Volume 11, Number 1

Printed ISSN: 1939-2230
PDF ISSN: 1939-2249

ACADEMY OF BANKING STUDIES JOURNAL

Kurt Jesswein
Editor
Sam Houston State University

The *Academy of Banking Studies Journal* is owned and published by the DreamCatchers Group, LLC. Editorial content is under the control of the Allied Academies, Inc., a non-profit association of scholars, whose purpose is to support and encourage research and the sharing and exchange of ideas and insights throughout the world.

Authors execute a publication permission agreement and assume all liabilities. Neither the DreamCatchers Group nor Allied Academies is responsible for the content of the individual manuscripts. Any omissions or errors are the sole responsibility of the authors. The Editorial Board is responsible for the selection of manuscripts for publication from among those submitted for consideration. The Publishers accept final manuscripts in digital form and make adjustments solely for the purposes of pagination and organization.

The *Academy of Banking Studies Journal* is owned and published by the DreamCatchers Group, LLC, PO Box 1708, Arden, NC 28704, USA. Those interested in communicating with the *Journal,* should contact the Executive Director of the Allied Academies at info@.alliedacademies.org.

Copyright 2012 by the DreamCatchers Group, LLC, Arden NC, USA

EDITORIAL REVIEW BOARD

Bora Aktan
Yasar University
Turkey

Tor Brodtkorb
American University of Sharjah
United Arab Emirates

Susan Coleman
University of Hartford
Hartford, Connecticut

Richard T. Henage
Utah Valley State College
Orem, Utah

Joseph Horton
University of Central Arkansas
Conway, Arkansas

Terrance Jalbert
University of Hawaii at Hilo
Hilo, Hawaii

Gianluca Mattarocci
University of Rome "Tor Vergata"
Italy

James Nelson
New Mexico State University
Las Cruces, New Mexico

Paul Newsom
Valparaiso University
Valparaiso, Indiana

Christopher Ngassam
Florida A&M University
Tallahassee, Florida

Gbadebo Olusegun Odularu
Forum for Agricultural Research in Africa
Ghana

Shekar Shetty
Gulf University for Science & Technology
Kuwait

Robert J. Tokle
Idaho State University
Pocatello, Idaho

Marsha Weber
Minnesota State University Moorhead
Moorhead, Minnesota

William H. Wells
Georgia Southern University
Statesboro, Georgia

TABLE OF CONTENTS

LETTER FROM THE EDITOR

The *Academy of Banking Studies Journal* is owned and published by the DreamCatchers Group, LLC. The Editorial Board and the Editors are appointed by the Allied Academies, Inc., a non profit association of scholars whose purpose is to encourage and support the advancement and exchange of knowledge, understanding and teaching throughout the world. The *ABSJ* is a principal vehicle for achieving the objectives of the organization.

The mission of the *ABSJ* is to publish theoretical and empirical manuscripts which further the disciplines of banking and institutional finance. All articles contained in this volume have been double blind refereed, and the acceptance rate was 25%, in keeping with the editorial policy of the *Journal*.

It is our mission to foster a supportive, mentoring effort on the part of the referees which will result in encouraging and supporting writers. We welcome different viewpoints because in those differences we improve knowledge and understanding.

Information about the Allied Academies, the *ABSJ*, and the other journals published by affiliates of the Academy, as well as calls for conferences, are published on our web site, www.alliedacademies.org, which is updated regularly. Please visit our site and know that we welcome hearing from you at any time.

Kurt Jesswein
Sam Houston State University

AN EMPIRICAL STUDY ON MULTINATIONAL BANKS DECISION TO GO ABROAD

Hamadou Boubacar, University of Moncton

ABSTRACT

This paper aims to show that, in addition to macro-economic factors, bank specific characteristics can help to understand the decisions of MNBs when establishing themselves abroad through a type of organizational form. We conducted this study by using a sample of 63 MNBs established in 25 foreign countries. Our results show that it is mainly the distance, as a major indicator of control difficulties, which supports the branch choice for its centralized decisions at the expense of the subsidiary and the affiliated bank choices. They also show that the international experience of MNBs affects positively the subsidiary and the branch choice and negatively affects the representative office choice. For example, the decision to go abroad through branch and subsidiary as organizational forms helps MNBs to transfer the knowledge acquired in their home countries to the overseas markets. Indeed, MNBs prefer these two organizational forms because they constitute a means of exploiting the rich in-house experience in their home countries while acquiring new knowledge from the overseas markets, as the establishment of a subsidiary bank requires a transfer of knowledge and an important investment in human resources.

INTRODUCTION

Literature related to Multionational banking [see for example Miller and Parkhe (1998), Blandon (1998 and 2000), Mutinelli and Piscitello (2001), Focarelli and Pozzolo (2005), Tschoegl (2004), and Cerutti and al. (2007)], mostly defends that economic and financial factors are decisive in the choice of the organizational form of representation that multinational banks (MNBs) choose when expanding abroad such as subsidiary, branch, affiliate-bank and representative office. The purpose of this paper is to consider parent-bank own characterics in its decision to choice an organizational form of establishment in foreign countries. Thus, our approach is different from macro-economic one, because it considers agency theory and resource-based theory to study the choice of organizational forms of representation abroad. As Fama and Jensen (1983) assert, the survival of an organization like multinational bank, depends on its capacity to solve agency problems that occur by doing its activities. This capacity depends on the type of organisational form chosed by the MNB to exert in a particular area of activity abroad. The agency theory make easy to understand more about the strategy of bank's internationalization. For example, in a multinational bank, agency problems which may be caused by the distance between home country and host country, would depend on the nature of the organizational form of representation abroad. The resource-based theory enables to take into account parent-bank specific characteristics such as capabilities in human resources and international experience.

Different from macro-economic approach, this study presents an important contribution because it allaows to understand better how do MNBs choise among many organizational forms when going abroad. It focuses on the following two research questions : (a) Why does a MNB hold several organizational forms of reprsentation in a same host country? (b) Why do MNBs from a same home country choose to be established via different organizational forms of representation in another foreign country?

The remainder of the paper is organized as follows. In the section 2, we review the literature relating to banking internationalization. Then, the section 3 describes the data and explains the methodology used in the empirical study. The section 4 presents and discusses the empirical results that show, when MNBs expand internationally, that the parent-bank specific characteristics play a leading role. Section 5 concludes.

REVIEW OF LITERATURE

The impact of banking regulations on MNBs and their decision to go abroad is therefore closely linked since it determines the conditions they must comply with in order to conduct their banking activities. According to Dalen and Olsen (2003), Calzolari and Loranth (2005), and Harr and Ronde (2005), from a legal point of view, there exists a significant difference between the branch and the subsidiary as organizational forms when establishing abroad. Indeed, when creating a branch, the parent-bank must conform to the home country's regulations while in the case of a subsidiary form (new creation or an acquisition of a local bank), it is the regulations in the host country which apply. In our research, we consider that the legal framework in a given country is characterized principally by corporate tax imposition and by administrative adherence to regulatory procedures and bodies (barriers to entry) whose compliance constitutes a precondition to any establishment for banks in foreign countries. Cerutti et al. (2007) assert that restrictions imposed on MNBs by the home country and the host country affect negatively and significantly the choice of the organizational form of representation. Thus, the barriers to entry have a negative effect on the establishment of the branch forms. What this implies is that the restrictions on the branches do not encourage the banks to set up this type of organisational form.

According to Bain et al. (2003), some countries like the United Kingdom and Switzerland adopted banking laws on the principle of reciprocity. Consequently, a foreign bank can be established in these countries only when its home country accommodates English and Swiss banks under similar conditions. Each country places conditions on the required capital for the setting up of a branch or a subsidiary as organizational forms of representation. One can also note a difference in taxation according to whether it is a branch or a subsidiary of a foreign banking institution. From a viewpoint of corporate taxation, the branch is more favourable than the subsidiary because tax on a bank branch is paid at a lower rate in the host country, and the benefits are exempted in the parent-bank's home country in which they are returned. Indeed, as Cerutti et al. (2007) assert, even in countries where the corporate tax is relatively high, the branch form is less taxed than the subsidiary form because it allows an easier transfer of tangible benefits towards the home country. On the other hand, for the subsidiary form, often the revenue is taxed, in part, twice. However, this last form presents some advantages, especially in taxation. For example, in France, foreign bank subsidiaries have profited for their international lending operations based in the host country, despite the competitive network and double taxation required by the country. By taking into account these advantages, some foreign banks, initially established in France through the branch form, have transformed their representations into subsidiary banks.

A well developed banking sector should provide many opportunities for the operating financial institutions. In such an environment, banks must, in order to compete, be able to offer a variety of financial products and services. According to Di Antonio et al. (2002), Italian MNBs prefer the branch and the subsidiary as organisational forms when the host country's banking sector is of considerable size and relative strength. Other studies measuring the economic development level as per the GDP per capita (see Cerutti et al., 2007) show a negative impact on the choice of the branch as organizational form of representation abroad. Such results are partly justified by the fact that foreign bank subsidiaries are often created following restructuring of local banks in difficulty in the developing countries. Another reason for the choice of the subsidiary in developing countries may be the fact that foreign banks consider these countries as opportunities "where they believe there is ample room for expansion and these are typically poorer economies, where the local banks are less developed and capitalized, and hence easier to compete against" Cerutti et al. (2007, p. 1686).

In politically unstable countries, foreign banks prefer subsidiary or affiliate-bank as organizational forms of representation in order to limit the in-country risk. If this is the case, one should note that the establishment of French banks in African countries where the political risk is relatively high are all subsidiary and/or affiliate-bank forms. According to Di Antonio et al. (2002), Italian MNBs are established in countries that have great financial centers, through branches as a first choice, and then via the subsidiary form as a second choice. The results of Cerutti et al. (2007) go in the same direction and attest that the banks prefer the branch to the subsidiary as organizational forms in countries which present less of an economical risk. In the same way, these authors stress that in the presence of a proven political risk (governmental interference in the businesses of foreign banks, civil wars, etc), foreign banks prefer the branch form in such environments. Indeed, in the event of civil war or of political interference, foreign bank branches are less state dependant than subsidiaries which have host country capital including important investments in fixed local assets.

Once established abroad, MNBs are inclined to generally concentrate on wholesale and retail banking activities. According to multinational banking theory (see Grubel, 1977; Gray and Gray, 1981; Aliber, 1984; Williams, 1997), MNBs go abroad in order to exploit specific advantages they themselves acquired on national markets. Ursacki and Vertinsky (1992) contend that banks also go abroad to benefit from more of the advantages locally acquired in wholesale and retail activity areas. Ursacki and Vertinsky (1992) use three ratios to measure the parent-bank business orientation. The first ratio (Credit Amount to Total Assets) indicates the importance that the parent bank grants to extend credit compared to other services such as investment services. The second ratio (Deposits to Total Assets) highlights the importance of deposits compared to other sources of funds (in particular inter-banking funds) and thus represents the existence or not of a large available domestic network. The third ratio (Credit Amount to Deposits Amount) can be regarded as an indicator of the level of the parent-bank financial intermediation. Accordingly, a high ratio means that the bank grants more credit than it receives through deposits, and should then have recourse to other funds such as inter-banking to replenish its funds and reduce or eliminate its deficit.

The parent-bank size reflects both its financial and human resources dimensions. Size is an important factor because MNBs need a minimum size in order to be able to develop an activity abroad and to compete successfully with local banks (Blandon, 1998). Indeed, considerable resources are needed for absorbing the high costs of marketing and taking advantage of the economies of scale, when they exist in foreign markets. Ball and Tschoegl (1982) find that bank size has been a main determinant of MNB expansion in California and Japan. Ursacki and Vertinsky (1992) obtain that whereas the size of the bank positively affects the setting up of foreign branch, it does not affect the establishment of representative offices abroad. The establishment of banks abroad, via branches and subsidiaries requires the deployment of great amounts of resources. The representative office and the affiliate-bank constitute means of internationalization less expensive than the subsidiary and the branch. However, concerning the activities to be exerted in the host country, the representative office and the affiliate-bank offer very reduced possibilities, contrary to subsidiary and branch. These last two organizational forms make possible for the parent bank to offer various products and financial services. In many researches, size is measured by the total asset. But, in our study, the size will be measured by the total staff number of the parent-bank in order to take into account, the overall bank capacity in terms of human resources for its internationalization strategy.

The international experience, that is the degree of familiarity with foreign countries allows the parent-bank to know more about the international environment. This is a factor expected to encourage the bank's expansion abroad. Foreign direct investments include many risks such as political risk, economic risk, financial risk and so one. The lack of international experience may cause the parent-bank to take inappropriate decisions or lead to errors in managing relations with customers, competitors, local authorities (Mutinelli and Piscitello, 2001). Blandon (1998) asserts that banks without this experience will hardly assume the risk associated with an important foreign direct investment like the acquisition of foreign banks. Such parent-banks are expected to start their foreign ventures via organizational forms which involve smaller amounts of investment, such as representative offices. According to Agarwal and Ramaswani (1992), firms with important international experience will enjoy a larger capability for adapting their activities in different countries at a lower cost. This simply means that, large and more experienced banks tend to establish themselves through branches and subsidiaries implying a high level of commitment with the host country. Similar results obtained by Mutinelli and Piscitello (2001) indicate that the establishment of Italian banks abroad through branches and representative offices depended on the experience obtained from the overseas markets. Banks with little international experience must, at the beginning of their expansion abroad, rely on the representative office and the affiliated-bank which limits the risk related to direct foreign investment.

Distance between home country and host country is considered to be physical distance or cultural distance. Physical distance is generally regarded as a factor which fosters the increase of monitoring costs of the parent bank's investments in foreign countries. In this scenario, distance constitutes a barrier of entry to international banking. For example, Blandon (1998) affirms that the distance between Madrid and other countries constitutes a barrier to the internationalization of the Spanish banks. When distance is important, the parent bank cannot manage its foreign entities without high control costs. Ball and Tschoegl (1982) report that the physical distance negatively affects the selection of foreign subsidiaries and branches as organizational options. International banking operations incur additional costs for remaining informed along with coordination costs insofar as the distance makes it considerably more difficult for MNBs to be kept informed about their operations abroad. Distance can be considered in terms of cultural differences between the country of origin and the host country. Cultural variations can then affect the type of activities that banks practice abroad. Regarded as an entry barrier, cultural distance is especially visible when foreign banks wish to practice in the retail banking in the host country.

HYPOTHESES

H1 We expect the host-country bank entry requirements to have a negative impact on the parent-bank decision to establish itself abroad by branch and/or representative office, and a positive effect on its decision to operate abroad via a subsidiary and/or affiliate- bank.

H2 We expect the corporate tax rate to have a positive effect on the parent-bank decision to establish itself abroad by branch and/or representative office, and a negative impact on its decision to operate abroad via subsidiary and/or affiliate-bank.

H3 We expect the host country banking sector development to have a positive effect on the parent-bank decision to establish itself abroad by branch and/or subsidiary, and a negative impact on its decision to operate abroad via representative office and/or affiliate-bank.

H4 We expect the host country-risk to have a positive effect on the parent-bank decision to establish itself abroad by affiliate-bank and/or subsidiary, and a negative impact on its decision to operate abroad via representative office and/or branch.

H5 We expect the parent-bank retail business orientation to have a positive effect on the parent-bank decision to establish itself abroad by affiliate-bank and/or subsidiary, and a negative impact on its decision to operate abroad via representative office and/or branch.

