

Association for Information Systems AIS Electronic Library (AISeL)

PACIS 2014 Proceedings

Pacific Asia Conference on Information Systems
(PACIS)

2014

USING NON-FINANCIAL DATA TO ASSESS THE CREDITWORTHINESS OF BUSINESSES IN ONLINE TRADE

Roozmehr Safi

Texas Tech University, r.safi@ttu.edu

Zhangxi Lin

Texas Tech University, zhangxi.lin@ttu.edu

Follow this and additional works at: <http://aisel.aisnet.org/pacis2014>

Recommended Citation

Safi, Roozmehr and Lin, Zhangxi, "USING NON-FINANCIAL DATA TO ASSESS THE CREDITWORTHINESS OF BUSINESSES IN ONLINE TRADE" (2014). *PACIS 2014 Proceedings*. 206.

<http://aisel.aisnet.org/pacis2014/206>

This material is brought to you by the Pacific Asia Conference on Information Systems (PACIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in PACIS 2014 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

USING NON-FINANCIAL DATA TO ASSESS THE CREDITWORTHINESS OF BUSINESSES IN ONLINE TRADE

Roozmehr Safi, Rawls College of Business, Texas Tech University, Texas, USA, r.safi@ttu.edu

Zhangxi Lin, Rawls College of Business, Texas Tech University, Texas, USA,
zhangxi.lin@ttu.edu

Abstract

Assessing the creditworthiness of prospective business partners is the first step in conducting trade. Traditionally the creditworthiness of partners was assessed using transactional methods, methods based on close observation of the other party and the heavy use of mostly subjective, soft information. During recent decades, however, these relational methods were largely replaced with transactional methods relying almost exclusively on objective financial data, otherwise known as hard data. A considerable portion of firms involved in business to business trade are now small companies that do not to have any reliable or comparable financial information. In the absence of such information, transactional methods of assessing business creditworthiness have very limited practical value. To provide a remedy, this study proposes using non-financial information available from the Web and thus a return to the more transactional methods. We identify sources of credit-related information available from a typical business to business exchange and test if such information can predict firm creditworthiness. We conduct a study with a group of online businesses on a major B2B exchange and empirically show that a number of non-financial factors can in fact predict online businesses' level of creditworthiness.

Keywords: Non-financial information, Relational credit assessment, E-commerce, Business-to-Business Trade.

1 INTRODUCTION

Shortly after the proliferation of its use in 1990s, the Internet started to shape a new economic ecosystem. While businesses have already exploited a lot of what this new technology has had to offer in their business-to-customer (B2C) transactions, business-to-business trade (B2B) still lags behind in coping with the trend. In practice, in most cases the use of the Internet in B2B trade does not go beyond messaging and email services. The reason for this phenomenon should be sought in those characteristics that differentiate B2B from B2C trade. Transaction size, for example, is one of the most important differentiating factors (Achrol & Kotler 1999): compared to B2C, the value of B2B transactions is substantially large. These unique characteristics coupled with the difficulties involved in assessing the creditworthiness of the other party makes companies very conservative when it comes to conducting business to business trade on the Internet.

Assessing the creditworthiness and reliability of one's business partners is one of the first steps to take in any transaction. Creditworthiness is the intrinsic quality of people and businesses reflected in their ability *and* willingness to fulfil their business obligations. In the traditional business environment, over the years, reasonably effective methods have been developed for assessing the creditworthiness of business partners (Balcaen & Ooghe 2006). The online environment, however, is different from the traditional environment in many ways and this makes traditional ways of assessing creditworthiness inefficient and impractical for e-commerce.

Small businesses from different corners of the world now form the majority of online businesses and as the use of the Internet becomes more popular in developing countries, the number and importance of these businesses continues to grow. Excessive heterogeneity of these firms due to vastly diverse business environments across the world is a key factor that makes assessing the level of creditworthiness in B2B trade difficult (Anderson 2007). In trade, information problems obstruct the efficient execution of many economic transactions as information is often asymmetrically distributed between the two parties (Zhu 2002). Compared to their larger counterparts, small businesses are much more informationally opaque in the eyes of outsiders (Anderson 2007). The Internet has now enabled these small businesses to reach out to a significantly larger pool of potential customers. However, the Internet has not been able to effectively solve their information asymmetry problem.

