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To cite this article: Daniel Zdolšek, Timotej Jagrič & Iztok Kolar (2022) Auditor's going-concern opinion prediction: the case of Slovenia, Economic Research-Ekonomski Istraživanja, 35:1, 106-121, DOI: [10.1080/1331677X.2021.1888766](https://doi.org/10.1080/1331677X.2021.1888766)

To link to this article: <https://doi.org/10.1080/1331677X.2021.1888766>



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Published online: 22 Feb 2021.



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Auditor's going-concern opinion prediction: the case of Slovenia

Daniel Zdošek , Timotej Jagrič  and Iztok Kolar

Faculty of Economics and Business, University of Maribor, Maribor, Slovenia

ABSTRACT

In an audit of a firm's financial statements, the auditor assesses whether there is material uncertainty about the firm's ability to continue as a going concern. If the existence of material uncertainty is confirmed, the auditor considers the adequacy of the firm's disclosures regarding its going concern in the firm's annual report. Most commonly, if the firm's disclosures are adequate, the auditor issues a going-concern opinion in the auditor's report. The auditor modifies his opinion on firm's financial statements because of auditor's going-concern doubt on the firm's ability to continue as a going-concern rarely in specific circumstances. In the present paper we provide an auditor's going-concern prediction model using various combinations of a firm's economic predictors. A sample data of 14,761 firm-year observations from Slovenia during the period 2005–2013 has been used for the model. The results reveal that firms with a going-concern qualification have a worse financial structure (i.e., lower equity financing rates), worse liquidity, worse efficiency, and worse profitability in comparison to firms without this qualification. Using a logistic regression prediction model for a going concern qualification in auditor's report, qualification can be predicted with sufficient accuracy on a sample data of Slovenian firms.

ARTICLE HISTORY

Received 4 April 2020

Accepted 5 February 2021

KEYWORDS

Audit; going-concern opinion; prediction; audit model; Slovenia

JEL CLASSIFICATION

M41; M42; G00; C25; C30

1. Introduction

A firm's management must prepare financial statements on the basis of the going-concern principle (that is, in accordance with generally accepted accounting principles). In an audit of a firm's financial statements, the auditor assesses whether there is material uncertainty about the firm's ability to continue as a going concern. If the existence of material uncertainty is confirmed, the auditor considers the adequacy of the firm's disclosures regarding its going concern in the firm's annual report. If the firm's disclosures are inadequate, the auditor issues a going-concern opinion in the auditor's report. The auditor assesses the firm's financial statements to determine whether the firm's financial statements representation is true and fair (in accordance

CONTACT Daniel Zdošek  daniel.zdosek@um.si

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with the generally accepted accounting framework). In an audit it is also assessed whether the firm is able to continue its (business) operations. The auditor's going-concern opinion has been and continues to be of interest to firms' stakeholders (i.e., current and possible future investors, creditors, other business partners, academia, etc.). This interest increased further in the most recent worldwide financial crisis, which started in 2007. Among other criticisms, auditors were criticised for not qualifying firms' financial statements for going-concern doubt.

There are not many empirical studies in the field of going-concern opinions for continental European countries. For European countries, excluding Great Britain and Ireland, a handful of studies reveal data for firms in the following countries: Belgium (Hardies et al., 2016; 2018; Knechel & Vanstraelen, 2007); Germany (Ratzinger-Sakel, 2013); Italy (Ianniello & Galloppo, 2015); Spain (Barnes & Renart, 2013; Mareque et al., 2017); Sweden (Sundgren & Svanström, 2014); etc. For countries in the south-eastern region of Europe no such empirical studies exist, at least to the best of our knowledge. For Slovenia, there are only a few studies in the field of auditing, mainly due to data unavailability in the past. Zdolšek et al. (2019) give a short overview of previous research in the field. Nevertheless, currently there is no publicly available information in Slovenia on going-concern opinions. Previous studies (Zaman et al., 2017; Zdolšek et al., 2015) did not cover this avenue of research.

Going-concern opinion in an auditor's report has always been in the limelight. The primal reason is well known: business failures (i.e. insolvency) of firms that had recently had an audit. These events, among others, have led to various proposals that could change audits, national audit regulation, and audit markets (Brydon, 2019; House of Commons (The Business & Energy & Industrial Strategy Committee), 2019; International Federation of Accountants (International Auditing & Assurance Standards Board), 2009; Kingman, 2018; Sikka, 2009; The Public Company Accounting Oversight Board, 2010). Stakeholders, especially the media and the wider public, believe and demand that a going-concern opinion is a primary warning signal of business failure (bankruptcy) that will happen (not just that it *could* happen). Users of firms' financial statements have an interest in and a need for predicting the going-concern opinion (for audited firms). For firm operating in Slovenia it is unknown whether prediction of a going-concern opinion is possible using a combination of a firm's economic predictors. Our primary motivation for conducting the present study is the absence of a publicly available going-concern prediction model for Slovenian firms. Previous studies (Hardies et al., 2018; Ratzinger-Sakel, 2013; Sundgren & Svanström, 2014) presented going-concern models that include variables which are usually unavailable for the vast majority of auditees, especially private firms (market-related variables, country-specific variables, etc.). There is also an increase in interest among various stakeholders for a going-concern qualification or lack of it. A lack of known usual characteristics of a going-concern qualification also motivated our present study.

