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A Credit Scoring Model for SMEs Based on Accounting Ethics

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Received: 19 July 2017; Accepted: 5 September 2017; Published: 6 September 2017

Abstract: Various types of government credit guarantee programs exist for small- and medium-sized enterprises (SMEs). The SMEs guaranteed by these programs can resolve their financial difficulties by obtaining loans from banks or being included in a pool for the issuance of primary collateralized bond obligations. However, the loan default rate for these supported firms is high owing to their moral hazard, which can be associated with unethical behavior in the accounting process. Since the stakeholders of credit guarantee programs initiated by the government include not only lenders and borrowers, but also taxpayers, the default risk of moral hazard must be minimized. Thus, an additional evaluation step is required to deal with accounting ethics, which has not thus far been considered in the literature. In this study, we propose an accounting ethics-based credit scoring model as a complementary approach, which can be used to select suitable borrowers. The proposed model is expected to reduce the default rate resulting from the moral hazard associated with unethical accounting behaviors in the supported firms.

Keywords: credit scoring model; SMEs; accounting ethics

1. Introduction

Small- and medium-sized enterprises (SMEs) play an important role in entrepreneurship and job generation. However, SMEs often have difficulty attracting funding for their activities. To resolve such financial problems, government agencies operate a range of support policies, including credit guarantee programs. A credit guarantee from a government agency helps SMEs procure loans from commercial banks or participate in a pool for P-CBOs (primary collateralized bond obligations). However, when a government-guaranteed SME reports a default, the government agency is obligated to cover the loss, which ultimately burdens taxpayers. From the perspective of stakeholder theory [1], credit guarantee programs backed by the government broaden the stakeholder base of supported firms to include not only the government agency responsible for the guarantee program but also the taxpayers to whom losses from defaults are transferred [2].

To minimize the risks for stakeholders, government agencies use an evaluation process to screen SMEs applying for funding programs, based on their tangible and intangible assets. Despite the existing credit scoring model is designed to estimate the default risk by firm's financial creditworthiness, there is still a very high rate of financial default among recipient SMEs owing to moral hazard. Most moral hazard event can be detected in part by unethical behavior in the accounting process. A high-quality accounting process may represent a low risk of moral hazard because of the reduced degree of information asymmetry between insiders and outside suppliers of capital [3]. In this context, we believe that a firm's ethical accounting practices must be assessed during the evaluation process to reduce the risk of default from moral hazard. An additional tool that evaluates a firm's accounting behavior can be used to complement conventional financial creditworthiness model.

Against this background, there have been attempts to define firms' accounting ethics and practices with a scorecard system. In 2005, Korea's Small and Medium Business Administration ran a P-CBO program with a maturity period of three years to support SMEs. To select appropriate SMEs, the program reviewed firms' basic information and financial status, following a general evaluation process. In addition, for the first time, firms' accounting ethics were evaluated by using a scorecard with predetermined weights for individual attributes.

Consideration of moral hazard behavior of the supported SMEs is particularly important in Korea. This is because the Korean government continuously expanded its credit guarantee scheme to avoid a temporarily illiquid in SMEs after the Asian financial crisis and the scale of credit guarantee reached to about 6–8% of GDP, which is much higher than other nations—0.1% in the United States and less than 3% in Taiwan. In this situation, such large-scale budget may bring government institution's indiscriminate supports and the selected SMEs' careless management. This can increase the burden of stakeholders without efficacy of government supports. In this context, government decided to evaluate firm's accounting ethics and the scorecard and weights of the attributes that present firm's accounting behavior were proposed by certified public accountants (CPAs) based on their experience, and these were not updated based the actual data. However, the default rate among P-CBO guaranteed firms turned out to be high, the weights assigned to the individual components of the scorecard needed to be re-tuned to predict default risk in a better manner.

Against this background, this study proposes a complementary credit scoring model based on the accounting ethics of SMEs. The proposed model is developed based on P-CBO data. The proposed accounting ethics scoring model is designed to be used as a complementary screening method for firms already shortlisted based on their credit score of financial creditworthiness and financial information. The suggested model is thus expected to reduce the risk of default due to moral hazard. Hence, our model can prevent stakeholders in government-supported programs, including the public, from making losses.

The logistic regression model is one of the most widely used approaches for developing credit scoring models [4]. We use a logistic regression model to gain insight into credit scoring based on accounting ethics. The adoption of the proposed ethics-based credit scoring model can contribute to more sound funding than the use of single conventional credit scoring models.

