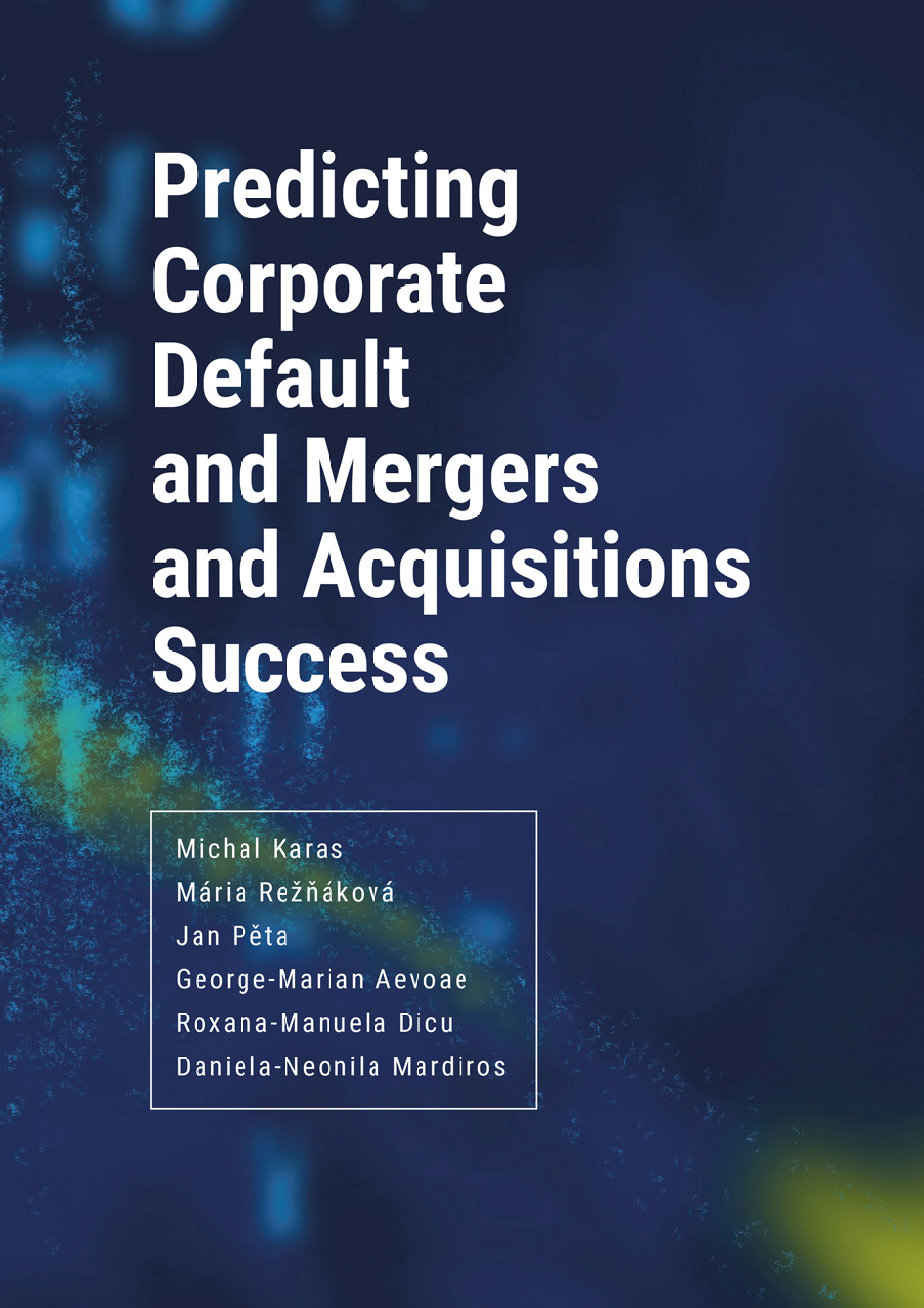

Predicting Corporate Default and Mergers and Acquisitions Success

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Preface

Prediction models are widely used in many aspects of life, including the social sciences (e.g. finance), natural sciences (e.g. medicine) and technical sciences (e.g. engineering). The doctor wants to know what nuances in the heartrate curve are symptoms of certain diseases or malfunctions so as to make a diagnosis before the patient's condition becomes fatal. The businessman, when entering into a contract with a new partner, needs to know whether this partner's financial situation will allow him to meet his obligations, so that the contract will benefit both parties. When designing a new airplane, the engineer is interested in whether the plane's wings will withstand possible inflight turbulence so that the plane will not crash.