The aim of the current study is to construct a going-concern prediction model for Slovenian firms. The prediction model will reveal a firm's economic and financial circumstances that led to a going-concern opinion qualification. The sample data covers the period 2005–2013 and includes listed and unlisted (private) firms. In previous

studies, several statistical models were developed to explain the going-concern opinion qualification (see research overview in Carson et al., 2013; Geiger et al., 2017; and Geiger & Kumas, 2018; Hardies et al., 2018; etc.). We will use logistic regression to construct our prediction model using various firms' predictors (e.g. accounting ratios) to predict the qualification of the going-concern opinion for Slovenian firms. The predictors used in the study are limited to publicly available data. Data are accessible and obtainable through various financial databases (Agency of the Republic of Slovenia for Public Legal Records and Related Services (AJPES): www.ajpes.si/jolp). The results of the logistic regression model represent the likelihood of a going-concern opinion qualification for a firm with a given combination of predictors. The constructed prediction model can be used by auditors, lenders, financial data collection agencies, Slovenian auditing oversight agency, and other interested users (further elaborated in Chapter 2).

The remainder of the paper is organised as follows. Chapter 2 gives an overview of reasons for using prediction models in audits and in relation to auditing. Chapter 3 presents sample data. Chapter 4 describes the methodology and selection of predictors. The research results are presented in Chapter 5, including an analysis of the results, accompanied by a discussion. Chapter 6 summarises the paper's research findings.

2. Usage of a prediction model in relation to auditing

There has long been strong interest in the field of going-concern opinion qualification. Carson et al. (2013) give an overview of academics' research in relation to going-concern opinion. Geiger et al. (2017) present an update to the Carson et al. (2013) study. Since mid-2017, various authors have published papers in relation to going-concern opinion (Berglund et al., 2018; Czerney et al., 2019; Geiger & Kumas, 2018; Hardies et al., 2018). In addition to the academic community, there has long been interest from various stakeholders in going-concern opinion in auditors' reports and decision-making process. Investors (current and prospective), supervisory boards, audit committees, lenders, other creditors, regulators, and the wider public (media) all have an interest, especially when recently-audited firms experience business failure (insolvency) (House of Commons (The Business & Energy & Industrial Strategy Committee), 2019; Kingman, 2018; Sikka et al., 2018).

Criticism of audits and auditing in the aftermath of the 2007 global financial crisis gave an additional boost to such interest (Carson et al., 2013; Geiger et al., 2017; Sikka, 2009). Further, in the last decade, the availability of an array of novel methodological approaches has accelerated the development of various models, including audit models (Bahrami et al., 2020; Gepp et al., 2018; Guslawa et al., 2018; Stanišić et al., 2019; etc.). Authors used various modelling techniques to identify (classify) or predict firms with a going-concern opinion (Goo et al., 2016; Martens et al., 2008; Yeh et al., 2014). Identification or prediction is primarily made using data from the auditee's reported financial statements, but other various non-financial data are also occasionally used (market data, publicly unavailable data, etc.). Newer studies also use data that are not directly related to the auditee but instead to the auditor (audit firm,

auditor in charge) (Hardies et al., 2016; Lennox & Wu, 2018; Sundgren & Svanström, 2014).

As previously stated, the motivation for the present study is the absence of a publicly available going-concern prediction model for Slovenian firms. In our opinion, public availability of an audit model that is simple to use would further increase interest in going-concern opinions. Additionally, for the Slovenian audience a model would establish a much needed benchmark. Therefore, the aim of this study is to construct a statistical logistic model to predict going-concern opinion in auditors' reports for Slovenian firms. There are only a few studies in the field of auditing in Slovenia, which in our opinion is due to past data unavailability (see Zdolšek et al. (2019), who give an overview of the last two decades of Slovene-related research in auditing). Currently there is no publicly available information in Slovenia in relation to going-concern opinions in auditors' reports (data set providers do not collect this data). Therefore, in previous studies (Zaman et al., 2017; Zdolšek et al., 2015) this avenue of research has not been covered.

