Scientific Research Publishing

Business Prohibition—How Company's Financial Statements Reflect the Positions of Convicted Persons?

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Abstract

This study deals with the companies where persons who are convicted of a business prohibition for aggravated financial crimes, have acted in various positions. The main question is how the key figures in the financial statements of these contact companies reflect the activities of these convicted people. The study mainly concentrates on companies where the convicted person has acted as a CEO or deputy CEO. Five research hypotheses are derived and four of them are supported by evidence. The hypotheses were tested with empirical data, which mainly consisted of very small micro, limited, private companies with only 3 - 4 employees. There were originally 22 financial variables in the data, of which 10 were selected for continuation. Finally, stepwise logistic regression (LR) analysis was used to develop a model to detect companies with convicted persons. This model included variables measuring company growth, liquidity, and solidity, but not profitability. Moreover, a variable reflecting inconsistency in behavior of financial ratios was incorporated into the model. In years 1 - 5 before the sentence, the model correctly classified 63.4% of contact companies and 64.2% of non-contact companies. The classification accuracy of the model decreased systematically when the positions of the convicted persons decreased.

Keywords

Financial Crime, Business Prohibition, Convicted Persons, Financial Statements, Finnish Companies

1. Introduction

The economic impacts of fraud and other economic crimes are very large all over the world. In PwC's Global Economic Crime and Fraud Survey 2022 re-

sponded by 1296 companies in 53 countries almost half of the companies (46%) reported experiencing some form of fraud or other economic crime within the last two years.[1] The crimes reported by firms included a wide variety of crimes, for example, accounting and financial statement crimes and tax frauds. The increase in the number of crimes can be prevented in many different ways. One way to prevent crimes is to ensure that persons who have engaged in unfair business practices cannot join the business community. In Finland, this is the main purpose of the Business Prohibition Act (13.12.1985/1059A) determining that a business prohibition can be imposed on a person who has in his or her business activity essentially neglected statutory duties or has been found guilty of a criminal activity in business.[2] In addition, a business prohibition may be imposed also for general serious crime offences. In Finland, annually on average 313 persons during 2009-2021 have been convicted of business prohibition.[3] The convicted persons have worked in business companies in various positions, including CEOs, board chairmen, board members, auditors and procurators. The main question in this study is how the key figures in the financial statements of these companies reflect the activities of these convicted people who worked in different positions.

The persons convicted by the Business Prohibition Act have committed a serious crime that transgresses a line separating right from wrong, where such a line separates legal behavior from its antithesis. Thus, the question is about wrongdoing in a legal meaning (Greve, Palmer, & Pozner, 2010; Schnatterly, Gangloff, & Tuschke, 2018). The Fraud Triangle suggests that the persons committing a crime (fraud) have pressure, opportunity, and rationalization to do that (Trompeter, Carpenter, Desai, Jones, & Riley, 2013). In Finland, persons sentenced according to the mentioned law are most usually guilty of aggravated crimes such as accounting offense, dishonesty by a debtor, and tax fraud. These persons have usually had financial pressure (distress) in their operations, they have worked in companies in an important position with considerable authority (opportunity), and in addition they have accepted the criminal mode of operation (rationalization) in their minds. It is possible to prevent the criminal behavior of these persons with various governance and control mechanisms, but when these mechanisms are disrupted, they increase tendencies for law-breaking behavior of employees (Snatterly, 2003).

In Finland, persons convicted under this law have typically worked in very small companies, where they have had a particularly high level of authority (for example, as owner-CEO) and where their actions have had a significant impact on the company's future. These kinds of small firms are often reliant on one or two large customers, have a limited product range and a small market base. They often, therefore, do not require the same kinds of governance and control sys-

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[1]https://www.pwc.com/gx/en/forensics/gecsm-2022/pdf/PwC%E2%80%99s-Global-Economic-Crime-and-Fraud-Survey-2022.pdf.
[2]https://finlex.fi/fi/laki/ajantasa/1985/19851059.
[3]https://pxdata.stat.fi/PxWeb/pxweb/en/StatFin/StatFin__syyttr/statfin_syyttr_pxt_126u.px/.

tems as large firms (Fuller-Love, 2006). In these kinds of small firms, the business is seen as an extension of the self-image of the key persons and also as a personal possession to do with what they want the business being essentially an extension of their own ego (Scott, Roberts, Holroyd, & Sawbridge, 1989: p. 91). Since these persons have committed serious crimes while acting in important positions in very small companies, where governance and control mechanisms are deficient and where they have great authority, it is to be expected that the criminal activity has also been reflected in the companies' financial statements.

The aim of this study is to assess how the criminal behavior of the key persons has affected the indicators calculated from the company's financial statements. It is expected that the higher the convicted person has worked in the company, the more clearly the effects of the action can be detected. The research examines companies where the convicted person may have worked in a high or lower position, but the assessment of the effects is focused above all on those companies where the convicted person has acted as a CEO. In a very small firm, the CEO has a lot of power and plays the central role in management. The more power the person has, the more opportunity he or she has to misbehave by overruling the board or ignoring organizational controls (Schnatterly, Gangloff, & Tuschke, 2018). Thus, it is to be expected that the work of a person convicted of crimes as the CEO of a company is reflected in the key figures of the financial statements more clearly than work in other positions. This kind of expectation is also in accordance with the upper-echelons theory, according to which the behaviors of the company reflect the cognitions and values of the CEO (Gupta, Briscoe, & Hambrick, 2017).

The aim of the present research is to produce results that make it possible to at least roughly identify, based on financial statement information, companies whose responsible manager is involved in criminal activity in his or her business, for which he or she can be sentenced to a business prohibition. The study is thus an important and new part of management wrongdoing research, of which Schnatterly, Gangloff, & Tuschke (2018) have presented an extensive summary. Many previous studies deal with unethical decision making by managers (for example, earnings management or lying), but not criminal activity per se. The target of this study are companies whose senior manager has typically committed aggravated crimes such as accounting offence, dishonesty by a debtor or tax fraud. Schnatterly, Gangloff, & Tuschke present studies related to these crimes, which deal with financial misconduct as reflected in financial misreporting, theft, embezzlement, or inappropriate use of company resources, and including cash or other assets, and fraud. They define following Zahra, Priem, & Rasheed (2005) fraud as deliberate actions taken by management at any level to deceive, con, swindle, or cheat investors and other key stakeholders. Schnatterly, Gangloff, & Tuschke report that during the last times, financial misreporting as reflected by financial restatements has been one of the most popular research approaches.

From the point of view of this study, the variable to be explained in relevant

previous studies is usually binary along the style of "committed the wrong" versus "did not commit the wrong" (Schnatterly, Gangloff, & Tuschke, 2018; Snatterly, 2003: Table 1). In this study, too, two groups of companies are compared in a binary way, one of which has the person in a leading position "sentenced to a business prohibition" whereas the leaders of the other company group "have not been sentenced to a business prohibition". Prior studies have then generally used a large set of independent variables to explain the selected binary variable. A good summary of such studies is provided by Zhao & Bai (2022), who themselves initially use 353 explanatory variables to explain, applying Machine Learning Algorithms, the dependent binary variable defined as "a legitimate company" and "a fraudulent company". Zhao and Bai selected for the final runs13 explanatory variables classified to the groups cash flow, operating capacity, and profitability. The result of their study was a statistical model that makes it possible to classify companies into two groups relatively accurately. The best model resulted as 0.794 AUC (area under the ROC curve). The most famous such statistical model is the F-score developed by Dechow, Ge, Larson, & Sloan (2011), of which there are three different models depending on which variables are used to explain material misstatements in financial statements. In the first version of the model, only variables calculated from the financial statements (accrual quality and firm performance) were used as variables. The model produced errors in classification such that TYPE I errors occurred in 36.31% and TYPE II errors in 31.38%.

The starting point of the current research is to evaluate the behavior of companies over a longer period of time with the help of variables calculated from the financial statements and to develop a simple statistical model that can be used to evaluate the significance of the differences between the groups of companies. The key special feature of this study is that the companies under investigation are private companies and very small, with a median size of only 3 employees. In these companies, the CEO is clearly the person who sets "the tone at the top" with regard to activities. Prior studies are almost all concentrated on large public companies. In addition, the category "sentenced to a business prohibition" consists of a heterogeneous group of companies whose responsible manager or employee may have committed a wide range of crimes. Persons sentenced to a business prohibition have been convicted of a total of 44 different crimes in court. In prior studies, the sample is usually homogenous with respect to the crime (for example, misstatement in financial statements). This means that the effects of the crimes that led to a business prohibition on companies' financial statements are very different, making it difficult to find common features in the companies' behavior. Therefore, the explanatory variables used in this study are general key ratios calculated from the financial statements, and for example different accruals variables are not used. It is clear that the same efficiency requirements cannot be set for a model developed in this way as for models that

investigate homogeneous frauds.

The contents of this study are organized in five sections as follows. First, the background, motivation and aim of the study were presented in the introductory section. In the second section, the framework of the study is presented, which first briefly discusses the relevant studies conducted earlier and then the key points of the Business Prohibition Act, the persons convicted and sentences based on this act in Finland. Finally, in this section, the research hypotheses are derived for the significance of financial key indicators as explanatory variables. The third section presents the empirical data and statistical methods. The observations in the data consist of less than 200 companies whose senior executive has been convicted under the Business Prohibition Act, and over 400 reference companies whose managers have not been convicted under the Act. The behavior of business groups is evaluated on the basis of five years' financial statements 1-5 years before the sentence. Since the companies in the data are very small, their financial statements contain a lot of outliers and the distributions of their indicators do not follow a normal distribution. Therefore, non-parametric methods and methods that are not sensitive to the normality assumption are mainly used in the evaluation of the results. The fourth section presents the results of the study, which for the most part support the presented hypotheses. The results indicate, that the criminal activity of the company's managers is reflected above all in the company's liquidity and solvency. In the final section, a short summary of research findings is presented and suggestions are made for future research in the field.