What all these have in common is that they are based on the assumption that there are certain patterns that have occurred in the past, and that these can be recognised in the present, making prediction possible. In statistical jargon this is the pattern recognition process.

Such predictions are usually performed on the basis of past personal experience or by means of statistical techniques derived to make this process less demanding and time-consuming.

The first steps were taken in 1936 by Roland Fisher, who discovered discriminant analysis. He used data on iris flowers, or rather the morphological variation of three related species. The data set consisted of fifty samples of each species of iris and four features were measured on each sample. Fisher's idea of developing linear discriminant analysis lay in the creation of a model that would distinguish the species from one another.

Research on prediction in the natural sciences has a longer history than in the social sciences, particularly in economics and business.

This publication results from the project *"Prediction Models in Finance: Analysis of Factors and Predictions of Bankruptcy, Company Performance and Value"*. Its authors work at the Department of Finance at the Faculty of Business and Management at Brno University of Technology and are engaged in research and teaching focusing on corporate finance and financial management. Their work on this publication was based on their experience published in individual papers and dissertations. They decided to summarise that experience in the form of a comprehensive overview of methods suitable for the creation of prediction models in finance and methods useable to verify the nature of the data entered into these models. This procedure is a basic precondition for the correct application of models and, thereby, the validity of the results obtained. A further reason for their deciding to write this monograph is that research into corporate prediction models is generally based on public companies, with little attention having been devoted to private companies. Since only a few companies in the Czech Republic have issued publicly tradeable shares, the results published to date have little applicability under the conditions prevailing there. In addition, the accuracy of models developed in other countries drops significantly when applied to a different environment.

The authors believe that this publication may also inspire other authors engaged in research into companies in other countries with a similar company structure.

This book is divided into three basic areas. The first is an introduction to the issue of prediction and an overview of methods that can be used for the statistical testing of data and methods suitable for the creation of prediction models. This issue forms the content of the first and second chapters of this publication. This section also contains an overview of methods suitable for measurement of the differentiation capability of models.

The second area is the prediction of corporate distress. This section presents the reasons for company bankruptcy and selected models, though first and foremost it presents four models created by the authors for the segment small and medium-sized enterprises. The description of model creation may serve other authors in deriving their own models.

The third area is prediction in mergers and acquisitions, trends and the success of company mergers. Mergers and acquisitions are an extremely popular route for company growth, though they do not always end in success. This section of the publication presents the reasons for M&As, approaches to the measurement of their success, and two prediction models for predicting the success of M&As. The premise of this procedure is the creation of a methodology for determining the synergy value, i.e. the effect achieved by the merger of separate companies. The analysis of determinants of acquirers' behaviour on the Romanian acquisitions market are presented in this part as well.

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1 Introduction

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A prerequisite for a company to be a going concern is its ability to satisfy its customers' needs, efficiently utilise available assets and resources, seek and implement development projects and, at the same time, always remain solvent. In the short-term, the objective of business is to generate profit, with profit being the positive difference between revenues and attributable direct costs over a period. The long-term objective of a business in a market economy is the value that an investor gains from their investment, i.e. the business value.

The value created by doing business is the sum of the results of countless decisions made by managers and employees at all levels. Each decision rests on consideration of a number of options that are judged against the criteria chosen (usually the expected effect). Even when every decision is carefully considered, the outcome cannot be guaranteed. This is due to the risk that assumptions made when taking decisions do not prove to be correct. The way to reduce risk in business lies in the identification of its sources, its diversification and in taking measures to reduce the incidence of risk factors. Prediction models based on the identification of risk factors and the identification of companies with a high likelihood of risk occurrence have an important role to play in the process.

1.1 Risk in Economics and Business

In the broadest sense, risk can be defined as any source of randomness that may have an adverse impact on a business. Risk cannot, however, be perceived only negatively – the negative consequences of risk often provide an impetus for innovation and progress. As with the outcomes of research and development they can only be assumed and are not certain in advance.