Various additional practical reasons for model development exist. Auditors can use the model as an additional tool to aid them in determining the scope of and risky areas in the audit. An empirical prediction model can be used to assess the extent to which qualification for going-concern doubt could be expected based on publicly available data from a firm's financial statements (Gepp et al., 2018; Martens et al., 2008). The model would enable auditors to better organise their work in cases where there are large amounts of data to be reviewed, a large scope of audit work to be done, time and cost constraints, etc. The model's output can be used for pre-engagement screening of auditees and for achievement of an acceptable audit risk level in audits (Bell & Tabor, 1991). Furthermore, after completing their audits, auditors can use the model as an additional 'check-up' or monitoring tool that enables them to review their work. The model presents an objective control (Koskivaara, 2004). If a mismatch exists, additional testing and review can be done to verify the auditors' decisions during audits. Furthermore, auditors can use the model as a decision aid in the peer-review process, for example when considering how other auditors could decide in similar circumstances, etc. A further use of the developed model is in evaluations of potential clients, as a defence in lawsuits, etc. (Laitinen & Laitinen, 1998; for more on the usefulness of the developed model, see Bell, 1997). Various regulators, e.g. an auditing oversight agency, can use the prediction model in their oversight of an audit and the auditee. A publicly available prediction model can be used by any interested party, e.g. lenders, in their ad hoc analysis of an auditee. Financial data collection agencies (financial database providers) can add additional variables to their available data based on the use of the prediction model. Other researchers can use the model's results as new predictor in their ongoing studies (e.g., as a proxy for audit quality; DeFond & Zhang, 2014).

Various national regulators, especially auditing oversight agency, such as the Agency for Public Oversight of Auditing in Slovenia (www.anr.si), can use the prediction model as their permanent surveillance supplementary tool, especially when conducting oversight of an audit and auditee. Agencies that publish company data (rating agencies, other data set providers) can add a new variable to their publicly

available data sets. The variable would indicate the probability that a firm will be issued a going-concern opinion. A new variable based on the model's results can also be used by academics in new studies in the field of auditing. As a proxy for audit quality, the model's output of going-concern opinion is commonly used (DeFond & Zhang, 2014; Hardies et al., 2018; Knechel & Vanstraelen, 2007). Any other interested party, e.g. supervisory boards, audit committees, lenders, media, the Slovenian Institute of Auditors (members association representing the auditing profession: www.si-revizija.si), etc., can use the publicly available prediction model in their ad hoc analysis of an auditee. As we present our study's aim, we have been seeking an answer to a dilemma that is an empirical dilemma. Therefore, there is no need for us to form a theoretical hypothesis.¹

3. Sample data for Slovenian firms

Our analysis was conducted using a sample of 14,761 Slovenian firm-year observations. In accordance with Slovenian law (Companies Act, or *Zakon o gospodarskih družbah*, ZGD-1 in the Slovenian language), public firms, large firms and medium-sized firms must appoint an auditor to conduct an audit. Audits of financial statements and accompanying disclosures (in the firm's annual report) must be conducted in accordance with the International Standards on Auditing (ISA). In their report on a firm's financial statements, the auditor gives an opinion regarding the accuracy and fairness of those statements. Mareque et al. (2015) explain in detail rules regarding various auditors' opinions (note: equal rules are in Spain and Slovenia). The auditor's report states the auditor's opinion on whether the financial statements are a truthful representation and can be unqualified (clean, unmodified opinion) or if they are not truthful, resulting in a modified (qualified or adverse) opinion. Auditors also express their opinion about a threat to a firm's ability to continue its business as a going concern if such a threat exists (going-concern opinion). Following ISA 570 (Revised), *Going concern*, the auditor shall express an adverse opinion if the use of going concern basis of accounting is inappropriate in preparation of financial statements. If the use of going concern basis of accounting is appropriate, the auditor shall express a qualified opinion or adverse opinion if adequate disclosure about the material uncertainty is not made in the financial statements. Nevertheless, most commonly the auditor's report includes a going-concern-related emphasis of matter paragraph. In this case the use of going concern basis of accounting is appropriate and adequate disclosure about the material uncertainty is made in the financial statements. In the present study, if an auditor reports going-concern doubt for an auditee (i.e., the auditor's report with a going-concern-related emphasis of matter paragraph or the auditor's report with modified opinion because of auditor's going-concern doubt on the firm's ability to continue as a going-concern) is classified as qualified (note: we use the terms going-concern opinion and going-concern opinion qualification). An auditor's report without a going-concern-related emphasis of matter paragraph is otherwise classified as unqualified.