2. The Framework of the Analysis

2.1. Relevant Prior Studies

From the point of view of this study, the most central wrongdoing studies deal with the manipulation of financial statement information and fraud as dependent variables. In these relevant studies, variables based on financial statement data are used as independent variables. In the wrongdoing research, the most popular approach in recent years has indeed been financial misconduct as reflected in financial misreporting (Schnatterly, Gangloff, & Tuschke, 2018). In these studies, scholars have often used financial restatement as a dependent binary variable to explore wrongdoing (Troy, Smith, & Domino, 2011; Schnatterly, Gangloff, & Tuschke, 2018). In general, the binary variable, say Y, is defined as

$$Y = \begin{cases} 1, & when\ wrongdoing; \\ 0, & when\ not\ wrongdoing. \end{cases} \quad (1)$$

The binary variable has been defined in several different ways in studies. Harris & Bromiley (2007) and Pfarrer, Smith, Bartol, Khanin, & Zhang (2008) used a variable based on voluntary restatement of firm financial earnings for a specific year in a GAO report, while Beneish (1999), Cecchini, Aytug, Koehler, & Pathak (2010) and Dechow, Ge, Larson, & Sloan (2011) used restatements in AAERs

(Accounting and Auditing Enforcement Releases) as a measure. In addition to these, researchers have used restatements reported in news (Agrawal & Chadha, 2005; Donoher, Reed, & Storrud-Barnes, 2007; Ndofor, Wesley, & Priem, 2015) and restatements based on SEC/DOJ investigations (Carberry & King, 2012; Troy, Smith, & Domino, 2011).

The goal of these studies has usually been to develop an approach or model (forensic accounting tools) that can be used to identify a company that has manipulated its financial statements and committed a possible crime in connection with it. The best known of these models are the M-score (Beneish, 1999; Beneish, Lee, & Nichols, 2013) and the F-score (Dechow, Ge, Larson, & Sloan, 2011). Beneish (1999) compared the differences in traditional financial ratios between manipulators (n = 74) and non-manipulators (n = 2332) selected on the basis of restatements. Beneish showed that these groups of companies did not differ statistically significantly in profitability (ROI) or liquidity (Current ratio), but the manipulators were smaller, faster growing and more indebted (Debt to assets ratio) than non-manipulators. Beneish chose the explanatory variables for his M-model on three different bases, first, based on the literature future prospect metrics, secondly, variables based on cash flow and accruals, and thirdly, based on positive theory, metrics reflecting earnings management incentives. Eight variables came into the final M-score: Days' sales in receivables index (Collection period of trade receivables); Gross margin index; Asset quality index; Sales growth index; Depreciation index; Sales, general, and Administrative expenses index; Leverage index; and Total accruals to total assets (Beneish, 1999: pp. 26-28). Beneish used weighted exogenous sample maximum likelihood Probit (WESML) and unweighted Probit analysis to develop the M-score. M-score worked relatively efficiently in the classification, as it in the estimation data correctly classified 58% - 76% of the manipulators (holdout 37.5% - 56.1%) and 82.5% - 92.4% of the non-manipulators (holdout 90.9% - 96.5%).

Dechow, Ge, Larson, & Sloan (2011) examined the 2 190 AAERs released between 1982 and 2005. They identified 676 unique firms that have misstated at least one of their quarterly or annual financial statements. The authors used the terms earnings management, manipulation, and misstatement interchangeably, although fraud is often implied by the SEC allegations. In developing the F-score model, the authors focused on variables that can be easily measured from the financial statements, because they wanted the model to be applicable in most settings facing investors, regulators, or auditors. They used five types of variables in developing the model: Accrual quality; Financial performance; Nonfinancial measures; Off-balance-sheet activities; and Market-based measures. The authors compared five performance indicators in misstatement and non-misstatement companies (Change in cash sales; Change in cash margin; Change in return on assets; Change in free cash flows; and Deferred tax expense) and found only one statistically significant difference: Change in cash sales were significantly higher in misstatement than non-misstatement companies. The authors developed

three versions of the F-score: Model 1 included only financial-statement variables as predictors, Model 2 added nonfinancial-statement and off-balance-sheet variables, and Model 3 incorporated market-based measures. They applied the logistic regression analysis in a backward elimination mode to select the variables to arrive at the models. Finally, Model 1 (financial statement model) had only three variables: Change in cash sales; Change in return on assets; and Actual issuance. The variable actual issuance is an indicator variable identifying whether the firm has issued new debt or equity during the misstatement period. The three versions of F-score all had a comparable accuracy in classification. Model 1 classified correctly 68.6% of misstating companies and 63.7% of the non-misstating companies.

The classification ability of the traditional statistical models is not always high. Therefore, in order to identify fraudulent financial statements, a lot of research has also been done by developing efficient models using data mining methods (Kirkos, Spathis, & Manolopoulos, 2007; Ravisankar, Ravi, Rao, & Bose, 2011; Zhao & Bai, 2022). Kirkos, Spathis, & Manolopoulos investigated the usefulness of Decision Trees (DT), Neural Networks (NN) and Bayesian Belief Networks (BBN) in the identification of fraudulent financial statements (FFS). They had in their sample financial data from 76 Greek manufacturing firms whose status were checked by auditors. For 38 of these firms there was published indication or proof of involvement in issuing FFS, whereas 38 were characterized by the absence of any indication or proof of FFS in the auditors' reports. The independent variables were composed of ratios derived from financial statements. Using ANOVA tests, they selected ten financial variables out of 27 initial variables to be used in the three data mining models. The authors showed that BBN classified companies to fraudulent and non-fraudulent companies most effectively. BBN correctly classified in cross-validation 91.7% of fraudulent companies and 88.9% of non-fraudulent companies. Five variables calculated from the financial statements were selected to enter into the model (Altman Z-score; Net profit to total assets; Debt to equity; Sales to total assets; Working capital to total assets).

Ravisankar, Ravi, Rao, & Bose (2011) used data mining techniques Multilayer Feed Forward Neural Network (MLFF), Support Vector Machines (SVM), Genetic Programming (GP), Group Method of Data Handling (GMDH), Logistic Regression (LR), and Probabilistic Neural Network (PNN) to identify companies that resort to financial statement fraud. They had at their disposal a relatively narrow material, 101 fraudulent and 101 non-fraudulent companies from Chinese stock exchanges. The authors initially had 35 financial variables, of which 28 measured liquidity, safety, profitability, and efficiency of companies. Then, they selected the top 10 and 18 variables for further analyzes using the t-test. The selected top 10 financial variables were the following: Net profit; Gross profit; Primary business income; Primary business income to total assets; Gross profit to total assets; Net profit to total assets; Inventory to total assets; Inventory to current liabilities; Net profit to primary business income; Primary business income to fixed assets. Thus, eight variables out of ten were associated with the

profitability of the firm. In cross-valuation, PNN with 10 top variables outperformed all the techniques resulting in accuracy of 87.53 for fraudulent companies and 94.07 for non-fraudulent companies. The AUC (area under the ROC curve) for the PNN model was 90.80, reflecting a high classification accuracy.

Zhao & Bai (2022) collected their data of 18,060 transactions from Chinese stock markets ending with 1.01% fraudulent and 98.99% non-fraudulent companies. The authors initially had 353 independent variables to be used to explain the flag (binary dependent) variable. They finally extracted 13 variables which had an important impact on financial fraud detection. These variables were divided into three categories, including the cash flow, operating capacity, and profitability. The category of the cash flow variables included the following six variables: Cash paid for fixed assets; Intangible assets and other long-term assets; Non-business expenditure; Cash received relating to operating activities; Inventory; Business taxes and surcharges; and Operating cash flow. The category of operating capacity included three financial variables, Construction work in process; Minority equity; and Gain on disposal of assets. Finally, the profitability category included Undistributed profits; Deposit received; Primary earnings per share; and Total comprehensive income attributable to minority shareholders. Then, the authors established five single classification models and three ensemble models for the prediction of financial fraud records of listed companies, including Logistic Regression (LR); Random Forest (RF); Extreme Gradient Boosting (XGBOOST); Support Vector Machine (SVM); and Decision Tree (DT) and ensemble models with a voting classifier. The analyzes showed that a hybrid model which combines a logistic regression model with an XGBOOST model is the best among all models. The accuracy, recall, and precision are 98.523%, 99.017%, and 99.497%, respectively. Its AUC reached the highest point at 0.794. The result indicates that this ensemble model can predict whether companies have committed financial fraud efficiently and more accurately compared with others (Zhao & Bai, 2022).

This section presented a brief summary of studies that have dealt with the derivation of a statistical model for the identification of financial crimes, primarily fraudulent financial statements, using key figures calculated from financial statements. This narrow and limited review shows that studies have used a large number of very different indicators that have been found to be statistically significant. In the selection of key figures, a method has generally been used, in which a large set of key figures is initially available, from which a narrower set (a short list) is then selected for the model using statistical methods. Since indicators are usually correlated with each other, many indicators can work equally effectively in the model, so there are plenty of alternative equally significant indicators for the model. The review indicates that almost all traditional profitability, liquidity and solidity ratios are found important in the detection of fraud. In addition to that, changes in financial statement items and rapid growth are found to be important variables in the models. The complexity of the models shows a

high variety. However, an important observation in the studies is that a model that effectively explains fraud does not have to be complex and contain a large number of indicators. For example, the findings of Bell & Carcello (2000: p. 182) suggest that a relatively simple decision aid performs quite well in differentiating between fraud and non-fraud observations. Their logistic regression model consisted of seven independent variables, including rapid company growth and inadequate or inconsistent relative profitability. Similarly, Spathis, Doumpos, & Zopounidis (2002: p. 527) reported that a simple logistic regression model with a reduced set of variables leads in cross-validation to a better classification accuracy than a model with the complete set of variables. The authors summarize that a higher model fit does not ensure higher generalizing ability, which is the ultimate objective in decision models, developed through regression-based techniques.

