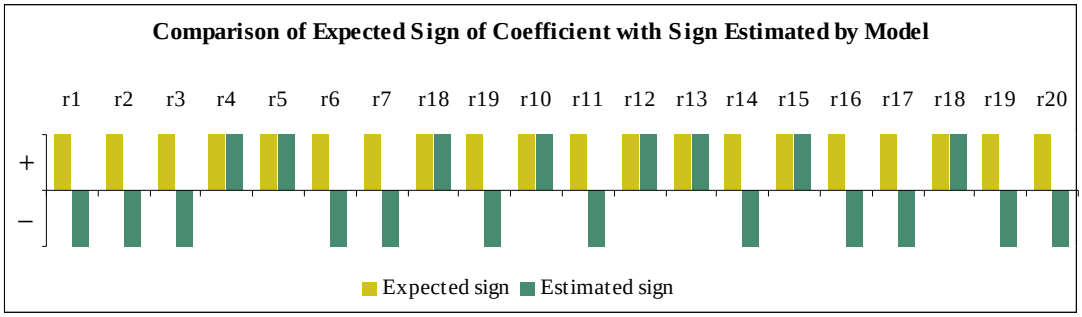
Results from the univariate regression are shown in the following table. These are results when using approach I from *Chapter 4.2.1*. Therefore, collected data are used in the regression without any modifications. How can be seen in the table, seven coefficient estimates from the total 22 are significant at a 10% significance level. This means that the p-value in the last column is less or equal to 0.1. It thus seems that following ratios could capture information about future earnings: 2 liquidity ratios,

1 financial leverage ratio, 1 profitability ratio and 3 efficiency ratios. The most significant coefficient estimates seem to be the estimates of current ratio, equity to fixed assets ratio, return on equity and quick ratio.

On the other hand, none of the coefficient estimate of cash flow ratios is significant. One possible explanation is that cash flow is not a relevant indicator for prediction of future earnings. However, more probable explanation will be that the data sample in the case of cash flow ratios is not robust enough. The number of observations is the lowest one in comparison to other ratios in case of all three ratios.

If we compare signs of the coefficient estimates with our expectations, we can see in *Figure 18* that our expectations differ from the model results in approximately 60%. Only one coefficient estimate, which is significant, receivables turnover, has the same sign as we expected. This fact could stem from the character of our data sample. The data sample is relatively small and covers the transition period in the Czech Republic. This caused that even companies with negative shareholders' equity were listed on the stock exchange after its creation. The quality of the data can thus be questioned. On the other hand, the signs of coefficient estimates of Ou and Penman (1989a), whose model is applied to much larger data sample than our model (in order of tens of thousands of observations in comparison to our order of hundreds of observations) do not always correspond to the expectations either.

Figure 18: *Comparison of Expect Sign of Coefficient with Sign of Coefficient Estimated by Model*



Source: Author's calculations

As we can see above, the expectations do not correspond to the model estimated in more than half of the cases. *Table 11* summarizes results from univariate regressions using approach II. Values of financial ratios were modified in case when future earnings cannot be assumed to be monotonously dependent on values of financial indicators

based on empirical evidence. We identified five such cases: all three liquidity ratios and two financial leverage ratios.

When we look at liquidity ratios (r_1, r_2, r_3) and the results from the regression, we can see that the transformation of values did not improve the results, moreover, p-values significantly increased, especially in case of quick ratio (r_2) and cash ratio (r_3). Also standard errors are much higher in the case of transformed values.

On the contrary, using transformed values of debt ratio (r_4) and debt/equity ratio (r_5) seems to have a positive impact on the p-values. The coefficient estimates are still not significance but the p-value decreased more than two times in case of debt ratio and more than five times in case of debt/equity ratio. Signs of the coefficient remained the same in four cases; however, the sign of coefficient estimate of debt/equity has changed and does not correspond to our expectations.

Table 11: *Results from Univariate Regression Using Approach II in Comparison Approach I*

Explanatory Variable		Coefficient	Standard Error	P-value
Name	**Symbol**			
Current ratio	r_1	- 0.3909114	0.1261900	0.002
	r_1 modified	- 1.4969810	0.5417158	0.006
Quick ratio	r_2	- 0.4002387	0.1591843	0.012
	r_2 modified	- 0.7293574	0.4185678	0.081
Cash ratio	r_3	- 0.3324880	0.2048418	0.105
	r_3 modified	- 0.3113418	0.4177422	0.456
Debt ratio	r_4	0.4127722	0.6848432	0.547
	r_4 modified	0.4620713	0.4158537	0.267
Debt/Equity ratio	r_5	0.0150957	0.0505761	0.765
	r_5 modified	- 0.6688318	0.4451609	0.133

Source: Author's calculations

In conclusion, we can say that by transforming values of financial ratios the regression results do not improve. Therefore, we will continue in determining future earnings power measure (P_i) only under assumption I.

Step B: Multivariate regression

We have already excluded all variables, whose coefficient estimates were not significant at 10% significance level in the univariate regression. Now in step B, we run a multivariate regression. There is seven explanatory variables in the logit model, therefore $K = 7$ in equation (4.4) at this time. If any of the seven financial ratios is missing for a certain company in a certain year, this observation is excluded. Therefore, the total number of observations is 306 for 55 companies in total.