H6 We expect the parent-bank size to have a positive effect on the parent-bank decision to establish itsef abroad by branch and/or subsidiary, and a negative impact on its decision to operate abroad via representative office and/or affiliate-bank.

H7 We expect the international experience to have a positive effect on the parent-bank decision to establish itsef abroad by branch and/or subsidiary, and a negative impact on its decision to operate abroad via representative office and/or affiliate-bank.

H8a We expect the physical distance between home country and host country to have a positive effect on the parent-bank decision to establish itsef abroad by affiliate-bank and/or subsidiary, and a negative impact on its decision to operate abroad via representative office and/or branch.

H8b We expect the difference between home country and host country official languages to have a positive effect on the parent-bank decision to establish itsef abroad by affiliate-bank and/or subsidiary, and a negative impact on its decision to operate abroad via representative office and/or branch.

DATA AND METHODOLOGY

In order to conduct this study on the decision of MNBs to expand their activities abroad via representative office, affiliated-bank, subsidiary and branch as organizational forms, we collected data from both host countries and parent-banks. The economic, financial and lawful data relate to 25 host countries (five in each of these areas: Africa, South and Central America, Eastern Europe, South-East Asia and the Middle-East). (See table 1). By doing this, we avoided studying international banking within countries that are economically similar to their home countries. Initially, our sample consists of about 100 MNBs. From these, we retain only 82 which have operations in at least five countries. The constitution of the final sample led us to dismiss 19 MNBs for various reasons. For example, we excluded Almanij bank (Belgium) because it was absorbed in 2005 by another Belgium bank, KBC bank. Similarly, we eliminated Fleet National Bank (USA) acquired by Bank of America. Other MNBs such as the Belgolaise (Belgium), Le Crédit Lyonnais (France), Lehmann Brothers (USA) and Sumitomo Trust Bank (Japan) were removed from our sample because of the unavailability of certain information required for the study. Finally, the sample is formed of 63 multinational banks (See table 2).

Table 1: Distribution of the organizational forms of representation by geographical areas

Forms	RO	AB	SU	BR	Total
Africa	*38*	*10*	*25*	*30*	*103*
South and central America	*90*	*7*	*63*	*67*	*227*
Eastern Europe	*28*	*9*	*43*	*24*	*104*
Middle-East	*34*	*4*	*4*	*43*	*85*
South-East Asia	*64*	*14*	*44*	*143*	*265*
Total	254	44	179	307	784

RO = Representative office, AB = Affiliate-bank, SU = Subsidiary and BR = Branch

Table 2 : Distribution of the sample of MNBs by home country

Home country	Number of MNBs
1. Australia	3
2. Austria	1
3. Belgium	3
4. Canada	5
5. China	3
6. France	6
7. Germany	10
8. India	1
9. Ireland	1
10. Italy	4
11. Japan	4
12. Netherlands	3
13. South Korea	2
14. Spain	2
15. Sweden	2
16. Switzerland	2
17. United Kingdom	4
18. United States	7
Total	63

We then study how MNBs make a choice among the four organizational forms used abroad: representative office (RO), affiliated-bank (AB), subsidiary (SU) and branch (BR). We use a seemingly unrelated regression equation (SURE) model, where (RO), (AB), (SU) and (BR) are dependent variables defined by the same explanatory variables mainly related to parent-bank owned characteristics. The following SURE model was developed by Arnold Zellner (1962) and is a technique for analyzing a system of multiple equations with cross-equation parameter restrictions and correlated error terms.

$$\begin{aligned}(RO_{ij}, AB_{ij}, SU_{ij}, BR_{ij}) \\ &= \beta_0 + \beta_1 Bus\_Orientation_i + \beta_2 Bank\_Size_i + \beta_3 Inter\_Exp_i + \beta_4 Physcal\_Dist_{ij} \\ &+ \beta_5 Cultural\_Dist_{ij} + \beta_6 Regulations_j \\ &+ \beta_7 Corp\_Tax_j + \beta_8 Home\_BSD_i + \beta_9 Host\_BSD_j + \beta_{10} Count\_Risk_j + \varepsilon\end{aligned}$$

ROij, ABij, SUij and BRij represent, respectively, the number of representative offices, affiliated banks, bank subsidiaries and bank branches of the parent bank (i) in the host country (j). It is equal to 1 if the bank (i) has at least one form of representation in the host country (j) and is equal to 0 if not. *Business orientation* (Bus_Orientation): bank retail activity is characterized by preponderance for financial intermediation (deposits and loans). We measured this variable as per Ursacki and Vertinsky (1992) by the ratio of credit to deposits. *Parent Bank Size* (Bank_Size): measures the capacity of parent-bank in human resources. To have "high quantity" of personnel constitutes a considerable asset. We calculated this variable by the effective total personnel. *International experience* (Inter_Exp): refers to the degree of the parent-bank's internationalism. This variable is calculated by the number of countries in which the parent bank has established offices. *Physical Distance* (Physical_Dist): is the distance between the home country *and the* foreign country where the bank is registered. *Cultural Distance* (Cultural_Dist): is a variable which is equal to 1 if the home country and the host country have the same official language and 0 if not. *Host-Country Bank Entry Requirements* (Rugulations): is an index that has values from 0 to 8, depending on the number of legal submissions required to obtain a license to operate as a bank in the host country. These requirements may include none, all or some of the following: (a) draft by laws, (b) proposed organizational chart, (c) first 3-year financial projections, (d) financial information on main potential shareholders, (e) background/experience of future directors, (f) background experience of future managers, (g) sources of funds to capitalize new bank and (h) intended differentiation of new bank from others. Restrictive entry regulations is likely to favour entry by acquisition and, hence, subsidiaries (see discussion above). This index is constructed using the data collected and methodology proposed by Barth et al. (2001). *Corporate tax rate* (Corp_Tax): refers to corporate tax rate in the host country. *Home country banking sector development* (Home_BSD): we considered the proportion of banks that each home country has in the top 50 of the largest banks of the world according to a classification of *Bankers' almanac* in 2006. Then we calculated the average number of banks in the top 50 per country. Home_BSD has a value of 1 if a given country has a number of banks higher than the average and 0 if not. *Host country banking sector development* (Host_BSD): this variable was measured by the relationship between bank deposits (USD) and the GDP (USD).

Since a bank can be established in several countries, we calculated the average level of development of the countries where it is established. *Host country risk* (Count_Risk): is the host country risk. The OECD classifies countries on a scale of 0 (weak risk) to 7 (high risk). With data from this organization, we estimated country-risk as follows: on scale 7, the risk is considered to be very high and corresponds to a probability of realization is equal to 1%; on another scale, 3 for example, the probability of realization is equal to 42%; etc.

EMPIRICAL RESULTS AND DISCUSSION

Table 3: The determinants of a MNB decision to establish in a foreign country

Independent variables	Dependent variables			
	RO	AB	SU	**BR**
Retail business orientation	-0,041 (-1,86)*	-0,004 (-0,4)	0,055 (2,79)***	-0,051 (-2,41)***
Parent-bank size	-0,006 (-0,33)	0,006 (0,67)	0,024 (0,38)	0,028 (1,56)*
International experience	-0,061 (-2,28)**	0,014 (1,03)	0,046 (1,88)*	0,090 (3,45)***
Physical distance	0,021 (0,88)	-0,047 (-3,62)***	-0,067 (-3,04)***	0,085 (3,63)***
Cultural distance	-0,258 (-3,53)***	0,114 (2,94)***	0,209 (3,16)***	0,074 (1,05)
Host-country bank entry requirements	0,181 (2,83)***	0,012 (0,35)	-0,075 (-1,32)	-0,166 (-2,69)***
Corporate tax	-0,256 (-0,98)	-0,023 (-0,15)	-0,019 (-0,17)	0,178 (0,63)
Home-country banking sector development	-0,142 (-2,80)***	0,087 (0,26)	-0,033 (-0,72)	0,122 (2,49)***
Host-country banking sector development	0,025 (0,36)	0,037 (0,64)	-0,041 (-1,35)	0,002 (2,11)**
Host country risk	0,326 (3,67)***	0,014 (0,39)	0,207 (2,56)***	-0,549 (-6,4)***
Constant	0,600 (2,18)**	0,342 (2,33)**	0,557 (2,22)**	-0,668 (-2,50)***
Number of observations	503	503	503	503
R^2	53,72%	54,17%	58,08%	55,60%

(.) Test de Student, * : Significant at 10% level of significance, ** : Significant at 5% level of significance,
*** : Significant at 1% level of significance.

Taking into account MNBs particular characteristics to better understand how they choose among many organizational forms available when going abroad....

Our results show that parent-bank business orientation affects negatively the bank decision to establish either a representative office or a branch, but it exerts a positive effect on the choice of a subsidiary as a form of representation abroad. As Cerutti et al. (2007) note, we find that MNBs with high capacity of intermediation are more encouraged to practice retail banking activities abroad by organizational forms like subsidiaries. It is important to note that the choice of the subsidiary relies considerably on the availability of an important network of potential customers in the host country. Among all of the four organizational forms of representation abroad, the subsidiary and the affiliate-bank are generally the two organizational forms that make it possible for MNBs to constitute quickly such a network. We find a negative relationship between the parent-bank business orientation variable and the decision to go abroad *via* branch form. This means that the branch form is adopted when competing on foreign financial markets where wholesale banking activities dominate.

When we measure bank size by the parent's total number of employees, we find that the size affects positively the decision to go abroad by establishing a branch. This result enables us to assert that MNBs which have sufficient human resources are ready to open branches abroad. In addition, our study permits us to conclude that international experience negatively affects the choice of representative office but exerts a positive impact on the choice of subsidiary and/or branch as organizational forms. According to the resource-based theory, the human capital of MNBs constitutes a source of competitive advantages. Therefore, any bank which plans to internationalize its activities must have qualified personnel able to be transferred to the host country to manage the new entity (subsidiary, branch). The need for transfers is especially inherent in the branch form and, to a certain extent, in the subsidiary company as well. Our results confirm the assertion of Merrett (2002; p. 391): "the expatriation of the human capital in the Australian banks stimulates the transfer of information and know-how".

The branch and the subsidiary as organizational forms of establishment abroad need appropriate international experience. This allows MNBs, through the subsidiary and the branch forms, to easily transfer knowledge via the competencies of the individuals transferred. Note that the role of the personnel transferred is to be the channel through which the parent bank transfers its expertise towards the host country. According to Huber (1991), the transfer of qualified managers constitutes an effective means for the subsidiary companies to increase their knowledge base as quickly as possible. It is abundantly clear, as mentioned by Tsang (2001), that when knowledge is tacitly transferred with the aim of changing the attitude of the recipients, it is essential that the transferred managers be present during the training process to act as anchors. The decision to go abroad through branch and subsidiary as organizational forms thus makes it possible for multinational corporations to transfer knowledge acquired in their home countries to overseas markets (Kogut and Zander, 1996). Indeed, we explained the preference of MNBs for these two organizational forms by the fact that they constitute a means of exploiting the rich knowledge-base from the personnel of their home countries and, similarly, to also acquire new knowledge from overseas markets, as Kogut and Zander (1992) asserted. In short, the establishment of a subsidiary company requires a transfer of knowledge and an important investment in human resources. Accordingly, the creation by BNP Paribas of a Development Centre of Competencies within its subsidiary bank of El Djazaïr in Algeria is a concrete example thus illustrating the positive relation which exists between the holdings of a subsidiary bank abroad and the capacity of the MNB (BNP Paribas) to provide its establishment abroad with qualified personnel. By opening this training centre, BNP Paribas transferred knowledge thereby making it possible "to develop the quality of human resources and to continue the improvement of such services for its customers" within this subsidiary bank created in 2002. The aforementioned experience and competency are necessary to develop the subsidiary and the branch forms in banking environments which are in the initial developmental stage, as is the case of the 25 host countries in our sample.

If experience with overseas markets constitutes an important factor, it should be noted that MNBs are also confronted with a problem of supervision related to the distance which separates their home countries from the host countries. We find that physical distance affects positively the choice of the branch but influences negatively the affiliated-bank and the subsidiary. The results, although in opposition of that which we predicted, are not very surprising because distance constitutes an obstacle to controlling the entity abroad. However, the necessity for control is undoubtedly more important in the subsidiary and the affiliated-bank then that in the branch. In the first two organizational forms, the parent-bank can be confronted with some problems of control because of the presence of other shareholders in the ownership structure of the foreign entity. The negative effects of -0.047 and -0.067 (respectively) are statistically significant at the 1% level on the choice of either the affiliated-bank and/or the subsidiary. This indicates that distance does not encourage MNBs to take participations in foreign banks. The distance creates, according to the agency theory (see Berger and DeYoung, 2001), an asymmetry of information between the subsidiary and the parent-bank since the interests of the subsidiary directors are often opposite to those of the persons in charge of the MNB's head office. Indeed, the persons in charge of the subsidiary could pursue personal secondary goals which are not in the interests of the subsidiary itself (Mishra and Gobeli, 1998). This arises from the fact that head office may be unable to control the opportunistic behaviours of the subsidiary directors without the higher costs such a control would entail.

Our results also indicate that physical distance exerts a positive effect of 0.085, statistically significant at the 1% level, on the MNB's decision to go abroad through a branch. In such an organizational form of representation abroad, management is centralized, thus implying that problems of control are less acute than in the subsidiary. In the branch form, the parent-bank holds mainly all the decision-making powers and can easily impose its values and methods of management. The strategic decisions concerning the branch are made according to the objectives and the interests of head office (Meier and Schier, 2005). The parent-bank exerts a permanent control on the branch which has only a weak autonomy. Key positions in the branch are primarily held by the personnel of the parent-bank and local executives occupy only a few positions of lesser importance since the expatriation is made from parent-bank towards the branch in order to transfer values and knowledge. Hence, all the individuals working in the branch must be devoted the underlying principals of the parent-bank.

... Whithout omitting economic and financial factors which are also decisive when banks decide to establish themselves abroad.

Host country-risk affects positively the choice of both subsidiary and representative office while it affects negatively the choice of branch. The results show that country-risk has a negative effect of -0.549 on the choice of the branch and a positive effect of 0.326 and of 0.207 respectively on the choice of representative office and subsidiary. The negative influence of this variable on a parent-bank's decision to go abroad via a branch confirms the results found by Spremann et al. (2000). According to them, political instability does not encourage MNBs to establish themselves abroad through branch forms. Similarly, our results coincide with those of Di Antonio et al. (2002) who support that in politically and economically stable countries, Italian banks prefer branch and subsidiary as organizational forms of representation. In addition, the positive relationship between the host country-risk and the decision to go abroad through a subsidiary can be explained in the context of political and economical instability where investors must be prudent, hence MNBs prefer to join other institutions in order to establish themselves abroad. This leads in particular to the creation of subsidiaries abroad. Finally, parent-banks prefer to orient their international strategies towards more prudent arrangements as representative office and/or affiliate-bank because these forms allow the risks involved in foreign direct investment to be reduced.