Development of our sample started with identification of all audited Slovenian firms from 2009–2013 (note: 2009 is the first year for which AJPEs makes data

publicly available that enable identification of auditees in each year).² After identification of all auditees, sample data were obtained from the GVIN database, a firms' financial statements and other data provided by Bisnode (www.bisnode.si/produkti/bisnode-gvin), and hand-collected from the annual reports of audited firms. Going-concern opinions data were hand-collected from auditors' reports (included in firms' annual reports). We manually examined all audit reports to determine whether audit opinions were modified for going-concern uncertainty, as there is no other electronic source which would enable us to mechanically collect these data. Audit opinions were classified as either qualified for a going-concern opinion or unqualified (without a going-concern opinion). Firms from the financial industry (banks, insurance companies) were eliminated from the sample. Firms with consolidated financial statements data were also eliminated from the sample due to possible duplication of going-concern opinions. Based on identification of all auditees, we retrieved data for audited firms from the period 2005–2013. Out of 17,979 firm-year observations, there was no publicly available annual report, no financial statements data, and no auditor's report for 3,218 firm-year observations. In total, our final sample comprises 14,761 firm-year observations. In our sample, an average of 1,640 firms' annual reports were audited each year (from 1,431 in 2005 to 1,598 in 2013, with a maximum of 1,816 in 2009). Of the 14,761 firm-year observations, 8% (1,204) had received a going-concern opinion. In the nine-year period (2005–2013), the number of going-concern opinions per year rose constantly, from 3.2% in 2006 to 13.3% in 2013. In the period 2009–2013, the average going-concern opinion rate was 11.2%. (Note: there was an average of 1,698 audits and 189 going-concern opinions per year.)

An overview of other national going-concern opinion rates reveals that in Slovenia the going-concern opinion rate of 11.2% (average over the period 2009–2013) is in line with rates in many other countries. For example, Tušek and Ježovita (2018) report that Croatia, a Slovenian neighbour country, had a going-concern opinion rate of 16% (for listed firms in the period 2016–2017). Furthermore, a study by Gutierrez et al. (2015) gives an overview of going-concern opinion rates in 17 countries; average rates for all countries together were between 10 and 17% (average rates are over the period 2000–2012). Between various countries the rates are different. Gutierrez et al. (2015) report the following average rates for countries in Europe (note: all average rates from Gutierrez et al. (2015) study are over the period 2000–2012): 2% for Sweden, 3% for Denmark and the Netherlands, 5% for Norway, 6% for Spain (note: Mareque et al. (2017) report a rise in rate from 2% in 2007 to 9% in 2010), 13% for France and Germany, and 18% for Italy (note: Carlino, Brunelli, and Giosi (2018) report a rate between 12 and 21% for Italian listed firms in the period 2008–2015). Surprisingly, for Belgium the reported rate is higher than 20% (Gaeremynck & Willekens, 2003; Knechel & Vanstraelen, 2007; Hardies et al., 2018; note: rates do not cover the same periods). For illustrative purposes we add going-concern opinion rates for some other (mostly non-European) countries. For China, the reported average rate is 15% (Gutierrez et al., 2015). For English-speaking countries the rates are the following: for Australia an average rate of 21% (Gutierrez et al., 2015; but note Xu et al. (2013) report for listed Australian firms in the period 2005–2009 the rate between 12 and 22%); for the United Kingdom an average rate of 13% (Gutierrez

et al., 2015); and 18% for Canada (Gutierrez et al., 2015). For the U.S.A. the rates are between 10 and 22% (Carson et al., 2012; Carson et al., 2013; Cheffers et al., 2010; DeFond et al., 2002; Mareque et al., 2017; Reynolds & Francis, 2000; note: rates do not cover the same periods) with an average rate of 16% for listed firms in the period 2000–2010 (Carson et al., 2013). There are various reasons for the lack of qualification of going-concern doubts in auditors' reports (see Laitinen and Laitinen (1998), which give an overview of reasons for lack of apportionment of qualified auditors' reports).

Firstly, auditors are not sufficiently competent to identify going-concern viability risks. Consequently, an auditor's report is not modified for going-concern doubt. Secondly, auditors' awareness of possible realisation of self-fulfilling prophecy affects their qualification in the auditor's report. Auditors consider the effects of a going-concern opinion on the auditee's ability to continue its business, so they could (intentionally) disregard various signs related to the going concern and not report their going-concern opinion. Thirdly, auditors consider the possible effects of the qualification on their future business, especially being engaged to carry out future audits for the auditee. Also, auditors' awareness of the potential of losing clients (including prospective clients) because of a going-concern qualification in the auditor's report weakens their independence. Because of this consideration, auditors could act in ways so as not to qualify the auditor's report for going-concern doubt. Nevertheless, we must clarify that going-concern opinions are generally rare among firms. In a healthy national economy under usual circumstances, auditors' reports predominantly contain no going-concern opinions. Frankly, in normal economic circumstances a low rate of going-concern opinion qualifications should be expected in auditors' reports.