2.2. The Finnish Business Prohibition Act

The sentence of business prohibition is not usually based on only one specific type of crime, but is a combination of several aggravated crimes. The dependent variable of this study is therefore significantly different from the variables used in previous studies, for example the variable fraudulent financial statements (FFS), so in this framework it is necessary to go through the law on business prohibition and the crimes committed in connection with it in more detail. The general purpose of prohibitions on business activities is to ensure that persons who have engaged in unfair business practices cannot join the business community. In Finland, the Business Prohibition Act (13.12.1985/1059A) determines that a business prohibition can be imposed on a private practitioner of business involving the accounting obligation, on a partner in a general partnership, a liable partner in a limited partnership and a member of a European economic interest group and those, who are corporation board members or managing directors or in other comparable positions, similarly as those, who actually direct the activity of the corporation or foundation or a foreign branch or manage its administration.[4] A business prohibition can be imposed on a person if he or she has in his or her business activity essentially neglected his or her statutory duties or has been found guilty of a criminal activity in business.

In addition, a business prohibition may be imposed for the following general crime offences: distribution of a sexually offensive picture; aggravated distribution of a sexually offensive picture depicting a child; possession of a sexually offensive picture depicting a child; trafficking in human beings; and aggravated trafficking in human beings. A business prohibition may also be imposed for the offences of pandering and aggravated pandering if the object is a person aged under 18. A business prohibition may be imposed for at least three years and for at most seven years.

In Finland, according to Statistics Finland, a total of 4072 people were sen-

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[4]https://finlex.fi/fi/laki/ajantasa/1985/19851059.

tenced to business prohibitions in the years 2009-2021, an average of 313 per year. Most of the convicts were men, 87.0%. In 2009-2021, only a few people under 20 or over 70 years were sentenced to a business prohibition.[5] Most of the persons sentenced to a business prohibition were between 30 and 59 years old. On average, 80.8% of convicted persons belonged to this age group. Business prohibitions were sentenced for a wide variety of crimes. The majority, 68.9%, of the sentences handed down in 2009-2021 were based on the crime of Aggravated accounting offense (Criminal Code 30:9a§1/1-3). In addition, 4.0% of the sentences were based on the similar milder crime (not aggravated) of Accounting offence (Criminal Code 30:9§1/1-3). The second most common sentence, 14.7%, was for the crime of Aggravated dishonesty by a debtor (Criminal Code 39:1a§1/1-3). The third most common crime, 5.6%, was Aggravated tax fraud (Criminal Code 29:2§1/1-2).[6] These four types of crime formed 92.2% of sentences on average. In practice, almost all sentences are related to business crimes. The lengths of business prohibition sentences varied between 3 and 7 years, so that the majority of sentences were between 3.5 and 4.5 years. On average, 89.8% of the sentences handed down in the years 2009-2021 were placed in between (Statistics Finland).

The first most common crime leading to a business prohibition is Aggravated accounting offense, of which there are also many convictions for the milder form of Accounting offense. A person shall according to the Finnish Criminal Code (Criminal Code 30:9§1/1-3) be sentenced for an accounting offense to a fine or to imprisonment for at most two years, if the person with an obligation to keep accounting records, his or her representative, the person exercising effective control in a legal person with an obligation to keep accounting records, or the person entrusted with the keeping of accounting records by commission, 1) in violation of the statutory accounting obligations, neglects to record business transactions or to prepare financial statements, 2) enters false or misleading data into the accounting records, or 3) destroys, conceals or damages account documentation, and thus impedes the obtaining of a true and sufficient picture of the financial result or financial standing of the business activities of the person or legal person with an obligation to keep accounting records. However, the person shall be sentenced for an Aggravated accounting offence (Criminal Code 30:9a§1/1-3) to imprisonment for at least four months and at most four years, if in an accounting offence, 1) the recording of business transactions or the preparation of financial statements is neglected in full or to an essential degree, 2) there is a considerable amount of false or misleading information, these pertain to large amounts of money or they are based on falsified receipts, or 3) the accounting records are destroyed or hidden in full or to an essential degree or they are damaged to an essential degree, and the accounting offence is also aggravated when assessed as a whole.

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[5]https://pxdata.stat.fi/PxWeb/pxweb/en/StatFin/StatFin__syyttr/statfin_syyttr_pxt_126u.px/.
[6]See https://finlex.fi/en/laki/kaannokset/1889/en18890039_20210433.pdf.

The second most common crime for business prohibition is Aggravated dishonesty by a debtor (Criminal Code 39:1a§1/1-3). A debtor shall be sentenced for dishonesty by a debtor to a fine or to imprisonment for at most two years if the debtor 1) destroys his or her property, 2) gives away or otherwise surrenders his or her property without an acceptable reason, 3) transfers his or her property abroad in order to place it beyond the reach of his or her creditors, or 4) increases his or her liabilities without basis, and thus causes himself or herself to become insolvent or essentially worsens his or her state of insolvency. However, the debtor shall be sentenced for aggravated dishonesty by a debtor, if in dishonesty by a debtor 1) considerable benefit is sought, 2) considerable or particularly significant damage is caused to the creditors, or 3) the offence is committed in a particularly premeditated manner, and the dishonesty by a debtor is also aggravated when assessed as a whole.

The third most common crime leading to a business prohibition is Aggravated tax fraud (Criminal Code 29:2§1/1-2). A person shall be sentenced for tax fraud to a fine or to imprisonment for at most two years, if he or she 1) for the purposes of taxation provides an authority with false information on a fact that affects the determination of tax, 2) files a tax return concealing a fact that affects the determination of tax, 3) for the purpose of avoiding tax, fails to observe a statutory duty pertaining to taxation that is of significance in the determination of tax, or 4) otherwise acts fraudulently, and thus causes or attempts to cause a tax not to be determined. However, the person shall be sentenced for aggravated tax fraud to imprisonment for at least four months and at most four years, if, in tax fraud, 1) considerable economic benefit is sought, or 2) the offence is committed in a particularly premeditated manner, and the tax fraud is also aggravated when assessed as a whole.[7]

2.3. Hypotheses of the Study

2.3.1. General Expectations

This study concentrates on detecting companies whose responsible person has convicted for a business prohibition. Sudjianto, Yuan, Kern, Nair, Zhang, & Cela-Díaz (2010) define detection as the ability to discover that a financial crime occurred. Thus, a detection system tries to identify patterns and trends of suspicious behavior. Usually, the system will generate a suspicion score that indicates how likely a case is to be criminal and cases exceeding a certain suspicion score threshold will be investigated. The performance of the detection system depends ultimately on speed at which the crime is detected, the range of crimes that the system can detect, and the number of correct classifications generated. In this study, detection of companies is challenging since the range of crimes is wide and the patterns of behavior can be very diverse. If a person has committed an aggravated accounting offense, the accounting material on which the financial statements are based may be completely misleading or it may have been mostly

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[7]https://finlex.fi/en/laki/kaannokset/1889/en18890039_20210433.pdf.

destroyed, in which case the connection between the book-keeping and the financial statements cannot be established. It may also be that no financial statements have been drawn up at all so that it is not possible to use detection systems based on financial statements. Thus, aggravated accounting offence complicates the investigation of the crime or at least gives a false (too good or bad) picture of the company's financial state, especially profitability.

The behavior of financial statements reflecting other types of crime is different. If a person has committed aggravated dishonesty by a debtor, he or she may have destroyed a part of the company's fixed assets, given them away at a very low price, or hidden them, worsening in this way the position of the creditors. If the changes in fixed assets have been recorded in the balance sheet, dishonest activity is reflected in an excessive decrease in fixed assets and equity weakening the ratio of the company's own funds to the total capital (solvency ratio). Furthermore, this dishonest activity weakens the profit of the firm if the loss on sale of fixed assets is shown in the income statement. If a person is guilty of aggravated tax fraud, it means that the person has tried to evade taxes and other public obligations, for example by not recording part of the cash income (avoiding value added and income tax) or salary expenses paid in cash (avoiding labor payment obligations) in the accounting. This kind of activity creates (non-negative) hidden cash outside of book-keeping, where unrecorded cash payments come and go. This hidden cash weakens the official liquidity calculated from the company's balance sheet (quick or current ratio). If both revenues and expenses are missing from book-keeping, the net effect of the activity on the profitability (profit) calculated from the financial statements may however be relatively small.

In practice, it is difficult to detect the impact of the actions of the convicted persons on the financial indicators of these contact companies directly using only financial statement data. The financial ratios calculated from the financial statements of these (contact) companies may differ statistically from the financial ratios of other (non-contact) companies in an insignificant way, if the crimes are not exceptionally large. Therefore, a potentially more efficient way to evaluate the differences between these groups of companies may be to study the behavior (patterns) of key financial figures over a period of several years. Inconsistencies in this behavior can be a sign of manipulation or a financial crime. In this context, an inconsistency means that the behavior of financial ratios contradicts with the logic. The simple logic behind financial statement analysis tells that the profitability of the company has a direct connection with the company's solidity and liquidity, which in turn are connected to each other. If the company's profitability is reasonable and does not decrease over time, solidity and liquidity should also remain reasonable. If profitability decreases, according to the logic solidity and liquidity should also decrease. Moreover, a decline in liquidity usually follows a decline in solidity. It can be expected that the behavior of contact companies over a period of several years may differ from this general logic

of non-contact companies. Since the financial statements in the contact companies may be falsified, there may not potentially be a clear connection between the behavior of profitability, liquidity, and solidity ratios. In these connections, profitability plays the central role.