The results show that the variable "*home country banking sector development*" has a negative effect of -0.142 and is statistically significant at the 1% level on the choice of the representative office also has a positive effect of 0.122 and is statistically significant at the 1% level on the choice of the branch form. According to Heinkel and Levi (1992), MNBs from home countries with well developed markets choose to establish in the United States by the means of the branch form. However, our results make it possible to conclude that the establishment of the representative office is not sensitive to the fact that the parent-bank comes from a country with a developed banking sector and conductive environment. This mode of representation abroad, which makes it possible to seek and develop opportunities in the host country, is especially chosen by the MNBs when their home countries maintain important commercial relations with the host countries. Similarly, we find that the variable "*host country banking sector development*" affects positively the choice of the branch form. That implies that in the 25 host countries having a developed banking environment, the foreign banks prefer to use the branch form to conduct their financial transactions. Our results confirm the conclusions of the study by Di Antonio et al (2002) that Italian banks are established in countries having such a developed banking environment by means of the branch form. Also, according to Miller and Parkhe (1998), the level of development of the host banking market (measured by the total of the bank deposits) has a positive effect on the choice of the subsidiary and the branch forms in developed countries. To a certain extent, our results go in the same direction as those of Miller and Parkhe (1998) since we find a positive and statistically significant relationship between variable "*host country banking sector development*" and the choice of the branch form. Indeed, in countries like Singapore or Malaysia, the branch is chosen because foreign banks wish to fully exploit all the business opportunities that these emergent markets offer with very promising economical outlooks.

The banking regulations in the host country have a positive impact of 0.181 and are statistically significant at the1% level on the choice of the representative office. In addition, banking regulations have a negative impact on the establishment of branches by foreign banks in the 25 host countries. Restrictive regulations have a dissuasive effect on the choice of the branch, as our results corroborate those of Cerutti et al (2007). For example, in South Africa, the banking laws restricted the conditions under which foreign banks could operate as branch forms. Similarly, in Mexico, regulators cannot authorize the establishment of bank branches whose loan activities are undertaken only with residents outside of Mexico. Also, in Morocco, according to Bank Al-Maghrib (Central Bank of Morocco), when "the application emanates from a financial company having its seat abroad, either for the creation of a subsidiary company, or for the opening of a branch in Morocco, this request must be accompanied by the opinion of the authority of the home country entitled to deliver such an opinion". The Central Bank of Morocco also ensures that legislative measures and laws applicable to financial companies of the home country are unlikely to block the monitoring of the subsidiary or the branch under consideration in Morocco. Our study shows a positive and significant effect of the variable "*regulations*" on the choice of the representative office. As a form of representation abroad, the representative office does not authorize or require the parent-bank to undertake traditional banking activities (loans and deposits). Its mission simply consists in facilitating the commercial transactions for the customers of the parent-bank.

Apart from regulatory constraints, MNBs must also contend with linguistic barriers. By integrating (inserting) a binary variable in our model, the objective is to highlight the effects of cultural similarities and differences on the choice of the organizational form of representation abroad. Indeed, the following question must be answered: does a French MNB like Société Générale decide to establish itself through the same organizational form in the Ivory Coast as in in Malaysia? Our results indicate that when the home country and the host country share the same linguistic values, banking internationalism is done more often via the affiliate-bank and the subsidiary forms without necessarily passing by the establishment of a representative office. In fact, many countries which have the same official language are, in the majority of cases, bound by historical ties such as colonization, which can explain the sharing of cultural values thus being an additional factor in supporting the acquisition of a bank in a former colony (host country) by a bank from the colonizing country (home country). Our study confirms the results of Focarelli and Pozzolo (2005) that MNBs have a preference for the subsidiary form to the detriment of the branch form when they decide to establish in countries using the same working language. We find a negative and statistically significant effect for the variable "*language*" on the choice of representative office as others authors have asserted because the representative office, according to its core mission, is not essential if the home and host countries share the same linguistic values.

CONCLUSION

The phenomenon of banking internationalization held the attention of many researchers who proposed answers to relative questions regarding the operational decisions of multinational banks and sometimes tried to explain the rationale of the MNBs decision to go abroad through a type of organizational form. These studies concentrated on macroeconomic theories and analysis, with little interest in any micro-economic approach however complementary. Thus, in our paper, we recognized that other factors had to be taken into account when studying the choice of organizational forms preferred when embarking on foreign markets. The consideration of these factors leads us to resort to certain theoretical currents such as the agency theory, which is not used often enough to treat banking internationalization. A very important motivation for bank internationalization is undoubtedly the increase in market shares and improvements in performance. Indeed, a good positioning abroad necessarily passes by a better knowledge of the host countries through a particular type of organizational form.

REFERENCES

Agarwal, S., Ramaswami, S. N. (1992), "Choice of foreign market entry mode: impact of ownership, location and Internalization factors", *Journal of International Business Studies*, first quarter, 1- 27.

Aliber, R. Z. (1984), "International Banking: A survey", Journal of Money, Credit and Banking, 16(4), 661-712.

Bain, E. A., Fung J.G., Harper, I.R. (1999), "Multinational banking: Historical, empirical and case perspectives", Working Paper n° 5, Melbourne Business School, Australia.

Ball, C., Tschoegl, A. (1982), "The decision to establish a foreign bank branch or subsidiary: An application of binary classification procedures", Journal of Financial and Quantitative Analysis, 17, 411-424.

Barth, J.-R., Caprio, G., Levine, R. (2001), "The Regulation and Supervision of BanksAround the World: A New Database", Working Paper Financial Sector Research, World Bank.

Berger, A. N., DeYoung R. (2001), "The effects of geographic expansion on bank efficiency", Journal of Financial Services Research, 19(2-3), 163-184.

Blandon, J. G. (1998), "The choice of the form of representation in multinational banking: Evidence from Spain", Working Paper n° 271, University Pompeu Fabra Spain.

Blandon, J. G. (2000), "Cross-border banking in Europe: An empirical investigation", Working Paper n° 509, University Pompeu Fabra, Spain.

Calzolari, G., Loranth, G. (2005), "Regulation of multinational banks: A theoretical Inquiry", Working Paper, University of Bologna and University of London.

Cerutti E., Dell'Ariccia G. Martinez Peria M. S. (2007), "How banks go abroad. Branches or subsidiaries?", Journal of Banking and Finance, 31(6), 1669-1692.

Dalen, D. M., Olsen T.E. (2003), "Regulatory competition and multinational banking", CESIFO Working Paper n° 971, Norway.

Di Antonio, P., Mariotti, S., Piscitello, L. (2002), "Multinational banks in the global economy: Evidence from Italian case", 28th Conference of The European International Business Academy, December 8-10, 2002.

Fama, E. F., Jensen, M. C. (1983), "Agency problems and residual claims", Journal of Law and Economics, 26, 327-349.

Focarelli, D., Pozzolo, A. F. (2005), "Where do banks expand abroad? An empirical analysis", Journal of Business, 78(6), 2435-2463.

Gray, J. M., Gray, H. P. (1981), "The multinational bank: a financial MNC?" Journal of Banking and Finance, 5, 33-63.

Grubel, H. (1977), “A theory of multinational banking”, Banca Nazionale del Lavoro Quarterly Review, 123, 349-363.

Harr, T., Ronde, T. (2005) “Branch or Subsidiary? Capital Regulation of Multinational Banks”, Working Paper CEBR, CEPR University of Copenhagen.

Heinkel, R. L., Levi, M. D. (1992), “The structure of international banking”, Journal of International Money and Finance, 11, 251-272.

Huber, G. P. (1991), “Organizational learning: the contribution processes and the literatures”, Organization Science, 2(1), 88-115.

Kogut, B., Zander, U. (1992), “Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology”, Organization Science, 3(3), 383-397.

Kogut, B., Zander, U. (1996), “What Do Firms Do? Coordination, Identity and Learning”, Organization Science, 7, 502-518.

Meier, O., Schier, G. (2005), Entreprises multinationales : stratégie, restructuration et gouvernance, Dunod, Paris.

Merrett, D. T., (2002), “The internationalization of australian banks”, Journal of International Financial Markets, Institutions and Money, 12, 377-397.

Miller, S. R., Parkhe, A. (1998), “Patterns in the expansion of U.S. banks’ foreign operations”, Journal of International Business Studies, 29(2), 359-389.

Mishra, C. S., Gobeli, D. H. (1998), “Managerial incentives, internalization, and market valuation of multinational firms”, Journal of International Business Studies, 29(3), 583-598.

Mutinelli, M., Piscitello, L. (2001), “Foreign direct investment in the banking sector: the case of Italian banks in the ’90s”, International Business Review, 10 (6), 661-685.

Tsang, E. W. K. (2001), “Managerial learning in foreign-invested enterprises of China”, Management International Review, 41, 29-51.

Tschoegl, A. E. (2004), “Who owns the major US subsidiaries of foreign banks?” A note, Journal of International Financial Markets, Institutions and Money, 14, 255-266.

Ursacki, T., Vertinsky, I. (1992), “Choice of entry timing and scale by foreign banks in Japan and Korea”, Journal of Banking and Finance, 16, 405-421.

Williams, B., (1997), “Positive theories of multinational banking: Eclectic theory versus internalisation theory”, Journal of Economic Surveys, 11(1), 71-100.

A PARSIMONIOUS AND PREDICTIVE MODEL OF THE RECENT BANK FAILURES

John Trussel, Dalton State College
Larry Johnson, Dalton State College

ABSTRACT

This paper investigates the financial indicators associated with recent bank failures. The number of predictor variables is limited to six for reasons of parsimony. The regression model results in a prediction of the likelihood of failure, which correctly classifies up to 98% of the sample as failed or not. The model also allows for an analysis of the impact of a change in a financial indicator on the likelihood of failure. An increase in tier one capital as a percent of total assets and an increase in return on assets have the biggest influences on reducing the likelihood of failure.

INTRODUCTION

The collapse of the housing and equity markets and the ensuing recession has led to the largest number of bank failures since the Savings and Loan crisis of the late 1980s and early 1990s. Since the start of the financial crisis in 2008 through 2009, there have been 167 bank failures in the United States (FDIC Bank Failures, 2010). The purpose of this analysis is to examine the financial condition of banks during this recent financial crisis and determine whether there are key financial indicators that could signal potential failure.The seriousness of the financial crisis is described by the Federal Deposit Insurance Corporation (FDIC) in the 2008 Quarterly Report.

FDIC-insured institutions reported a net loss of $32.1 billion in the fourth quarter of 2008, a decline of $32.7 billion from the $575 million that the industry earned in the fourth quarter of 2007 and the first quarterly loss since 1990. Rising loan-loss provisions, large write-downs of goodwill and other assets, and sizable losses in trading accounts all contributed to the industry's net loss. More than two-thirds of all insured institutions were profitable in the fourth quarter, but their earnings were outweighed by large losses at a number of big banks (p. 1).

The increase in bank failures that began in 2008 was largely precipitated by the collapse of the U.S. housing market. Falling home prices led to declines in securities tied to home loans forcing banks to take write-downs on their balance sheets. Falling home prices combined with losses in the stock and bond markets resulted in historic declines in household wealth. The U.S. officially entered into recession in December 2007.

The financial crisis that began in early 2008 worsened the recession, making this not only one of the longest but also one of the most severe U.S. recessions since World War II. Real gross domestic product (GDP) declined at an annualized rate of 5.4% in the fourth quarter of 2008, 6.4% in the first quarter of 2009, and 0.7% quarter of 2009. Real GNP returned to positive growth of 2.2% on an annualized basis for the third quarter of 2009 and 5.7% in the fourth quarter of 2009. (Bureau of Economic Analysis, 2010). Because of the recession, bank failures continued with 130 failed banks in 2009 (FDIC Bank Failures, 2010).

The current banking crisis is broad based and linked closely to defaults on residential real estate and small business loans. Smaller banks that were linked to construction, real estate development, and small businesses loans were most at risk. This current bank crisis is different from the bank crisis of the late 1980s and 1990s, which was largely linked to defaults in the commercial real estate, agricultural, and petroleum industries, and particularly in oil and agricultural producing regions.

This paper investigates the financial indicators associated with recent bank failures. The number of predictor variables is limited to six for reasons of parsimony. Previous literature has addressed the topic of predicting bank failure; however, our model differs from previous studies in four important ways. First, our model is parsimonious, using only six financial indicators to predict bank failure. Second, our model uses logistic regression to weight the six financial indicators into a composite measure of failure. Third, we use data from the recent bank failures to develop our model. Fourth, we incorporate various costs of misclassifying banks as failed or not failed. The regression model results in a prediction of the likelihood of failure, which correctly classifies up to 98% of the sample as failed or not.

The remainder of the paper is organized as follows: Section 1 describes the extant literature on failure in banks. Section 2 discusses the indicators associated with failure and the related hypotheses testing. The results of testing the failure model are analyzed in Section 3, and the Section 4 concludes the paper.

BANK FAILURE MODELS IN THE LITERATURE

The Uniform Financial Institutions Rating System

The Uniform Financial Institutions Rating System (UFIRS) was adopted by the Federal Financial Institutions Examination Council (FFIEC) on November 13, 1979, with revisions made since then. Federal supervisory agencies use this system to evaluate the soundness of financial institutions and to identify those institutions requiring special attention. Under the UFIRS, each financial institution is rated based on six components: the adequacy of capital, the quality of assets, the capability of management, the quality and level of earnings, the adequacy of liquidity, and the sensitivity to market risk. This rating approach is called the CAMELS system, which is an acronym for these six components—Capital adequacy, Asset quality, Management risk, Earnings strength, Liquidity, and Sensitivity to market risk. In previous iterations of the rating system there was no measure of market risk, and the acronym was CAMEL.

Each of the CAMELS components is evaluated and assigned a score from one-to-five with one being the best relative to the institution's size, complexity, and risk profile. The scores from each of the six categories are summed and the institution is placed into one of five composite groups based on this total score. Institutions in the bottom group will cause the highest level of supervisory concern.

Bank regulators evaluate the financial condition of banks using on-site examinations and off-site statistical analysis. On-site exams use the CAMELS system and result in a rating of one-to-five with one being the highest rating and five the lowest rating for financial condition. While on-site examinations are the most extensive reviews, the rating can decline between on-site examinations. (Cole and Gunthner, 1998)

Existing Early Warning Systems

Besides the UFIRS, the FDIC also uses a bank's capital adequacy as an early warning for further action. The FDIC has minimum capital requirements, below which a bank must (with certain exceptions) file a written capitalization plan with the FDIC regional director (FDIC Bank Examinations, 2010, Section 325.3). The minimum ratio of tier one (or core) capital to total capital is four percent (and in some cases three percent). Tier one capital is common equity plus noncumulative perpetual preferred stock plus minority interests in consolidated subsidiaries less goodwill and other ineligible intangible assets. The amount of eligible intangibles (including mortgage servicing rights) included in core capital is limited in accordance with supervisory capital regulations. If a bank's tier one capital falls below two percent of total assets, then the FDIC considers the bank to operating in an "unsafe or unsound condition" (FDIC Bank Examinations, 2010, Section 325.4). However, only one of the 167 banks that failed in 2008 and 2009 had tier one capital less than two-percent, and only two had tier one capital less than four-percent at the end of 2007. Thus, this system is not a good predictor of failure.

Numerous studies have focused on early warning systems as a supplement to on-site bank examinations with the purpose of determining troubled banks between bank examinations. Such systems typically utilize indicators from the CAMELS system as inputs into a prediction model. For example, Jagtiani, et al. (2003) evaluated early warning systems using a simple logit analysis, a more complete stepwise logit analysis, and a non-parametric trait recognition (TRA) model. They concluded that the simple logit was better in predicting capital inadequate banks.

