



Predicting Korean lodging firm failures: An artificial neural network model along with a logistic regression model

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ABSTRACT

Using financial variables as predictors, this study developed logistic regression and artificial neural network (ANN) models to predict business failures for Korean lodging firms. While both models demonstrated comparable Type I errors, the ANN model showed considerably lower Type II errors for both in-sample and hold-out sample predictions. This study also found that interest coverage is the most important signal of business failure for the Korean hotel industry. This ratio is directly related to the hotel's solvency, ability to service debts and productivity of profits and can thus be regarded as a survival indicator of Korean hotel firms.

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1. Introduction

1.1. Background of the study

Korean business firms in the hospitality sector have been facing great challenges in recent years. A recent study by Korean government reports that more than 70% of hospitality firms fail within the first 5 years of operation (Choi, 2008). For the last few years, these firms failed to break free of the downward trend and continued on a downward path (Bank of Korea, 2008). In particular, the overall market saturation in the lodging sector has not only led to the dreadful operating performance of individual firms (Park et al., 2008) but also intensified the already high competition among these firms. A recent report on lodging firms indicates a sign of oversupply in Korean lodging industry (KOSIS, 2008). Korean hotels' average occupancy rate between 1998 and 2004 was less than 60% (KOSIS, 2008), even lower than the 60.5% occupancy rate experienced by the U.S. hotel industry in 2001 which witnessed the 9.11 events and an economy recession (Hospitality Net, 2001). Firms operating in this highly competitive environment are vulnerable to failures especially under poor market conditions. The current credit crisis and the extended slowdown of the nation's economy are likely to make market conditions even tougher in the near future and may possibly lead to more hospitality firm failures.

1.2. Purpose of the study

For a long time, business failure prediction has been a major preoccupation of researchers and practitioners. In particular, smaller economies are more concerned about business failures because smaller nations are especially vulnerable to financial crises resulting from failures of individual entities (Altman, 1984). Previous research on business failure has shown that not all firms fail in an unforeseen manner (Altman, 1984). The problems causing the failure seldom arise overnight. Warning signals of a company heading for business failure emerge much earlier than the actual failure. Therefore these signals could be used to predict the failure in advance (Gu, 2002). To this date, most failure prediction studies have been conducted for the U.S. firms and only a handful of studies have developed failure prediction models for the Korean business firms. The primary interest of these studies was on the development of failure prediction models that can be used for prediction one or more years prior to actual failure. For the Korean hospitality firms, there has been only one documented failure prediction study despite the high failure occurrences in this sector (Choi, 2008).

Failure affects a firm's entire existence and it has high costs to the firm, the associates, the society and finally the country's economy (Warner, 1977). The far-reaching consequence of the failure is one of the reasons why researchers continue to build failure prediction models and experiment with techniques that improve prediction (Sexton et al., 2003). For everyone involved, it is crucial that an objective opinion on the probability of failure be formed as early as possible (Wilson and Sharda, 1994). The early

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discovery of financial distress and the use of preventive measures are always preferable to protection under bankruptcy law (Aziz and Dar, 2006). Developing reliable models for predicting failures would enable these firms to take measures early to prevent failure from happening. Based on financial data of Korean lodging firms, this study developed business failure prediction models using artificial neural networks (ANN) in comparison to logistic regression. Such models should be of particular importance as Korean economy is currently undergoing economic distress, triggered by global financial turmoil. In comparison to multiple discriminant analysis (MDA) and logistic regression, ANN is a relatively new classification technique, and to the best of our knowledge, has never been documented in hospitality failure research. Applying ANN to Korean lodging firm failure prediction, this study also attempts to make a methodological contribution in hospitality research.

2. Previous business failure studies in Korea

There are only a few studies conducted on business failures of Korean companies. Altman et al. (1995) carried out a study to test a failure classification model for Korean companies. Their sample consisted of 34 failed firms from 1990 to 1993 and a control sample of 61 non-failed firms. Two different models were developed, one for public firms and the other for both public and private firms. From 20 initially selected financial variables, four were retained in the models, including total assets, sales to total assets, retained earnings to total assets, and book value of equity to total liabilities. Both models demonstrated excellent classification rates in the first 2 years prior to distress with 89.36% and 93.10% accuracy, respectively. They concluded that the use of a failure prediction model may be more effective for U.S. firms than for Korean firms. This was because some distressed Korean firms demonstrated unexpected behaviors such as raising the equity capital and continuing to grow in size as late as a year or two prior to distress.