The rest of this paper is organized as follows. In Section 2, we review previous studies of credit scoring models as well as the attributes of a firm's accounting behaviors. In Section 3, we introduce the data and variables used in our proposed model. In Section 4, our logistic regression analysis is introduced to propose a credit scoring model based on accounting ethics. In Section 5, we summarize our results and suggest areas of further research.

2. Literature Review

The focus of this study is loan defaults among SMEs associated with moral hazard that can be predicted by accounting practices. Loan defaults due to moral hazard must be taken seriously. This is particularly so with P-CBO programs, which are initiated by government agencies at the burden of taxpayers. To minimize such defaults, the accounting ethics of SMEs need to be assessed along with the conventional credit evaluation. This section reviews previous works of credit scoring models for SMEs and accounting ethics. We examine how credit scoring models for firms have been developed historically and explore aspects of accounting ethics.

2.1. Credit Scoring Models

Many SMEs experiencing capital problems use debt or credit guarantees to improve their financial resources. Traditionally, assessing an applicant's default risk was a matter of using human judgment based on previous decision experience. However, given the increased demand for such evaluation and the recent advances in computer technology, model-based credit scoring approaches are now used, mainly based on logistic regression [4,5] and the neural network model [6].

Typical approaches of making lending decisions for SMEs—called lending technologies—all consider factors such as the financial status of the business owner and the firm's assets. Only a few studies have proposed a credit scoring model for SMEs based on non-financial information [7]. Technological credit scoring models are examples based on non-financial attributes. Sohn et al. [4] developed the first technology credit scoring model by using a logistic regression based on four non-financial aspects: management ability, technology level, marketability of technology, and profitability of technology. This model was subsequently extended to reflect various practical situations [8–24].

Default stemming from internal fraud can provide larger negative effects on government policies by ultimately providing a burden on taxpayers [1]. Stakeholder theory explains the complex relationship between a firm and its stakeholders. Credit guarantee programs backed by governments broaden the stakeholder base of supported firms, including both the government agencies responsible for the guarantee program and taxpayers, to whom losses from defaults are transferred [2]. However, stakeholders' different interests and complicated connections raise ethical questions about business activities [25]. Further, accounting ethics have thus far been underutilized for credit scoring.

2.2. Aspects of Accounting Behavior

Blake et al. [26] provided the case of “creative accounting” in Spain and discussed the ethical issues of manipulating the accounts of businesses. The authors argued that creative accounting has been preferred by firms to mask their financial status even though it is perceived as ethically undesirable.

For the stakeholders of governments' credit guarantee programs, inaccurate financial reporting is one of the risk factors associated with loan default [27]. When unethical management behavior occurs during an accounting process, it weakens the financial structure of the company involved, decreases employees' willingness to work, and can ultimately lead to default [28]. For example, since the Enron scandal erupted, firm defaults due to moral hazard have led to a general mistrust of accounting, financial reporting, and auditing practices [29,30]. Accounting fraud has adverse effects on companies and industries as well as shakes the very foundations of capitalism [31]. As accounting processes are directly related to the allocation of benefits, there is a high likelihood of making unethical decisions.

Accounting fraud is likely to take place when a firm has a weak internal control system. In particular, many SMEs are exposed to the risk of fraud because of their weak internal control. This is because few SMEs can afford the labor and financial resources needed to conduct external and internal audits. Bruns and Fletcher [32] pointed out that because the information released by some SMEs having weak internal control may be manipulated or incomplete, banks have difficulty making lending decisions concerning SMEs. The Sarbanes–Oxley Act is now being enforced in the United States, which has increased the need for accounting and financial reporting by small businesses [33]. As such, SMEs have to resolve issues involved in information asymmetry, which violates stakeholders' rights and ultimately decreases outside investment [34].

Unethical behavior within a firm is likely to spoil governance transparency and eventually bring about financial opacity, which is linked to the risk of misappropriation. A credit scoring model based on accounting ethics should estimate the levels of governance transparency and financial transparency that result from business/managerial ethics and misappropriation risk, respectively.

First, in terms of governance transparency, a firm's internal control structure reflects its degree of business ethics. The risk of unethical business decisions can be reduced when an internal control structure dealing with the firm's business processes such as internal regulatory systems and clear role assignments is well established. Further, it is much easier to rectify a fault when it occurs in a firm with more governance transparency [35,36]. In terms of financial transparency, business routines embedded in the internal control structure can also affect the accuracy of accounting records, which is associated with the risk of misappropriation.