4. Methodology and selection of predictors

The list of predictors (explanatory variables) is provided in Table 1. These predictors are used to predict a going-concern opinion qualification. Predictors from the list were used in various research studies and were usually statistically significant (Carson et al., 2012, 2013; Geiger et al., 2017; Goo et al., 2016; etc.). It is anticipated that these predictors will enable prediction of going-concern opinion qualification and reveal a firm's characteristics (financial and others). Sixteen predictors are based on numbers from firms' financial statements. An additional four predictors are added. Of these, the first is the only dummy variable. It shows whether a firm's financial statements are audited during the auditor's busy season. It is anticipated that during the busy season auditors will be less likely to issue going-concern doubt. If a firm's financial statement reporting date is 31 December, then its financial statements are audited during the busy season. The second additional predictor measures the time lag between the financial statement reporting date and the issuance of the auditor's report. It is anticipated that the longer the time lag, the more likely the auditor will issue going-concern doubt for the auditee. This time lag is measured as the number of days between the annual closing date of the firm's financial statements and the date of the auditor's report (Laitinen & Laitinen, 1998). The third additional predictor considers a firm's age, which is measured in number of years. It is anticipated that

Table 1. List of possible predictors.

	Name of possible predictor	Number of observations (N)	Data coverage in sample (in %)
Y	Dependent variable: 1 if auditor issues a going-concern opinion, 0 otherwise	14,761	100.0
X ₁	Auditor's busy season: 1 if financial statements reporting data is 31 st December, 0 otherwise	13,515	91.6
X ₂	Auditor's report time lag (natural logarithm of number of days)	13,415	90.9
X ₃	Firm's age (natural logarithm of number of firm's age in years)	14,581	98.8
X ₄	Total assets (natural logarithm of total assets)	14,753	99.9
X ₅	Firm's loss in current year: 1 if loss in current year, 0 otherwise	14,754	100.0
X ₆	Equity financing rate	14,754	100.0
X ₇	Debt to equity ratio	14,753	99.9
X ₈	Long-term financing to long-term assets ratio	14,443	97.8
X ₉	Current ratio	14,443	97.8
X ₁₀	Short-term business receivables to short-term business liabilities ratio	14,443	97.8
X ₁₁	Inventory turnover ratio	13,307	90.1
X ₁₂	Total efficiency ratio	14,754	100.0
X ₁₃	Total assets turnover	13,307	90.1
X ₁₄	Current liabilities turnover	12,958	87.8
X ₁₅	Capital employed turnover	13,308	90.2
X ₁₆	Short-term assets rate	14,754	100.0
X ₁₇	Cash assets rate	14,754	100.0
X ₁₈	Return on sales	14,754	100.0
X ₁₉	Return on assets	13,307	90.1
X ₂₀	Net return on equity ratio	13,308	90.2

Source: Own calculation.

older firms are more stable than younger firms. The final additional predictor considers a firm's size, which is measured in terms of the firm's total assets (in euros). It is anticipated that larger firms are more stable than smaller firms. Data for predictors from the list in Table 1 were retrieved and calculated from the firms' financial statements, annual reports, and auditors' reports. The sample data include non-listed (private) firms. Therefore, predictors in relation to market data are not used in this study.

After careful consideration of the pros and cons of the various statistical methods, we decided to use a logistic regression for our prediction modelling. We have several reasons for making this choice. First, we follow the approach from previous studies (Hardies et al., 2016, 2018; Martens et al., 2008; Sundgren & Svanström, 2014; see additional note provided in Carson et al., 2013, pp. 371–372). Using the same approach to new data in our study makes our study comparable to previous studies. When logistic regression is used, validation is possible. Second, the results of the logistic regression model are relatively easy to interpret. Transformation is based on the sigmoid logistic regression, so the outcome of the model is interpreted as the probability of an auditor qualifying a firm for going-concern doubt. Logistic regression is also simple to use and widely available for use in various software packages. Third, logistic regression is considered robust in comparison to other previously used methods (Gepp et al., 2018; Martens et al., 2008; Stanišić et al., 2019). When estimating the predictors' parameters, the maximum likelihood method was used.

In the present study we used the approach presented in Zdošek et al. (2015). During the iterative process of combining all possible predictors from the list of 20

Table 2. Summary statistics for best logit models with the lowest BIC values.

Model abbreviation	Number of predictors	Bayes information criterion	Nagelkerke's determination coefficient (R_N^2)	Overall accuracy (in %)
Intercept only model	–	8,351.87	–	50.00
Model_1	8	5,164.80	0.3479	85.24
Model_2	9	5,166.39	0.3489	85.14
Model_3	9	5,169.89	0.3489	85.27

Note: Predictors included in the model and parameter values are presented in Table 4.

Source: Own calculation.

predictors, 1,048,575 models were created. The results of each model were recorded. For selection between various competing models, Bayes information criterion (BIC) was used. BIC is a measure that imposes a penalty when additional predictors are added to the model (Gujarati, 2003). The model with the lowest BIC value is preferred. Table 2 shows the results for three models with the lowest BIC value.