Kumar and Arora (1995) also used a logit model to predict bank failures during 1991. They used a risk rating rather than the CAMELS system as their predictors and compared both linear and quadratic models. They concluded that both models give similar and satisfactory results. Likewise, Gunsel (2007) used the CAMEL rating system and logit analysis to measure the probability of bank failure for banks in North Cyprus. He concluded that the CAMEL modeling approach is appropriate for predicting bank failures in emerging economies.

Kolari, et.al. (2002) compared logit analysis as an early warning system to a nonparametric trait recognition model for large bank failures during the late 1980's and early 1990's. They found that both approaches for an early warning system are appropriate but the trait recognition model worked best for minimizing Type I (misclassifying failures as not failures) and Type II errors (misclassifying not failures as failures). Kasa and Spiegel (2008) also used logit regression to compare bank failures using an "absolute closure rule" (when asset-liability ratios fall below a threshold) versus a "relative closure rule" (when asset-liability ratios fall below an industry average) which implies forbearance during economic downturns. They conclude that bank closures are based more on relative performance than an absolute closure rule.

Thomson (1991), in his article on predicting bank failures in the 1980's, also used logit analysis to predict default using a combination of accounting and economic variables as the explanatory variables. His results indicate that solvency and liquidity are the most important variables and showed hints of distress up to thirty months before default. His final model included solvency, capital adequacy, asset quality, management quality, earnings performance, and relative liquidity variables.

Cole and Gunther (1998) in their comparison of on-and off-site monitoring systems used a probit model as the early warning system. They suggested the econometric model was useful for monitoring banks six months past their on-site examination date. Other studies of early warning systems using advanced analytical techniques include Swicegood and Clark (2001), who compared neural networks and discriminant analysis to professional human judgment, and Salchenberger, et al. (1992), who also used neural networks in an analysis of thrift failures. Both concluded that neural networks could perform as good as or better than other early warning systems for bank failure. Ozkan-Gunay and Ozhan (2007) recommend neural networks for monitoring banks in emerging economies. Curry, et al. (2007) take a different approach and analyze bank failures based on equity market data and conclude that market data could improve the early warning system based solely on accounting data. Jesswein (2009) tests the so-called "Texas ratio" (non-performing assets divided by the sum of tangible equity capital and loan loss reserves). He finds that the ratio provides important insights, but it is probably not a good tool for an overall analysis of bank failure.

Various financial, accounting, and economic variables are used across the different studies. For example, Jagtiani, et. al (2003) incorporated forty-two explanatory variables in their analysis as compared to Cole and Gunther (1998) who used only eight. A review of different analytical techniques and variables used in the different analysis was completed by Demirguc-Kunt (1989), who summarized significant independent variables from seven previous studies. Table 1 includes a representative sample of variables used in previous studies by CAMELS category. In this study, we utilize one variable per category, similar to the ones used in these previous studies.

TABLE 1 REPRESENTATIVE INDICATORS OF FAILURE FROM SELECTED PREVIOUS STUDIES	
VARIABLES BY CATEGORY	REFERENCE
Capital Adequacy	
Total Equity / Total Assets	Swicegood and Clark (2001)
Earned Surplus / Total Assets	Salchenberger, Cinar and Lash (1992)
Regulator Recognized Capital / Total Assets	Gajewski (1988)
Asset Quality	
(Loans + Leases) / Total Assets	Thompson (1991)
Real Estate Loans / Total Loans	Hirtle and Lopez (1999)
Non-accrual Loans / Total Loans	Gajewski (1988)
Real Estate Owned / Total Assets	Salchenberger, Cinar and Lash (1992)
Management Competence	
Insider Loans / Total Assets	Thompson (1991)
Operating Expense / Gross Operating Income	Salchenberger, Cinar and Lash (1992)
Compensation / Gross Operating Income	Pantalone and Platt (1987)
Sensitive Deposits / Total Deposits	Gajewski (1988)
Earnings	
Net Income / Total Assets	Thompson (1991)
Non-interest Income / Total Assets	Swicegood and Clark (2001)
Net Interest Margin	Salchenberger, Cinar and Lash (1992)
Retained Earnings / Total Assets	Pantalone and Platt (1987)
Liquidity	
Non-deposit Liabilities / (Cash + Securities)	Thompson (1991)
Total Securities / Total Assets	Swicegood and Clark (2001)
Cash / Total Assets	Hirtle and Lopez (1999)
(Cash + Securities) / Savings + Borrowings	Swicegood and Clark (2001)
Cash / Total Deposits	Carlson (2010)
Sensitivity to Risk	
Loan Loss Allowance / Total Loans	Swicegood and Clark (2001)
Off Balance Sheet Commitments / Total Assets	Swicegood and Clark (2001)
Non-performing Assets / Total Assets	Swicegood and Clark (2001)
Asset Growth	Swicegood and Clark (2001)

MODEL DEVELOPMENT AND FINANCIAL INDICATORS

Previous models of bank failure are deficient for several reasons. Our model incorporates methods to compensate for the shortcomings of previous studies.

First, the UFIRS/CAMELS system used by bank regulators and previous researchers is problematic. Several items are considered and measured to evaluate each category, making the system quite complex. Including too many variables to proxy for each category could over-specify the model and cause multicollinearity. For example, in the capital adequacy category, evaluators consider these items at a minimum (FDIC, 2009):

- The level and quality of capital and the overall financial condition of the institution.

- The ability of management to address emerging needs for additional capital.
- The nature, trend, and volume of problem assets, and the adequacy of allowances for loan and lease losses and other valuation reserves.
- Balance sheet composition, including the nature and amount of intangible assets, market risk, concentration risk, and risks associated with nontraditional activities.
- Risk exposure represented by off-balance sheet activities.
- The quality and strength of earnings, and the reasonableness of dividends.
- Prospects and plans for growth, as well as past experience in managing growth.
- Access to capital markets and other sources of capital, including support provided by a parent holding company.

Our model is parsimonious, with one variable per CAMELS category, chosen based on popularity in the literature.

Second, there is no conceptually sound system for weighting each of these items to determine the score for each category and the composite score. We use logistic regression analysis to develop our model of bank failure. The multivariate model weights each of the variables using the sample data and results in a composite likelihood of failure. Unlike the composite score from the UFIRS system, our composite score will weight each variable according to results of the regression analysis.

Third, the recent failures arise from differing reasons than previous failures. The recent failures occurred during a unique economic period. Banks tied to home mortgages were faced with unprecedented foreclosures especially in areas that had experienced rapid increases in home prices. Defaults on sub-prime loans and subsequent foreclosures depressed home prices in many regions of the country. Defaults then moved to prime borrowers as many owed more on their mortgages that the homes were worth. Many community banks also became vulnerable due to exposure from real estate and construction loans and commercial loans linked to the residential sector. Thus, the relationship among the predictor variables is likely different than previous periods.

Fourth, we take into account various costs of misclassification errors. Previous studies do not take into account the likelihood that costs of Type I errors (misclassifying failures as non-failures) are higher that the costs of Type II errors (misclassifying non-failures as failures)..

Indicators of Failure

We incorporate the same six categories from the UFRIS to develop our failure model; however, we use one variable to proxy each category. The variables were chosen based upon their usage in the literature on bank failure to best reflect each category. Obviously, one variable cannot capture the complexities of each category; however, our goal is to have a parsimonious model that will result in a reliable model of failure prediction.

Capital Adequacy (CAP). A financial institution is expected to maintain capital corresponding with the risks to the institution. The nature and extent of inherent risk will drive the levels of capital needed by the institution to meet these risks. There are also regulatory minimums that are required of financial institutions. We proxy capital adequacy as the ratio of tier one capital to total assets and expect a negative correlation with the likelihood of failure. Tier one (or core) capital includes common equity, noncumulative perpetual preferred stock, minority interests in consolidated subsidiaries and excludes goodwill and other ineligible intangible assets. The amount of eligible intangibles (such as mortgage servicing rights) is limited in accordance with supervisory capital regulations.

Asset Quality (QUAL). Asset quality reflects "the quantity of existing and potential credit risk associated with the loan and investment portfolios, other real estate owned, and other assets, as well as off-balance sheet transactions" (FDIC 2009). One of the most risky assets is the institution's loan portfolio. We measure asset quality as the ratio of total loans and leases to total assets and anticipate a positive correlation with the likelihood of failure. Higher amounts of loans and leases in the asset portfolio imply more risk of failure.

Management Risk (MGT). This category represents a measure of "the capability of the board of directors and management, in their respective roles, to identify, measure, monitor, and control the risks of an institution's activities and to ensure a financial institution's safe, sound, and efficient operation in compliance with applicable laws and regulations" (FDIC 2009). Management must address all risks, maintain appropriate controls, and monitor the information systems. We proxy management risk as the ratio of insider loans to total loans and expect a positive correlation with the likelihood of failure. Insider loans are a measure of potential management fraud.

Earnings Strength (EARN). Financial institutions, as well as any proprietary organization, need to be profitable in order to continue to operate. We measure earnings strength as the return on assets, which is the ratio of net income to total assets. We anticipate a negative association with failure.

Liquidity Position (LIQ). Liquidity is the ability of an entity to pay its short-term obligations in a timely manner. Also, financial institutions must consider the funds necessary to meet the banking needs of their communities. We proxy the liquidity position as the ratio of cash plus securities to total deposits and expect a negative relationship with failure.

Sensitivity to Market Risk (RISK). This component reflects the degree to which changes in market conditions, such as interest rates, foreign exchange rates, commodity prices, or equity prices, can adversely affect earnings and capital. For many institutions, the primary source of market risk arises from loans and deposits and their sensitivity to changes in interest rates. We measure the sensitivity to market risk as the ratio of loan loss reserves to total loans and anticipate a positive correlation with the probability of failure. The six indicators of bank failure are summarized in Table 2.

TABLE 2 INDICATORS OF FAILURE USED IN THIS STUDY		
CAMELS CATEGORY	MEASURE	EXPECTED RELATIONSHIP WITH FAILURE
Capital Adequacy (CAP)	Tier one Capital[a] Total Assets	-
Asset Quality (QUAL)	Total Loans + Leases Total Assets	+
Management Risk (MGT)	Insider Loans Total Loans	+
Earnings (EARN)	Net Income Total Assets	-
Liquidity (LIQ)	Cash + Securities Total Deposits	-
Sensitivity to Risk (RISK)	Loan Loss Allowance Total Loans	+

[a]Tier one (core or regulatory) capital includes: common equity plus noncumulative perpetual preferred stock plus minority interests in consolidated subsidiaries less goodwill and other ineligible intangible assets. The amount of eligible intangibles (including mortgage servicing rights) included in core capital is limited in accordance with supervisory capital regulations.

RESULTS OF TESTING THE FAILURE PREDICTION MODEL

This study focuses on a limited set of financial indicators and the prediction of recent bank failures. Certain financial indicators are hypothesized to be related to failure and are described in the previous section. This section presents the empirical tests of the failure prediction model.

Sample Selection and Descriptive Statistics

According to the FDIC, there have been 193 bank failures since 2000, of which 167 were in 2008 and 2009. Thus, we focus on the huge number of failures in recent years. We define a failed bank as one that fell under the receivership of the FDIC during 2008 or 2009. In order to develop a predictive model, we obtained data from the FDIC for all banks as of 2007. There are 8,548 banks on the FDIC database as of December 31, 2007. Of these, 86 do not have complete data to compute the indicators from Table 1 and are not included in the sample. This leaves 8,462 banks in the sample, of which 165 (2%) failed in 2007 or 2008.

Summary statistics are included in Table 3. As predicted, statistically speaking, failed banks have less tier one capital (as a percent of total assets), less net income (as a percent of total assets), and less cash and securities (as a percent of total deposits) than banks that did not fail. Also as expected, failed banks have more loans and leases (as a percent of total assets) and a higher allowance for loan losses (as a percent of total loans) than their counterparts that did not fail. However, we did not expect that failed banks have fewer insider loans (as a percent of total loans).

TABLE 3 DESCRIPTIVE STATISTICS AND TESTS OF SIGNIFICANCE OF DIFFERENCES BETWEEN FAILED AND NOT FAILED BANKS				
Panel A: Descriptive Statistics				
CATEGORY	STATUS	MEAN	STANDARD DEVIATION	*T*-STATISTIC (SIGNIFICANCE)
CATEGORY CAP	Not Failed	0.1206	0.09443	4.762
	Failed	0.0870	0.03243	(<0.001)
QUAL	Not Failed	0.6525	0.17459	-6.920
	Failed	0.7473	0.12225	(<0.001)
MGT	Not Failed	0.0143	0.01881	2.399
	Failed	0.0116	0.01527	(0.018)
EARN	Not Failed	0.0084	0.05032	4.198
	Failed	-0.0018	0.01956	(<0.001)
LIQ	Not Failed	1.0060	21.46679	2.327
	Failed	0.2163	0.27656	(0.020)
RISK	Not Failed	0.0131	0.01562	-4.880
	Failed	0.0191	0.01459	(<0.001)
Panel B: Correlations				
	CAP	QUAL	MGT	EARN
QUAL	-0.377**			
MGT	0.074**	0.145**		
EARN	0.034**	-0.059**	-0.056**	
RISK	0.098**	-0.142**	-0.016	-0.028**
LIQ	0.060**	-0.063**	-0.026*	0.098**

The Multivariate Model

We use cross-sectional data from 2007 to test our model of failure. Since the dependent variable is categorical, the significance of the multivariate model is addressed using logistic regression analysis. Carlson (2010) suggests using both logit analysis and survival analysis in a similar situation of bank failures. We only use logit analysis, due to the short time period of the study. Using this method, the underlying latent dependent variable is the probability of failure for bank *i*, which is related to the observed variable, $Status_i$, through the relation:

$Status_i = 0$ if the organization has not failed,

$Status_i = 1$ if the organization has failed.

The model includes all of the independent variables from Table 2. The predicted probability of the k^{th} status for bank *i*, $P(Status_{ik})$ is calculated as:

$$P(Status_{ik}) = \frac{1}{1+e^{-Z}} \tag{1}$$

where

$$Z_i = \alpha + \beta_1 \overset{-}{CAP} + \beta_2 \overset{+}{QUAL} + \beta_3 \overset{-}{MGT} + \beta_4 \overset{-}{EARN} + \beta_5 \overset{-}{LIQ} + \beta_6 \overset{+}{RISK}$$

We use a random sample of approximately one-half of the banks to develop the model (the estimation sample) and the other half to test the model (the holdout sample). The results of the logistic regression model are included in Table 4. Overall, the model is statistically significant at less than the 0.01 level according to the chi-square statistic. Also, all of the indicators, except LIQ, are significantly related to the probability of failure (at less than the 0.05 level). LIQ is not statistically significant in the multivariate model. All of the variables have the predicted signs, except for MGT. As with the univariate results, the multivariate results find that failed banks actually have fewer insider loans that do banks that did not fail. A review of literature shows Thomson (1991) finds a positive and significant relationship between insider loans and bank failure but it is not identified as a significant variable in the seven studies summarized by Demirguc-Kunt (1989). Perhaps more insider loans in a bank that did not fail reflect management's confidence in the bank to continue operating.