Second, financial transactions provide evidence of financial transparency in practices. Hasumi and Hirata [37] argued that the transparency of SMEs' financial statements is an important factor in credit scoring. Higher transparency in financial transactions means less risk of embezzlement. When Patel and Dallas [38] evaluated a firm's transparency, they screened financial transactions based on accounting policy factors such as the statuses of accounts, financial statements, and balance sheets, which shed light on ethical accounting behaviors, in the form of an accounting system's output. Similarly, Simon [39] found that accounting fraud often occurs through the manipulation of cash balances on balance sheets. For example, to exaggerate the status of the current amounts of cash in hand, a company might issue an accommodation bill without a corresponding business transaction.

Third, Yeh et al. [40] found that a firm's relationship with its related party or affiliated company is concerned with both governance and financial transparency because such financial transactions have an issue with wealth exploitation [41], with subsequent increases in information asymmetry [42]. Related party transactions (RPTs) involving loans and guarantees negatively influence a firm's financial transparency. Therefore, to evaluate governance transparency, RPTs should be monitored in terms of their lending behaviors involving related parties, their loans to affiliated companies, and the financial statuses of their affiliated companies.

Finally, the importance of the business and managerial ethics considered by key decision makers is reflected in business practices. Scandals such as those resulting from the actions of Enron and Arthur Andersen, which were driven by unethical behaviors—especially in their accounting processes—demonstrate the necessity of certain business ethics. These types of scandals damage public trust in business, and so ethics regulations that prevent corporate crimes must be imposed. Majority shareholder compensation is another crucial factor in the screening of SMEs' business practices because, from a structural standpoint, SMEs have an owner-manager structure [43]. Thus, shareholders are usually the firm's CEO and parties related to the CEO, meaning that their compensation packages can violate business ethics.

3. Data and Variables

In Korea, P-CBOs are issued to support SMEs that hold competitive technologies but nonetheless require funding support to sustain their businesses. The typical process of evaluating an SME's application for a P-CBO involves a basic document review and a subsequent credit scoring evaluation. In addition, accounting ethics evaluation procedures have recently been proposed to increase the discrimination power of moral hazard.

Table 1 describes five screening areas and associated variables that reflect such procedures. The data source for this research is the P-CBO program, which evaluates SMEs by using three steps: a basic document review, a financial credit scoring evaluation, and an accounting ethics scorecard. After a document review and financial credit evaluation of the 329 applicant firms, 74 companies were selected. Instead of directly granting the P-CBO to the 74 accepted firms, accounting ethics were additionally assessed to increase the discrimination power for those with high levels of moral hazard. Eventually, the P-CBO was granted to 68 firms that passed all three evaluation processes.

The final evaluation step was performed by a CPA on the basis of a scorecard with 16 elements classified into five screening areas: internal control structure, financial transactions, related parties, business ethics, and "other unethical conduct." The proposed attributes cover the firm's aspects in business ethics, managerial ethics, and risk of misappropriation in accounting behavior. Tables 1–5 provide details on the individual attributes (denoted by "X" and a number) in the scorecard. Table 1 presents the variables used to evaluate the internal control structures of SMEs. As the internal control structure represents financial transparency, internal control regulations, role assignments, and the accuracy of accounting are used.

Table 1. Variables of the internal control structure.

Variables		Score	Description
X1	Internal Control Regulations	3.0	There exist full internal control regulations with no absence of audit reports in the recent IACS (Internal Accounting Control System).
		1.5	Some internal control regulations are not provided, but there is no absence of audit reports in the recent IACS.
		0	Other—the previous statuses of the internal control regulations are missing.
X2	Role Assignments	3.0	Roles related to transaction approvals, financial executions, and accounting records are well divided.
		1.5	The roles of transaction approvals are separated, but those related to financial executions and accounting records are not.
		0	All roles of transaction approvals, financial executions, and accounting records are not separately controlled.
X3	Accuracy of Accounting Records	9.0	Matched records with deposits and cash in hand.
		6.0	Matched with cash records in hand only.
		3.0	Matched records with deposits only.
		0	No matches for either deposits or cash in hand.

Next, Table 2 presents the variables of financial transactions to provide evidence of financial transparency. As higher transparency in financial transactions means that managers consider the interests of shareholders, the credit scoring model should include related variables such as the number of accounts, withdrawal methods, evidence of expenditure, and cash in hand. For the X5 and X6 variables, additional demerit points were assigned. For example, if a company was assigned three points for X5 because of one discovered cash-out transaction related to a business deal, and if that company was found to have used its own promissory note rather than a credit card for a commerce purchase transaction, then its final score became one point.