2.3.2. Hypotheses

The majority of persons sentenced to a business prohibition have committed aggravated crimes accounting offense, dishonesty by a debtor, or tax fraud, which have different effects on the company's financial statements. The rough effects of these crimes on the variables calculated from the financial statements can be illustrated with the help of a simple mathematical analysis in the following way. First, a sentenced person can commit an accounting offense by neglecting or destroying the accounting records or by providing false or misleading information. False or misleading accounting information is often in a small company associated with profit manipulation, which is used to reduce taxes. The company's profit P_t can be represented by revenues R_t, expenses D_t, expenditures E_t and depreciable assets A_t using the accounting identity in the following way:

$$P_t = R_t - D_t = R_t - E_t + A_t - A_{t-1} \tag{2}$$

Thus, expenses are defined as the difference between expenditures and the change in assets.

The company's profit can be manipulated by valuating assets lower or higher than the actual value. If the company uses in the current and the previous year the same fixed value coefficient a to value assets in relation to the actual value (consistent accounting principle), the company's profit in the official income statement will be the following:

$$P_t \rightarrow R_t - E_t + a(A_t - A_{t-1}) \rightarrow P_t - (1-a)(A_t - A_{t-1}) \tag{3}$$

If a company undervalues assets so that $a < 1$, which at the same time increases expenses, profit and taxes will decrease. It is important to notice that growth has a significant effect on increasing expenses. If the company does not grow, then $A_t = A_{t-1}$ and valuation for a constant a does not affect profit. Thus, growth is a significant and necessary factor in manipulation. In practice, the company can affect the profit through (3) using asset revaluations or different methods of depreciation. It can decrease profit to diminish taxes through write-downs and accelerated depreciations. However, it can also use write-ups and decelerated depreciations to increase profit to report higher earnings. In that case, $a > 1$.

Since undervaluation of assets diminishes the value of assets, the effect of manipulation on the return on investment ratio (*ROI*) is not directly comparable with that on profit, and consequently, on the profit margin (%). The undervaluation of assets leads to that *ROI* will be changed in the following way:

$$ROI \rightarrow \frac{R_t - E_t + a(A_t - A_{t-1})}{aA_{t-1}} = \frac{ROI - g(1-a)}{a} \tag{4}$$

In Equation (4) g refers to the growth of assets as $A_t/A_{t-1} - 1$. This equation

shows that when $a = 1$, ROI does not change because there is no undervaluation. However, when $a < 1$ but $g = 0$, ROI will increase due to the undervalued assets in the denominator. The lower the valuation coefficient a and the higher the growth rate g, the larger is the impact of undervaluation on ROI. Thus, in this framework, undervaluation and growth of assets are important determinants of ROI.

Secondly, the convicted person can engage with an aggravated dishonesty by a debtor when he or she gives away or sells at a very cheap price his or her property without an acceptable reason. This kind of situation can be approximated assuming that the person sells a part e of assets A_t in the balance sheet at a low price (level) p and worsens in this way his or her state of insolvency. If $p = 1$, the assets are sold at the price corresponding to the balance sheet value. The selling of part e of assets means that the value of the assets will after the sale become $(1 - e) \cdot A_t + p \cdot e \cdot A_t$. If the equity of the company before the sale is F_t, then it will be after the sale $F_t + p \cdot e \cdot A_t - e \cdot A_t$ when the sale revenue is added to F_t and the balance sheet value of sold assets is deducted from F_t, to get loss of sales. Selling the part e of assets A_t means that after the sale the assets in the balance sheet is $(1 - e) \cdot A_t$, which leads the solidity ratio S to change as follows:

$$S = \frac{F_t}{A_t} \rightarrow \frac{F_t + e(p-1)A_t}{(1-e)A_t} = \frac{S + e(p-1)}{1-e} \tag{5}$$

Equation (5) indicates that the selling price level p and the share e of A_t that is sold, remarkably affect the solidity of the company in terms of the equity ratio.

The sale of A_t at a cheap price also affects the profitability of the company (ROI) in the same way as it affects the solidity in (5). The sale will diminish the profit P_t by the loss $e(1 - p) \cdot A_t$. However, the denominator A_{t-1} of ROI will stay unchanged so that ROI after the sale will be as follows:

$$ROI = \frac{P_t}{A_{t-1}} \rightarrow \frac{P_t + e(p-1)A_t}{A_{t-1}} = ROI + e(p-1)(1+g) \tag{6}$$

In Equation (6) g refers to the growth of A_{t-1} during the period t. Thus, the selling of assets at low price affects the profitability of the company also through the growth of assets.

Thirdly, a person can commit a tax fraud by neglecting public payments and transferring cash payments to a hidden cash, bypassing book-keeping. The person can then take cash from this hidden cash to pay, for example, salaries that are not recorded in the book-keeping. If the person transfers during a period from revenues R_t a share of $b \cdot R_t$ to the hidden cash and uses the cash to pay from wages W_t a share $c \cdot W_t$, the hidden cash will change during the period by $b \cdot R_t - c \cdot W_t$ that is missing from the book-keeping. This kind of action will change the relation of revenues and wages in the book-keeping in the following way:

$$\frac{R_t}{W_t} \rightarrow \frac{bR_t}{cW_t} \tag{7}$$

Equation (7) indicates that the transfer to the hidden cash has the following

impact on the margin after salaries:

$$\frac{R_t - W_t}{R_t} \rightarrow \frac{(1-b)R_t - (1-c)W_t}{(1-b)R_t} = 1 - \frac{(1-c)W_t}{(1-b)R_t} \tag{8}$$

If $b = c$, the cash transfer to the hidden cash does not affect the ratios (7) and (8). If the values of the ratios significantly differ from the typical value for such a company, it may attract attention from the side of tax officers. Therefore, the company may set the ratios to remain identical, in which case $b = c$ and cash $b(R_t - W_t) = c(R_t - W_t)$ (>0) is added to the hidden cash.

The hidden cash created in this way affects the company's taxation and the key indicators of the official financial statement in several different ways. By forming a hidden cash, the net sales of the company's official income statement will decrease by $b \cdot R_t$, which reduces the growth and profit, as well as income tax and value added tax. Correspondingly, due to the cash payments made outside the book-keeping to pay hidden salaries, the salaries in the official income statement decrease by $c \cdot W_t$. This hidden payment increases the profit (in the official income statement) and thus also the income tax, but at the same time it reduces the labor payment obligations related to the workforce. The cash transferred to the hidden cash also reduces the cash assets shown in the company's official balance sheet. For example, the quick ratio QR showing the ratio of financial assets C_t to current liabilities L_t will change due to the hidden cash in the following way:

$$QR = \frac{C_t}{L_t} \rightarrow \frac{C_t - bR_t + cW_t}{L_t} = QR - \frac{bR_t - cW_t}{L_t} \tag{9}$$

Thus, the hidden cash diminish financial assets in the official balance sheet and impairs QR. If the sales revenue $b \cdot R_t$ received in cash and transferred to the hidden cash register is obtained from products sold from the inventory, the current assets in the official balance sheet in terms of inventory will be correspondingly smaller. Using hidden cash outside of official accounting thus reduces the growth (growth of net sales and salaries), profit (profitability) and liquidity estimated from the financial statements calculated on the basis of book-keeping. Thus, it weakens cash and cash equivalents (quick ratio) and, for a company that has inventories, product inventory (current ratio), which are the key indicators for assessing traditional liquidity. Moreover, a decrease of the profit in the income statement also weakens the company's solvency (equity ratio).

The simple results of this section of the study show the same thing that the previous studies indicated. Financial crimes can have a significant impact on almost all key figures calculated from the financial statements. In many cases, it is essential that the company grows quickly, in which case their effects are greatly amplified. However, it is difficult to give a clear answer about the effects of financial crimes on profitability, because illegal means in earnings management (EM) have also been used to show too good profitability to stakeholders, and not just to reduce profits in order to reduce taxes. The results show, however, that

such crimes, which are typical to business prohibition convictions, have a clear weakening effect on the indicators measuring the company's liquidity and solvency. In addition, it is expected that the effects will be stronger on the financial statements of those companies where the person sentenced to a business prohibition has worked in more responsible positions (for example as CEO) and possessed, according to the Fraud Triangle theory, pressure, opportunity, and rationalization to commit a crime. According to the theory, these three factors together increase the probability that a person commits crimes. The following hypotheses can therefore be set for the study:

H1. Companies contacted with a person sentenced to a business prohibition, can be detected more likely, the higher the position the person has worked.

H2. Companies contacted with a person sentenced to a business prohibition, have a higher grow rate than companies without contact.

H3. Companies contacted with a person sentenced to a business prohibition, have a lower profitability than companies without contact.

H4. Companies contacted with a person sentenced to a business prohibition, have a lower liquidity than companies without contact.

H5. Companies contacted with a person sentenced to a business prohibition, have a lower solidity than companies without contact.

It should be noted that the effect of a contact on profitability as expressed in H3 can also be inconsistent due to the earnings management (Bell & Carcello, 2000). If profitability is inconsistent, financial ratios do not necessarily follow the logic of financial statements.

3. Empirical Data and Statistical Methods

3.1. Empirical Data

The sample of contact companies was selected from the group of companies where the sentenced persons had an important position when the business prohibition was sentenced. The sample was made from the companies where the person in charge was sentenced in the period 2014-2021. However, the sentences for the sample firms are mainly concentrated on the period 2016-2020. In the period from 2014 to 2021, the number of sentences was respectively 2, 6, 14, 15, 17, 30, 74, and 4. Thus, for the period 2014-2015 there are only two sentences and for the year 2021 four sentences. The selected companies are all small private limited companies whose financial statements were publicly available.[8] The size distribution of the contact companies is very skewed since the average number of employees is 8.9 but the median is only 4 employees. The contact companies are distributed on different industrial categories. Most companies belong to the NACE industries wholesale and retail trade (G), construction (F), manufacturing (C), professional, scientific and technical activities (M), or information and communication (J). In all, about 65.4% of the companies belong

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[8]Financial statement data have been gathered using Voitto+ data base maintained by Suomen Asia-kastieto Oy.

to one of these industries. The distribution of companies by NACE industry is presented in Table A1. For control purposes, a set of non-contact companies were chosen randomly from among companies where sentenced persons have not held any position. These companies are used in the study for control purposes only. The non-contact companies are about the same size (median is 3 employees) and from the similar industries as the contact companies.