Table 2 shows the summary statistics for the three best logistic regression models. The prediction model with the lowest BIC value among all the models is called *Model_1* and has the value of Nagelkerke's determination coefficient (R_N^2) of 0.348. This value can be interpreted so that 34.8% of the dependent variable's variability is explained by the eight variables included in the model. Among all the developed models, the overall highest R_N^2 value is 0.357, which means that 35.7% of the dependent variable's variability is explained by 17 variables included in the model. For R_N^2 a higher value is anticipated for a model with a higher number of predictors and vice versa. Nevertheless, high R_N^2 values are unusual (Gujarati, 2003; Tabachnick & Fidell, 2001), especially in the field of auditing. Results of R_N^2 values are normal (not too high or too low).

5. Prediction of auditor's going-concern opinion

The univariate statistics are presented in Table 3. Quartiles are presented for two groups of firms: those with a going-concern opinion and those without. Means and variances are not presented because of observed non-normality in the sample data. Quartiles are used instead. Differences between both groups are presented with Kruskal-Wallis statistics. Statistically significant differences between both groups are detected with almost all predictors (18 out of 20). Firm age (X_3) is statistically significant at the risk level of 0.05; 17 other predictors are statistically significant at the risk level of 0.01. It is worth noting that auditor's busy season (X_1) and auditor's report time lag (X_2) are statistically significant at the risk level of 0.01. Surprisingly, firm size (measured with a natural logarithm of the firm's total assets, X_3) and debt to equity ratio (X_7) are statistically insignificant. Thus, firms with a going-concern opinion qualification have lower equity financing rates (i.e., higher debt financing rates) and a lower long-term financing to long-term assets ratio. This points to a worse financial structure for firms with a going-concern opinion than those with no going-concern opinion. Firms with a going-concern opinion have worse liquidity and efficiency (lower current liabilities turnover, higher capital employed turnover, higher short-term assets rate, higher total assets turnover, etc.) than firms without a going-concern opinion. Furthermore, firms with a going-concern opinion have worse profitability than firms without a going-concern opinion. To summarise, a going-concern

Table 3. Quartiles and Kruskal–Wallis statistics.

	Firms with no GCO				Firms with GCO				Kruskal-Wallis test	
	N	Q ₁	Median	Q ₃	N	Q ₁	Median	Q ₃	χ^2	Stat. sign.
X ₁	12,365	1	1	1	1,150	1	1	1	8.7741	0.0031
-	12,271	91	132	175	1,144	114.25	166	182	213.2500	0.0000
X ₂	12,271	4,5109	4,8828	5,1648	1,144	4,7384	5,1120	5,2040	213.2500	0.0000
-	13,530	10	16	20	1,194	9	17	21	5.4013	0.0201
X ₃	13,395	2,3979	2,7726	2,9957	1,186	2,1972	2,8332	3,0445	4.6846	0.0304
-	13,547	5,696,783	10,666,219	24,468,929	1,203	4,875,473	10,679,887	26,773,240	1.0516	0.3051
X ₄	13,551	15,5554	16,1826	17,0125	1,202	15,405175	16,18445	17,1031	0.9583	0.3276
-	13,547	27,294	272,385	975,779	1,203	-2,347,999	-536,743	4,323	1,528,3556	0.0000
X ₅	13,551	0	0	0	1,203	0	1	1	2,141,5148	0.0000
X ₆	13,551	0,2153	0,3954	0,6141	1,203	-0,0313	0,1122	0,2954	1,041,8908	0.0000
X ₇	13,550	0,6031	1,4881	3,5271	1,203	-2,3303	1,9626	6,2701	0,2769	0,5987
X ₈	13,252	0,9187	1,1335	1,6678	1,191	0,2976	0,7392	0,9866	978,5440	0.0000
X ₉	13,252	0,8584	1,1976	1,8478	1,191	0,3876	0,6796	0,9932	796,1295	0.0000
X ₁₀	13,252	0,3232	0,6216	0,9867	1,191	0,1251	0,2823	0,5213	534,1710	0.0000
X ₁₁	12,166	2,7193	7,6362	21,5826	1,141	1,9926	5,8777	15,6536	22,1336	0.0000
X ₁₂	13,551	1,0038	1,0257	1,0807	1,203	0,7598	0,9288	1,0014	1,402,9612	0.0000
X ₁₃	12,166	0,5178	1,0781	1,7310	1,141	0,3020	0,7358	1,2719	129,0229	0.0000
X ₁₄	11,831	1,8781	3,1718	5,1671	1,127	0,7063	1,4867	2,4570	687,1987	0.0000
X ₁₅	12,167	1,2686	2,9771	6,9824	1,141	0,3925	2,2543	6,8745	53,0104	0.0000
X ₁₆	13,551	0,2644	0,4777	0,6970	1,203	0,2070	0,3910	0,6340	42,9193	0.0000
X ₁₇	13,551	0,0174	0,0585	0,1551	1,203	0,0090	0,0390	0,1073	73,1409	0.0000
X ₁₈	13,551	0,0031	0,0209	0,0619	1,203	-0,3099	-0,0753	0,0010	1,392,2288	0.0000
X ₁₉	12,166	0,0147	0,0404	0,0839	1,141	-0,1387	-0,0314	0,0171	1,253,3713	0.0000
X ₂₀	12,167	0,0087	0,0658	0,1955	1,141	-0,7382	-0,1781	0,0140	981,7450	0.0000