These small sellers often join B2B exchange portals that for a relatively small fee provide some degree of assurance about the authenticity of their member sellers. However, such assurances are typically very limited in scope. As such, after identifying these small suppliers on exchanges, buyers still have to rely on traditional ways for assessing their creditworthiness, for example by holding face to face meetings with them. These traditional methods, however, are too costly and often ineffective. In practice, the inability of buyers to assess the creditworthiness of online sellers is among the main reasons for buyers' hesitation to engage in B2B trade. As such, developing reliable mechanisms for assessing the creditworthiness of sellers on the Internet is one of the main priorities in expanding B2B trade.

In this article we set out to propose a method for assessing the creditworthiness of businesses in the online environment. To that aim, we first turn to the traditional business environment. Traditionally the creditworthiness of business partners was assessed using relational methods that involved long-term interaction and observation of the other party. In recent decades, however, these relational methods have been mostly replaced with the more objective transactional methods based largely on statistical analysis of annual financial statements (Balcaen & Ooghe 2006). In online B2B trade, however, there is little reliable information available about the financial health of prospective trade partners (Anderson 2007). Nevertheless, the Web now has the potential to serve as a rich source of non-financial and qualitative information about businesses. The main question that we set out to answer is which non-financial information available from the Internet can be used to assess the creditworthiness of businesses. To the best of our knowledge, no previous study has attempted to provide an answer to this question.

The remainder of this paper is organized as follows: we first explain what creditworthiness is in the context of trade. We then present a background about how credit and creditworthiness have been assessed in the traditional business environment. Next, we discuss how a method based on non-financial information can be developed for use in the online environment. Based on that, we formulate our hypotheses and test them using historical data from a major B2B portal. We conclude with a discussion of our findings, limitations of the study, and directions for further research.

2 LITERATURE REVIEW

2.1 Electronic Commerce and B2B Trade

In recent decades, the volume of trade among businesses has been on a sharp rise. This increase is attributable to a number of factors. The main factor is the mere increase in the volume and value of manufactured goods and services owing to industrialization and improved manufacturing techniques. At the same time, business functions and manufacturing methods have become progressively specialized, leading firms to outsource “everything but their core competencies” (McKinley, Zhao, & Rust 2000). Although it may not be evident, the value and the number of B2B transactions are considerably higher than that of B2C. That is because in a typical supply chain there are many transactions involving parts and components between businesses before a final sale to the end customer happens. For many companies the Internet is now the main source of finding suppliers. However, although B2B trade has been around for almost two decades now, it has not duly flourished yet. The difficulty involved in assessing the creditworthiness of prospective business parties is a major obstacle in B2B trade’s growth (Piao, Zhang, Han, & An 2008).

2.2 The Notion of Creditworthiness in Business Transactions

Creditworthiness is a dynamic, intrinsic attribute, or an internal quality of people or businesses. In business, credit can be defined both in a broad and in a narrow sense. In the narrow sense, credit can reflect the debt relationship of owner and debtor and encompasses any form of deferred payment (O'sullivan & Sheffrin 2003) . In the broad sense, however, credit is the unity of the subjective faith and objective behaviour (Cancer & Knez-Riedl 2005). In this way, creditworthiness can be defined as the probability associated with *both* the ability and the willingness of a trade participant to fulfil its trade obligations. In this paper we use the term creditworthiness in its broader sense. As such, our discussion goes beyond problems of payment alone.

2.3 Creditworthiness and the related concepts

Credit and creditworthiness are closely tied to a number of other concepts in the domain of trade and e-commerce. Trust and trustworthiness are often used interchangeably with credit and creditworthiness (Mayer, Davis, & Schoorman,1995). The notions of trust and trustworthiness are among the most widely studied constructs. Trust, in the *Oxford English Dictionary*, is defined as “confidence in or reliance on some quality or attribute of a person or thing, or the truth of a statement (Oxford 1998).” As a personal trait, trust has been widely studied by psychologists, As a social structure, this concept has been studied by social scientists and as a cost-benefit mechanism, the construct has been the subject of many economic and business studies (Mayer 1995). In e-commerce too, trust is among the most widely studied constructs (see for example Pavlou 2003; Pavlou & Gefen 2004; Ratnasingam, Gefen, & Pavlou 2005). In the domain of business transactions, Mayer et al. (1995) defined trust as “the willingness of a buyer to be vulnerable to a seller’s non-desirable actions while expecting the seller to perform actions that are beneficial to the buyer without the buyer having to monitor these actions.” While trust deals mainly with the *willingness* of the trade partner to live up

to its obligations, creditworthiness encompasses the *ability* of fulfilling such obligations as well. Keeping promises in the business domain is just as much contingent on one's willingness as it is on one's ability. In practice, tight economic situations and other internal or external factors often provide grounds for businesses' inability to live up to their promises in spite of their goodwill.