Results from the multivariate regression are shown in *Table 12*. We can see that four coefficient estimates are significant: current ratio, equity to fixed assets ratio, return on equity and receivables turnover. These ratios represent following groups: liquidity ratios, financial leverage ratios, profitability ratios and efficiency ratios. Thus, a representative of each group (except cash flow ratios already excluded in step A) is present in the final model. Three ratios have a negative coefficient estimate (r_1, r_7 and r_{11}), while one is positive (r_{12}). Return on equity has the most significant coefficient estimate, standard deviation being also the highest one.

Table 12: *Results from Multivariate Regression*

Explanatory Variable		Coefficient Estimate	Standard Error	P-value
Name	Symbol			
Current ratio	r_1	**-0.4434834**	**0.2436688**	**0.069**
Quick ratio	r_2	0.3627379	0.3154582	0.250
Equity to fixed assets ratio	r_7	**-0.4673717**	**0.2334891**	**0.045**
Return on equity	r_{11}	**-2.6497490**	**0.9783400**	**0.007**
Receivables turnover	r_{12}	**0.0238680**	**0.0110699**	**0.031**
Sales to working capital ratio	r_{16}	-0.0020558	0.0016669	0.217
Fixed assets turnover	r_{17}	-0.0510459	0.0463169	0.270

Source: Author's calculations

Step C: Likelihood Ratio Test

In this step, it is tested if all four ratios which were significant in step B remain significant also if they are investigated stepwise using likelihood ratio test. At first, we estimate the final model, which is the result of two previous steps. The final model is shown in *Table 13*. *K* is equal to 4 and this model is called 'unrestricted' for the purpose of the LR test. 'Unrestricted' means that all four variables are included. We can see that the p-value of current ratio is not lower than 0.1, however the LR test is used to tell us if this variable should be omitted or not.

Table 13: *Unrestricted Model*

Explanatory Variable/Intercept		Coefficient Estimate	Standard Error	P-value
Name	Symbol			
Intercept	α	0.9141720	0.1292705	0.004
Current ratio	r_1	-0.2099652	0.2448704	0.104
Equity to fixed assets ratio	r_7	-0.5136049	1.0198420	0.036
Return on equity	r_{11}	-2.6514870	0.0105791	0.009
Receivables turnover	r_{12}	0.0229460	0.3212312	0.030

Source: Author's calculations

The LR test is a test of the goodness-of-fit between two models. The unrestricted model is compared to the restricted model in which some of the explanatory variables' coefficients are assumed to be zero. This means, in fact, that these explanatory variables are excluded from the model. By comparing these two models we can see, which model fits the dataset significantly better and therefore, if all or just some explanatory variables should be used in the final model. Likelihood ratio is calculated using following equation:

$$LR = -2\log L_{restricted} - \left(-2\log L_{unrestricted}\right), \tag{4.10}$$

where $log\ L_{restricted}$ denotes log-likelihood of the restricted model and $log\ L_{unrestricted}$ denotes log-likelihood of the unrestricted model. The LR test statistic approximately follows a chi-square distribution.

Following restricted models are defined:

RM_1.....current ratio excluded from the model

RM_7.....equity to fixed assets ratio excluded from the model

RM_{11}.....return on equity excluded from the model

RM_{12}.....receivables turnover excluded from the model

The values of log-likelihood of individual models can be seen in *Table 14*.

Table 14: *Log Likelihood of Unrestricted Model and Restricted Models*

Restricted Model	Log Likelihood of Restricted model	Log Likelihood of Unrestricted Model
RM_1	-197.52944	-194.69555
RM_7	-198.01909	
RM_{11}	-199.83053	
RM_{12}	-198.39557	

Source: Author's calculations

Using equation (4.10) and values from *Table 14*, the likelihood ratio is calculated for each of the restricted model. The values are shown in Table 15. The critical value of χ^2 distribution with 1 degree of freedom at the significance level of 10% is equal to 2.707.[30] As all values of LR in the following table are higher than the critical value, we can conclude that unrestricted model fits the data significantly better than any of the restricted models.

Table 15: *Values of Likelihood Ratio*

Restricted Model	LR
RM_1	5.66778
RM_7	6.64708
RM_{11}	10.27950
RM_{12}	7.40004

Source: Author's calculations

[30] A number of degrees of freedom is calculated as a number of variables from the unrestricted model whose coefficients are assumed to be zero in the restricted model.

Result from Steps A - C: Estimated Probability

Equation (4.11) represents the final probability, which was estimated by three steps described above. This probability is used as the measure of the earnings power in the subsequent chapter.

$$P_i = \frac{1}{1+e^{-\alpha-\beta X_i}} = \frac{1}{1+\exp\left(-0.914172+0.2099652r_1+0.5136049r_7+2.651487r_{11}-0.022946r_{12}\right)} \tag{4.11}$$

The following financial ratios were indicated to capture value-relevant information about future earnings: *current ratio*, *equity to fixed assets ratio*, *return on equity* and *receivables turnover*. These financial ratios contain following information from financial statements:

- accounts receivables
- currents assets
- fixed assets
- current liabilities
- total shareholders equity
- net sales
- net income

Five of the financial items listed above come from the balance sheet, two are reported in the income statement. We find quite interesting that the only measure of long-term indebtedness is equity to fixed assets ratio. It seems to be irrelevant which capital structure the company uses in relation to one-year-ahead earnings.