Risk, like all aspects of business, is defined in financial terms. It is most frequently measured as the variability of business and economic indicators; particularly the variability of cash flow. If the risk is low, it is merely monitored, and no particular attention is paid to it. The increasing variability of an indicator is cause for a change in risk perception or can even signal approaching company failure. This risk is commonly referred to as direct credit risk, default risk or downgrade risk (Culp, 2001). Credit risk occurs mainly in the financial sector and gauges the counterparty's ability to deliver the required assets or financial resources. It is therefore associated with an issuer of securities or with the counterparty in a credit relationship. Because company failure is the end result of many factors, efforts are made to identify all potential sources of risk that may signal an increasing threat of failure. These are collectively called business risks. The perception of sources of risk changes over time and is related to the objectives of the company. Initially, risk factors were examined in relation to the return on invested capital, i.e. the objective was to determine which factors could negatively affect the company's profitability. Currently, risks are predominantly assessed in relation to cash flow. For instance Sadgrove (2005) uses the term "revenue drivers" in this context for the decisive factors contributing most to corporate earnings and deems it justified to create a risk strategy for them.

There are four main areas of business risk: strategic, operational, financial and compliance.

Strategic risks are crucial from the perspective of the company’s long-term prospects. They are usually associated with the company’s external environment (opportunities and threats) and the company’s ability to respond to changes in that environment. The main sources of risk are the macroeconomic environment, competitors, consumer needs, technology, legal issues (e.g. contracts, litigation and intellectual property rights), mergers and acquisitions, changes in the market structure and market developments.

Operational risks are those relating to the organisation’s production and operations. They comprise of risks such as the delivery of poor-quality materials and services, the failure of suppliers and a significant proportion of customers, loss of distribution channels and errors in logistics, a decline in the quality of products and services, employee skills, errors in investment decision-making, downtime at production facilities, IS and IT support, insufficient quality of management, etc. According to financial managers of large companies, the decisive revenue drivers are their production facilities, logistics and IT equipment (Sadgrove, 2005).

Compliance risks are associated with the observance of rules and regulations, such as stock exchange rules, tax requirements, environmental legislation, accounting standards, ethics and internal controls. The importance of identifying and managing these risks is of particular importance in public companies.

Financial risks are mainly associated with the loss of a company’s profitability and solvency (resulting from an imbalance between current inflows and expenditure). They may be (and usually are) a consequence of other risks (e.g. failure of customers, an increase in interest rates, unfavourable exchange rates, or an increase in the price of materials and overhead expenses), though also of errors in credit and cash management.

The traditional assumption of microeconomics and financial economics is that people are risk averse. This is certainly true in areas related to protection of the environment, health and safety and leads to attempts to identify the reasons for the occurrence of the given risks (i.e. their sources) and, based on this, to anticipate future developments and estimate potential consequences. The aim in running a business is to make an estimate in advance as to whether the outcome of an activity will have a positive or a negative impact on cash flow or, rather, what is the probability of the assumption of a positive impact (i.e. that cash flow will increase and when this will happen). The result is that activities and projects that should lead to positive results are selected, and activities that are associated with the risk of loss are eliminated (by avoiding them or transferring them to other entities). It should be noted that even this approach may not guarantee success from a long-term perspective, as it may lead to a decrease in potential cash flow. Incorrect evaluation of the impact of activities leads to losses. In statistics, this problem is described as a Type I or Type II error. A Type I error occurs when a hypothesis that is true is rejected, while a Type II error occurs when a hypothesis that is false is accepted (Culp, 2001). In the economy, this means that the consequence of a Type I error is a loss due to a missed opportunity, while a Type II error leads to a real loss due to the failure of the counterparty. It is natural to try, in particular, to avoid Type II errors, which generate direct losses.

An alternative view of business risk can be seen from the viewpoint of the ability to diversify risks. Risks are divided into those the firm can diversify or hedge away and those it cannot. Diversifiable or idiosyncratic risks are those that are related to a particular company and impact its cash flows. Systematic risks, in contrast, refer to changes in the cash flow of all companies and, as a result, changes in their value. Culp (2001) states that a systematic risk factor is any economic factor where changes drive all asset prices in some direction. The division into idiosyncratic and systematic risks is mainly used in financial matters when deciding on investments in companies or projects, i.e. when creating and managing the investment portfolio. If the investment risk increases, investors expect a higher return (or cash flow); on the other hand, given the same expected return, they prefer low-risk investments.