Table 2. Variables of financial transactions.

Variables		Score	Description
X4	Number of Accounts	3.0	Fewer than three accounts for withdrawals.
		2.0	Three accounts for withdrawals.
		1.0	Four accounts for withdrawals.
		0.5	Five accounts for withdrawals.
		0	More than five accounts for withdrawals.
X5	Withdrawal Method *	9.0	Withdrawal by account transfer.
		6.0	Business transactions are done by account transfers but loans and investment transactions are done through cash withdrawals.
		3.0	One cash-out transaction was found to be related to a business deal.
		0	Two cash-out transactions were found to be related to business deals.
X6	Evidence of Expenditure **	6.0	All evidence has been correctly confirmed.
		3.0	One item of evidence has not been confirmed.
		0	Two items of evidence have not been confirmed.
X7	Cash on Hand (Average for Previous Year)	9.0	Average cash flow is under 5 million Korean won.
		7.0	Average cash flow is between 5 and 10 million Korean won.
		5.0	Average cash flow is between 10 and 20 million Korean won.
		2.0	Average cash flow is between 20 and 30 million Korean won.
		0	Average cash flow is over 30 million Korean won.

* Subtract 2 points from the assigned score (except for a score of 0) when a company's promissory notes have been used, rather than credit cards, for a commerce purchase transaction; ** Subtract 2 points from the assigned score (except for a score of 0) when there is no loan agreement for more than 100 million Korean won.

As RPTs are closely related to the risk of wealth exploitation, the P-CBO programs evaluated the status of related parties and their relationships (Table 3). Loans to related parties, loans to affiliated companies, and the financial statuses of affiliated companies were examined for RPTs.

Table 3. Variables of related parties.

Variables		Score	Description
X8	Loans to Related Parties	9.0	No loans have been made.
		7.0	Loans are less than 100 million Korean won.
		5.0	Loans are between 100 and 300 million Korean won.
		4.0	Loans are between 300 and 500 million Korean won.
		2.0	Loans are between 500 and 1 billion Korean won.
		0	Loans are greater than 1 billion Korean won.
X9	Loans to Affiliated Companies	6.0	No loans have been given.
		4.5	Loans are less than 5% of total assets.
		3.0	Loans are between 5% and 10% of total assets.
		2.0	Loans are between 10% and 20% of total assets.
		0	Loans are greater than 20% of total assets.
X10	Financial Statuses of Affiliated Companies	6.0	Affiliates' debt ratios are less than 160%.
		4.0	Affiliates' debt ratios are between 160% and 200%.
		3.0	Affiliates' debt ratios are between 200% and 300%.
		2.0	Affiliates' debt ratios are between 300% and 400%.
		0	Affiliates' debt ratios are greater than 400%.

Tables 4 and 5 show the variables for evaluating business ethics and other related factors. Accounting fraud scandals such as the Enron and Arthur Andersen cases are associated with the practices of business ethics in a firm. Therefore, it is necessary to assess a firm's business ethics. Ethical regulations (X11) cover three types of ethical rules, regarding: (1) whether there are codes of behavior to protect against conflicts of interest with regard to customers; (2) whether there are protection regulations for people who report a colleague's violations of ethical standards; and (3) whether there are protection (information security) regulations regarding a firm's trade secrets.

The scale of each attribute is preset based on the CPA's opinions. CPAs assigned weights between 3 and 9—except X16 (other unethical conduct)—depending on what attributes are associated. As shown in the previous section, the attributes of accounting ethics cover the business and managerial ethics and risk of misappropriation. The CPAs set a weight of 9 for the attributes presenting the risk of misappropriation, while they set 3 and 6 to those of business ethics and managerial ethics, respectively. Most attributes can be evaluated by using the information in a firm's one-year accounting records; the remaining attributes—mostly the business ethics-related attributes—are scored based on an in-depth interview with the firm's manager.

Table 4. Variables of business ethics.

Variables		Score	Description
X11	Regulation of Ethics	3.0	There are well-defined ethical regulations.
		2.0	One ethics rule is missing from the ethical regulations.
		1.0	Two ethics rules are missing from the ethical regulations.
		0	Other cases than the previous three cases for regulations.
X12	Criminal Penalties	6.0	No penalties.
		5.0	Penalties are under 10 million Korean won.
		4.0	Penalties are between 10 and 50 million Korean won.
		3.0	Penalties are between 50 and 100 million Korean won.
		2.0	Penalties are between 100 and 200 million Korean won.
		0	Penalties are greater than 200 million Korean won.