Risk is another concept that is closely related, and sometimes mistaken with the notion of credit. In business, risk can be manifested in lower incomes or higher expenditures than expected (Galasyuk & Galasyuk 2007). Risk can be quantified as the product of uncertainty and monetary values. As such, risk is meaningful only in the context of a particular transaction and therefore, different levels of risk can exist when conducting two different transactions with the same partner. For instance, a hike in the price of raw materials will impose higher levels of risk on larger orders. However, creditworthiness, by definition, is an intrinsic quality of a supplier irrespective of any specific transaction.

Reputation is another concept related to, but different from creditworthiness. Reputation can be defined as the opinion about an entity resulting from social evaluation on a set of criteria. An online reputation is the perception that others have built about a company based on its behavior or its digital footprints. Although reputation metrics can be useful in assessing the quality of an online supplier, it has been shown that online reputation can be easily manipulated (Clemons 2007). In other words, unlike creditworthiness, reputation is not an intrinsic characteristic and therefore can be easily faked.

While notions of trust, risk, and reputation have been extensively studied in the domain of online trade, we are unaware of any study about assessing supplier creditworthiness. We argue that creditworthiness, in its broad sense, captures more relevant features and qualities related to effective execution of online businesses than any other related construct studied before.

2.4 An overview of the traditional process of credit assessment

Assessing the creditworthiness and the health of a business is the first step to take before entering into any type of interaction. In the past, outsiders would assess the creditworthiness of businesses subjectively. Their assessment was based on the information that they had accumulated about the other party over long periods of – oftentimes direct – interaction (Balcaen & Ooghe, 2006). With the advent of new statistical methods in 1960s (Altman 1968; Beaver 1966), assessing the creditworthiness and health of businesses became automated and more objective. Since then, numerous modified models for assessing health of businesses based on statistical methods have been introduced. Balcaen and Ooghe (2006) have studied the evolution of these methods over a 35-year horizon, spanning from late 1960s to early 2000s. According to them, Beaver's work and the works following that relied heavily on information from the annual financial reports of the firms, otherwise known as hard data. In building these statistical models, variable selection has proved to be one of the most controversial parts. Typically, the process of variable selection starts with considering a huge number of candidate variables based on their popularity in the literature or their perceived success in previous research. This was mainly because no theory indicating which variables are the best existed (Scott 1981). For the same reason, often it has been argued that that field lacks a scientific approach. According to some, the arbitrary selection of variable and methods, and lack of solid theories in this field, has made it a “messy” area for research (Pretorius 2008).

2.5 Problems with and limitations of using purely financial data for assessing creditworthiness

Although useful for assessing the creditworthiness of large firms, financial data and ratios are not that useful when it comes to assessing the creditworthiness of small firms. Most of the time, these firms either do not have the expertise to prepare dependable financial reports or their reports are not reliable from the standpoint of accuracy or lack of bias. As such, the only alternative way to assess small and

very small businesses is to use non-financial data. In practice, non-financial data have not been extensively used in assessing firms' creditworthiness since gathering and quantifying non-financial information has been a challenging task in the traditional environment (Lussier 1995). Nevertheless, the Internet has now radically changed the situation by allows for easy and cost-effective access to such information. In the sections that follow we present our method for using a number of non-financial measures obtainable from the Internet for predicting the creditworthiness of firms.

3 RESEARCH MODEL AND HYPOTHESIS

3.1 Developing a relational method for assessing small business creditworthiness

Traditionally, assessing the level of creditworthiness of firms was done using a few known mechanisms. Face-to-face meetings for exchange of information, obtaining references from other customers and partners and personal negotiation of contracts helped the transacting parties to develop some instincts on and assessment of the relative creditworthiness of the other party. Over the years additional sources of information have been employed. These information help analysts determine the so-called 4C of credit: character (attitude toward business partners), capital (e.g. loan to equity ratio), capacity (business's earnings volatility), and conditions (effects of macroeconomic factors on business) (Anderson 2007).

Allen et al.(2004) classify small business credit assessment to relational and transactional methods. Relational methods use soft information. In these methods, local knowledge and close observation of firms are of key importance. Transactional methods, however, use hard information and apply qualitative statistical techniques, mostly on businesses' financial data, to assess firms' creditworthiness. Overtime, the trend for financial services and credit assessor has been to move away from relational to transactional methods. In this article we show that the Internet now has the potential to change this paradigm by providing additional information to be used in the credit assessment of the large number of small businesses active on B2B exchanges. In Figure 1, we identify two main types of creditworthiness-related information: traditional creditworthiness-related data and B2B platform-specific information; information about firms' online behavior that are observed and recorded in an unobtrusive manner as members conduct business on any typical B2B exchange.