TABLE 4
THE LOGISTIC REGRESSION RESULTS OF THE RELATION AMONG THE FINANCIAL INDICATORS AND FAILURE

VARIABLE	COEFFICIENT	STD. ERROR	*P-VALUE*	IMPACT (0.01)
Constant	-3.416	.878	.000	
CAP	-34.217	6.503	.000	-.290
QUAL	3.940	1.025	.000	.040
MGT	-21.560	9.805	.028	-.194
EARN	-34.143	7.591	.000	-.289
LIQ	-.021	.082	.798	.000
RISK	19.801	4.586	.000	.219
Model Summary: -2 Log Likelihood = 1,422.427; Nagelkerke R^2 = 0.136; χ^2 (Significance) = 203.675 (<0.001)				

NOTE: See Table 2 for a description of the independent variables. The latent dependent variable equals 0 if the bank is not failed and 1 if the bank is failed. The last column represents the impact on the predicted likelihood of failure due to a 0.01 increase in the value of the covariate. The impact is the change in the probability of failure due to a 0.01 increase in the variable and is computed as $Exp(B)^{.010}$ - 1.

The results of the regression analysis also allow one to address the impact of a change in a financial indicator on the likelihood of failure. In Table 5, *Exp(B)* is the odds ratio, which is the change in the odds of the event (failure) occurring for a one-unit change in the financial indicator. The last column in Table 3 represents the impact on the predicted likelihood of failure due to a 0.01 increase in the value of the financial indicator. The impact for the 0.01 increase is computed as $Exp(b)^{0.010}$ - 1. The financial indicators CAP, EARN and RISK have the biggest influences on the likelihood of failure. An increase in CAP (EARN) by 0.01 will decrease the likelihood by 0.290 (0.289). A decrease in RISK of 0.01 will increase the predicted likelihood of failure by 0.219. Based on the financial indicators in this model, banks attempting to reduce the likelihood of failure will have the biggest impact by increasing the amount of tier one capital (relative to total assets), by increasing the return on assets or by decreasing loan loss reserves (relative to total loans). Also, an increase in MGT (insider loans as a percent of total loans) of 0.01 will decrease the risk of failure by 0.194. Changes in QUAL or LIQ do not have nearly the impact on the likelihood of failure.

Predicting Failure

We use the results of the logistic regression analysis to test the predictive ability of the failure model. The observed logistic regression equation (from Table 4) for bank *i* at time *t* is:

$$P(i,t) = 1/(1+e^{-Zi})$$

where:

$$Z_i = \alpha + \beta_1 \overset{-}{CAP} + \beta_2 \overset{+}{QUAL} + \beta_3 \overset{-}{MGT} + \beta_4 \overset{-}{EARN} + \beta_5 \overset{-}{LIQ} + \beta_6 \overset{+}{RISK}$$

The predicted dependent variable, *P(i,t)* the probability of failure for bank *i*, is computed using the actual financial indicators for each bank in the estimation sample. The resulting probabilities are used to classify banks as failed or not. Jones (1987) suggests adjusting the cutoff probability for classifying as failed or not failed in two ways. Following the suggestion of Jones, we first incorporate the prior probability of failure and then include the expected cost of misclassification.

Using logit, the proportion of failed banks in the sample must be the same as the proportion in the population to account for the prior probability of failure. If the proportion is not the same, then the constant must be adjusted (Maddala 1991). This is more of a problem when a paired sample method is used, which is not the case here. Since two percent of the banks in the sample are failed, we assume that the prior probability of failure is 0.02. We evaluated the sensitivity of the model to other assumptions of the prior probability of failure by using prior probabilities of 0.005, 0.01 and 0.03. These assumptions did not alter the results (not shown) significantly. The tenor of the results is similar; however, the cutoff probabilities for classification differ.

The ratios of the cost of type I errors (incorrectly classifying failed banks as not failed –a false negative) to type II errors (incorrectly classifying banks that are not failed as failed –a false positive) also must be determined. The particular cost function is difficult to ascertain and will depend on the user of the information. For example, a creditor may want to minimize loan losses (and thus type I errors); however, he or she will suffer an opportunity cost (type II error) if credit is granted to another borrower at a lower rate. In most cases, the cost of a type II error is likely to be much smaller than a type I error. Thus, we incorporate several relative cost ratios (and cutoff probabilities) into our analysis. Specifically, we include the relative costs of type I to type II errors of 1:1, 10:1, 20:1, 30:1, 40:1, 60:1, and 100:1 (Beneish 1999; Trussel 2002).

The results of using the logit model to classify banks as failed or not are included in Table 5, Panel A, for the estimation sample. The cutoff probabilities presented are those that minimize the expected costs of misclassification. Following Beneish (1999), the expected costs of misclassification (ECM) are computed as:

$$ECM = P(FAIL)P_I C_I + [1 - P(FAIL)]P_{II} C_{II},$$

where P(FAIL) is the prior probability of failure, P_I and P_{II} are the conditional probabilities of type I and type II errors, respectively, and C_I and C_{II} are the costs of type I and type II errors, respectively.

TABLE 5
THE PREDICTIVE ABILITY OF THE FAILURE MODEL INCLUDING THE EXPECTED COSTS OF MISCLASSIFICATION AND THE RELATIVE COSTS OF TYPE I ERROR TO TYPE II ERROR

Panel A: Estimation Sample							
	Ratio of the Cost of Type I to Type II Errors						
	1:1	10:1	20:1	30:1	40:1	60:1	100:1
Cutoff	0.120	0.060	0.040	0.040	0.020	0.020	0.010
Type I Error	0.885	0.718	0.564	0.564	0.231	0.231	0.064
Type II Error	0.004	0.025	0.080	0.080	0.309	0.309	0.550
Overall Error	0.020	0.038	0.089	0.089	0.307	0.307	0.541
ECM Model	0.021	0.165	0.299	0.409	0.483	0.573	0.665
ECM Naïve	0.020	0.195	0.390	0.585	0.780	0.981	0.981
Relative Costs	1.065	0.844	0.766	0.699	0.619	0.584	0.678
Overall Correct	0.980	0.962	0.911	0.911	0.693	0.693	0.459
Panel B: Holdout Sample							
	Ratio of the Cost of Type I to Type II Errors						
	1:1	10:1	20:1	30:1	40:1	60:1	100:1
Cutoff	0.120	0.060	0.040	0.040	0.020	0.020	0.010
Type I Error	0.885	0.705	0.551	0.551	0.231	0.231	0.064
Type II Error	0.005	0.028	0.089	0.089	0.316	0.316	0.554
Overall Error	0.021	0.040	0.097	0.097	0.314	0.314	0.545
ECM Model	0.022	0.165	0.302	0.409	0.490	0.580	0.668
ECM Naïve	0.020	0.195	0.390	0.585	0.780	0.981	0.981
Relative Costs	1.149	0.844	0.774	0.700	0.628	0.591	0.681
Overall Correct	0.979	0.960	0.903	0.903	0.686	0.686	0.455

NOTE: The cutoff is the probability of failure that minimizes the expected cost of misclassification, ECM. ECM is computed as $P(FAIL)P_I C_I + [1 - P(FAIL)]P_{II} C_{II}$, where P(FAIL) is the prior probability of failure (0.02), P_I and P_{II} are the conditional probabilities of Type I and Type II errors, respectively. C_I and C_{II} are the costs of Type I and type II errors, respectively. The relative costs are the ECM Model divided by the ECM Naïve.

The validity of the model is tested on the holdout sample using the same cutoff probabilities from the estimation sample. Table 5, Panel B, includes the results for the holdout sample. The results indicate that the model can identify failed banks with 46% (at a cost ratio of 100:1) to 98% (at a cost ratio of 1:1) of the banks in the estimation sample correctly classified.

Although the overall classification results are strong at the lower cost ratios, the type I error rates are very high. A more balanced result is obtained at the middle cost ratios of 40:1 and 60:1. Similar results are obtained using the holdout sample.

To test the usefulness of the model, we compare these results to a naïve strategy. This strategy classifies all banks as failed (not failed) when the ratio of relative costs is greater than (less than or equal to) the prior probability of failure. This switch in strategy between classifying all organizations as not failed to classifying all of them as failed occurs at relative cost ratios of 50:1 [i.e., 1/P(Fail) or 1 / 0.02]. If all banks are classified as failed (not failed), then the naïve strategy makes no type I (type II) errors. In this case, P_I (P_{II}) is zero, and P_{II} (P_I) is one. The expected cost of misclassification for the naïve strategy of classifying all banks as not failed (failed) reduces to $0.98C_{II}$ ($0.02C_I$), since the prior probability of failure is 0.02.

We also report the relative costs or the ratio of the ECM for our model to the ECM for the naïve strategy in both panels of Table 5. Relative costs below 1.0 indicate a cost-effective model. For both the estimation and holdout samples, our model has a much lower ECM than the naïve strategy, except for the 1:1 cost ratio. In fact, the relative costs are below 84% for all levels of type I to type II errors except 1:1. These results provide evidence to suggest that our failure model is extremely cost-effective in relation to a naïve strategy for almost all the ranges of the costs of type I and type II errors.

Applying the prediction model

We use one of the banks from the sample to illustrate the model. The model allows one to predict the status of the bank as failed or not failed. From the results of the logistic regression, the probability of the failure for bank *i* at time *t*, *P(i,t)* is:

$$P(i,t) = \frac{1}{1+e^{-zi}} \qquad (1)$$

where

$$Z_i = -3.416 - 34.217\,\overset{-}{CAP} + 3.940\,\overset{+}{QUAL} - 21.560\,\overset{-}{MGT} - 34.143\,\overset{-}{EARN} - 0.021\,\overset{-}{LIQ} + 19.801\,\overset{+}{RISK}$$

Substituting the actual variables from the example entity (in parentheses), we obtain:

$$Z_i = -3.416 - 34.217(0.052) + 3.940(0.118) - 21.560(0) - 34.143(0.009) - 0.021(0.861) + 19.801(0.001)$$

Z_i = -5.036

Substituting the value into equation (1) obtains:

$P = 1 / (1+e^{-5.036})$

$P = 0.006$.

Table 5, Panel A, shows that the selected bank is predicted not to be failed, since the actual probability of failure at the end of 2007 (0.006) is less than the cutoff at all levels of the ratio of type I to type II errors. The entity's actual status is not failed as of the end of 2009. Thus, the model correctly predicted the financial status of this bank.

CONCLUSION

The collapse of the housing and equity markets and the ensuing recession has led to the largest number of bank failures since the Saving and Loan crisis of the late 1980s and early 1990s. The recent failures arise from a unique economic period compared with the previous failures. The purpose of this analysis is to examine the financial condition of banks during this recent financial crisis and determine whether there are key financial indicators that could signal potential failure. Our model uses logistic regression to weight the six financial indicators into a composite measure of failure from recent bank failures. In addition, the study incorporates various costs of misclassifying banks as failed or not.

The regression model results in a prediction of the likelihood of failure, which correctly classified up to 98% of the sample as failed or not. The model also allowed for an analysis of the impact of a change in a financial indicator on the likelihood of failure. As predicted, statistically speaking, failed banks have less tier one capital (as a percent of total assets), less net income (as a percent of total assets), and less cash and securities (as a percent of total deposits) than banks that did not fail. Also as expected, failed banks have more loans and leases (as a percent of total assets) and a higher allowance for loan losses (as a percent of total loans) than their counterparts that did not fail. However, we did not expect that failed banks have fewer insider loans (as a percent of total loans).

We also report the relative costs or the ratio of the ECM for our model to the ECM for a naïve strategy. For both the estimation and holdout samples, our model has a much lower ECM than the naïve strategy, except for the 1:1 cost ratio. In fact, the relative costs are below 84% for all levels of type I to type II errors except 1:1. These results provide evidence to suggest that our failure model is extremely cost-effective in relation to a naïve strategy for almost all the ranges of the costs of type I and type II errors.

REFERENCES

Beneish, M.D., 1999. The Detection of Earnings Manipulation. *Financial Analysis Journal*. Sep/Oct; 55, 5.

Bureau of Economic Analysis. Gross Domestic Product. www.bea.gov [Accessed January 31, 2010].

Carlson, M. Alternatives for Depressed Banks during the Great Depression. *Journal of Money*, Credit and Banking 42:2 and 3, 421-441.

Cole, R.A., Gunther J.W., 1998. Predicting Bank Failures: A Comparison of On- and Off-Site Monitoring Systems. *Journal of Financial Services Research* 13:2, 103-117.

Curry, T.J., Elmer P.J., Fissel G.S., 2007. Equity Market Data, Bank Failures and Market Efficiency. *Journal of Economics and Business*. New York: Nov/Dec. Vol. 59, Iss. 6. p. 538.

Demirguc-Kunt, A., 1989. Deposit-Institution Failures: A Review of Empirical Literature. *Economic Review - Federal Reserve Bank of Cleveland*, Fourth Quarter: 25, 4; 2-19.

FDIC. Bank Examinations. www.fdic.gov/regulations/examinations/index.html [Accessed February 18, 2010].

FDIC. Bank Failures in Brief. www.fdic.gov/bank/historical/bank/index.html [Accessed January 31, 2010].

FDIC. *Quarterly Banking Profile*. Fourth Quarter 2008. Vol. 3, No. 1.

Gajewski, G., 1988. *Bank Risk, Regulatory Behavior, and Bank Closure in the Mid-1980s: A Two-Step Logit Model.* Unpublished Dissertation, George Washington University.

Gunsel, N., 2007. Financial Ratios and the Probabilistic Prediction of Bank Failure in North Cyprus. *European Journal of Scientific Research.* Sep, Vol. 18, Issue 2, 191-200.

Hirtle, B., Lopez, J., 1999. Supervisory Information and the Frequency of Bank Examinations. *Federal Reserve Bank of New York. Economic Policy Review*. 5, 1, 1-20.

Jagtiani, J., Kolari, J., Lemieux, C., Shin H., 2003. Early Warning Models for Bank Supervision: Simpler Could be Better. *Economic Perspectives*. 3rd Quarter, Vol. 27, Issue 3, 49-61.

Jesswein, K. 2009. An Examination of the Texas Ratio as a Bank Failure Model. *Academy of Banking Studies Journal*. 8, 2, 63-73.

Jones, F., 1987. Current Techniques in Bankruptcy Prediction. *Journal of Accounting Literature*. 6, 131-164.

Karsa, K., Spiegel M., 2008. The Role of Relative Performance in Bank Closure Decisions. *Economic Review*. 17-29.

Kolari, J., Glennon, D., Shin H., Caputo, M., 2002. Predicting Large Commercial Bank Failures. *Journal of Economics and Business*. Jul/Aug. Vol. 54, Iss. 4, 361.

Kumar, S., Arora, S., 1995. A Model for Risk Classification of Banks. *Managerial and Decision Economics*. Mar/Apr . 16, 2.

Maddala, G., 1991. A Perspective on the Use of Limited-Dependent and Qualitative Variables Models in Accounting Research. *Accounting Review* (October): 788-807.

Ozkan-Gunay, Nur, E., Ozkan, M., 2007. Prediction of Bank Failures in Emerging Markets: A ANN Approach. *Journal of Risk Finance*. London:. Vol.,8, Iss. 5; 46

Pantalone, C., Platt C., Marjorie, B., 1987. Predicting Failure of Savings & Loan Associations. *AREUEA Journal*. Summer; 15, 2; 46-65.