Table 1 shows the number of company-years for distance from the closing of accounts to the sentence year for 0 to 6 years for the contact and non-contact companies. For the contact companies, the company-years are classified by the position of the convicted person in the company. The number of company-years are quite small for the positions of the chairman of the board and the procurator or the authorized signatory. When evaluating the company sample, it should be noted that the same convicted person may have held several positions in the same company. For example, in small firms the CEO is often also a member of the board. In this study, the highest position is associated with the contact company.[9] The sentenced person can also have different positions in several contact companies. The higher the position the convicted person has in the company, the greater the opportunities the person has to commit significant financial abuses and the more clearly their consequences are reflected in the key figures calculated from the company's financial statements. For the sentence year(distance = 0), the number of company-years is small. In addition, the analysis of the financial statement data indicated that the financial ratios are frequently abnormal for this sentence year. For the distance of six years, the number of company-years is also small. Therefore, for the statistical analysis of this study, the research period is limited to the distance years from 1 to 5 (grey area in the table). For the non-contact companies, the artificial (calculated) distance is calculated subtracting the accounting year from 2020 to maximize the number

Table 1. Contact companies (CC) and non-contact companies (NCC) in the study.

	Number of company-years						
	Distance to the sentence year:						
Position of the sentenced person	0	1	2	3	4	5	6
CEO or deputy CEO	10	43	49	50	50	38	17
Chairman of the board	2	3	4	7	7	5	6
Full or deputy member of the board	12	58	69	73	73	60	24
Procurator or authorized signatory	2	10	12	12	12	8	3
Auditor or deputy auditor	12	46	50	52	52	39	15
Total	38	160	184	194	194	150	65
Non-contact companies	70	423	443	440	405	314	56

[9]The following rank order was used in selecting the highest position: CEO, Chairman of the board, Deputy CEO, Procurator or authorized signatory, Full member of the board, Auditor, Deputy audi-

of company-years.

In this study, ten of out 22 available key figures calculated from financial statement data are used to describe the financial situation and development of companies.[10] The purpose was to select financial indicators which are useful in detecting criminal behavior behind financial statements. This selection is based on the results of prior studies, current theoretical consideration, and statistical tests used in comparison of the company groups (median test). Moreover, the purpose was to select traditional financial ratios which are commonly used in financial ratio analyses and which cover all the main areas of importance (growth, profitability, liquidity, and solidity). Several financial ratios also had a high number of missing values and were excluded from the further analyses. In some cases, financial ratios included too little variation to be significant. For example, in the last year of the period (one year prior to sentence) inventories were zero (or missing) for 69.1% of the sample companies. Inventory turnover was found a significant variable for companies with positive inventories, but insignificant for all companies. Finally, ten financial variables out of 22 initial ratios were selected to the empirical analyses.

First, the company's growth is measured by the change in net sales (%) and the change in gross profit (%). Secondly, the company's profitability is measured by the ratio of earnings before interest and tax (EBIT) to net sales (EBIT margin (%)). Profitability is also assessed by the ratio of EBIT to the average of two last balance sheet totals minus interest-free debt (return on investment (%)). This ratio, return on investment (*ROI*) is practically the most generally used indicator of profitability. Third, liquidity is assessed by three different financial ratios: traditional quick ratio, current ratio, and working capital to net sales ratio (%). Quick ratio is defined as the ratio of current financial assets to current liabilities, whereas current ratio relates financial assets plus inventories to current liabilities. Working capital is calculated as inventories plus account receivables minus account payables and advances received. In this study, current ratio and working capital ratio are important ratios because they consider also inventories which are frequently missing from the published data but which may be relevant to committing fraud. Fourth, solidity is also measured using three financial statement indicators. The first of these measures is the equity ratio (%), which is calculated by dividing equity by total capital (minus advances received). Equity ratio is a very commonly used financial statement measure, which may be one of the most effective predictors of bankruptcy or payment difficulties. Solidity is also measured by the ratio called net gearing, where the difference between interest-bearing liabilities minus cash and marketable securities is divided by the equity. In addition to these ratios, solidity is measured by dividing the company's debts by net sales, resulting in the debt to net sales ratio (%).

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[10]For exact formulas of the 22 variables see:
https://www.asiakastieto.fi/voitto/ohje/tunnusluvut_eng.htm#cha.

3.2. Statistical Methods

The contact companies and non-contact companies in the sample of this study are almost all small micro companies. Before the actual statistical runs, it turned out that the financial statement data published by these companies are often incomplete. Furthermore, the distributions of key figures are much skewed, in which case, due to several extreme observations; the average of the original variables had very little informational value. Therefore, non-parametric methods, where the median of the data plays a central role, are used in comparing the statistical distributions in the groups of companies. In the first stage, the development of the medians of the ten key indicators is analyzed, when the distance between the sentence year and the closing of accounts year varies from five years to one year. Secondly, the differences between the contact companies and the non-contact companies are tested using the non-parametric Mann-Whitney U-test as a statistical test. The null hypothesis (H0) of the test is that the distributions of the variables (financial indicators) in both populations are identical. The alternative hypothesis (H1) is that the distributions of these variables are not identical. The potential trends of the financial indicators are investigated using Spearman rank correlation coefficient (Rho) between the indicators and the distance variable (time variable from 5 to 1). This correlation is a nonparametric measure of rank correlation reflecting statistical dependence between the rankings of two variables.

The purpose of the study is to analyze the behavior of the financial variables in contact and non-contact companies but also to try to develop a detection model to classify the companies into these two groups. For this purpose, the binary logistic regression analysis (LRA) is adopted to estimate a model to discriminate between contact and non-contact companies. Because the distributions of the financial variables in the present sample are skewed and include extreme observations (outliers), winsorizing (2%) was used to reduce the effect of possibly spurious outliers. In these kinds of situations, winsorizing is a useful transformation of data by limiting extreme values of variables, which also improves the normality of the data. Logistic regression analysis is in this case a recommended method, because it does not require that independent variables are multivariate normal or that the groups have equal covariance matrices. For statistical estimation, a binary variable Y is used to describe a company with ($Y = 1$) or without ($Y = 0$) a contact to a sentenced person. LRA creates a linear score (logit) score L for every observation using a set of independent variables (X). This score or logit is used to determine the conditional probability of having a contact with a sentenced person ($Y = 1$) as follows:

$$p(Y = 1 \mid X) = \frac{1}{1 + e^{-L}} = \frac{1}{1 + e^{-(b_0 + b_1 X_1 + \cdots + b_n X_n)}} \tag{10}$$

where b_i are the coefficients and X_i the independent variables ($i = 1, 2, \cdots, n$). The logistic regression model is estimated to detect primarily the contact companies,

where the sentenced person has been a CEO or a deputy CEO. For this group, the differences to the non-contact companies in the independent variables are expected to be most significant. LRA is adopted to a pooled data where all company-year observations from the distance 1 - 5 years are used to estimate the model. The use of pooled data improves the ability to detect a contacted company already several years before the sentence. The framework of the study indicates that there are several candidates of variables to belong to *X*. Therefore, conditional forward stepwise selection method with entry testing based on the significance of the score statistics was adopted to select the predictors.[11] In this method, the removal of a selected variable is based on the probability of a likelihood-ratio statistic based on conditional parameter estimates. The performance of the estimated model is assessed by the rate of correctly classified companies and the area of the ROC curve (AUC). The classification accuracy is validated using a simple bootstrap procedure based on 1000 samples.

4. Empirical Results

4.1. CEO and Deputy CEO

Table 2 shows the medians of the ten key financial ratios by distance from the year of sentence for the contact companies of the CEO or deputy CEO. This table shows how the financial ratios tend to behave when the convicted person has acted as CEO or deputy CEO. The table indicates that the growth rates of net sales and gross profit have generally rapidly increased over the last few years. However, the profitability indicators EBIT margin and return on investment ratio have developed unevenly. Quick ratio and current ratio, indicators of traditional liquidity, have been very low in last years before the sentence and indicate serious payment difficulties. For example, the critical value used generally for quick ratio is 1, while the median of the ratio for these companies has varied between 0.5 and 0.6. In the same way, low values of current ratio being below 0.9 refer to difficulties in liquidity and, in addition, to small inventories. The median of equity ratio is less than 10% one year before the sentence, which refers to serious solidity difficulties caused by lack of equity. However, median companies do not have very much debt in relation to net sales, perhaps due to the rapid growth of sales. In this case, net gearing gives an inconsistent view of indebtedness, because for example one year prior to the sentence, 39.0% of the companies have zero or negative equity (divisor of the key figure).

Table 3 presents the medians of the financial variables for the non-contact companies to compare the behavior of financial ratios in companies without convicted persons. In this group of companies, the medians of almost all variables have remained stable over the five-year period. However, solidity as measured by equity ratio and net gearing was good already in the initial year but

[11]See
https://www.ibm.com/docs/en/spss-statistics/29.0.0?topic=regression-logistic-variable-selection-methods.

has also further improved steadily. The growth in net sales and gross profit has at the median level been very slow, with growth rates close to zero. Profitability indicators EBIT margin and return on investment ratio for these companies are not high, but have anyway remained stable. The medians of the indicators quick ratio and current ratio indicate sufficient and stable liquidity throughout the period.