We further classify information from the online trade environment into three categories: (1) membership-related information, (2) activity-related information, (3) and buyer-base related information. In the following section we discuss some elements belonging to each category and develop research hypothesis accordingly.

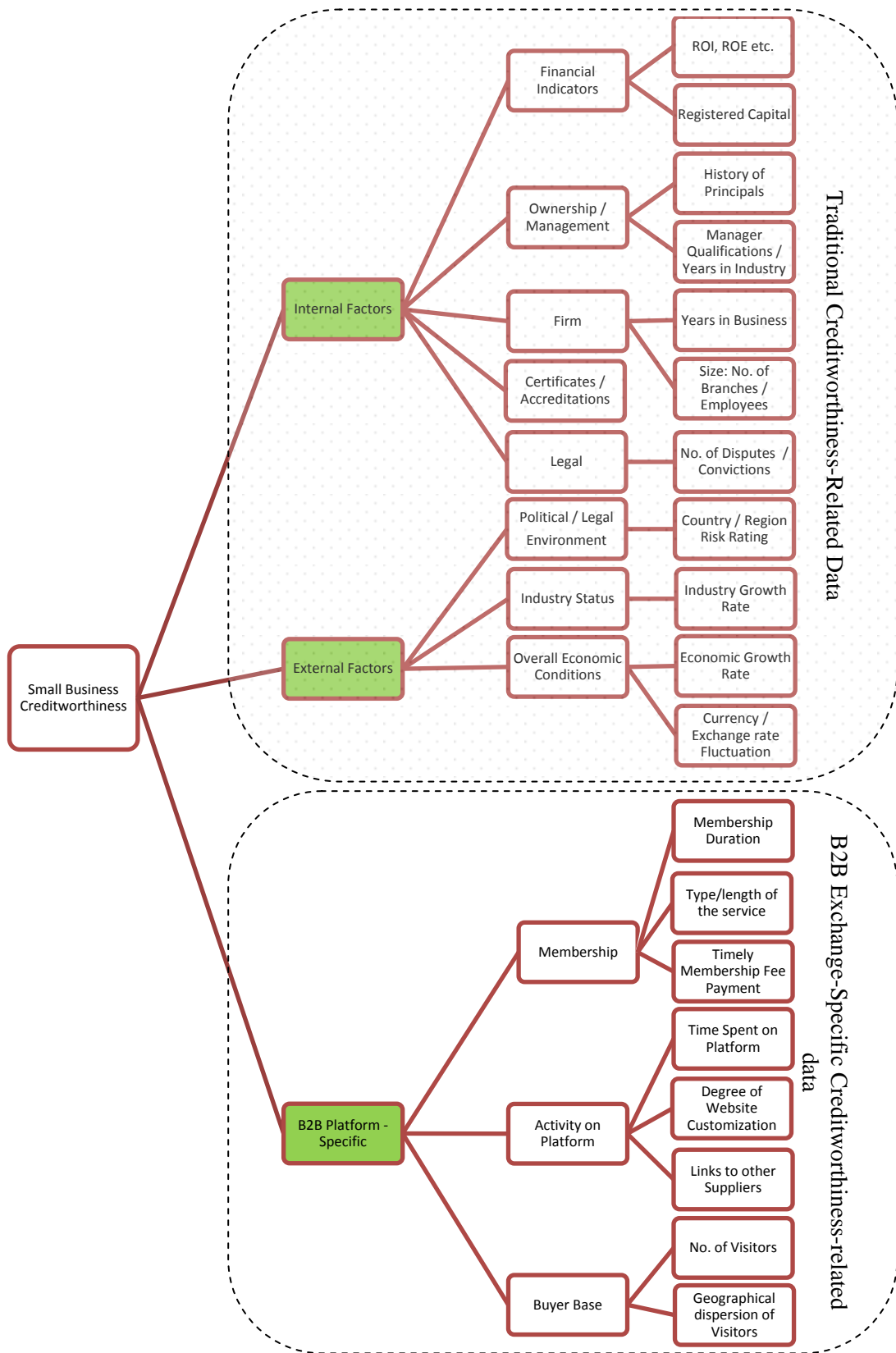


Figure 1. Classification of creditworthiness-related data.