1.2 The Focus of the Monograph

The effort to avoid risk is precisely what motivates interest in prediction models in economics and finance. In the broadest sense, the purpose of creating prediction models is to predict the occurrence of risks in the future by identifying risk factors in the past and in the present. Economic indicators used for this purpose measure a company's performance, management, indebtedness, liquidity, etc., i.e. the effectiveness of the company's activities. The authors of prediction models work on the assumption that some indicators (particularly ratios) have different values in the group of companies that are managed efficiently, i.e. that are financially sound and able to meet their obligations, and in the group of companies threatened by bankruptcy, i.e. that are unable to meet their obligations and may jeopardise their creditors, suppliers, employees, owners and, in short, all stakeholders.

The effectiveness of corporate activities is increasingly measured not merely by non-financial indicators, which may provide advance signals of changes in the company's behaviour, but also by indicators of the external environment affecting the company. This trend reflects experience that the past does not repeat itself exactly. As a result, the resolving power of such models is not good enough and thus there is no justification for their use in the prediction of future developments. Attempts are being made for this reason to analyse the past development of an ever-increasing number of indicators and to use model construction methods that have produced higher resolution accuracy in other areas. The use of models in economics encounters yet another problem, which is the dependence of indicators. Statistical models assume that the occurrence of events is independent. This assumption is unrealistic in the economy. If, for example, a company goes into bankruptcy, this is reflected in all aspects of its activity, i.e. in all indicators that can be used to monitor the company. The situation becomes even more complicated due to globalisation and the mutual interconnectedness of markets. The creation of prediction models requires careful selection of variables that meet the requirements of statistical models or the search for and use of methods to construct models able to eliminate the effect of the interdependence of indicators.

This monograph gives an overview of statistical methods that can be used to analyse past data and select the most important indicators for the construction of prediction models, and presents methods suitable for the construction of prediction models. These methods are applied to two of the most important decision-making problems in corporate finance – identification of companies at risk of bankruptcy and prediction of the success of mergers and acquisitions. In choosing areas of prediction, we worked on the assumption that investors are interested in investing in companies that meet their obligations and are not, therefore, threatened by insolvency and the takeover of their assets by creditors, while being able to increase their efficiency at the same time.

The efforts of assessing of bankruptcy risk date back to 1930s, the research published by Bureau of Business Research (1930), study of FitzPatrick (1932), Merwin (1942) could be named as examples. A comprehensive review of bankruptcy prediction studies since 1930 could be found in Gissel, Giacomino, Akers (2007). The turning point came in 1968 with the work of Edward Altman.

Altman (1968) was among the first to look into the issue of bankruptcy prediction, for which purpose he used the linear discriminant analysis method. This model has been an inspiration for many authors and the subject of countless articles. Prediction models aimed at predicting financial distress are often referred to as credit scoring models. Credit risk is not limited merely to financial loans, but also to trade credit provided by companies on the sale of their goods and services. The reason for the construction of these models is to identify in advance the risk of insufficient cash inflow to cover cash outflow requirements. To eliminate this risk, it is often necessary to sell off part of the company's assets quickly (albeit at a loss) and use the cash inflow to pay off any payables and restore balance to the cash flow. For this reason, they focus not only on analysing past profitability, but also on the behaviour of the company in terms of raising cash.

A trend in recent years has been the growing volume of mergers and acquisitions as one of the decisive approaches to corporate expansion. They enable relatively fast entry onto new markets, acquisition of new customers, technological innovations, an increase in bargaining power, efficient use of available capacities, the achievement of savings in administration, etc., which translate into increases in the return on invested capital and the value of companies. Even though the most recent research by Alexandridis et al. (2017) showed that during the post-crisis period (2010–2015) public acquisitions and private mega-deals have generated abnormally positive returns for acquiring shareholders, some earlier research has alleged that no synergy is achieved from mergers. On the other hand, there are many studies that question whether it is possible to achieve the effects expected from M&As (recent studies include those by Meckl and Röhrle (2016) and Martynova and Renneboog (2008), while older studies include that by Cartwright and Cooper (1995). In this publication, we focus on mergers in the private corporate sector. Our research was conducted on data on enterprises in the Czech Republic. The aim is to predict the success of a merger, with success being defined as an improvement in the performance of the combined company and an increase in its value.