Salchenberger, L., Cinar, M., Mine, E., Lash, N., 1992. A. Neural Networks: A New Tool for Predicting Thrift Failures. *Decision Sciences*. Jul/Aug; 23, 4; 899-917.

Swicegood, P., Clark J., 2001. Off-Site Monitoring Systems for Predicting Bank Underperformance: A Comparison of Neural Networks, Discriminant Analysis, and Professional Human Judgment. *International Journal of Intelligent Systems in Accounting, Finance and Management.* Sep; 10, 3; 169-187.

Thomson, J., 1991. Predicting Bank Failures in the 1980s. *Economic Review - Federal Reserve Bank of Cleveland.* First Quarter; 27, 1; 9-20.

THE EVOLUTION OF COMMERCIAL BANKING IN ESTONIA

V. Sivarama Krishnan, University of Central Oklahoma
Enn Listra, Tallinn University of Technology
Shekar Shetty, Gulf University for Science & Technology, Kuwait

ABSTRACT

The paper describes the remarkable story of the evolution of commercial banking in Estonia. Estonia emerged from the shackles of Soviet rule in 1991. Commercial banking in the country started a few years before that and the early period was one of turbulence and financial crises. Despite this the banking industry evolved and emerged as a healthy and highly successful industry, providing a range of consumer and commercial banking services on par with the best in the industrialized world. While the overall market size is small, the banks have modernized to a level seen in few countries and offer totally paperless banking. Among the reasons for the healthy evolution of the banks is the unique regulatory approach pursued by the central bank, Bank of Estonia. While the approach included some early hand-holding, it was also a sound free market approach where errant banks with unsound policies and poor balance sheets were allowed to fail.

INTRODUCTION

Estonia regained its independence and emerged from the shackles of the Soviet rule in 1991. Estonia was an independent country from 1918 to 1941 and was under Soviet rule from 1941 to 1991. The smallest of the former Soviet Union Republics, it developed into a thriving free market economy in the remarkably short time since then. An important part of this economic revolution is the story of the evolution of the Estonian commercial banking industry that has developed into one of the most modern and competitive in the region. The first commercial bank in Estonia was actually licensed in 1988 and the early period was one of turbulence and financial crises. Despite this, the banking industry evolved and emerged as healthy, highly competitive institutions providing a range of consumer and commercial banking services on par with the best in the industrialized world. While the overall market size is small, the banks have modernized to a level seen in few countries and offer totally paperless banking.

The primary factor behind this healthy evolution of the banks was the unique regulatory approach pursued by the central bank, Bank of Estonia (BOE), which served as the main regulatory authority during the first decade of the newly independent Estonia. The early years saw easy entry with very low share capital requirements and very limited regulations. The approach included some missteps, hand-holding, and over time a sound free market approach where errant banks with unsound policies and balance sheets were allowed to fail. BOE was able to assert its leadership after the currency reform and reintroduction of the kroon backed by a currency board arrangement. BOE appeared to quickly find its regulatory bearings and was able to guide the Estonian banking industry to develop into a healthy and efficient one. This paper provides a historic and critical overview of the industry's evolution and attempts to draw key lessons from the Estonian experience. The paper is organized as follows. The first section gives a summary history of the Estonian banking industry. The following section describes the regulatory and legal framework of the period. The next section summarizes the current structure and features of the Estonian banking industry. The last section attempts to draw key lessons offered by the Estonian experience and offers concluding comments.

A SUMMARY HISTORY OF ESTONIAN BANKING

Zirnask (2002) provides a very colorful and insightful view of the history of commercial banking in Estonia. Vensel (2001) chronicles the developments in the industry with a more critical and academic view and reviews the performance of the industry players using financial ratio analysis. Sorg (2003) and Sorg and Tuusis (2008) describe the reform and reconstruction of banking system in Estonia that brought down the number of commercial banks from more than 50 when the country became independent from USSR in 1991 to mere 7 in 2000. Probably by a lucky coincidence or perhaps because of its small size and distance from Moscow, Estonia happened to be in the forefront of the early and hesitant attempts at economic reform in the Soviet Union. These reforms began in 1987 with decontrol of many state enterprises as well as permission given to run co-operatives in some sectors of the economy. The banking system was reorganized with the creation of five specialized sector banks separate from the Soviet central bank (Gosbank). This was the beginning of the two-tier banking system – a central bank to manage the monetary policy aspects and commercial banks to handle business and individual credits and deposits. The very first licenses for independent commercial banks were issued in September, 1988 and some Estonians proudly cite that the first commercial bank to be licensed in the Soviet Union was an Estonian Bank – Tartu Commercial Bank (TCB). This sure was coincidence. The same day another bank was licensed in Latvia and the license number for TCB happened to be 1 and for the Latvian bank it was 2. Before the end of the year more than 10 different banks were licensed in the different republics of the Union. The shareholders of TCB were Estonian public sector enterprises. TCB had a difficult time at first attracting customers, as the specialized state-owned banks were reluctant to let go of their customers (Jumpponnen et al, 2004)).

In December 1989, the Estonian Republic passed the Estonian Banking Act and re-established the Bank of Estonia (BOE). These were rather symbolic acts as Estonia still remained a part of the Soviet Union and used the ruble as its currency. During 1990, BOE assumed control or ownership of the Estonian branches and divisions of the specialized public sector banks. These banks remained key players in the banking industry for several years and were at the center of the financial crisis later. In retrospect it could be viewed that these early acts gave the Estonian banking industry a head start and prepared them for ensuing economic and political freedom of Estonia, which came on August 20, 1991. This was soon followed by BOE establishing its independence from the Soviet central bank.

The early years of economic reforms saw the Estonian economy experience both very high inflation and a steep fall in GDP. Annual inflation ranged from 17 percent in 1989 to 954 percent in 1992. The cumulative decline in GDP between 1989 and 1992 was over 30 percent. The high inflation made it very easy for potential bankers to meet the share capital requirements of 5 million rubles (equivalent to 0.5 million kroons when the kroon was reintroduced) needed to get a banking license. Entry barriers were practically non-existent and there was a boom in new banking licenses issued. The number of banks nearly doubled during 1992 though many of these banks were very small and had very few shareholders (Jumpponnen, et al, 2004)). The high inflation and reallocation of public assets gave venturesome businessmen and banks willing to finance them opportunities for some very easy profits. Currency exchange was also an extremely profitable business. The economy was transitioning between completely controlled or administered prices and free-market prices for a number of essential commodities and industrial raw materials. It was fairly easy to arbitrage between the administered prices and the market prices, if one knew the right persons like the people running the state-run enterprises that produced the commodities and products that they were required to sell for controlled prices. Under these circumstances, banks found it fairly easy to make money through very short-term loans financing these transactions without having to engage in serious banking and lending operations. Zirnask (2002, p.46) provides examples. Many banks did not realize that these conditions were to change very drastically soon.

The foundation for lasting economic reforms for the new nation was laid in June 1992 with the re-launching of the Estonian kroon. The kroon was the currency of Estonia between 1918 and 1941. This could be considered the beginning of the economic and financial sector reforms for the country. The currency was launched at a fixed-exchange rate of 8 kroons to 1 German Mark and was backed by a currency board arrangement. Even though inflation continued at a high rate for the first couple of years after the launch of national currency, BOE's willingness to stick to the fixed exchange rate and the currency board arrangement boosted the credibility of BOE and the kroon. Currency exchange market became less profitable and banks, which did not develop skills of credit management, found themselves victims of the changed market. A number of these banks failed and the BOE let them. There was no deposit insurance and many depositors paid a heavy price.

The period 1992 to 1994 were watershed years - some cite these as the crisis years- for Estonian banking industry as the industry faced a wrenching shakeout. In October 1992, BOE made the first of its many moves to strengthen the banking industry by raising the equity capital requirement from 0.5 million kroons to 6 million kroons. A month later BOE declared moratorium on three leading banks, which had a combined market share of over 50 percent of banking assets, and were facing serious liquidity and asset quality problems. The moratorium involved suspension of all banking activities and take-over of effective control by a BOE appointed administrator. One of the three banks was TCB, perhaps the best known bank at that time. BOE ultimately forced the liquidation of TCB and merger of the other two banks. Another five banks lost their licenses in early 1993 and eleven other banks were combined to form a new bank (Estonian Union Bank). The number of banks came down from 41 at the beginning of 1992 to 24 in early 1993. The first banking crisis of Estonia would soon be over and the economy was about to take a turn for the better.

The Estonian parliament passed the Bank of Estonia Act in May 1993. The BOE now had more formal powers and had clearly emerged as a credible central bank. BOE, as part of its new banking policy, announced that no new bank will be licensed for at least a year. Actually, no new license was issued till 1999 and probably no one felt the need for it. BOE also decided to raise the share capital requirements to 15 million kroons by April 1, 1995 and further to 25 million kroons by April 1, 1996, and to 35 million kroons by April 1, 1997. BOE was sending a clear signal that it would encourage larger size (Zirnask, 2002, p 96). Estonia had removed all restrictions on capital flows in 1994. The year 1994 also saw the first public share offering by an Estonian company and this happened to be Hansa Bank (now known as Swedbank), which later became the most profitable and largest Estonian bank. The bank also expanded successfully into neighboring Latvia and Lithuania. There were some serious problems with two major banks during the period between 1994 and 1996 involving the largest bank at the time (Sotsiaalpank) and the third largest bank (Pohja-Eesti Pank (PEP)). Government deposits were about 60 percent of the assets of Sotsiaalpank and when the government decided to withdraw this business from the bank, the bank faced a crisis of loss of customer confidence. The bank's deposits came down sharply (by more than 70 percent). The bank could not survive this disruption. PEP, which was a successor to a Soviet-era bank and under the effective ownership of BOE, got a $10 million dollar loan to that was used to fund a scam perpetrated by some criminal operators. Zirnask (2002) provides detailed account of these unfortunate episodes of early Estonian banking history. The period, in general turned out to be one during which the Estonian economy and the banking industry stabilized (See Table 1 and Cavalcanti & Oks, 1998). The Credit Institutions Act was in place and formed a better basis for banking regulations (Zirnask, 2002, p.121-2). Inflation, while still high, was declining and was 23 percent in 1996. The period saw large increases in bank deposits as well as increased commercial bank lending to private sector (Cavalcanti & Oks, 1998).

Table 1: The Economy and Banking				
Year	GDP growth rate (%)	Inflation rate %)	Number of Banks	Assets (billion EEK)
1992	-15.0	954	41	5.2
1993	-6.0	89.8	22	6.4
1994	-2.0	47.7	24	10.4
1995	4.3	29.0	18	15.5
1996	3.9	23.1	13	22.9
1997	10.6	11.2	11	40.6
1998	4.7	8.2	6	41.0
1999	-1.1	3.3	7	47.1
2000	6.4	4.0	7	57.8
2001	7.1	5.6	7	68.4
2002	7.5	3.6	7	81.7
2003	9.2	1.4	7	98.6
2004	10.4	3.0	9	133.6
2005	6.3	4.1	12	185.1
2006	-3.6	4.4	12	239.5
2007	-10.3	6.7	13	320.6
2008	-0.8	10.6	15	N/A
Source: Zirnask (2002) and Bank of Estonia (2008)				

Cottarelli et al. (2003) identify Estonia as one of the "early birds" among the transition economies of Central and Eastern Europe, which showed a very healthy increase in commercial banking credit to private sector. By the mid 1990s, the Estonian banking industry had clearly established itself as one of the healthiest ones among the transition economies of central Europe (Cottarelli, 2003; Cavalcanti & Oks, 1998). The period also saw further consolidation in the industry, which continued till 1998 (see Table 1). The industry consolidation was driven by both the existing market conditions as well as BOE's push to raise capital requirements (Sorg & Tuusis, 2008). BOE raised equity capital requirements to 50 million Estonian Kroons (EEK) by January 1996, 60 million EEK by January 1997, and 75 million EEK by 1998. The period also saw increasing foreign investment in the industry.

The Estonian stock market represented by the Tallinn stock exchange started trading in the summer of 1996. After a quiet start, the market took off to a boom in 1997. The number of issues traded increased from 11 (including six bond issues) to 41 (including nine bond issues and 3 investment funds) by the end of 1997. The Tallinn stock index rose by a whopping 380 percent in the first 8 months of 1997. Shares of several banks rose three or four fold. The boom, or bubble as it was characterized later, was partly fueled by a number of positive factors. The economy grew by over 10 percent in 1997 and foreign capital was flooding in. The crowning glory for Estonia was that the European Commission included it, ahead of its larger neighbors, in the list of countries invited to start negotiations to join the European Union. The stock market peaked in August 1997 and then started a sharp downward spiral and by March of 1998 the market had lost most of the gains. The bursting of the bubble had serious consequences on several banks that were direct or indirect participants in the stock market boom. Sorg and Tuusis (2008) call this period as characterized by naïve optimism. Banks with poor risk management paid a high price. The crisis caused bankruptcy of three small banks and investment by foreign banks in the largest of the Estonian Banks. Again, BOE stepped in and acted quickly and the banks in financial distress were forced to merge with healthier banks. BOE had reacted proactively to the stock market boom as well as the budding Asian crisis of 1997 with more stringent capital adequacy requirements as well as tighter approach to computing the reserve requirements.

Overall and in retrospect, Estonian banking industry weathered the bursting of the bubble in 1998 and the Russian crisis, which followed, reasonably well (See Sorg & Tuusis, 2008). The Russian crisis claimed a few banks as its victims, but its impact on the economy and the banking industry was limited. The industry was more or less fully consolidated by the end of 1998 and there were six banks standing. It was a remarkable journey that in about 7 years the number of banks had fallen from 41 to 7 by a fairly rapid process involving a combination of attrition, forced closures and mergers. Another change in the industry was that two Swedish banks ended up as majority owners of the two largest banks of Estonia. This was followed by a Finnish acquisition of the third largest bank in 2000 resulting in foreign ownership level of over 87 percent. Today the foreign ownership is over 90 percent (Sorg & Tuusis, 2008).

REGULATORY REGIME

Estonian banking industry's development took place over a remarkably short period of less than 15 years. During most of this period, BOE was essentially the sole regulatory authority. BOE often followed its "seat of the pants" instinct as the country had very limited formal laws and little legal tradition relating to commercial banking. It could be said that the laws were evolving slower than the pace of the industry. The early banking could easily be described as free banking in the best sense of the phrase, where BOE was content to let the market forces determine the winners and losers. While BOE was sometimes criticized as arbitrary for its actions, at no time, BOE allowed the TBTF (too-big-to-fail) syndrome affect its decisions. BOE used minimum capital requirements and prudent ratios to force the banks to conform to its standards. BOE has systematically increased capital requirements and capital adequacy ratios over time. BOE also required banks to satisfy a number of ratios to minimum standards. These ratios include:

- Equity to liabilities - 10 percent,
- Liquid assets, defined as net assets redeemable in 30 days or less, to demand deposits – 35 percent,
- Size of loans granted to one borrower – equal to or less than bank's equity, and

- otal of big loans, defined as loans of more than 10 percent of bank's equity – not to exceed 800 percent of bank's equity.

BOE also regulated a bank's relationship with its subsidiaries and loans to the management, shareholders and employees. Table 2 gives an overview of the regulatory framework, which developed over time and governed the Estonian banking industry's evolution during the last two decades.