Notes:A description of the explanatory predictors is provided in Table 1. Abbreviations in table: GCO means auditor's going-concern opinion in auditor's report. N in number of data. Q₁ is 1st quartile, Q₃ is 3rd quartile. ** Significant at 0.01. * Significant at 0.05. Source: Own calculation.

Table 4. Logistic regression results.

		Model_1		Model_2		Model_3	
		Param. est.	Odds ratio	Param. est.	Odds ratio	Param. est.	Odds ratio
X_1	Auditor's busy season	1.4468 **	4.2494	1.2787 **	3.5919	1.4644 **	4.3248
X_2	Auditor's report time lag (ln)	1.1065 **	3.0236	1.0945 **	2.9876	1.1244 **	3.0785
X_3	Firm's age (ln)	0.3103 **	1.3638	0.3044 **	1.3558	0.3222 **	1.3802
X_5	Firm's loss in current year	2.0845 **	8.0408	2.0705 **	7.9290	2.0955 **	8.1291
X_6	Equity financing rate	-2.7735 **	0.0624	-2.8167 **	0.0598	-2.8231 **	0.0594
X_{13}	Total assets turnover	-	-	-0.1161 *	0.8904	-	-
X_{14}	Current liabilities turnover	-0.0003 -	0.9997	-0.0003	0.9997	-0.0003	0.9997
X_{16}	Short-term assets rate	-0.9308 **	0.3942	-0.6904 **	0.5014	-1.0757 **	0.3411
X_{17}	Cash assets rate	-	-	-	-	0.6755 *	1.9650
X_{19}	Return on assets	-1.4927 **	0.2248	-1.4096 **	0.2442	-1.4185 **	0.2421
β_0	Intercept	-9.6834 **	0.0001	-9.3969 **	0.0001	-9.8153 **	0.0001

Notes: Predictors X_4 , X_7 , X_8 , X_9 , X_{10} , X_{11} , X_{12} , X_{15} , X_{18} and X_{20} are not shown in table because predictors are not included in the above models. A description of explanatory predictors is provided in Table 1.

** Significant at 0.01. * Significant at 0.05.

Source: Own calculation.

Table 5. Models' performance results.

	Model_1	Model_2	Model_3
Nagelkere's det. coef. (R_N^2) *	0.3479 (0.3276)	0.3489 (0.3303)	0.3489 (0.3301)
Overall accuracy (in %)	85.24	85.14	85.27
True positive rate †	0.7511	0.7566	0.7584
False positive rate ‡	0.1379	0.1396	0.1384
c-index *	0.8834 (0.8979)	0.8834 (0.8973)	0.8834 (0.8974)

Notes: † The true positive rate presents the correct prediction of firms with auditor's going-concern opinion qualification among the firms with qualified auditors' reports for going-concern doubt.

‡ The false positive rate presents the incorrect prediction of firms with auditor's going-concern opinion qualification among the firms with an unqualified auditor's report for going-concern doubt.

* The results in brackets show results of internal validation using the bootstrap method (with usage of 1,000 bootstrap samples).

Source: Own calculation.

opinion qualification is related to higher indebtedness, lower liquidity, lower efficiency, and lower profitability. Furthermore, it takes longer to complete an audit when an auditor reports a going-concern opinion and, contrary to our anticipation, a going-concern opinion is more likely during the auditor's busy season.

As previously stated, we used logistic regression to develop prediction models for going-concern opinions. The results for the parameters' estimates for three selected models with the lowest BIC values are shown in Table 4. The odds ratios are shown for meaningful interpretation of the estimated predictors' parameters. The odds ratio gives the odds of variable X_i to the odds of other variable X_j (where: $j = 1, \dots, n; j \neq i; n$ is number of variables in the model) in the prediction model. For example, when interpreting the odds ratio for predictor X_3 , which shows whether a firm's financial statements end at 31 December (during the busy season), *ceteris paribus*, the firm has 4.23 times higher odds of a going-concern opinion qualification than a non-qualification. Statistically significant variables in the selected prediction models are shown in Table 4.