3.2 B2B Platform Membership

The total length of exchange membership is among the most basic information available to exchanges. In the traditional trade environment, it has been shown that young companies tend to be less stable than their older counterparts (Anderson 2007). Younger companies tend to be less experienced in dealing with adverse circumstances (Hudson 1987). They also tend to have fewer strong ties with their business partners and therefore, have weaker social capital to rely on at times of difficulty (Griffith, Harvey, & Lusch 2006). We propose that the same is true about members of a B2B exchange. In fact, membership duration can be considered the equivalent of company age in the traditional world of trade.

Every time members renew their membership, they have the option of renewing it for a short or for a long period of time. Long-term investment of a firm in its online presence is indicative of the intention of its owners to stay in business. Firms that plan on a long-term online presence are more likely to increase their odds of survival and success by carrying out their business obligations in a duly diligent manner. Even though the cost of buying longer membership services is not very high, the length of the service that members choose to purchase can be seen as an investment decision which can be short, medium, or a long-term. Accordingly we hypothesize that:

H1-A: Longer B2B membership history is positively associated with higher levels of creditworthiness.

H1-B: Renewing B2B exchange membership for longer periods of time is positively associated with higher levels of creditworthiness.

3.3 Activity on B2B platforms

The level of a firm's activity on the Web can be easily observed by a B2B exchange. This information can provide new ways for assessing the creditworthiness of businesses. A firm's performance has been shown to have a direct relationship with the degree of aggressiveness that it exhibits in the competitive environment (Covin & Covin 1990). Firms that are aggressive in their approach spend more time online managing their page and actively strengthening their relationship with buyers.

Previous research shows that the strength and intensity of business networking is key to business success. Network intensity is defined as "amount of valuable information obtained from the network of connected relationships that supports a focal business relationship" (Lusch & Brown 1996). On a B2B exchange, providing links to other trusted suppliers is a good proxy for the breath of firms' businesses networks.

Previous research has also demonstrated that relational mechanism between members of a supply chain can mitigate opportunism (Barney & Hansen, 1994; Heide & Miner, 1992; Lusch & Brown 1996). The stronger the communication between sellers and buyers, the lower the amount of information asymmetry via activities such as joint planning and joint problem-solving. Posting blogs is a prevalent method that companies use to disseminate information about their activities to their target audience. Customizing company website is another for enriching supplier-buyer relationship. Accordingly we hypothesize that:

H2-A: Longer time spent on a B2B portal is positively associated with higher levels of creditworthiness.

H2-B: Compared to firms that have generic webpages, firms with customized websites tend to have higher levels of creditworthiness.

H2-C: Having pages with links to other suppliers is positively related to higher levels of creditworthiness.

H2-D: Higher number of blog posts is positively associated with higher levels of firm creditworthiness.

3.4 Buyer-related factors

Compared to companies with customers from a limited geographical region, companies that have their customers from different geographical areas experience more stable demand and therefore, should be less affected by economic or political turmoil in certain geographical regions of the world. Also companies with a more diversified customer base have more opportunities for learning. It has been argued that as the involvement of a firm in international markets increase, it can better exploit intangible and tangible resources from its environment and thus perform better (Hymer 1976). Besides, compared to companies that have fewer buyers, companies with a larger pool of potential buyers are more likely to craft financially rewarding deals and are therefore are more likely to be able to carry out their obligations. Accordingly we hypothesise that:

H3-A: higher numbers of page visits is positively associated with higher levels of firm creditworthiness.

H3-B: the wider the geographical diversification of customers of a company, the more creditable the company.

In the following section details of the data source and results from our data analysis are provided.

4 DATA AND STATISTICAL ANALYSIS

4.1 Data

To assess the value of non-financial information mentioned in the previous section in determining B2B members' level of creditworthiness, we used a dataset containing supplier data from a major business to business horizontal public exchange. Members of this exchange are from different parts of the world and from different industries. Both finished goods and parts are traded on this exchange. The exchange enjoys having a reputation for providing high quality service to member buyers and sellers. To combat fraud and misconduct by seller members, it has implemented mechanism such as verification of sellers' trade certificate or inspection of physical plant etc. However, recently there have been highly publicized instances in which sellers have mistreated their buyers and these cases have adversely affected the image of the exchange. In addition to usual services such as messaging and product display, this exchange furnishes its members with advanced services such as dispute resolution and arbitration. As such, this B2B exchange provides an excellent environment for conducting our study both because of the large and wide scale operations and because of the mechanism it has for identifying untrustworthy members.

Our original dataset consisted of records of 1223 seller members of the B2B exchange. These members belong to different industries and vary in size. They are aged from less than a year to thirty years (mean 5.7, $\sigma = 4.6$). After pre-processing the dataset and eliminating rows with missing values, we were left with 858 usable records.