If we compare our results to those of Ou and Penman (1989a), we can see that our future earnings power measure is more limited, which rises questions about the robustness of our results. The final model of Ou and Penman includes 16 descriptors in the first estimation period and 18 in the second estimation period.[31]

The aim of the estimated model is to correctly separate companies, whose one-year-ahead earnings will rise, and companies, for which one can expect earnings

[31] They divided the total estimation period into two parts in order to compare results and evaluate the robustness of the final models.

decline. In order to evaluate performance of the estimated model, in other words to assess its ability to correctly separate companies according to the aforementioned measure, the basic information about its predictive ability are summarized in *Table 16*.

Table 16: *Summary of Performance of Estimated Prediction Model*

	P_i cutoff		
	(0.5, 0.5)	**(0.6, 0.4)**	**(0.7, 0.3)**
Number of Observations	311	174	69
% of Correct Predictions	63.3 %	70.1 %	78.3 %
% of Correctly Predicted EPS Increases	64.1 %	72.0 %	79.7 %
% of Correctly Predicted EPS Decreases	60.6 %	61.3 %	70.0 %
χ^2 from 2 x 2 Contingency Table (P-value)	0.270 (0.603)	1.400 (0.236)	0.469 (0.493)

Source: Author's calculations

In case that a value of 0.5 is considered to be a cutoff for both predicted earnings increase and decrease, the predictions seem to be correct in 63% of cases.[32] However, the chi-square test for 2 x 2 contingency table is used to verify if the results are significant or not. The chi-square test enables us to test the null hypothesis that there is no relationship between the observed number of earnings increases and earnings decreases in relation to the value of P_i measure and the number of frequencies we would expect. Assuming a 10% significance level and one degree of freedom, we cannot reject the null hypothesis because the p-value is greater than 0.1.[33] It thus signifies that the model does not work well for the threshold of (0.5, 0.5).

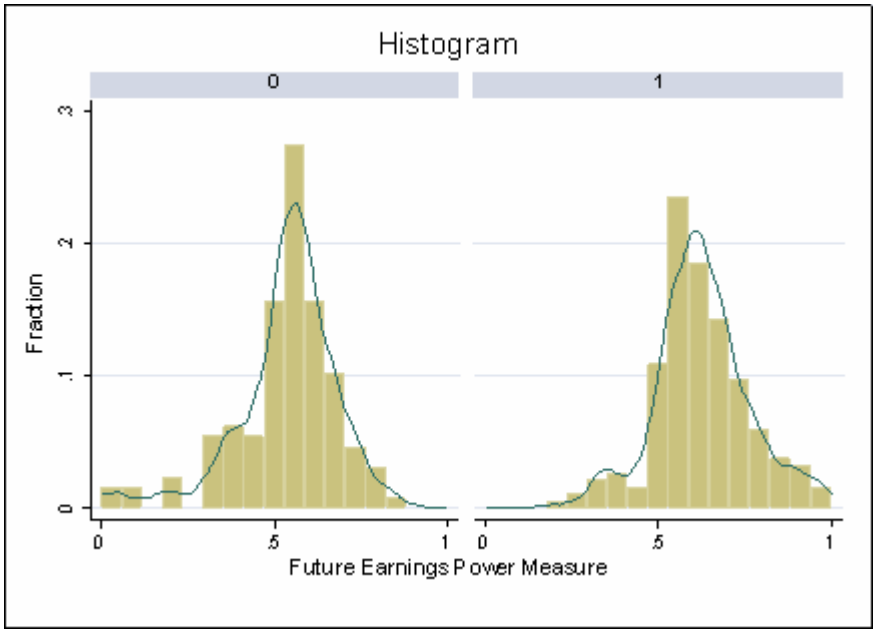
The situation slightly ameliorates when we take values 0.6 and 0.4 as the P_i cutoffs. In this case, even 70% of predictions are correct but chi-square is still not significant. The (0.7, 0.3) cutoff is shown just to gain a comprehensive idea of the model performance. This cutoff increases the percentage of correct predictions;

[32] Values of P_i should be higher than 0.5 for earnings increase and lower than 0.5 for earnings decrease.
[33] The number of degrees of freedom is calculated as a number of rows from contingency table minus one times a number of columns from contingency table minus one. Therefore, the number of degrees of freedom in case of 2 x 2 contingency is equal to one.

nevertheless, the number of observations becomes too small and the p-value is again much higher than if the cutoff (0.6, 0.4) is used.

The quality of the estimated model can be also seen in *Figure 19*. Histogram shows the distribution of observations according to their P_i value denoted as future earnings power measure in the figure and according to the fact if earnings of the company increased (1) or decreased (0) in the following year. Ideally, all observations with earnings decrease should have the value of P_i between 0 and 0.5 and vice versa. However, our model is not able to separate observations in a satisfactory manner. Especially observations of earnings decrease (0) are not ideally distributed as they are classified as earnings increase in 69% while earnings increases are classified as earnings decreases only in 14%.