Table 4. Cont.

Variables	Score	Description
X13	Majority Shareholder Compensation	6.0 Majority shareholder compensation is up to four times that of defined employee compensation.
		4.0 Majority shareholder compensation is between four and 4.5 times that of defined employee compensation.
		2.0 Majority shareholder compensation is between four and five times that of defined employee compensation.
		0 Majority shareholder compensation is greater than five times that of defined employee compensation.
X14	Business Practices *	−4 There have been infringements of corporate property (real estate, etc.) rights (seizure, injunction, auction proceeds, etc.) in the last two years.
		−6 The corporate head office and its registration addresses are different.
		−6 After acquiring majority shareholder status, residence or nationality was changed to a foreign country.
		−2 The property of shareholders or the CEO (or the CEO's spouse) has been infringed upon in the last two years.
		−6 There are legal rights limitations on the property of shareholders, set by an unconfirmed institution.
		−4 There are people who are separately in authority, other than the CEO or shareholders.
		−4~−9 There were sales returns of more than 100 million Korean won during the year before the evaluation date.
		−9 Accommodations bills have been issued.
		−9 Accommodations bills have been borrowed.
		−9 Accounts containing company funds are managed not by a named company authority but by other people (shareholders, etc.)
		−6 There have been unfavorable audit reports within the last three years.
		−4 Accounting firms responsible for external audits were changed up to two years before the evaluation date.
		−4 A core staff member (finance, management, sales, and chief executive officer) retired during the last year.
		−2 The auditor is related to the shareholders, or holds another position in the company.

* Subtract the assigned score from 9 when a case is applicable to the company. This can be done more than once, but the final score should not be less than 0.

Table 5. Other variables.

Variables	Score	Description
X15	Level of a Firm's Cooperation	3.0 The firm is judged as appropriate for policy loans and is cooperative.
		2.0 The firm is judged as inappropriate for policy loans but is cooperative.
		1.0 The firm is judged as appropriate for policy loans but is uncooperative.
		0 The firm is judged as inappropriate for policy loans and is uncooperative.
X16	Other Unethical Conduct	10 No special unethical cases have been observed.
		0 A special unethical case has been observed.

The preset weights can be updated when the funding result based on this score is obtained. Thus, we use a logistic regression model to formulate a credit scoring model based on the accounting ethics practices of fund applicant firms and their default. Before using this logistic regression model, it is necessary to eliminate the preset weights assigned by the experts. Hence, we transform the original scale (X) of all the attributes into the same six-point scale as follows:

$$X' = \frac{X}{\text{Max}(X)} \times 6. \quad (1)$$

In this study, we set the scale of the attributes to 6, which is the median of the most preset weights (except X16); the rest of the attributes have weights from 3 to 9. The number chosen as the scale does not affect the default probability to be estimated from the logistic regression. Further, instead of

directly applying this to the logistic regression, we take its inverse to reflect the potentially non-linear relationship between the ethics attributes and the log odds ratio of default:

$$Z = \frac{1}{X' + 1}. \quad (2)$$

Specifically, by using a logistic regression model, we model the probability of non-default, P_z , as a function of attributes Z as follows:

$$\ln \frac{P_z}{1 - P_z} = \beta_0 + \sum_{i=1}^K \beta_i Z_i \quad (3)$$

where β_i is the weight corresponding to Z_i estimated by using the maximum likelihood method. Among the 68 firms for which the P-CBO was granted, 22 (32.35%) defaulted before the date of maturity. The average accounting ethics score for the 68 firms was 75.2, while those for the non-defaulting and defaulting firms were 76.7 and 72.1, respectively. Table A1 presents the descriptive statistics of the defaults as well as the means and standard deviations of each variable X , while Table A2 provides information on the correlation matrix of ethics attributes X . Moreover, Table A3 shows the potential for multicollinearity in terms of the transformed independent variable Z , by using variance inflation factors. Values exceeding 20 indicate a problem with multicollinearity. However, no significant multicollinearity problems were found in this study, and thus we conducted the logistic regression with all 16 Z variables.

4. Results of the Logistic Regression

To distinguish non-defaulting SMEs from defaulting ones, we used the reciprocal values ($Z1$ – $Z16$) of the 16 variables ($X1$ – $X16$) introduced in Section 3 for the logistic regression. As displayed in Table 6, we found five significant variables related to the non-default condition at a significance level of 10%: $Z3$ (accuracy of the accounting records), $Z7$ (cash in hand), $Z8$ (loans to related parties), $Z9$ (loans to affiliated companies), and $Z13$ (majority shareholder compensation).