Table 2: Regulatory Framework

Laws/Key regulations	Action Initiated in Year	Key Elements	Comments
Banking Act	1991	Licensing of banks Liquidation of credit institutions	Included provisions relating to BOE
Currency law of the Republic of Estonia	1992	Currency board system	
Law of the Republic of Estonia on the security for Estonian kroon	1992	Backing the kroon under currency board	
Bank of Estonia Act	1993	Additional powers for BOE to liquidate banks and remove management	Revision and separate act
Capital adequacy ratio	1993	Set at 8 percent in 1993; increased to 10 percent in 1996 in response to Asian crisis and stock market boom	
Maximum exposure to a single borrower	1993	Set at 50 percent of net own funds, lowered to 25 percent in1994	
Credit Institutions Act	1995	More powers for BOE	Replaced Banking Act
Deposit Guarantee Fund Act	1998	Deposits guaranteed up to 20,000 kroons; covers 90 percent of the deposit. The maximum coverage increases to 313,000 by 2010.	
Money Laundering and Terrorist Financing Prevention Act	1999	Regulations in line with those of European Union	
Savings and Loan Associations Act	1999	Act determines the legal status, the bases of the activities and the procedure for foundation and dissolution of savings and loan associations	
Financial Supervision Authority Act	2001	Separate agency within BOE with its own budget and with regulatory powers over all financial institutions	Reform of financial supervision in Estonia
Securities Market Act	2001	Act regulates the public offer of securities, the activities of investment firms, the provision of investment services, the operations of securities markets as well as the exercising of supervision	

ESTONIAN BANKING TODAY

Table 3 gives the details of banks, which operate in Estonia today. The Estonian banks operate as universal banking institutions and offer a range of services offered to the consumer include, besides the usual choice of checking and savings accounts, accounts in different foreign currencies, online and inter-bank payment options. The commercial banking services include, besides loans, checking accounts, and payment services, a range of leasing and factoring services. The banks or their subsidiaries also offer a full array of insurance and investment services.

T hese figures are as of the end of 2008. Besides the above banks, eleven foreign credit institutions have branches in Estonia. The market share indicated above is for the total financial sector including leasing and factoring services. The total assets of banks as of the end of 2008 are estimated at about 320 billion kroons (approximately $30 billion). It is interesting to note that external or foreign borrowing, as reported in the annual report of BOE, ranged from 65 to 75 percent of the liabilities for the 4 largest banks. The total foreign ownership of the banking industry is about 90 percent. This was 55 percent in 1998. Despite the market share picture, the competition has intensified in recent years and smaller banks have gained market share at the cost of leaders, as reported in the Financial Stability Review (2009). The Review also highlights the fact that the industry is very competitive as reflected by tight net interest and profit margins. The commercial banks listed above account most of the leasing operations, investment funds market, and pension funds. While the dominance of the commercial banks in financial sector and the high concentration of market share might be a cause for concern, it is not unusual in small markets.

Table 3: Estonian Banking Industry Today

Bank	Market share – %	Majority Ownership
Swedbank AS	48	Swedbank (Sweden)
SEB Pank	25	SEB (Sweden)
Nordea Bank	7	Finland
Danske Bank	15	Denmark
Estonian Credit Bank	3	Latvian
Tallinn Business Bank	1	
Bigbank	< 1	Estonian
LHV Pank	< 1	Estonian
Marfin Pank Estonia	<1	Cyprus, Greece
Source: Bank of Estonia Report (2008)		

A number of recent research papers attempt to evaluate the operating performance (Vensel, 2001), range of services as well quality of services (Lutsoja & Lutsoja, 2004; Aarma & Vensel, 2001; and Listra, 2001). For an industry, which was only about 15 years old, the performance is really creditable. Sorg and Tuusis (2008) cite a European Central Bank study that showed several performance measures – net cost to income, return on assets, and net interest margin – for the Estonian banks are as good or better compared to Euro area banks. Jumpponnen et al. (2004) and Sorg and Uiboupin (2001) evaluate the motivation and rationale of internationalization of banking in Estonia as well as Estonian banks' attempts at overseas expansion. The primary rationale appeared to be driven by pursuit of following the customer into foreign markets. Estonian banks did well in both Latvia and Lithuania. Among the most remarkable features of Estonian banking today is the use of technology, Internet and E-banking to the point over 95 percent of the total volume of payment transactions are carried out through electronic banking (Lustisik, 2003). Estonian banking had the advantage of avoiding paper-oriented banking using checks, drafts and other instruments and encouraged customers to use electronic banking for all transactions. The high level of e-banking usage has enabled the Estonian banks to extremely productive. Forrester Research in 2000 ranked Hansa Bank's Internet banking as one of the best in Europe (Lustisik, 2003). According to the Financial Stability Review of BOE (2009 and 2010), the relative strength of Estonian banking industry has helped them withstand the financial crisis of 2007-2009 relatively well, even though the industry has suffered heavy losses. There was no need for government bail-outs. While the assets of the banking industry have fallen sharply and profitability has been affected, the four leading banks have maintained their investment grade bond ratings.

SUMMARY AND CONCLUSION

The paper chronicles the remarkable story of the evolution of banking industry in Estonia, the smallest of the former Soviet Union countries. Through a combination of market-oriented policies, currency reforms and vigilant, but not excessive banking regulations the Estonian central bank facilitated the emergence of a very healthy and competitive banking industry. This successful and very rapid evolution of Estonian banking industry has received general acclaim (Cottarelli et al, 2003; Schipke et al, 2004). The key questions relate to the lessons to be learned for banking industry outside Estonia. Can the success factors be replicated in other countries and other banking industries?

It should be noted that some factors that played a significant part in the industry's evolution may be unique to Estonia. Estonia is a very small country with a compact geography. The early political leadership wanted to break away from the shackles of socialism as fast as possible. BOE did a very good job of managing the currency reforms as well as the several crises that the country had to face. The hands-off approach to licensing and control of the emerging phases of the industry with neither deposit insurance nor any implied TBTF policy definitely introduced a "free-banking" atmosphere. This made the errant banks with poor credit management and high risk policies pay the price for their inadequacies and weaknesses. The fact that foreign entry was permitted from very early days, even though major foreign presence did not materialize till much later, made the market "contestable" and extremely competitive. Either by design or by chance, deposit insurance was introduced only in 1998, when the industry has stabilized and consolidated to a handful of strong players. This reduced the incidence of moral hazard in the early years. The deposit insurance still covers only 90 percent of the deposit, thus providing enough incentives for the depositor to be vigilant.

Consistent market-oriented policies from the very beginning enabled the stronger and better managed banks to survive and succeed. Sound credit management, investment in modern and productive technology, and innovative product and services were the hallmarks of the successful banks. These are worthy lessons for bankers, banking regulators, and the political leadership, which craft the legal framework for regulations.

REFERENCES

Aarma, A. & V. Vensel (2001). Banks' Retail Customer Satisfaction and Development of Bank Customer Relationships. Published in the *Estonia on the Threshold of the European Union: Financial Sector and Enterprise Restructuring in the Changing Economic Environment;* Collection of Papers; Ed. V. Vensel and C. Wihloborg.

Bank of Estonia (2008) – Report on Estonian and Non-Financial Sector, from http://www.eestipank.info/frontpage/en/

Cavalcanti, C. & D. Oks (1998). Estonia: The Challenge of Financial Integration, *The World Bank Policy Research working paper*.

Cottarelli, C., G. Della'Ariccia & I. Vladkova-Hollar. (2003). Early Birds, Late Risers, and Sleeping Beauties: Bank Credit Growth to the Private Sector in Central and Eastern Europe and the Balkans, International Monetary Fund Working Paper.

Jumpponnen, J., K. Liuhto, M. Sorg & V. Vensel (2004). Banks' Internationalization: Estonian and Russian Banks' Expansion to Foreign Markets. Working Papers in Economics, Tallinn Technical University-TUTWPE No.04/109.

Listra, E. (2001). Development of Financial Sector and Banking Services, Published in the *Estonia on the Threshold of the European Union: Financial Sector and Enterprise Restructuring in the Changing Economic Environment;* Collection of Papers; Ed. V. Vensel and C. Wihloborg.

Lustsik, O. (2003). E-banking in Estonia: Reasons and Benefits of Rapid Growth, Kroons *and Economy*3/2003.

Lutsoja, K. & M. Lutsoja (2004). The Main Changes in Financial Behavior of Firms in Transition: An Estonian Case." Working Papers in Economics, Tallinn Technical University-TUTWPE No.04/1113.

Schipke, A., C. Beddies, S. M. George & N. Sheridan (2004). Capital Markets and Financial Intermediation in the Baltics. International Monetary Fund Occasional Paper 228.

Sorg, M & J. Uiboupin (2001). Internationalization and the Entry of Foreign Banks into Estonian Market, Published in the *Estonia on the Threshold of the European Union: Financial Sector and Enterprise Restructuring in the Changing Economic Environment;* Collection of Papers; Ed. V. Vensel and C. Wihlborg.

Sorg, M. (2003). Reformation of the Estonian Banking System. Discussion Paper, University of Greifswald, Germany.

Sorg, M. & D. Tuusis (2008). Foreign Banks Increase the Social Orientation of Estonian Financial Sector, Discussion Paper, University of Greifswald, Germany.

Vensel, V. (2001). Estonian Banking System Performance, 1994-2000. Published in the *Estonia on the Threshold of the European Union: Financial Sector and Enterprise Restructuring in the Changing Economic Environment;* Collection of Papers; Ed. V. Vensel and C. Wihlborg.

Uiboupin, J. & V. Vensel (2001). Motives and Impact of Foreign Banks Entry into Estonia. Published in the *Estonia on the Threshold of the European Union: Financial Sector and Enterprise Restructuring in the Changing Economic Environment;* Collection of Papers; Ed. V. Vensel and C. Wihlborg.

Zirnask, V. (2002). *15 years of New Estonian Banking*. Published by the Bank of Estonia.

MINIMIZING INFORMATION ASYMMETRY: DOES FIRM'S CHARACTERISTICS MATTER?

William H. Brent, Howard University
Charles K. Addo, Catholic University College of Ghana

ABSTRACT

Lending exposure constitutes the most material risk concentrations within banks, and information asymmetry in lender-borrower relationship can adversely affect the quality of credit decisions. This paper is a systematic literature review on information asymmetry in light of two perspectives: (1) A large firm is more efficient at minimizing information asymmetry and (2) A small firm is more efficient at minimizing information asymmetry. The purpose of this systematic literature review is to evaluate the relative merit of those two perspectives. Based upon our review, we deduce that a large firm is more efficient at minimizing information asymmetry. This review contributes to academic literature on firm size and correlation with information asymmetry in light of the two perspectives. This review will also help lenders to improve on their lending policies.

Key words: Credit rationing, information asymmetry, financial reporting, small business

INTRODUCTION

Lending exposure constitutes the most material risk concentrations within banks, and granting of credit is a very important decision linking durable goods consumption spending and investment. It enables investors to generate profit-oriented economic activities that directly impact on the level of employment within an economy. Information asymmetry (i.e., information imperfection) in lender-borrower relationship can adversely affect the quality of credit decisions, and may result in high incidence of loan defaults.

This paper is a systematic literature review on information asymmetry in light of two perspectives: (1) A large firm is more efficient at minimizing information asymmetry and (2) A small firm is more efficient at minimizing information asymmetry. In particular, we are interested in the extent to which the size of a firm impacts information imperfection. We define "large firm" as publicly-traded equity firm with publicly available US Securities and Exchange Commission (SEC) filings; and "small firm" as small, private, unrated, growing, entrepreneurial corporations or Small Business Enterprises (SBEs).

The classification of an enterprise as a small business is not uniform across all countries. In the current review, we shall employ the US definition of a small business, which is a business that is “independently owned and operated and which is not *dominant* [italics added] in its field of operation” (Volpe & Schenck, 2008, p. 19). This definition may closely approximate that of other jurisdictions, given that the very name of “small business” must necessitate the absence of dominance and monopolies, where “only one firm, which is *large* [emphasis added] in size” (Duffy, 1993, p. 119) provides all of the market’s supply. The US Congress developed a quantitative standard for classifying an SBE that is based on the number of employees of the enterprise and the average annual income generated by the firm. Table 1 provides an example of the numerical standards used by the US to classify an SBE within certain industries:

Table 1: US Numerical Standards for Small Business Designation	
Industry Group	Number of employees/Annual income (US $)
Manufacturing	500 employees
Agriculture	$750,000
Retail Trade	$6.5 million
Business and Personal Services	$6.5 million
Source: US Small Business Administration	

The purpose of this review is to evaluate the relative merit of those two perspectives with regard to minimizing information asymmetry in credit rationing decisions. Our method of review involved a systematic comparison of literature of the different proxy variables used to measure information asymmetry. Those proxy variables include but not limited to access to credit, firm size and information on stock offering, equity market valuation, size of borrower, and the Herfindhal index for measuring market concentrations.

This systematic literature review appears to be strikingly skewed in favor of large firms being more efficient at minimizing information asymmetry. The primary reason may be that stricter regulatory requirements, compliance, and firm-specific benefits compel large firms to make public disclosures of their financial position under the environment of generally accepted accounting principles. The resultant effect is efficiency at minimizing information asymmetry.

This review contributes to academic literature on firm size and correlation with information asymmetry. It is, to our knowledge, the first to document systematic difference between amount of information asymmetry and the size of a firm in light of the two perspectives. This fact is made evidenced by the limited and implicit literature on the subject, particularly with regards to small firms being more efficient at minimizing information asymmetry (perspective 2). This review will help institutional lenders to improve upon their lending policies by minimizing the problem of information asymmetry. But before we begin reviewing the systematic literature on the two perspectives, we briefly discuss information asymmetry and few related concepts.

WHAT IS INFORMATION ASYMMETRY?

The seminal work of Akerloff (1970), suggested that the premise of information asymmetry (i.e., deviation from perfect information) is the concept that at least one party to a contract relationship, such as lender-borrower or buyer-seller, is ignorant of relevant information pertaining to a transaction. This creates the attendant problems of "moral hazard" and "adverse selection." A moral hazard may be a situation where a stakeholder to a contract may have the propensity to exercise less caution in a contract because the responsibility for any adverse effect is also partly borne by the other party or a third party to a contract (Dembe & Boden, 2000). For example, lender, *L*, may extend credit to borrower, *B*, in an amount that may far overwhelm *B's* ability to repay with applicable interest. Given that *L* may have taken insurance policy coverage against default with insurer *I*, which information may not be available to either *B* or *I*. Under such situation, asymmetric information develops, because *L* is passing on the risk of default to *I*, while leaving *B* also with imprecise information as to *B's* own capability to repay the loan relative to income. Thus there is compartmentalization of information that works solely to the advantage of *L*, and which leaves *L* to grow less responsible in the loan decision making.

Adverse selection develops when *B* suffers the negative consequences of that information compartmentalization. This negative consequence may manifest as deluge of loan default situations on the part of *L's* customers. Although, the initial incidence of defaults may be covered by the policy with *I*, the resultant cumulative effects may ricochet on *L* in the form of being left with significant pool of noncredit-worthy customers. Additionally, *I* may also want to scrutinize or challenge, in a court of law, the lending practices of *L* that may have contributed to such unusually high incidences of default, as a way of shirking responsibility for the loan repayments of a large number of defaults.