Figure 19: *Histogram of Estimated Future Earnings Power Measure (P_i)*

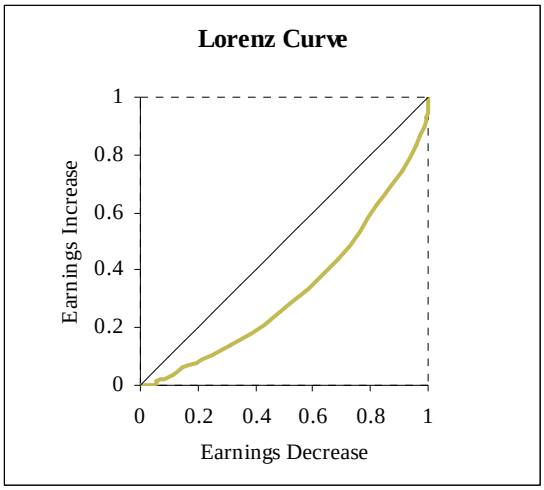


Source: Author's calculations

Also Lorenz curve in *Figure 20* indicates that the model performance is not sufficient. Lorenz curve demonstrates the cumulative distribution of values of the P_i measure of observations with earnings increases and earnings decreases. The ideal situation would be if the curve took the form of a right angle. This would mean that observations with earnings increases are perfectly separated from observations with earnings decreases.

Lorenz curve can be used for a calculation of the Gini coefficient. This coefficient measures the ratio of the area between the Lorenz curve and the black diagonal and the total area below the 45 degree curve. The ideal value of the Gini coefficient should be 1. Our model has the value of 0.35. In other words, our model separates the observations by 35% which cannot be considered as a sufficient rate of separation.

Figure 20: *Lorenz Curve*



Source: Author's calculations

In conclusion, we proved that it is not possible to predict future earnings using financial statement analysis in the environment of the Czech capital market. The capital market is quite young and faced several aforementioned problems. It also took time until the Czech economy as a whole stabilized after the transition period. All these factors have its impact on the results of our model. Although the model does not work well, we will show in the following chapter how it could be applied to detect if financial statement analysis can be used to predict stock returns.

4.3. Model Implications

The model, which was estimated in the previous chapter, should predict the way of future earnings – increase or decrease. Although its performance is not too sound based on findings described above, we employ it now and determine investment strategy in order to evaluate if the model captures information, which is not reflected in prices.

We do it in two steps. At first we calculate the value of the future earnings power measure estimated by the model and using this value we decide, which investment positions to take. Then we invest in shares depending on the decision from the previous step and we check the results at the end of the investment horizon.

Step A: Decision about Investment Positions

Investment positions were taken at the end of March 2007, the third month after the end of the fiscal year 2006. We assume that annual report information was already publicly available at this time. The values of P_i are calculated from accounting data available in 2006 annual reports using equation (4.11). The future earnings power measure was calculated for 14 companies, which represent 67% of all companies listed on the PSE main market in 2006.[34]

Final values of the future earnings power measure are shown in *Table 17*. Each share is assigned to a long position if P_i is greater than 0.6 or to a short position if P_i is less than 0.4.[35] The values in parenthesis are investment positions, which would be additionally taken if we considered 0.5 as a threshold. In this case, long position would be taken if P_i was greater than 0.5 and short position if P_i was less than or equal to 0.5. If we invested in shares according to the P_i threshold of (0.4, 0.6), we would invest only in 6 shares out of 14. Therefore, we will compare results for both cases and the values under the threshold of (0.5, 0.5) will be written in parenthesis.

[34] The reason why 7 remaining companies (33%) were not included in the sample is that 2 are bank institution (Erste bank and Komerční banka), 2 were delisted due to squeeze out in 2007 (Česká zbrojovka and Západočeská Plynárenská) and 3 were moved from main market to free market at the beginning of 2008 (Severomoravská plynárenská, Středočeská plynárenská and Východočeská plynárenská).

[35] Long position means buying of a security in expectation that its value will go up. Short position means selling a borrowed security expecting that its price will go down.

As we can see in the following table, 4 (6) shares were assigned to the short position while 2 (8) shares were assigned to long position.

Table 17: *Values of P_i and Determination of Investment Positions*

Company	ISIN	P_i	Investment Position
CETV	BMG200452024	0.0158	S
ČEZ	CZ0005112300	0.5157	(L)
ECM	LU0259919230	0.4244	(S)
Jihomoravská Plynárenská	CZ0005078956	0.9184	L
Orco	LU0122624777	0.2649	S
PEGAS NONWOVENS	LU0275164910	0.4110	(S)
Pražská energetika	CZ0005078154	0.5755	(L)
Pražská plynárenská	CZ0005084350	0.5379	(L)
RM-Systém	CS0008416251	0.0008	S
Setuza	CZ0008460052	0.9749	L
Spolana	CS0008424958	0.5495	(L)
Telefonica O2	CZ0009093209	0.5015	(L)
Unipetrol	CZ0009091500	0.5250	(L)
Zentiva	NL0000405173	0.3092	S

Source: Author's calculations

Remark: "S" means short position, "L" means long position. (L) or (S) indicates that these positions are taken just in case of P_i threshold being (0.5,0.5).

Step B: Investment and Calculation of Stock Returns

Investment positions according to the above table were taken on March 30, 2007. Due to limited dataset we restricted our investment horizon to one year. Therefore, returns from long and short positions were observed on March 31, 2008. Returns from our investment positions are summarized in *Table 18*. We do not consider any transaction fees, the aim is just to evaluate if the ability of financial statement information in our future earnings power measure to predict stock returns.