Table 6. Results from the logistic regression model for non-defaults.

Variable	DF	Estimate	Standard Error	Wald Chi-Square	<i>p</i> -Value
Intercept	1	10.6977	5.8947	3.2934	0.0696
Z1	1	0.1822	1.1911	0.0234	0.8784
Z2	1	−24.2591	14.7633	2.7001	0.1003
Z3 *	1	−13.286	6.5754	4.0827	0.0433
Z4	1	−5.4597	4.1861	1.701	0.1922
Z5	1	−2.8686	2.0171	2.0225	0.155
Z6	1	−12.5774	9.8637	1.626	0.2023
Z7 *	1	8.8745	5.1378	2.9835	0.0841
Z8 *	1	−2.4006	1.3245	3.2851	0.0699
Z9 *	1	−8.2277	4.9323	2.7826	0.0953
Z10	1	1.945	2.6321	0.5461	0.4599
Z11	1	−0.7187	1.1615	0.3828	0.5361
Z12	1	9.4808	11.1131	0.7278	0.3936
Z13 *	1	−5.8424	3.3914	2.9677	0.0849
Z14	1	6.1149	6.0366	1.0261	0.3111
Z15	1	9.0634	6.9458	1.7027	0.1919
Z16	1	−2.5239	1.6712	2.281	0.131

* The significance level is set at 0.1.

We selected a significance level of 10% because of the relatively small sample size used in our study. A negative estimated coefficient for Z represents a positive association with preventing default, because we conducted a logistic regression with the reciprocal X values. In other words, the variables

associated with a higher positive estimated coefficient are associated with a higher risk of default, whereas a lower negative estimated value indicates a lower risk of default. The significant variables Z3, Z8, Z9 and Z13, which have negative estimates, indicate that the original variables (X3, X8, X9 and X13) are positively associated with non-default (Table 3). In the same vein, X7 is negatively related to the non-default condition.

For SMEs, a high-quality account management system may take a long time to be established. Nevertheless, companies have a responsibility to correctly record the full particulars of accounting results. People interested in a company's financial statements are stakeholders, such as corporate executives, employees, shareholders, stock market investors, governments (tax authorities), and the media. These groups can have a significant impact on the growth and activities of SMEs. If there is corruption connected to corporate accounting and financial statements, it can lead to mistrust from stakeholders and thus hinder the business activities of the enterprise in question. Therefore, enterprises are responsible for financial transparency in their financial statements. This fact supports the contention that the accuracy of accounting records (X3) has a positive effect on the assumption of a non-default condition.

Increases in loans to related parties (X8) and loans to affiliated companies by firms (X9) are undesirable with regard to business transparency. Generally, related parties are relatives of the CEO or major shareholders of the company, and loans to related parties or affiliated firms may indicate unethical behaviors. If a large amount of money is loaned in this manner, there is a high possibility that misappropriation will occur, along with other ethical problems. For a small business in poor financial health, in particular, providing short-term loans to related parties or affiliated companies can exacerbate cash problems. Majority shareholder compensation (X13) is another important factor when screening SMEs for unethical behavior. SMEs usually have an owner-manager structure, and excessive compensation to a major shareholder raises a red flag during an assessment [43].

Our logistic regression found that cash in hand (X7) was negatively correlated with the non-default condition. This indicator evaluates the adequacy of the cash balance in hand by checking recent transaction information on a book of original entries. If sudden changes in cash in hand are observed and the status of cash in hand exceeds a suitable level, CPAs assume that the firm has a strong possibility of being engaged in accounting fraud. The CPAs in our study suggested an appropriate level of cash in hand for guaranteed SMEs, and when the cash in hand exceeded this level, they subtracted points. Thus, a company with too much cash would be given a low score for this variable (X7). However, the logistic regression shows that companies with low cash in hand (X7) scores do not tend to default until bond maturity. As Laitinen and Laitinen [44] found, there is a higher failure risk for firms with less cash flow, suggesting that a company with a low score for this variable holds sufficient cash liquidity, which prevents default arising from low amounts of cash.

Comparing the performance of the proposed accounting ethics-based credit scoring model with the scorecard described in Tables 1–5, we found that threshold values varying from 0.355 to 0.405 provided the best prediction accuracy, using jackknife cross-validation. Jackknife cross-validation evaluates the proposed model by forming N samples by using the “leave one out” procedure. This cross-validation approach is therefore suitable to approximate the proposed model's error for small sample sizes [17]. Table 7 compares the classification performance for the currently used scorecard, which has been used to evaluate firms' accounting ethics, with the proposed ethics-based credit scoring model and the suggested threshold values.