The principal prerequisite for the procedure used is to select suitable indicators capable of measuring the performance and solvency of companies or, alternatively, of signalling changes in these. They are comprised, first and foremost, of business and economic indicators that draw on accounting data (what are known as accounting-based indicators), though also others that measure the relationship between selected groups of indicators and signal the risk of a cash flow imbalance in the future. Other groups of indicators are market-based variables that utilise information from financial markets, indicators signalling the development of economic and legislative conditions in a specific country (e.g. Duompos, Andriosopoulos, Galariotis, Makridiou and Zopoundis, 2017) and governance indicators (e.g. Liang, Lu, Tsai and Shih, 2016). The main groups of indicators used will be described below. Research into bankruptcy and M&A outcome prediction, the results of which are presented in this publication, was carried out on data on companies in the Czech Republic. Accounting-based indicators were used because only a small number of companies in the Czech Republic have issued publicly traded shares, for which reason only limited information was available from the capital market.

1.3 Accounting-based Indicators

1.3.1 Profitability ratios

Profitability ratios measure how efficiently a company generates returns on the capital invested in it. The ROE (earnings after taxes/ equity) measures the rate of appreciation of equity capital or of profit reinvested in the company. Earnings after tax are often referred to as earnings available for distribution. It is up to the owner to decide the purpose for which they will be used, i.e. whether they will be reinvested in the company (used to finance business activities) or paid out in the form of dividends. The amount of earnings generated depends on the efficiency of business activities, although also on the level of taxation and the company's indebtedness. Owners may opt to increase the company's indebtedness for the purpose of achieving higher profitability, though this increases the risk of a cash flow imbalance (inflow and outflow). Moreover, this means earnings that remain after interest on financial resources provided (capital) has been paid to creditors and income tax paid to the state, for which reason ROE does not give a fully accurate picture of the appreciation of disposable capital in the company and the effectiveness of its management.

ROA (EBIT/assets), which measures the efficiency with which all the company's assets (total assets) are being utilised to generate earnings, seems to be a more useful indicator, for which reason the asset value should also include assets acquired under leases. This is often interpreted as a measure of the appreciation of all capital invested, regardless of the form in which it was invested (equity or debt). Differences in accounting procedures in different standards may be a source of potential differences in the value of indicators. It is, therefore, always necessary to be aware of these differences and, if possible, to eliminate them.

Some other ratios have also been constructed to measure the efficiency of business activities (i.e. company management) as accurately as possible. They often focus on more accurate measurements of a company's operations, for example excluding items that are dependent on accounting practices (often used in tax avoidance) or the prices of purchased materials and services (though this is questionable as the ability to negotiate more favourable prices reflects the bargaining power of the company and the ability of its management). This has led to the design of new indicators, such as value added/total assets, operating income/operating assets, economic value added/net operating assets, etc. One of these is the indicator EBITDA/assets. Earnings before interest, taxes, depreciation and amortisation is an approximation of the operating cash flow and is the best approximation of the total operating income of a company that can be used to finance investment projects, pay interest, taxes and debts, and pay shares to owners. This means that it measures the potentially available cash flow for all stakeholders.

Another indicator belonging to the profitability ratios group is the return on sales. This can take different forms – earnings after tax/sales, EBIT/sales or EBITDA/sales. The value of this ratio is dependent on the volume of sales (the volume of sales influences both the numerator and denominator) and the cost structure, in particular the proportion of fixed costs that remains the same when the volume of sales changes. The EBITDA/sales and EBIT/sales ratios are mainly used to estimate future cash flows based on the prediction of future demand and sales. It is used relatively often in strategic planning and is therefore suitable for predicting the success of mergers and acquisitions (M&A). The EBIT/sales ratio is also referred to as the operating margin.

Profit-based ratios play a significant role in bankruptcy prediction, while cash-flow-based ratios have been neglected by the mainstream