We can see that when considering the P_i threshold of (0.4, 0.6), the sign of an expected stock price change was predicted correctly in 5 out of 6 cases, the remaining case being zero change. In case we take the P_i threshold of (0.5, 0.5), the results are 10 correctly predicted changes out of 14, which corresponds to 71%. Brackets in the last column indicate again those positions, which were additionally taken when extending the P_i threshold from (0.4, 0.6) to (0.5, 0.5).

Table 18: *Returns from Investment Positions*

Company	Exp. Stock Price Change	Real Stock Price Change	Annual Return	Profit/Loss
CETV	-	-	- 27.2 %	Profit
ČEZ	+	+	30.0 %	(Profit)
ECM	-	-	- 59.5 %	(Profit)
Jihomoravská Plynárenská	+	0	0.0 %	No profit/loss
Orco	-	-	- 59.3 %	Profit
PEGAS NONWOVENS	-	-	- 22.2 %	(Profit)
Pražská energetika	+	+	44.3 %	(Profit)
Pražská plynárenská	+		- 9.7 %	(Loss)
RM-Systém	-	-	- 5.0 %	Profit
Setuza	+	+	5.2 %	Profit
Spolana	+	-	- 7.4 %	(Loss)
Telefonica O2	+	-	- 6.5 %	(Loss)
Unipetrol	+	+	10.7 %	(Profit)
Zentiva	-	-	- 32.8 %	Profit

Source: Author's calculations

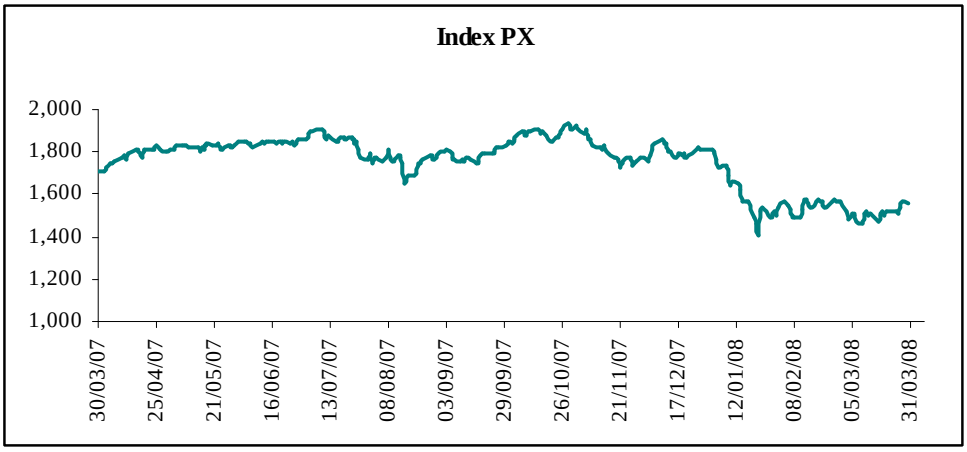
Note: (Loss) or (Profit) are considered only if P_i threshold is set at (0.5, 0.5).

The percentage of correct predictions is very high, hence, it would seem that financial statement descriptors really capture information that is not reflected in prices. However, we should be cautious about such conclusions. The model which is applied here did not work well for the data sample as was shown in the previous chapter. Another problem is that the period is not long enough for drawing general conclusions

about the model performance. Moreover, the end of year 2007 and the beginning of 2008 was influenced by significant external factors, which had impact on the stock prices on the whole PSE. This can be seen in *Figure 21* where the development of the index of Prague Stock Exchange, index PX, is shown. The value of the index started significantly decreasing at the beginning of 2008. The difference between the highest and the lowest value between March 30, 2007 and March 31, 2008 was 531 points, which means a drop by 27%.

This development on the PSE can be mainly explained by the U.S. mortgage crisis mentioned in *Chapter 4.1.1*. The impact of the crisis was and still is worldwide and the response of the PSE was a significant decrease in trade values of all stocks as can be seen in the following figure.

Figure 21: *Trend in Values of Index PX in the Period between March 2007 and March 2008*



Source: Author's calculations

This price movement could not be influenced by the companies and does not predicate anything about the companies' health. This makes the results difficult to evaluate. The example of such difficulties can be seen in *Table 19*. This table compares the total return from investment positions with an annual change of the index PX. The annual return on investments, about which we decided on the basis of our model, is equal to 18.9% (20.2%). This result more than exceeded the performance of the market, whose value decreased by 9.4%. If there was not any impact of a significant external factor, we would conclude that investment strategy based on the model can even beat the market. Nevertheless, this conclusion is not evident. We would rather conclude that such results were obtained by chance. Important factors influenced the soundness of

these results: insufficient performance of the estimated model and external shock having impact on the share values on the PSE.

Table 19: *Total Return from Investment Positions in Comparison to Annual change of PX Index Value*

	Annual Change
Total Return from Investment Positions under Threshold (0.4, 0.6)	18.9 %
Total Return from Investment Positions under Threshold (0.5, 0.5)	20.2 %
Index PX	- 9.4 %

Source: Prague Stock Exchange, author's calculations

However, the mortgage crisis would not have to necessarily cause biased results. The reason is that investors become more risk-averse during crises. This is then reflected on the stock exchange where stock prices of companies which are considered to be riskier drop much more. Therefore, firms could be better separated by the model.