Table 7. Classification table.

Predicted \ Real	Currently-Used Score Card		Accounting Ethics-Based Credit Scoring Model		Sum
	Non Default	Default	Non Default	Default	
Non default	46 (67.65%)	0	40 (58.82%)	6 (8.82%)	46
Default	22 (32.35%)	0	14 (20.59%)	8 (11.77%)	22
sum	68	0	54	14	68

By using our developed credit scoring model based on accounting ethics attributes, the default probabilities of 48 out of 68 companies were predicted correctly. The resulting accuracy rate was 70.59%. The existing scoring model predicted that all 68 companies would not default, but 22 companies (32.35%) eventually did, indicating that its accuracy was only 67.65%. Therefore, the proposed credit scoring model outperforms the existing method. Furthermore, the specificity of the proposed model is 36.4%, while the specificity of the existing model is 0%. Since the specificity is a proportion of identifying default to default, the result shows that the proposed model is more sensitive to detecting default risk than the existing model.

5. Conclusions

Stakeholder theory emphasizes that the interests of a firm and its diverse stakeholders should be fairly considered and addressed. In this context, business ethics in accounting can be emphasized as a firm's principal responsibility. Since the big accounting ethics scandals of the 2000s, firm transparency has become a particularly important requisite for investors as well as an influential factor in decisions on investments. Unethical accounting management activities occur frequently through weak internal control structures, unethical financial transactions, the lending of large amounts of money to related parties, and improper business ethics. These unethical accounting activities weaken the management conditions of SMEs and can lead to defaults in many cases. Defaults, in turn, damage both firms and their stakeholders. In a P-CBO program, which is backed by the government, the stakeholder base is broadened to include taxpayers. Thus, developing a proper credit scoring model based on accounting ethics is crucial for screening SMEs and realizing investments.

To develop a credit scoring model for accounting ethics, we reviewed previous studies and conducted a logistic regression with P-CBO program data. The factors in our scorecard reflect business transparency and cover both ethical processes and practices pertaining to accounting. Based on our results, we noted that the weights assigned by a CPA do not necessarily serve to bolster the default predictions. Moreover, some of them were insignificant. We found five variables that had significant meanings in relation to predicting non-defaults: the accuracy of accounting records, cash in hand amounts, loans to related parties, loans to affiliated companies, and majority shareholder compensation. These five variables can provide insights and implications for investors making investment decisions. It is essential that SMEs maintain transparent, fair, and ethical accounting approaches and establish methods for overcoming the risks associated with unclear accounting records, loans to related parties and affiliated companies, and excessive compensation to majority shareholders.

The proposed credit scoring model for ethical management in accounting is expected to help define an ethical foundation. It can also be used as a tool to aid financial support decisions concerning SMEs and to reduce the moral hazard associated with financing. When the suggested credit scoring model is used in the accounting process to select ethical SMEs, stakeholders can feel satisfied. As the model can prevent public losses, it has important implications for policies and government programs supporting SMEs. Its implication in the evaluation step can vary depending on the policy of support programs. For example, among the selected SMEs from the conventional evaluation step, the low scoring SMEs (i.e., those rejected by the new model) can be advised to invite external audit during the loan term to get funds, or the scale of the funding support can be adjusted.

For further research, more ethics attributes can be added to cover aspects related to corporate social responsibility. In particular, according to the specific accounting behaviors embedded in individual countries, new attributes describing such unique patterns should be included and their associations with default risk examined. The development of such enhanced models is clearly a worthy subject for further research.

Acknowledgments: This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIP) (2016R1A2A1A05005270). K. T. Lim participated in the early part of this research as a graduate research assistant.

Author Contributions: Bo Kyeong Lee reviewed the related literature, conducted the analysis, and wrote the manuscript. So Young Sohn implemented the research, designed the study, outlined the methodology, and helped draft the paper.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Descriptive statistics of data.