Table 2. Median values of the financial ratios by distance for the contact companies of CEO or deputy CEO.

	Median values of the financial ratios						
	Distance to the sentence year:						
Financial ratio	5	4	3	2	1	Correlation§	p-value
Growth of net sales (%)	−4.20	4.25	0.00	7.10	10.20	−0.900	0.037
Growth of gross profit (%)	−0.30	6.40	3.80	7.55	11.80	−0.900	0.037
EBIT margin (%)	1.50	5.00	1.80	8.85	2.90	−0.500	0.391
Quick ratio	0.70	0.60	0.50	0.55	0.60	0.462	0.434
Current ratio	0.90	1.00	0.80	0.85	0.80	0.718	0.172
Return on investment (%)	2.20	7.20	3.80	6.55	3.55	−0.100	0.873
Equity ratio (%)	13.40	16.90	13.30	20.00	9.60	0.300	0.624
Net gearing	0.00	−0.05	−0.10	−0.10	−0.35	0.975	0.005
Debt to net sales ratio (%)	28.40	29.40	30.30	34.20	32.50	−0.900	0.037
Working capital ratio (%)	1.10	0.15	2.20	4.35	1.50	−0.600	0.285

Legend: § = Spearman rank correlation between the median and the distance.

Table 3. Median values of the financial ratios by distance for the non-contact companies.

	Median values of the financial ratios						
	Distance to the sentence year:						
Financial ratio	5	4	3	2	1	Correlation§	p-value
Growth of net sales (%)	0.00	0.40	1.60	1.30	0.00	−0.103	0.870
Growth of gross profit (%)	0.80	0.00	1.95	0.00	0.00	0.447	0.450
EBIT margin (%)	4.25	4.15	4.90	4.95	4.95	−0.872	0.054
Quick ratio	1.40	1.30	1.35	1.40	1.60	−0.564	0.322
Current ratio	1.70	1.80	1.80	1.70	1.90	−0.527	0.361
Return on investment (%)	6.60	5.00	5.90	6.30	4.50	0.600	0.285
Equity ratio (%)	54.95	54.40	58.25	62.50	62.90	−0.900	0.037
Net gearing	−0.10	−0.10	−0.15	−0.20	−0.20	0.949	0.014
Debt to net sales ratio (%)	27.50	28.00	29.50	27.25	25.80	0.600	0.285
Working capital ratio (%)	5.90	5.15	5.60	5.00	4.65	0.900	0.037

Legend: § = Spearman rank correlation between the median and the distance.

Table 4 presents the significance levels of the Mann-Whitney U-test when the levels of the financial ratios in the non-contact companies are compared with those in the contact companies of the CEO or deputy CEO. Significance levels show that the differences between company groups have been statistically very significant in variables quick ratio, current ratio and equity ratio in each of the five years before the sentence. On the other hand, the differences found in profitability indicators EBIT margin and return on investment ratio are not statistically significant. The significance of the differences has increased in the last year in all financial variables other than the profitability ratios. This result indicates that the development of profitability in relation to other indicators has been inconsistent. Although the differences in the median growth rates between the company groups are intuitively remarkable, these differences are not statistically significant.

4.2. Other Positions

Table A2 presents the median values of the financial ratios for the contact companies by distance and position of the convicted person other than CEO or deputy CEO. Table A2(a) shows the median values for contact companies of the chairman of the board. The number of observations in this group is very small, so the results cannot be generalized. Especially the medians of the last year before the sentence are particularly exceptional. Both indicators of profitability and traditional liquidity, quick ratio and current ratio, have improved significantly in the last year. Since quick ratio and current ratio are practically equal, so companies have no inventories. Equity ratio has improved significantly in every year.

Table 4. Significance level of the Mann-Whitney U-test in comparison of the median of the financial ratios in all contact companies and in non-contact companies.

	Significance level of the Mann-Whitney test				
	Distance to the sentence year:				
Financial ratio	5	4	3	2	1
Growth of net sales (%)	0.786	0.507	0.464	0.467	0.165
Growth of gross profit (%)	0.893	0.158	0.687	0.276	0.121
EBIT margin (%)	0.323	0.897	0.457	0.168	0.897
Quick ratio	<0.001	<0.001	<0.001	<0.001	<0.001
Current ratio	<0.001	<0.001	<0.001	<0.001	<0.001
Return on investment (%)	0.375	0.288	0.751	0.295	0.663
Equity ratio (%)	<0.001	<0.001	<0.001	<0.001	<0.001
Net gearing	0.277	0.538	0.928	0.833	0.190
Debt to net sales ratio (%)	0.935	0.325	0.697	0.973	0.160
Working capital ratio (%)	0.080	0.102	0.258	0.308	0.108

Table A2(b) shows the medians of the independent variables for the contact companies of full or deputy member of the board. The medians of the growth rates refer to an uneven growth. The median of the profitability indicator return on investment ratio is low and fluctuates strongly, while the EBIT margin is flat and at a reasonable level throughout the period. The solidity of companies improves according to the median of equity ratio every year.

Table A2(c) shows the medians of the variables for the contact companies of procurator or authorized signatory. The median growth of companies fluctuates strongly and in the last year before the sentence the median growth in net sales and gross profit is strongly negative. The medians of both profitability indicators decrease significantly every year, while the median of equity ratio rises steadily and is at a good level despite the deterioration in the last year before sentence. The median ratio of debt to net sales rises all the time, but falls in the last year. The medians of the solidity indicators tend thus to develop in opposite directions.

Finally, **Table A2(d)** shows the medians of the financial ratios for the contact companies of the auditor or deputy auditor. The median growth of net sales indicates a quite slow growth, but the median of gross profit growth is getting stronger in recent years. The profitability of these companies is on average good and steady as measured by both EBIT margin and return on investment ratio. In the same way, the median level of the liquidity indicators quick ratio and current ratio is satisfactory and steady over the research period. The solidity of the companies, measured by the median of equity ratio, is good and its development is steady. Thus, in summary, the development of indicators is very diverse in different groups of contact companies and do not reflect similar tendencies as in the contact firms of CEO and deputy CEO.

Table 5 shows the medians of the financial variables in the pooled data, which include all contact companies, regardless of the convicted person's position. The idea of the table is show how financial ratios are reflected by the position of a convicted person in general. The medians of net sales and gross profit growth both fluctuate considerably, but especially gross profit growth is clearly strengthening in recent years. EBIT margin and return on investment ratio indicate satisfactory profitability, but with some annual variation. The medians of quick ratio and current ratio indicate that liquidity is consistently at a satisfactory level and that, based on the small difference in key figures, the importance of inventories for these contact firms in general is small. The solidity of the companies, as measured by equity ratio, improves steadily every year and is at a reasonable level in the last year before the sentence. At the same time, the median of debt to net sales ratio rises annually, but relatively slowly.

Table 6 shows the significance levels of the Mann-Whitney U-test for all financial variables to test statistical differences between all contact companies and all non-contact companies. The differences in the medians of company growth are not statistically significant, although the significance of gross profit growth is

improving in recent years. In the same way, there are no significant differences in profitability between groups. However, the differences in quick ratio, current ratio, and equity ratio are statistically very significant every year referring to long-term liquidity and solidity difficulties in contact companies.

Table 5. Median values of the financial ratios by distance for all contact companies.

	Median values of the financial ratios						
	Distance to the sentence year:						
Financial ratio	5	4	3	2	1	Correlation§	p-value
Growth of net sales (%)	1.85	1.30	1.45	3.90	0.25	0.300	0.624
Growth of gross profit (%)	1.45	0.00	−0.10	4.00	4.55	−0.600	0.285
EBIT margin (%)	5.30	4.60	3.20	6.70	4.35	0.200	0.747
Quick ratio	0.90	0.80	0.70	0.90	0.90	−0.224	0.718
Current ratio	1.10	1.10	0.90	1.10	1.10	0.000	1.000
Return on investment (%)	5.40	7.20	4.65	5.10	4.60	0.800	0.104
Equity ratio (%)	25.15	28.10	28.30	34.25	39.60	−1.000	.
Net gearing	0.00	−0.10	0.00	0.00	−0.05	0.112	0.858
Debt to net sales ratio (%)	34.40	30.20	33.50	34.95	35.60	−0.700	0.188
Working capital ratio (%)	1.75	0.30	2.50	3.40	3.20	−0.800	0.104

Legend: § = Spearman rank correlation between the median and the distance.

Table 6. The significance level of the Mann-Whitney U-test in comparison of the median of the financial ratios in all contact companies and in non-contact companies.

	Significance level of the Mann-Whitney U-test				
	Distance to the sentence year:				
Financial ratio	5	4	3	2	1
Growth of net sales (%)	0.306	0.831	0.631	0.495	0.627
Growth of gross profit (%)	0.948	0.784	0.722	0.290	0.127
EBIT margin (%)	0.829	0.743	0.942	0.234	0.796
Quick ratio	0.002	<0.001	<0.001	<0.001	<0.001
Current ratio	<0.001	<0.001	<0.001	<0.001	<0.001
Return on investment (%)	0.904	0.356	0.871	0.733	0.937
Equity ratio (%)	<0.001	<0.001	<0.001	<0.001	<0.001
Net gearing	0.168	0.295	0.085	0.197	0.040
Debt to net sales ratio (%)	0.238	0.094	0.483	0.161	0.014
Working capital ratio (%)	0.030	<0.001	0.029	0.054	0.060

4.3. Logistic Analysis

The logistic regression model was estimated for the periods 1 - 5 before the sentence using the financial data from the non-contact companies (binary variable = 0) and contact companies of CEO or deputy CEO (binary variable = 1). Logistic regression analysis showed that despite the statistically significant differences in the financial variables, developing a usable detection model is not easy due to the large variability of the variables. In the logistic regression model, four explanatory variables, growth of net sales, current ratio, equity ratio, and debt to net sales ratio, entered the model in the conditional stepwise (forward) selection. These variables represent the dimensions of growth, liquidity, and solidity. However, profitability does not appear explicitly in the final model. Since the profitability indicators behaved inconsistently in the financial statements of contact companies, a measure was developed to take this kind of inconsistency into account in the model. Thus, after several stages in the development of the measure, the process ended up with a binary variable that was given the value 1 if quick ratio < 0.8 & equity ratio (%) < 20 & return on investment (%) > 5, otherwise 0. The measure thus roughly reflects an inconsistent situation where the company's traditional liquidity and financial structure are weak, even though the company's profitability is sufficient. This inconsistency (Inconsistency = 1) occurred in 13.48% of contact companies, but only in 3.70% of non-contact companies. Thus, inconsistency (defined in this way) is 3.64 times more frequent in contact companies than in non-contact companies.