Based on the discussion mentioned above, it can be seen that the research should be repeated in the future when more data will be available. It is also recommended to choose a period without any large external shocks in the market for the part of the research where stocks are assigned to investment positions as these shocks could make results biased and difficult to assess.

5. Conclusion

This diploma thesis investigated whether we can predict stock returns using financial statement analysis. The thesis followed the research study of Ou and Penman (1989a) who discovered that financial statement indicators capture information, which is not reflected in prices. Their research was focused on the U.S. capital market in the time period of 1965–1983. This thesis represents an extension of their work. The methodology which they used was slightly adjusted and applied in the Czech environment.

The aim of this thesis was to find a measure, which would identify the direction of future earnings. Individual shares where then assigned to investment positions based on the estimated measure in order to examine whether such investment strategy brings excess returns. As the estimated measure is based on financial statement data, abnormal returns would indicate the ability of financial statement analysis to predict stock returns.

The measure was estimated in three steps using logit model – univariate regression, multivariate regression and likelihood ratio test. Four financial ratios were finally identified to be relevant for prediction of future earnings: current ratio, equity to fixed assets ratio, return on equity and receivables turnover. Liquidity, financial leverage, profitability, as well as efficiency ratios were thus represented in the estimated measure. Interesting finding is that neither a cash flow ratio, nor a measure of capital structure of a company was included in the final model.

These quite surprising results could be explained to a certain extent by tests of model performance. Several methods were used to assess the ability of the estimated model to sufficiently separate the companies with future earnings increase from observations with future earnings decrease. Unfortunately, the results implied that the ability is not too high, only 35% according to Gini coefficient. There are several reasons which could cause poor performance of the model. Firstly, the data sample was quite small and did not ensure necessary robustness of the model. The number of companies listed on the Czech stock exchange is much lower in comparison to foreign stock exchanges. This leads to limited amount of available data.

Further, the quality of data was affected by the circumstances of the Czech economic development and the creation of Prague Stock Exchange. The economy

passed through a transition period, which brought along the necessity of significant structural and institutional reforms. Moreover, the PSE needed to overcome initial problems with lack of liquidity and regulatory framework. It started to gain respect both in our country and abroad only several years ago.

Despite the aforementioned poor performance of the estimated model, the model was applied in order to show whether it could bring investment returns. The estimated measure was thus used for calculation of probability of future earnings increase and shares were then assigned to investment positions (short or long) at the end of March 2007. Portfolio performance was assessed one year after. Surprisingly, the return of this investment portfolio was positive and significantly better than the market performance. Therefore, the conclusion would seem to be that financial statement data of companies listed on the PSE really capture information not reflected in prices.

However, possible bias of such findings could be seen due to the impact of the U.S. mortgage crisis, which highly influenced the whole stock exchange market, especially at the beginning of 2008. On the other hand, consequences of this crisis could have positive contribution to the quality of these results. Since crises, in general, highlight the differences between companies, the impact of the mortgage crisis could result in better performance of the model rather than in bias of results. Nevertheless, the conclusion is not clear and further research is essential.

This thesis was the first attempt to explore relationship between financial data information and stock returns in the Czech capital market. Our findings indicate that further research should be done in this area. Progressively developing market will provide more possibilities and data for an extension of our work. Following research using both longer time series for model estimation and longer investment horizons is necessary to verify our results.

List of Abbreviations

CAPM .....Capital asset pricing model
CF.....Cash flow
DCF.....Discounted cash flow
EBIT.....Earnings before interest and taxes
EBITDA.....Earnings before interest, taxes, debt and amortization
EPS.....Earnings per share
FCFE.....Free cash flow to equity
FCFF .....Free cash flow to firm
FESE .....Federation of the European Securities Exchanges
GDP .....Gross domestic profit
IPO .....Initial public offering
LIFO.....Last in, first out
LR .....Likelihood ratio
P_i .....Probability of future earnings increase
PSE .....Prague Stock Exchange
P/BV.....Price to book value
P/E .....Price to earnings
P/S .....Price to sales
RM .....Restricted model
R&D.....Research and development

References

BIBLIOGRAPHY

Albrecht, W. S., Lookabill, L. L. et al. (1977): *The time series properties of annual earnings*, Vol. 15, No. 2, pp. 226 – 244, Autumn

Ball, R. and Brown., P (1968): *An Empirical Evaluation of Accounting Income Numbers*, Journal of Accounting Research, Vol 6, No. 2, pp. 159 – 178, Autumn

Ball, R. and Watts, R. L. (1972): *Some time series properties of accounting income*, Journal of Finance, Vol. 27, No. 3, pp. 663 – 681, June

Baltagi, B. H. (2005): *Econometric Analysis of Panel Data*, 3th edition, Wiley & Sons, Chichester

Basu, S. (1983): *The Relationship between Earnings Yield, Market Value and Return for NYSE Stocks: Further Evidence*, Journal of Financial Economics, Vol. 41, No. 1, pp. 129 – 156, June