We used the number of instances in which complaints against the member has been substantiated through the exchange's dispute resolution system as a proxy for sellers' level of creditworthiness as it is closely related to the definition of creditworthiness provided earlier in the article. Instances of misconduct include relatively severe to severe instances of misconduct such as non-delivery of products, delivery of sub-standard products or other serious violations of trade agreement or norms by sellers. We used this information as the dependent variable in our study. Table 1 demonstrates the distribution of instances of misconduct among seller members.

Number of substantiated misconducts	Percent
None	63%
One or more	37%

Table 1. Percentage of misconduct among members.

We coded the 63% companies that have not committed any misconduct as good companies (G) and the remaining 37% of the companies that had committed at least one misconduct during the same time period as bad (B). Table 2 shows how variables of our interest differ across the two groups.

Variable name	Description	Mean	Std Dev
Total No. of transactions	Total number of transactions performed within the past month.	G: 7.20, B: 7.73	G: 29, B: 51
Membership age (years)	Time since the company has joined the B2B exchange.	G: 2.11, B: 0.82	G: 1.68, B: 1.49
Membership renewal period	Length of the last membership service purchased	G: 1.25, B: 1.21	G: 4.20, B: 6.92
Time spent online	Minutes spent managing company profile on the portal	G: 18152, B: 10214	G: 9445, B: 9658
Website customization	If the member company has used the default webpage design (0) or if it has customized the pages (1).	G: 16%, B: 9%	G: 0.37, B: .29
Frequency of posting blogs	The number of weblogs posted by the company within the past 30 days.	G: 0.73, B: 0.14	G: 8.45, B: .92
Page-view count	Total number of page views during the last month.	G: 1434.32, B: 2167.98	G: 4006 B: 10965
Dispersion of visitors	An index of how geographically dispersed the visitors of the seller's website are.	G: 0.45, B: 0.51	G: 0.15, B: 0.21
Links to other suppliers	A binary value showing if the member has provided links to other suppliers (1 if yes, 0 if not).	G: 61%, B: 30%	G: 0.48, B: 0.46

Table 2. Descriptive statistics of variables (G= Good, B= Bad).

Values for most of the above control or independent variables have been recorded by the B2B exchange. An index for geographical dispersion of visitors was developed by calculating the ratio of the number of distinct geographical regions from which pages had been accessed to the total number of page views. Smaller indexes are indicative of higher geographical dispersion of visitors.

4.2 Analysis

We used logistic regression with binary outcome for our analysis. This is one of the most widely used and effective classification methods in credit assessment. To control for the moderating role of the industry to which the member company belonged, a categorical variable for industry was included in the model. To control for size, the total number of transactions performed by the member in the past period was included in the model. The logistic regression model has an overall likelihood ratio chi-square statistic of 324.59 with a p-value less than 0.001 which indicates that overall, our model fits the data significantly better than an empty model. Analysis of effect for every individual variable included in the model has been presented in Table 3. In logistic regression, coefficients are the change in the log odds of the outcome for every unit increase in the predictor variable.

Variable	H	Estimate	Standard Error	Wald Chi-Square	Supported / Not supported
Membership age	H1-A	-0.508	0.1669	9.283**	Supported
Membership Renewal period	H1-B	-6.592	1.7346	14.443***	Supported
Time spent online	H2-A	-0.735	0.1039	50.010***	Supported
Website Customization	H2-B	-0.646	0.2264	8.154**	Not supported
Link to other suppliers	H2-C	0.567	0.1029	30.380***	Supported
Blog posting frequency	H2-D	-0.525	0.5933	0.782	Not supported
Page view count	H3-A	0.496	0.2372	4.385*	Supported
Geographical dispersion of buyers	H3-B	0.978	0.4805	4.148*	Supported

*p < .05. **p < .01. ***p < .001.

Table 3. Results from logistic regression analysis.

Results of our analysis for variables in the “membership” category can be summarized as follows. The significant p-values for the variables “membership age” and “membership period” indicate that the inclusion of these variables significantly increases the predictive power of our model. The value of the coefficient associated with “membership age” indicates that every one year increase in the value of this variable decreases the log odds of misconduct by around 0.51 units. Similarly, a one year increase in the length of membership renewal period translates to 6.6 units decrease in the log odds of misconduct.