Table 7 shows the results of conditional stepwise logistic regression analysis. The model includes four financial variables and the inconsistency variable developed in this context. The most statistically significant variable of the model is the equity ratio. The significance of the equity ratio together with the significance of the debt to net sales ratio indicate the central importance of solvency in detecting a contact company. These ratios reflect solidity in different ways, since

Table 7. Estimated logistic regression model to detect the contact companies of CEO or deputy CEO.

Variable:	Coefficient B	Standard Error	Wald statistic	p-value	Exp(B)	Bootstrap p-value§
Growth of net sales (%)	0.003	0.001	3.825	0.051	1.003	0.405
Current ratio	−0.124	0.047	6.894	0.009	0.884	0.061
Equity ratio (%)	−0.010	0.002	27.332	<0.001	0.990	<0.001
Debt to net sales ratio (%)	−0.012	0.003	14.994	<0.001	0.988	0.002
Inconsistency*	0.757	0.280	7.315	0.007	2.131	0.005
Constant	−1.189	0.202	34.523	<0.001	0.305	<0.001
−2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square	Hosmer & Lemeshow Chi-square	p-value		
819.94	0.068	0.142	5.089	0.748		

Legend: *Inconsistency = 1, when Quick ratio < 0.8 & Equity ratio < 20 & Return on assets ratio > 5, otherwise 0. § = Bootstrap of the model variables is based on 1000 samples.

the equity ratio takes profits and losses into account as contributions to equity, while debt plays the central role in the debt to assets ratio. Liquidity measure current ratio also indicates a quite high significance, but the growth of net sales entered the model only hardly due to its low significance. The bootstrap analysis showed (on 1000 samples) that the importance of the variables other than growth and liquidity remained high even in validation. In particular, the growth of net sales proved to be clearly statistically insignificant in the validation. The percentiles of this variable are presented in Table A3 by company group. These percentiles show that in companies of both groups for growth below the median, the distributions are roughly similar, but in companies above the median, the growth in contact companies is significantly stronger than in non-contact companies. Thus, when the entire distribution of the variable is considered in the bootstrap validation of the LR model, the statistical significance remains small. Pseudo Nagelkerke R^2 of the model is only 0.142 referring to a quite low fit. However, the Hosmer-Lemeshow Chi-square test is not statistically significant (*p*-value is 0.748) indicating a good logistic regression model fit. Figure 1 presents the ROC curve for the model which refers to a fair (or acceptable) accuracy (AUC = 0.716).

Table 8(a) shows the classification accuracy of the developed logistic regression model for different years of distance and for critical probability 0.10 (corresponding the percent of contact companies in the data). For the distance of one year the model quite accurately classifies non-contact companies but not
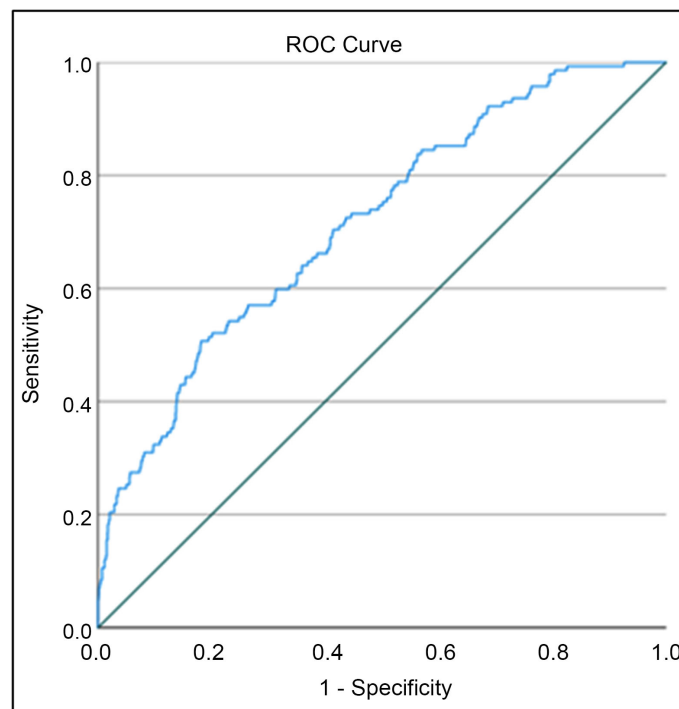

Figure 1. The ROC Curve of the logistic regression model (AUC = 0.716).

Table 8. Classification accuracy of the logistic regression model. (a) Classification accuracy by distance; (b) Classification accuracy of the logistic model by position of the convicted person.

(a)

	Correctly classified companies (%)		
Distance	Non-contact companies	Contact companies	All companies
1	0.6890	0.5652	0.6787
2	0.6540	0.6429	0.6529
3	0.6544	0.6563	0.6546
4	0.6087	0.6286	0.6111
5	0.5945	0.6667	0.6017
All (original)	0.6418	0.6338	0.6410
All (bootstrap)	0.6536	0.6186	0.6500

Legend: Critical probability = 0.10.

(b)

	Number of classified companies			
Position of the convicted person	Correctly classified	Misclassified	Total	Correctly classified (%)
CEO or deputy CEO	90	52	142	0.6338
Chairman of the Board	6	5	11	0.5455
Full or deputy member of the board	119	106	225	0.5289
Procurator or authorized signatory	17	21	38	0.4474
Auditor or deputy auditor	77	116	193	0.3990
Non-contact companies	808	451	1259	0.6418
All companies	1117	751	1868	0.5980

contact companies (company-years). For both groups of companies, classification is about at the same level for the distance of two and three years. For the distance of four to five years, the classification accuracy of the contact company-years still remains at the same level. The model correctly classifies 63.4% of all contact companies and 64.2% of non-contact companies (company-years), *i.e.* a total of 64.10% of the entire sample. The accuracy of the model in the estimation data roughly corresponds to the accuracy in the bootstrap validation procedure shown in the table. Table 8(b) shows the classification accuracy of the model for the contact companies of the different positions. The model works most accurately in the sample from which it is estimated (CEO or deputy CEO). When the position of the contact person decreases, also the classification accuracy of the model declines reflecting potentially a reduction in potential criminal activity. The classification accuracy is weakest when the position is auditor or deputy auditor (39.9%) indicating that about 60.1% of the company-years are

classified as non-contact company-years. For all company-years in the sample the overall classification accuracy is only 59.8%.

5. Conclusion

Financial crimes cause huge losses to society every year, so it is very important to develop both understanding and methods to detect and prevent them in a timely manner. An effective way to reduce economic crimes is to convict persons guilty of aggravated crimes to a business prohibition for several years. In Finland, in recent years on average more than 300 persons have been convicted of business prohibition according to the Business Prohibition Act. The persons convicted have worked in business companies in various positions, including CEOs or deputy CEOs, board chairmen, board members, auditors and procurators. Typically, these companies have been small private firms. The key question in this study is how the key figures in the financial statements of these companies reflect the activities of these convicted people who worked in different positions. In this question, the research focuses especially on companies where the convicted person has acted as a CEO or Deputy CEO. The Fraud Triangle suggests that the persons committing a crime (fraud) have pressure, opportunity, and rationalization to do that (Trompeter, Carpenter, Desai, Jones, & Riley, 2013). It is clear that these three dimensions vary with the position of the convicted person. CEO is the key person in a small firm. If the financial situation of the company is poor and threatens CEO's private economy, he or she has serious pressure and also an opportunity to commit a financial crime. If CEO is also able to rationalize the justification of the crime, he or she has a high probability to commit a financial crime. When the position of the person in the company is lower, it can however be expected that the probability is also lower.

In this study, five research hypotheses were derived. First, it was expected that the higher the position the contact person has in the company, the more likely it is that the contact company will be detected (H1). Persons in higher positions have better opportunities to commit more aggravated crimes having a deeper impact on financial statements. It was also assumed that the contact companies tend to have higher growth rate (H2), but lower profitability (H3), liquidity (H4), and solidity (H5), than the non-contact companies do. These hypotheses were tested using empirical data mainly consisting of very small (private limited) micro companies, whose median number of employees was only 3 - 4. The research was limited to the activities of companies (financial statements) 1 - 5 years before the convicted person's official sentence. Since the companies were very small, there were a number of missing observations in the financial statements, so company-years were included in the statistical analyzes in varying numbers. For the same reason, the distributions of the variables did not follow a normal distribution. Thus, comparison of medians, rank correlations and logistic regression analysis were used as research methods. There were originally 22 financial variables in the data, of which 10 were selected for the final analysis. The se-

lected variables measured the company's growth, profitability, liquidity and solidity.