Table 5 shows selected models' performance results. Overall performance of the selected prediction models is adequate, with an overall accuracy of 85%. However, the constructed prediction models are not perfect (as not all of their predictions are

correct). False positive rates are lower than expected, and overall, the prediction of a going-concern opinion is successful. The models' performance results were validated using the bootstrap method (on 1,000 bootstrap samples). Internal validation results are not different in relation to development sample results (see Table 5, results in brackets). The models' R_N^2 values are adequate, i.e. one-third of the dependent variable's variability is explained by the predictors included in each selected model. Internal validation results are approximately equal. We are of the opinion that use of prediction model *Model_1* with a minimum of eight predictors is preferred.

6. Conclusion

The aim of the present paper was to develop a going-concern prediction model for Slovenian firms. We developed this model using various predictors. All predictors are based on publicly available data and the majority are based on firms' financial statements data. We did not use market-related or country-specific predictors. The univariate statistics reveal that firms with a going-concern opinion qualification in the auditor's report have higher indebtedness (worse financial structure), lower liquidity and efficiency, and worse profitability in comparison to firms without a going-concern qualification. These characteristics were expected since going-concern opinions are usually linked to firms' threatened ability to continue operating (i.e., problems with business financing, cash liquidity, existence of loss programs, etc.). The logistic prediction model (*Model_1* with a minimum of eight predictors) distinguishes between firms with a going-concern opinion and firms without a going-concern opinion qualification. As expected from a statistical theory viewpoint, a single predictor does not provide a statistically significant association between that predictor and a modified auditor's report for going-concern doubt. This is obvious because there is not any statistically significant correlation between a single predictor and a modified report for going-concern doubt. However, from a statistical viewpoint, a prediction model using a firm's predictors enables prediction of a going-concern opinion and for non-modification for going-concern doubt.

After reviewing our results, we conclude that a statistical prediction model can be developed using a sample data of Slovenian firms. Our developed prediction model based on logistic regression achieves relatively satisfactory performance rates. However, this is not surprising since in previous studies logistic regression models performed well (Gepp et al., 2018; Martens et al., 2008; Stanišić et al., 2019). Due to the application of logistic regression, the prediction model presented in this study is simple to use, which was one of the main goals of our study. Publication of the model's coefficients enables the use of the prediction model. This model can be used in practice in the Slovenian environment by auditors, regulators, various rating agencies, academia, and any other interested parties. Examples of where and when the model can be used are discussed in the present study.

Nevertheless, a precautionary note is warranted. When auditing a firm's financial statements, auditors use their professional judgment, so their decision-making could be more subjective than objective. Various factors influence an auditor's decision. Therefore, a going-concern opinion qualification is, to some degree, the result of a

subjective process where different auditors adopt different risks. For example, auditors have different preferences in relation to incorrect qualifications regarding the existence of going-concern doubt (Zdolšek et al., 2015). Nevertheless, auditors can use statistical models in auditing as they enable better organisation and decision-making regarding various parameters.

The present paper represents the first research to predict a going-concern opinion on a sample data of Slovenian firms. The sample data cover a nine-year period (2005–2013). Going-concern opinion, the research interest of this paper, is a relatively low frequency phenomenon in our sample data (but not too low) and usually also in other samples (i.e. in various samples or populations the going-concern opinion rates are below 10%). There are various possible research directions, including an in-depth study of going-concern opinions in a sample data of heavily distressed firms and possibly bankrupt firms. Further studies that compare Slovenian firms with firms from other comparable countries and with countries in the southeastern region of Europe (so-called Balkan area) are warranted. Future research could address the role of a financial crisis on the auditing process, especially due to the possible lag effect of the crisis (Potocan et al., 2019). An unexplored course of research is the use of advanced statistics, machine learning, or a combination of the two on Slovenian firms' data in prediction of going-concern opinion. Due to data unavailability from audit firms (due to confidentiality concerns) a further unexplored stream of research is the use of various data in relation to audit firms and auditors (audit partners) in charge (i.e. audit engagement hours, fees, costs, efficiency, etc.). Availability of these data would make a previously unexplored avenue of research possible. Auditors' decision-making during an audit is to some extent subjective, so a possible research avenue is a study of various qualitative factors that relate to auditors' decision-making.

Notes

1. We proceed without stating hypothesis in our paper since our research is empirical in nature. This should be understood as that we do not formally state and elaborate hypothesis in the paper. We had to make a trade-off decision between the detailed explanation and the length of the paper, which is limited by the journal. Nevertheless, hypothesis is clearly embodied in the paper, i.e. auditor's going-concern opinion model for Slovenian firms is different that the former models for other countries.
2. In Slovenia there is no database with data about going-concern opinions for auditees. Data collection is a lengthy process. We started collecting data in 2015, and only auditees' annual reports until 2013 were available at the time. It took us three years to collect data for the database used in our study. Collecting data for an additional period (2014–2019) would take a further three years.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Daniel Zdolšek  <http://orcid.org/0000-0002-6316-4171>

Timotej Jagrič  <http://orcid.org/0000-0001-7767-9988>

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