Variable	Non-Default		Default		<i>t</i> -Test	
	N = 46		N = 22			
	Mean	Std. Dev	Mean	Std. Dev	T Value	<i>p</i> -Value
X1 *	1.5652	1.0467	1.0909	0.9466	1.80	0.0763
X2	1.8913	0.6659	1.7045	0.5269	1.15	0.2532
X3	7.3696	2.0040	6.5909	5.3851	1.33	0.1877
X4 *	2.5326	0.7703	2.0909	0.8541	2.14	0.0364
X5	6.7391	2.7198	5.8636	2.8502	1.22	0.2257
X6 *	5.2391	1.1389	4.6364	1.0931	2.07	0.0426
X7	6.4130	3.3037	7.4545	2.2830	−1.33	0.1875
X8 *	7.4565	2.8340	4.7727	3.9513	3.20	0.0021
X9	5.3913	1.0377	1.3241	0.2823	−0.68	0.5005
X10 *	3.9130	2.6569	5.0000	2.0237	−1.70	0.0947
X11	0.5217	0.6579	0.5000	0.8018	0.12	0.9059
X12	4.7826	1.8125	5.3636	1.1358	−1.38	0.1732
X13	5.6087	1.3077	5.5455	1.5032	0.18	0.8595
X14	6.6196	2.0848	7.3864	2.55	0.0131	0.1428
X15	2.5870	0.6856	2.5909	0.7341	−0.02	0.9827
X16 *	8.1087	3.0421	5.9091	3.8657	2.55	0.0131

* 10% significance level.

Table A2. Correlation matrix.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16
X1	1	0.384	0.163	0.226	0.064	0.041	−0.160	0.042	−0.238	−0.418	0.113	−0.313	−0.269	0.018	−0.007	0.394
X2	0.384	1.000	0.033	0.023	0.147	−0.066	0.023	−0.120	−0.364	−0.449	0.157	−0.310	−0.036	−0.091	0.130	0.224
X3	0.163	0.033	1.000	0.110	0.138	0.088	0.050	0.002	−0.012	−0.291	−0.028	−0.184	−0.235	0.192	0.135	0.016
X4	0.226	0.023	0.110	1.000	0.216	0.118	0.008	0.250	−0.049	−0.017	0.080	−0.124	−0.196	−0.034	−0.018	0.256
X5	0.064	0.147	0.138	0.216	1.000	0.013	0.401	0.090	−0.089	−0.189	−0.048	−0.099	−0.155	0.083	−0.033	0.073
X6	0.041	−0.066	0.088	0.118	0.013	1.000	0.052	0.442	0.329	−0.033	0.098	−0.038	0.001	0.089	−0.111	−0.080
X7	−0.160	0.023	0.050	0.008	0.401	0.052	1.000	−0.019	0.036	0.060	−0.051	0.068	−0.032	0.152	−0.099	−0.158
X8	0.042	−0.120	0.002	0.250	0.090	0.442	−0.019	1.000	0.207	−0.083	0.062	0.048	0.042	0.020	0.002	0.209
X9	−0.238	−0.364	−0.012	−0.049	−0.089	0.329	0.036	0.207	1.000	0.364	−0.038	0.249	0.017	0.067	−0.014	−0.226
X10	−0.418	−0.449	−0.291	−0.017	−0.189	−0.033	0.060	−0.083	0.364	1.000	−0.020	0.401	0.338	−0.085	−0.048	−0.195
X11	0.113	0.157	−0.028	0.080	−0.048	0.098	−0.051	0.062	−0.038	−0.020	1.000	−0.217	0.015	0.131	−0.063	0.110
X12	−0.313	−0.310	−0.184	−0.124	−0.099	−0.038	0.068	0.048	0.249	0.401	−0.217	1.000	0.208	−0.156	0.172	−0.037
X13	−0.269	−0.036	−0.235	−0.196	−0.155	0.001	−0.032	0.042	0.017	0.338	0.015	0.208	1.000	−0.012	0.133	0.007
X14	0.018	−0.091	0.192	−0.034	0.083	0.089	0.152	0.020	0.067	−0.085	0.131	−0.156	−0.012	1.000	0.115	0.034
X15	−0.007	0.130	0.135	−0.018	−0.033	−0.111	−0.099	0.002	−0.014	−0.048	−0.063	0.172	0.133	0.115	1.000	0.108
X16	0.394	0.224	0.016	0.256	0.073	−0.080	−0.158	0.209	−0.226	−0.195	0.110	−0.037	0.007	0.034	0.108	1.000

Table A3. Variance inflation for each variable.

Variable	Variance Inflation
Z1	1.27573
Z 2	1.56952
Z 3	1.25132
Z 4	1.16709
Z 5	1.28046
Z 6	1.22216
Z 7	1.33243
Z 8	1.35389
Z 9	1.43481
Z 10	2.05001
Z 11	1.19229
Z 12	1.40887
Z 13	1.39825
Z 14	1.19876
Z 15	1.26033
Z 16	1.27581

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