Concerning the level of activity on the B2B platform, results from our analysis indicate that longer time spent on the platform is associated with lower probabilities of misconduct and higher levels of creditworthiness. That is, members who spend more time on the portal are more likely to have higher levels of creditworthiness. The number of blogs posted, however, is not statistically significant in predicting creditworthiness at .05 level. We believe content analysis of the blog text may be needed to further interpret this result. The interpretation of the statistically significant coefficient of the binary predictors “link to other suppliers” and “website customization” are somehow different. The specified coefficient means that the log odds of misconduct by companies that recommend other suppliers is .57 units lower than their counterparts who do not have links to recommended companies. Concerning the predictive of power of website customization, we found that, interestingly, compared to companies that have customized web pages, companies that do not have customized web pages are by .65 log odds less likely to engage in misconduct. This is in fact in the opposite direction of what we had hypothesized.

Finally concerning variables in the “Buyer related factors” category, geographical dispersion of buyers is statistically significant at alpha of .05 with every unit of increase in the concentration index of buyers, the log odds of misconduct increases by 0.98 units. Results also show that higher frequency of page views is positively associated with the level of firm’s creditworthiness.

5 DISCUSSION

Over the last two decades the Internet has profoundly improved the efficiency of trade. However, one of the major areas of trade that can still substantially benefit from the Internet is B2B trade. The value and volume of B2B trade is often underestimated. The fact is that for every final sale to customers, many B2B transactions involving materials, parts and subcomponents are involved. Nevertheless, the use of the Internet in B2B trade is still often limited to basic communication and messaging. This is largely attributable to the high risk involved in B2B transactions and the difficulty involved in assessing the creditworthiness of near-anonymous sellers on the Web. As such, developing a method for reliably assessing the creditworthiness of businesses is of significant importance.

In this study we demonstrated that the internet can be viewed as a highly valuable source of information for assessing the creditworthiness of businesses in the online trade environment. We identified a set of predictors for determining the creditworthiness of businesses active on a typical B2B exchange. Our results show that basic information about the history of the firm in a B2B exchange, the level of its activity, the intensity of its interaction with partners and geographical dispersion of customers are important indicators of a firm's degree of creditworthiness.

6 LIMITATIONS AND FUTURE RESEARCH

Similar to any other empirical research, our study was not without limitations. Findings from our analysis show that a number of variables related to firm membership, level of activity on B2B exchange, intensity of interaction with buyers and the level of geographical dispersion of firm's customer base can predict firms' level of creditworthiness. However, the list of variables should by no means be considered as comprehensive. The predictive model developed here is one of the many appropriate models for this purpose. Further research needs to be conducted to find other predictors that can significantly predict creditworthiness or to find more parsimonious models. A limitation of our study is that even though the sample data we have is from a widely diversified pool of companies from different industries and geographical locations, the sample is still from a single B2B portal. Future research can consider using data from a wider collection of portals to improve generalizability of findings. Future research can also compare the predictive power of non-financial data discussed here with that of other types of data commonly used for credit assessment. It is also worth noting that in this study we distinguish between detecting low level of creditworthiness and detecting fraud. Detecting fraudulent activity and intentional deception takes a totally different approach and is therefore out of the scope of this study. From the practical perspective, detecting fraudulent activity is often most effectively achieved by employing relatively complicated models such as neural networks. Nevertheless, even though such methods often provide higher predictive power, the interpretation of their results is difficult for humans. Given the richness of this research domain, addressing these and many other issues remain promising areas for future research.

ACKNOWLEDGEMENT

This research has been supported by the Fundamental Research Funds for the Central Universities, No.JBK120505, and China Social Science Foundation, Grant No. 11AZD077.

References:

- Achrol, R. S., & Kotler, P. (1999). Marketing in the network economy. *The Journal of Marketing*, 146-163.
- Ajzen, I., & Fishbein, M. (1980). Understanding attitudes and predicting social behaviour.
- Akerlof, G. A. (1970). The market for "lemons": Quality uncertainty and the market mechanism. *The quarterly journal of economics*, 488-500.
- Allen, L., DeLong, G., & Saunders, A. (2004). Issues in the credit risk modeling of retail markets. *Journal of Banking & Finance*, 727--752.
- Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The journal of finance*, 589--609.
- Anderson, R. (2007). *The credit scoring toolkit: theory and practice for retail credit risk management and decision automation*: Oxford University Press, USA.
- Anderson, R. (2007). *The Credit Scoring Toolkit: Theory and Practice for Retail Credit Risk Management and Decision Automation: Theory and Practice for Retail Credit Risk Management and Decision Automation*: OUP Oxford.
- Balcaen, S., & Ooghe, H. (2006). 35 years of studies on business failure: an overview of the classic statistical methodologies and their related problems. *The British Accounting Review*, 63-93.
- Balcaen, S., & Ooghe, H. (2006). 35 years of studies on business failure: an overview of the classic statistical methodologies and their related problems. *British Accounting Review*, 38(1), 63-93. doi: 10.1016/j.bar.2005.09.001
- Barney, J. B., & Hansen, M. H. (1994). TRUSTWORTHINESS AS A SOURCE OF COMPETITIVE ADVANTAGE. *Strategic Management Journal*, 15, 175-190.
- Beaver, W. H. (1966). Financial ratios as predictors of failure. *Journal of accounting research*, 71--111.
- Cancer, V., & Knez-Riedl, J. (2005). Why and How to Evaluate the Creditworthiness of SMEs' Business Partners. *International Small Business Journal*, 143--162.
- Clemons, E. K. (2007). An empirical investigation of third-party seller rating systems in e-commerce: The case of buySAFE. *Journal of Management Information Systems*, 43-71.
- Covin, J. G., & Covin, T. J. (1990). Competitive aggressiveness, environmental context, and small firm performance.
- Galasyuk, V. V., & Galasyuk, V. V. (2007). Consideration of Economic Risks in a Valuation Practice: Journey from the Kingdom of Tradition to the Kingdom of Common Sense. Available at SSRN: <http://ssrn.com/abstract=1012812>.
- Griffith, D. A., Harvey, M. G., & Lusch, R. F. (2006). Social exchange in supply chain relationships: the resulting benefits of procedural and distributive justice. *Journal of Operations Management*, 24(2), 85-98.
- Heide, J. B., & Miner, A. S. (1992). THE SHADOW OF THE FUTURE: EFFECTS OF ANTICIPATED INTERACTION AND FREQUENCY OF CONTACT ON BUY-SELLER COOPERATION. *Academy of Management Journal*, 35(2), 265-291. doi: 10.2307/256374
- Hudson, J. (1987). The age, regional, and industrial structure of company liquidations. *Journal of Business Finance & Accounting*, 14(2), 199-213.
- Hymer, S. (1976). *The international operations of national firms: A study of direct foreign investment* (Vol. 14): MIT press Cambridge, MA.
- Lusch, R. F., & Brown, J. R. (1996). Interdependency, Contracting, and Relational Behavior in Marketing Channels. *Journal of Marketing*, 60(4), 19-38.

- Lussier, R. N. (1995). A nonfinancial business success versus failure prediction model for young firms. *Journal of Small Business Management*, 33(1), 8-20.
- Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *Academy of management review*, 709-734.
- McKinley, W., Zhao, J., & Rust, K. G. (2000). A sociocognitive interpretation of organizational downsizing. *Academy of Management Review*, 227-243.
- O'sullivan, A., & Sheffrin, S. M. (2003). *Macroeconomics: principles and tools*: Prentice Hall Upper Saddle River, NJ.
- Oxley, J. E., & Yeung, B. (2001). E-commerce readiness: institutional environment and international competitiveness. *Journal of International Business Studies*, 32(4), 705-723.
- Pavlou, P. A. (2003). Consumer Acceptance of Electronic Commerce: Integrating Trust and Risk with the Technology Acceptance Model. *International Journal of Electronic Commerce*, 7(3), 101-134.
- Pavlou, P. A., & Gefen, D. (2004). Building Effective Online Marketplaces with Institution-Based Trust. *Information Systems Research*, 15(1), 37-59. doi: 10.1287/isre.1040.0015
- Piao, C., Zhang, C., Han, X., & An, J. (2008). *Research on Credit Evaluation Model and Algorithm for B2B e-Commerce*. Paper presented at the e-Business Engineering, 2008. ICEBE'08. IEEE International Conference on.
- Pretorius, M. (2008). Critical variables of business failure: a review and classification framework. *SAJEMS*(11), 408-430.
- Ratnasingam, P., Gefen, D., & Pavlou, P. A. (2005). The Role of Facilitating Conditions and Institutional Trust in Electronic Marketplaces. *Journal of Electronic Commerce in Organizations*, 3(3), 69-82.
- Scott, J. (1981). The probability of bankruptcy: a comparison of empirical predictions and theoretical models. *Journal of Banking and Finance*, 317-334.
- Xu, B., & Yadav, S. (2003). *EFFECTS OF ONLINE REPUTATION SERVICE IN ELECTRONIC MARKETS: A Trust-BASED EMPIRICAL STUDY*. Paper presented at the Ninth Americas Conference on Information Systems.
- Zhu, K. (2002). Information transparency in electronic marketplaces: Why data transparency may hinder the adoption of B2B exchanges. *Electronic Markets*, 12(2), 92-99.