Bayldon, R.; Woods, A. and Zafiris, N. (1984): *A Note on the "Pyramide" Technique of Financial Ratio Analysis of Firms' Performance*, Journal of Business Finance and Accounting, Vol. 11, No. 1, pp. 99 – 106, March

Beaver, W. H., Clarke, R. et al. (1979): *The Association between Unsystematic Security Returns and the Magnitude of Earnings Forecast Errors*, Journal of Accounting Research, Vol. 17, No. 2, pp. 316 – 340, Autumn

Beaver, W. H.; Kettler, P. and Scholes, M (1970): *The Association between Market Determined and Accounting Determined Risk Measure*, Accounting Review, Vol. 45, No. 4, pp. 654 – 682, October

Beaver, W. H. and Morse, D. (1978): *What Determines Price-Earnings Ratio?*, Financial Analysts Journal, Vol. 34, No. 4, pp. 65-76, July-August

Beaver, W. H.; Lambert, R. A. and Morse, D. (1980): *The Information Content of Security Prices*, Journal of Accounting and Economics, Vol. 2, No. 1, pp. 3 – 28, March

Beaver, W. H.; Lambert, R. A. and Ryan, S. G. (1987): *The Information Content of Security Prices: A Second Look*, Journal of Accounting and Economics, Vol. 9, No. 2, pp. 139 – 157, July

Bláha, Z. S. and Jindřichovská, I. (2001): *Podnikové finance*, Management Press, Prague

Brealey, R. A. (1986): An Introduction to Risk and Return for Common Stocks, 2th edition, M.I.T. Press, Cambridge

Brealey, R. A.; Myers, S. C. and Allen, F. (2006): *Principles of Corporate Finance*, 8th edition, McGraw Hill, Boston

Cohen, J. B.; Zinbarg, E. D. et al. (1982): *Investment Analysis and Portfolio Investment*, 4th edition, Irwin, Homewood

Collins, D. W.; Kothari, S. P. and Rayburn, J. D. (1986): *Firm Size and the Information Content of Prices with Respect to Earnings*, Journal of Accounting and Economics, Vol. 9, No. 2, pp. 111 – 138, July

Collins, D. W. and Kothari, S. P. (1989): *An Analysis of Intertemporal and Cross-sectional Determinants of the Earnings Response Coefficients*, Journal of Accounting and Economics, Vol. 11, No. 2 - 3, pp. 143-181

Copeland, T.; Koller, T. et al. (2000): *Valuation: Measuring and Managing the Value of Companies*, 3rd edition, Wiley & Sons, New York

Copeland, T.; Weston, J. F. et al. (2005): *Financial Theory and Corporate Policy*, 4th edition, Pearson Addison Wesley, Boston

Courtis, J. K. (1978): *Modelling a Financial Ratios Categoric Framework*, Journal of Business Finance and Accounting, Vol. 5, No. 4, pp. 371 – 386, December

Cowen, S. S. and Hoffer, J. A. (1982): Usefulness of Financial Ratios in a Single Industry, Journal of Business Research, Vol. 10, No. 1, pp. 103 – 118, March

Czech National Bank (2005): *Financial Stability Report 2004*

Czech National Bank (2007): *Financial Stability Report 2005*

Damodaran, A (2001): *Corporate Finance: Theory and Practice*, 2th edition, Wiley & Sons, Hoboken

Damodaran, A. (2006): *Damodaran on Valuation: Security Analysis for Investment and Corporate Finance*, 2th edition, Wiley & Sons, Hoboken

Elton, E. J. and Gruber, M. J. (1991): *Modern Portfolio Theory and Investment Analysis*, 4th edition, Wiley & Sons, New York

Elton, E. D., Gruber, M. J. et al. (1978): *The Usefulness of Analyst Estimates of Earnings*, unpublished manuscript, summary of this manuscript available in Elton and Gruber (1991)

Fama, E. F. (1978): *The Effects of a Firm's Investment and Financial Decisions*, American Economic Review, Vol. 68, pp. 272 – 284, June

Freeman, R. N. (1987): *The Association between Accounting Earnings and Security Returns for Large and Small Firms*, Journal of Accounting and Economics, Vol. 9, No. 2, pp. 195 – 228, July

Garman, M. B. and Ohlson, J. A. (1980): *Information and the Sequential Valuation of Assets in Arbitrage-free Economics*, Journal of Accounting Research, Vol. 18, No. 2, pp. 420 – 440, Autumn

Gombola, M. J. and Ketz, E. (1983): *A Note on Cash Flow Classification Patterns of Financial Ratios*, Accounting Review, Vol. 58, No. 1, pp. 105-114, January

Graham, B. and Dodd, D. (1934): *Security Analysis*, McGraw-Hill, New York

Helfert, E. A. (2000): *Techniques of Financial Analysis: A Guide to Value Creation*, 10th edition, McGraw-Hill, Boston

Holthausen, R. W. and Larcker, D. F. (1992): *The Prediction of Stock Returns Using Financial Statement Information*, Journal of Accounting and Economics, Elsevier, Vol. 15, No. 2-3, pp. 373-411, August

Horrigan, J. O. (1968): *A Short History of Financial Statement Analysis*, Accounting Review, Vol. 43, No. 2, pp. 284-294, April

Hušek, R. and Pelikán, J. (2003): *Aplikovaná ekonometrie: teorie a praxe*, Professional Publishing, Prague