Lee (1998) attempted to address the failure of the overall business sector in South Korea. Based on the review of literature and secondary data, he identified two key elements that had contributed to the failure of the business sector. The first one was the lack of an effective corporate governance mechanism that could prevent business firms from engaging in wrong investment activities. The second one was the government-led credit allocation policy that excessively encouraged business firms to make more investments using borrowed funds. While his study enriched the business failure prediction literature in Korea, the main interest was on the causes of business failure from macro-perspectives.

Nam and Jinn (2000) empirically investigated the predictive ability of a business failure prediction model using a sample of 46 companies that went bankrupt during the 1997–1998 periods when the deep recession driven by the International Monetary Fund (IMF) crisis started in Korea. They used logistic regression analysis to develop the business failure prediction model. Out of 33 candidate variables, three financial ratios were identified as significant predictors of corporate bankruptcy. These three variables were financial expenses to sales, the ratio of net income plus depreciation and financial expenses to total borrowings plus bonds payable and financial expenses, and receivable turnover. The developed model demonstrated reasonable prediction accuracy, with the Type I accuracy at 80.4% and the Type II accuracy at 73.9%. This study further revealed that most of the firms that went bankrupt during the 1997–1998 periods had demonstrated signs of financial trouble many years before the economic crisis. The model developed based on data from 1991 to 1996 showed that the prediction accuracy remained consistent as the time prior to bankruptcy increased. The findings reveal that the 1997–1998

economic turmoil in Korea was not just an outcome of temporary foreign exchange crisis, but also a result of Korean business firms' poor financial performance over many years.

A more recent study by Lee et al. (2005) compared predictive accuracy and effectiveness of four different classification techniques, namely backpropagation neural network, Kohonen self-organizing neural network, quadratic discriminant analysis and logistic regression analysis. Their sample included 84 Korean firms that filed for bankruptcy during 1995–1998, matched by 84 non-bankrupt firms. They tested these four techniques on four different subsets of data using observations 2 and 3 years prior to bankruptcy, respectively. Their results indicated that the backpropagation neural network was the most accurate model with the highest classification accuracy, followed by logistic regression, Kohonen self-organizing neural network and discriminant analysis. The findings of this study are especially meaningful because the backpropagation neural network model, the model developed in this study, consistently outperformed the logistic model, even with the small sample size.

For the hospitality industry in Korea, there is only one documented business failure prediction study. Defining a failed firm as one with net loss for two consecutive years, Youn and Gu (2007) developed a logit model for predicting business firm failure in the Korean lodging industry. The model was developed using data from 75 failed firms matched by 75 non-failed firms. From the 10 candidate financial ratios, two were selected by the final model: debt ratio and total assets turnover ratio. The two-variable logit model achieved an in-sample classification accuracy rate of 82% and a hold-out sample classification accuracy rate of 75.6%, 1 year prior to the failure. The estimated model and retained variables suggest that to prevent business failures, Korean lodging firms should lower their reliance on debt financing and increase the efficiency in using existing assets to generate sales revenue.

3. Business failure definitions

A plethora of studies investigated failures of individual firms throughout the last 40 years. While the majority of these studies attempted to identify factors that can be used to predict failure with a reasonable level of accuracy, the definition of failure varies from one study to another depending on its purpose and scope (Dimitras et al., 1996; Gu, 2002). Many of these studies insist that failure does not always result in the reorganization or dissolution of a business. According to Bongini et al. (2000), there exists an entire range of failure possibilities, and some of them, such as economic failure, may be temporary and fixable if corrective actions are taken in time. In this study of business failure, economic failure of lodging firms was adopted as the definition of failure. Taking the cue from Cho's study (1994), business failure in this study is defined as 3 years of successive negative net income. Lussier and Pfeiffer (2000) also defined a failed firm as one with loss for three consecutive years.

4. Business failure prediction models

A substantial amount of effort has been devoted to the prediction of business failure during the last four decades. Since business failure prediction became a field of study with worldwide interest, researchers introduced a variety of failure prediction models based on a wide range of methodologies (Dimitras et al., 1996). In general, these failure prediction models evolve from the univariate linear model to multivariate analysis and from parametric models (conventional statistical models) to non-parametric models (artificial intelligence models) that are distribution-free techniques offering an opportunity to predict a failure under less restrictive statistical assumptions (Beaver, 1966;

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