Evidence showed that in the contact companies of CEO or deputy CEO several financial indicators indicated remarkable differences to the variables in the non-contact companies, supporting the research hypotheses. The growth rate of net sales was relatively high (*H*2), liquidity low (*H*4), and also solidity low (*H*5). However, profitability was not stable and did not significantly differ from that in non-contact companies, which contradicts with the profitability hypothesis (*H*3). Although the level of profitability was acceptable, liquidity and solidity were very low indicating a crisis which potentially reflects an inconsistent behavior of financial ratios. Therefore, an inconsistency index was developed and used in constructing a logistic regression model. This LR model consisted of four financial ratios and the index as independent variables. In addition to the index, the model included one growth indicator, one liquidity ratio, and two solidity ratios, but none profitability indicators.

In the validation of the model (bootstrap), it turned out that the dispersion of the coefficient of the growth measure is so large that it is not statistically significant. However, in the LR model, the statistical significance of liquidity and solidity ratios was clearly emphasized. Thus, the model reflects potential financial crisis confronted by the company. Financial distress may be a motivation for management fraud, which explains why failure indicators (for example, Altman Z-score) are often important variables in fraud models (Kirkos, Spathis, & Manolopoulos, 2007: p. 997). In years 1 - 5 before the sentence, the model correctly classified 63.38% of contact companies and 64.18% of non-contact companies, which is comparable with the accuracy of the financial variable LR model estimated by Dechow, Ge, Larson, & Sloan (2011: p. 59). Furthermore, AUC of the model was 0.716 comparable with that of the LR model developed by Zhao & Bai (2022), Table 5. However, from the point of view of applying the model in practice, it is important that the model developed in this study worked satisfactorily over a longer period of time, most precisely in the 2 - 3 years before the sentence, so that possible criminal activity can be detected earlier. This kind of model that helps identify financial crimes can be used as a first-pass screen to identify firms that warrant further investigation (Dechow, Ge, Larson, & Sloan, 2011: p. 54).

The behavior of financial statement indicators was also evaluated in contact companies other than those where the convicted person had acted as CEO or deputy CEO. The same systematic behavior as in the contact companies of CEO and deputy CEO was not observed in these companies. For the contact companies of the chairman of the board the number of companies was too small to be able to generalize. Furthermore, in these companies, the last year prior to sentence was highly exceptional. In the contact companies of other positions, the financial situation was not as critical in terms of liquidity or solidity as in the contact companies of CEO and deputy CEO. For example, in the contact companies of auditor and deputy auditor (lowest position), growth was average,

profitability and liquidity satisfactory, and solidity good. Thus, using statistical models, it was difficult or impossible to detect contact companies in these groups. When the developed LR model was applied in the company groups of different positions, the accuracy of the model decreased systematically when the positions decreased. Thus, in these companies of lower positions, the pressure and opportunity may be quite low making the probability to commit a financial crime small. These findings give support to the first hypothesis (H1).

In summary, this study has provided important findings about the effects of fraudulent behavior of the persons in different positions. However, the study also has several limitations that can be removed in future follow-up studies. First, this study is based on a limited sample of micro firms, whose financial statements are often incomplete and contain a significant number of outliers. In future research, larger companies and larger samples should be considered. Secondly, the sample for the contact companies of the chairman of the board was very limited. This group of companies needs to be studied in more detail in the future with larger data, because the chairman has an important position in the company. Thirdly, this study was based on the sentence of a business prohibition, which is a combination of several aggravated crimes. In the future, studies should deal with more cases where the committed crimes are homogeneous, making it possible to assess their effects in more detail. Fourthly, in this study, there was no information about in which years the crimes were committed. In future studies, it is recommendable to include this information to the data, so that the analyzes can be better targeted to the right years. Fifthly, only simple statistical methods have been used in this study. In the future, when larger data are used, advanced methods should be used to develop models, for example, Machine Learning Algorithms. Finally, the detection ability of new variables also outside financial ratios should be tested.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendices

Table A1. The distribution of sample companies by NACE industry.

Frequency	Percent	NACE
2	1.2	A Agriculture, forestry and fishing 01 - 03
2	1.2	B Mining and quarrying 05 - 09
19	11.4	C Manufacturing 10 - 33
1	0.6	D Electricity, gas, steam and air conditioning supply 35
26	15.6	F Construction 41 - 43
29	17.4	G Wholesale and retail trade; repair of motor vehicles and motorcycles 45 - 47
6	3.6	H Transportation and storage 49 - 53
12	7.2	I Accommodation and food service activities 55 - 56
17	10.2	J Information and communication 58 - 63
3	1.8	K Financial and insurance activities 64 - 66
12	7.2	L Real estate activities 68
18	10.8	M Professional, scientific and technical activities 69 - 75
4	2.4	N Administrative and support service activities 77 - 82
2	1.2	P Education 85
10	6	Q Human health and social work activities 86 - 88
3	1.8	R Arts, entertainment and recreation 90 - 93
1	0.6	S Other service activities 94 - 96
167	100	

Table A2. Median values of financial ratios by distance. (a) Median values of financial ratios by distance for the contact companies of chairman of the board; (b) Median values of financial ratios by distance for the contact companies of full or deputy member of the board; (c) Median values of financial ratios by distance for the contact companies of procurator or authorized signatory. (d) Median values of financial ratios by distance for the contact companies of auditor or deputy auditor.

(a)

	Median values of the financial ratios						
	Distance to the sentence year:						
Financial ratio	5	4	3	2	1	Correlation§	*p*-value
Growth of net sales (%)	23.20	3.90	18.95	12.90	−49.20	0.700	0.188
Growth of gross profit (%)	15.20	−20.80	−9.30	11.20	613.15	−0.400	0.505
EBIT margin (%)	10.00	1.90	3.45	10.50	32.75	−0.700	0.188
Quick ratio	1.10	1.50	0.65	1.05	5.30	−0.200	0.747
Current ratio	1.20	1.40	0.75	1.05	5.30	−0.200	0.747
Return on investment (%)	11.60	1.10	−1.40	3.60	31.00	−0.300	0.624
Equity ratio (%)	16.50	22.20	34.10	55.25	60.50	−1.000	.
Net gearing	−0.20	−1.30	−1.00	−1.20	0.55	−0.300	0.624
Debt to net sales ratio (%)	34.60	12.20	116.60	107.10	276.00	−0.800	0.104
Working capital ratio (%)	0.00	0.20	16.10	13.80	71.80	−0.900	0.037

(b)

Financial ratio	Median values of the financial ratios						
	Distance to the sentence year:						
	5	4	3	2	1	Correlation§	p-value
Growth of net sales (%)	7.70	1.20	2.30	3.20	−4.80	0.600	0.285
Growth of gross profit (%)	5.70	−1.90	0.80	1.40	1.35	0.100	0.873
EBIT margin (%)	5.20	4.60	4.15	5.00	4.30	0.500	0.391
Quick ratio	0.95	0.80	0.80	0.95	1.00	−0.527	0.361
Current ratio	1.05	0.80	1.00	1.10	1.10	−0.667	0.219
Return on investment (%)	2.30	3.60	3.15	0.90	2.20	0.600	0.285
Equity ratio (%)	17.20	18.35	20.80	26.10	31.70	−1.000	.
Net gearing	0.00	−0.20	−0.05	−0.10	0.00	−0.103	0.870
Debt to net sales ratio (%)	54.40	49.40	44.30	46.10	45.60	0.700	0.188
Working capital ratio (%)	1.15	0.00	1.50	3.85	4.30	−0.900	0.037

(c)

Financial ratio	Median values of the financial ratios						
	Distance to the sentence year:						
	5	4	3	2	1	Correlation§	p-value
Growth of net sales (%)	0.55	18.50	−9.50	12.60	−12.30	0.500	0.391
Growth of gross profit (%)	−1.70	16.60	4.25	7.80	−11.45	0.300	0.624
EBIT margin (%)	4.60	7.80	5.10	4.40	1.00	0.700	0.188
Quick ratio	1.35	0.75	0.95	1.00	0.80	0.300	0.624
Current ratio	1.30	0.95	1.05	1.00	0.80	0.700	0.188
Return on investment (%)	13.45	28.35	29.45	9.15	4.95	0.600	0.285
Equity ratio (%)	41.85	50.80	59.10	60.30	54.85	−0.700	0.188
Net gearing	−0.05	−0.30	−0.40	−0.40	−0.35	0.667	0.219
Debt to net sales ratio (%)	12.50	18.25	23.70	42.50	28.50	−0.900	0.037
Working capital ratio (%)	1.20	0.00	0.70	0.40	2.40	−0.300	0.624

(d)

Financial ratio	Median values of the financial ratios						
	Distance to the sentence year:						
	5	4	3	2	1	Correlation§	p-value
Growth of net sales (%)	1.65	0.00	2.30	0.10	1.10	0.100	0.873
Growth of gross profit (%)	0.35	0.00	−0.40	2.80	6.70	−0.600	0.285
EBIT margin (%)	7.70	4.50	2.90	6.60	5.90	0.200	0.747
Quick ratio	1.00	1.05	0.85	1.20	1.20	−0.667	0.219
Current ratio	1.40	1.50	1.35	1.30	1.50	0.051	0.935
Return on investment (%)	12.60	10.10	6.20	10.10	11.70	0.205	0.741
Equity ratio (%)	50.20	53.45	55.05	50.50	54.40	−0.500	0.391
Net gearing	0.10	0.20	0.20	0.20	0.10	0.000	1.000
Debt to net sales ratio (%)	20.10	24.10	22.25	22.20	30.20	−0.600	0.285
Working capital ratio (%)	5.10	3.20	4.40	3.85	3.30	0.400	0.505

Legend: § = Spearman rank correlation between the median and the distance.

Table A3. Percentiles of growth of net sales (%) for all non-contact companies and for contact companies of CEO or deputy CEO.

		Growth of net sales (%).
Percentile	Non-contact companies	Contact companies of CEO or deputy CEO
5	−69.80	−89.70
10	−45.20	−44.52
25	−15.00	−17.00
50	0.00	4.50
75	20.30	39.60
90	71.40	95.42
95	147.50	194.44