Jaffe, J. J.; Keim, D. B. and Westerfield, R. (1989): *Earnings Yield, Market Values and Stock Returns*, Journal of Finance, Vol. 44, No. 1, pp. 135 – 148, March

Jakubík, P., Teplý, P. (2008): *Scoring as an Indicator of Financial Stability*, Financial Stability Report 2007, Czech National Bank

Jennergren, P. L. (2007): *A Tutorial on the Discounted Cash Flow Model for Valuation of Companies*, SSE/EFI Working Paper Series in Business Administration No 1998:1, 7th revision, February

Jindřichovská, I. (2001): *The relationship between accounting numbers and returns: some empirical evidence from the emerging market of the Czech Republic*, European Accounting Review, Taylor and Francis Journals, Vol. 10, No. 1, pp. 107-131, May

Jindřichovská, I. and Bláha, Z. S. (2006): *Jak posoudit finanční zdraví firmy*, 3th edition, Management Press, Prague

Johnson, B. (1973): The Cross-sectional Stability of Financial Ratio Patterns, Journal of Financial and Quantitative Analysis, Vol. 14, No. 5, pp. 1053 – 1049, December

Kislingerová, E (2001): *Oceňování podniku*, 2th edition, C.H. Beck, Prague

Kislingerová, E. et al. (2007): *Manažerské finance*, 2th edition, C.H. Beck, Prague

Kothari, S. P. and Sloan, R. G. (1992): *Information in Prices and Future Earnings: Implications for Earnings Response Coefficients*, Journal of Accounting and Economics, Vol. 15, No. 2 – 3, pp. 143 – 171, February

Kothari, S. P., Zimmerman, J (1995): *Price and Return models*, Journal of Accounting and Economics, 1995, Vol. 20, No. 2, pp. 155 – 192, September

Lacker, D. F. (1989): *Discussion of Accounting Measurement, Price-Earnings Ratio, and the Information Content of Security Prices*, Journal of Accounting Research, Vol. 27, pp. 145 – 152

Laurent, C. R. (1979): *Improving the Efficiency and Effectiveness of Financial Ratio Analysis*, Journal of Business Finance and Accounting, Vol. 6, No. 3, pp. 401 – 413, September

Lev, B. and Thiagarajan, R. (1993): *Fundamental Information Analysis*, Journal of Accounting Research, Vol. 31, No. 2, pp. 190 – 215, Autumn

Lintner, J. (1965): *Security Prices, Risk and Maximal Gains from Diversification*, Journal of Finance, Vol 20, No. 4, pp. 587 – 615, December

McKibben, W. (1972): *Econometric Forecasting of Common Stock Investment Returns: A New Methodology Using Fundamental Operating Data*, Journal of Finance, Vol. 27, No. 2, pp. 371-380, May

Mejstřík, M. (1999): *Privatization, Foreign Investment and Corporate Governance: Theory and Practice in the Czech Republic*, IES Occasional Paper, No. 1/1999, Prague

Modigliani, F. and Miller, M. H. (1958): *The Cost of Capital, Corporation Finance and the Theory of Investment*, American Economic Review, Vol. 48, pp. 261 – 297, June

Ou, J. A. and Penman, S. H. (1989a): *Financial Statement Analysis and the Prediction of Stock Returns*, Journal of Accounting and Economics, Elsevier, Vol. 11, No. 4, pp. 295-329, November

Ou, J. A. and Penman, S. H. (1989b): *Accounting Measurement, Price-Earnings Ratio, and the Information Content of Security Prices*, Journal of Accounting Research, Vol. 27, pp. 111 – 144

Owen, L. (1998): *Earnings and Expected Returns*, NBER Working Paper, No. 5671, July

Penman, S. H. (2001): *Financial statement analysis and security valuation*, McGraw-Hill, Boston

Pinches, G. E.; Mingo, K. A. and Caruthers, K. (1973): The Stability of Financial Patterns in Industrial Organizations, Journal of Finance, Vol. 28, No. 2, pp. 389 – 396, May

Pohlman, R. A. and Hollinger, R. D. (1981): *Information redundancy in sets of financial ratios*, Journal of Business Finance and Accounting, Vol. 8, No. 4, pp. 511 – 528, December

Salmi, T. and Martikainen, T. (1994): *A Review of the Theoretical and Empirical Basis of Financial Ratio Analysis*, Finnish Journal of Business Economics, Vol. 4/94, pp. 426 - 448

Salmi, T.; Virtanen, I et al. (1990): *On the Classification of Financial Ratios: A Factor and Transformation Analysis of Accrual, Cash Flow, and Market-based Ratios*, Acta Wasaensia, No. 25, Vaasa

Stiglitz, J. E. (1974): *On the Irrelevance of Corporate Financial Policy*, American Economic Review, Vol. 64, pp. 851 – 866, December

OTHER SOURCES

Annual Reports of companies

Czech National Bank, http://www.cnb.cz/

Czech Statistical Office, http://www.czso.cz/

Damodaran, Aswath, http://pages.stern.nyu.edu/~adamodar/

Prague Stock Exchange, http://www.pse.cz/

Ministry of Finance, http://www.mfcr.cz/

Ministry of Industry and Trade, http://www.mpo.cz/

List of Figures

List of Tables