LITERATURE REVIEW

Perspective 1: A large firm is more efficient at minimizing information asymmetry

Financial reporting and disclosures are very important avenues whereby firms make available their financial performance to outside investors and all stakeholders, including lenders (Healy & Palepu, 2001). Shen and Reuer (2005) noted that regulation requirements for large firms to disclose financial information in accordance with generally accepted accounting principles directly minimize information asymmetry for public firms.

Although, regulatory requirements compel large firms to comply with public disclosures of financial information, such requirements can hardly be the sole motivator. There is also the benefit of voluntary disclosures that accrue to a firm doing the disclosures, which probably outweigh regulatory and compliance motivations. Studies (e.g., Amihud & Mendelson, 1986; Diamond & Verrecchia, 1991; Easley & O'ttara, 2004) suggest that more public disclosures reduce information asymmetry, which, in turn, reduces cost of capital (i.e., lower loan rates, better credit availability, etc.) by lenders and attract increased demand of investors due to increased liquidity of its securities.

Public disclosures minimize the risk borne by market makers or investors, and minimizing a large initial information asymmetry will increase the current price of a security as more investors, injected with more positive information about a company will demand more of its security, which will in turn push prices up (Diamond & Verrecchia, 1991). Contrary to the hypothesis that disclosure of information is detrimental to shareholder interests due to adverse risk-sharing effect, Diamond (1985) noted that the reverse is rather the case. Thus, it is reasonable to assume that the absence of such incentives for the small firm or SBEs, are quite likely to make such firms less inclined to reveal much information. Such a scenario does not contribute to minimization of information asymmetry on the part of the small firm. Rather, it contributes to maximization of information asymmetry for the small firm or SBE.

One study (Welker, 1995) observed that a well-regarded public information disclosure policy minimizes information asymmetry that leads to increased liquidity in equity markets. Such well-regarded disclosure is unlikely to be obtained within a small firm to the degree that it can be obtained within a large firm. Rather, a well-regarded financial information disclosure policy is more likely to be obtained within a large firm. This is because the combined effects of regulatory and compliance requirements, augmented by incentives of low cost of capital from lenders under the environment of generally accepted accounting principles raise the level of disclosures to a well-regarded status.

Chiang (2005) observed that a "company that signaled more information to outsiders will eliminate information asymmetry" (p. 12). Since the quality of information transparency through signaling within a large firm must necessarily be of a higher order than within a small firm, a result of the combined effects of regulatory requirements and benefits to the large firm, it is probably safe to draw the inference that large firms would be more efficient at minimizing information asymmetry than small firms.

Stein (2002) argued that small business lending is more dependent on information that can only be verified by the agent that produces such information. The fundamental reason is that the small firm is not under any regulatory compulsion to disclose much information. Additionally, the small firm is not a public equity business that reaps any benefits of voluntary disclosure of information. Thus the small business may choose to disclose much or less information. This characterization is suggestive of the fact that small businesses are less efficient at minimizing information asymmetry.

Given that small businesses are the sole verifiers of their information, there must be a necessary implication that large information asymmetry exist. This is because information is monopolized by the small business in its capacity as the sole verifier that also produces the information, leaving the other party to a contractual lending relationship without any recourse to information verification. The other party consequently is made to suffer from adverse selection effect. This characterization is supportive of perspective 1 (i.e., a large firm is more efficient at minimizing information asymmetry.)

Empirical studies (e.g., Blackwell & Kidwell, 1988; Houston & James, 1996) equate "smaller borrower size as proxy for higher information asymmetry" (as cited in Bharath, Dahiya, Saunders, & Srinivasan, 2004, p. 22). This characterization is suggestive of the fact that small businesses can hardly be efficient at minimizing information asymmetry. Such is the case because the borrowing power of small businesses is likely to be relatively smaller than that of large businesses.

For example, in the US, the small business credit granting process typically involves an evaluation of two sources of repayment: cash flow from business and collateral, including personal credit history of business owners from the credit bureaus (Volpe & Scheck, 2008). Given such unilinear access to borrowed funds, hardly can it be argued convincingly that the borrowing power of the small business would exceed or even equate that of the large business. Furthermore, the large firm can also access public funds through the money and capital markets, which avenue is not available to the small firm. This lifts the larger firm out of the "smaller borrower size" (p. 22) category to which the small business is confined.

> *Volpe and Schenck (2008) further noted that "smaller firms are also likely to be relatively more informationally opaque [i.e., high information asymmetry]" (p. 22), as opposed to information transparency (i.e., low information asymmetry). Petersen and Rajan (1994) also noted that large information asymmetries existed between small firms and "potential public investors," a characterization that may, by implication, be extended to other stakeholders and suggestive that small businesses are not efficient at minimizing information asymmetry. Inchausti (1997), noted among a number of characteristics that firm size does influence the level of public information disclosure, and that small firms are likely to have higher levels of information asymmetry. This observation supports perspective one, that is, a large firm is more efficient at minimizing information asymmetry. Binks and Ennew (1996) observed that restricted access to credit because of high information asymmetry posed a significant constraint on the growth of the small firm. This observation buttresses the fact that the large firm is more efficient at minimizing information asymmetry.*

Dennis and Sharpe (2005) noted among other factors that "information transparency is positively correlated with firm size" p. 32. This implies that the larger a firm, the larger the level of information transparency, and vice versa. Hull and Pinches (1995) observed that firm size effect is consistent with differential information effect and that firm size was positively related to the amount of information available about firms. This characterization suggests that a large firm is more information transparent; whereas, the small firm is information opaque. This implies that the large firm has less information asymmetry because the other party to lending contractual relationship will have more access to the large firm's information, and less access to the small firm's information. This view hews in much closely with perspective 1 (i.e., a large firm is more efficient at minimizing information asymmetry.)

One extensive empirical study (Sufi, 2007) on information asymmetry and firm size draws upon the concept of Herfindahl-Hirschman Index (HHI). The HHI also commonly known as concentration index was originally developed as a measure of the size of firms in relation to the industry and an indicator of the amount of competition among them. HHI is of the general form:

$$HHI = \sum_{i=1}^{N} Si$$

Where,

Si = market share of firm i in the market
N = Number of firms

In its original form and usage, the HHI is the summation of the squared market shares of the firms within an industry and is used largely by antitrust authorities to determine the degree of monopolies that would exist in an industry in mergers and acquisitions (Bryant, 2010). According to the empirical study by Sufi (2007), the HHI determines the partial contribution or coefficient evaluation of regressions relating syndicate structure to information asymmetry of the borrower. This constituted a proxy for information asymmetry. For example, to determine the value of the HHI for four firms in the telecommunications industry (TI) with the following market shares:

Firm 1 having 50% market shares
Firm 2 having 20% market shares
Firm 3 having 20%
Firm 4 having 10% market shares.

The procedure for calculating the HHI for the telecommunications industry is as follows:

(Firm 1 market share)^2 +(Firm 2 market share)^2 + (Firm 3 market share)^2
+(Firm 4 market share)^2 + (Company 5 market share)^2.

We substitute the example variables thus,

$HHI_{(TI)} = (0.50)^2 + (0.20)^2 + (0.20)^2 + (0.10)^2 = 0.34$

In general, an HHI below 0.1 signifies low concentration, while an index above 0.18 signifies high concentration (Bradley, 2010). Thus, in our example, the concentration is way too high, and may not receive the assent of antitrust regulators.

The study by Sufi (2007), of course, was not to determine concentration in industry mergers. Rather, this example draws on the high parallelism in that the study was closely based upon the HHI concept discussed above. The study found a strong relationship between information asymmetry and the size of a firm. That is, small firms have high information asymmetry, and vice versa. Although, presented indirectly in the context of syndicated borrower-lender situations, the study found that the lead syndicate lender tended to have 11% more concentration and hold 10% more of the loan for firms without publicly available SEC filings.

Esty and Megginson's study (2003) on loan syndicate structure conducted in firms stretching across more than 61 countries on project finance, found that concentration imply that the lead syndicate lender assumes more responsibility in terms of due diligence, monitoring, and larger share of the loan. Such responsibility compels it to concentrate more of the loan's contractual agreements into its hands as a "mechanism to prevent strategic default by borrowers" (as cited in Sufi, 2007, p. 635).

In other words, (Sufi, 2007) found that problems of information asymmetry molds syndicate structures by compelling "the lead arranger [lead syndicate] to take a larger stake in the loan and form a more concentrated syndicate" (p. 631). The study noted that firms without publicly available SEC filings tend to have high information asymmetry, requiring intense due diligence process and monitoring. This leads to higher levels of lead syndicate concentration. Such characterizations, expressed in terms of publicly available SEC filings and lack of it requiring more due diligence, stricter monitoring of borrower, and concentrated syndicate closely fits into perspective 1 (i.e., a large firm is more efficient at minimizing information asymmetry) because it has more public disclosure and low information asymmetry. More public disclosure, less monitoring, and low information asymmetry must necessarily conform to the characteristics of the large firm, as opposed to the small firm.

Bradley and Roberts (2003) observed that "smaller firms, firms with higher growth opportunities…are more likely to have *covenants* [italics added]" (as cited in Sufi, 207, p. 635). Mullineaux and Pyles (2004) studied restrictions on loan sales and found "that smaller firms are more likely to have *restrictions* [italics added] on loan sales, which they interpret as evidence of banks fostering relationship" (as cited in Sufi, 2007, p. 635). Why is it likely for smaller firms to have "covenants" and "restrictions?" Because they are suggestive of the fact that the smaller firms have higher information asymmetry that requires stricter oversight: agreements and control measures as safeguard against default. This characterization points to the fact that a small firm is not the most efficient at minimizing information asymmetry. Rather, it supports perspective 1 (i.e., large firms are more efficient at minimizing information asymmetry.)

Several studies have examined the differences in borrower characteristics that affect the availability and terms of credit to small firms (e.g., Berger & Udell, 1995; Brewer, III, 2006; Cole, 1998; Hamilton & Fox, 1998; Peterson & Rajan, 1994). In a study on lending-rate differentials between loans to small and large companies, using data from 15 Swiss regional banks, Dietrich (2010) cited several studies to buttress the fact that disparities of loan rates are primarily a result of a lower informational efficiency (i.e., information inefficiency) at small firms. This observation does not support the view that small firms are more efficient at minimizing information asymmetry. Rather, this empirical citations support perspective 1 (i.e., large firms are more efficient at minimizing information asymmetry).

Ortiz-Molina and Penas (2008) examined *what determines the maturity of lines of credit to small businesses. The study noted the existence of problems with borrower risk and information asymmetry, and that such problems were typical of small business lending. This characterization suggests that small business pose higher risk for lenders because of higher information asymmetry. This buttresses perspective one (1): That large firm is more efficient at minimizing information asymmetry.*

Perspective 2: A small firm is more efficient at minimizing information asymmetry

There appears to be lack of strong empirical evidence to buttress the view that small firms are more efficient at minimizing information asymmetry. One study (Yonghang, 2006) appears to be a notable exception to the general consensus that large firms are more efficient at minimizing information asymmetry. Yonghang (2006) noted that the difference in information asymmetry between large firms and lenders is not necessarily less than that of between small firms and lenders. The author argued that given that there are no differentials in information asymmetry, which constituted the fundamental reason of credit rationing by banks, the problems facing the small firm in accessing credit cannot be attributed to high information asymmetry. Rather the problem is as a result of the special governance at the small firm. Although, Yonghang (2006) may have rightfully noted that information asymmetry does exist in both the large and the small firm, the study falls short of specifying the degree or amount of information asymmetry.

Simply noting that there are no differentials in information asymmetry, runs against a number of literatures on the subject (e.g., Amihud & Mendelson, 1986; Diamond & Verrecchia, 1991; Easley & O'ttara, 2004; Shen & Reuer, 2005) that suggest that more public disclosures reduce information asymmetry. Given the overwhelming consensus that large firms exhibit low information asymmetry, a result of the combined motivations of regulatory and compliance requirements, augmented by incentives of low cost of capital from lenders, one may conclude that Yonghang omits a factor necessary to buttress his study.

Dennis and Mihov (2003) suggested that firms with higher levels of information asymmetry and lacking substantial tangibles (i.e., those with lower fixed asset ratios) tend to borrow privately. This characterization appears to fit a small firm. The implication is that small firms have higher levels of information asymmetry or are not efficient at minimizing information asymmetry. This does not support perspective 2 or the notion that a small firm is more efficient at minimizing information asymmetry.

CONCLUSION

This systematic literature review appears to be skewed in favor of the view that a large firm is more efficient at minimizing information asymmetry (perspective one). The primary explanation appears to be that large and public firms have more stringent accounting reportage requirements that may be stimulated by legal and self-interest considerations. Although these reviews appear to favor the view that a large firm is more efficient at minimizing information asymmetry, it should not be construed as conclusive review. For, between these two perspectives there may lay a range of reasonable assessments, since this review is not exhaustive. Additionally, the view that a large firm is more efficient at minimizing information asymmetry has many facets that occur in a complex environment.

Future studies need to explore ways of encouraging the small business to increase its level of information asymmetry in lender-borrower relationship. The big businesses of today (e.g., Intel, Apple Computers, Dell Computers, Microsoft, and Staples) were once small businesses. Hochberg (2010) noted that small business remains the best engine for economic growth, accounting for over 93% of all net new jobs (i.e., 22 million new jobs), and 99.7% of all employer firms in the US economy over the last 15 years. Small business creates most of the new jobs in the US employ about half of the private sector work force in the US, as well as providing a significant share of innovations (United States Small Business Administration, 2009). Obviously, the stimulating effects of the small business on macroeconomic activities cannot be overemphasized. In consideration of the important role played by the small business in macroeconomic activities, employing this systematic literature review as basis for any adversarial action regarding credit extension to the small business would not be economically prudent.

REFERENCES

Akerlof, G. A. (1970). The market for “lemons”: Quality, Uncertainty and the Market Mechanism. *The Quarterly Journal of Economics*, *84*(3), pp. 489-490. Retrieved on January 26, 2010 from http://www.econ.ox.ac.uk/members/christopher.bowdler/akerlof.pdf

Amihud, Y. & Mendelson, H. (1986). Asset pricing and bid-ask spread. *Journal of Financial Economics*, *17*, 223-249.

Berger, A., & Udell, G. (1995). Relationship lending and lines of credit in small firm Finance. *Journal of Finance*, *68*, 351-381

Bharath, S.; Dahiya, S.; Saunders, A.; & Srinivasan, A., (2007). So what do I get? The bank's view of lending relationships. *Journal of Financial Economics*, *85*(2), 368-419. Retrieved on January 27, 2010 from http://fcx.fdic.gov/bank/analytical/cfr/2004/oct/CFRSS_2004-02_Dahiya.pdf

Binks, M. & Ennew C. (1996) Growing firms and the credit constraint. *Small Business Economics*, *8*(1), 17-25.

Brewer, E., III. (2006). On lending to small firms. *Journal of Small Business Management*, *45*(1), 42-46

Bryant, B. J. (2010). How to calculate the Herfindhal index. Retrieved on July 16, 2010 from http://www.ehow.com/how_5136910_calculate-herfindahl-index.html

Chiang, H. (2005). Analyst's financial forecast accuracy and corporate transparency. *Proceedings of the Academy of Accounting and Financial Studies*, Memphis, USA, *10*(1) 12. Retrieved on June 29, 2010 from www.alliedacademies.org/public/proceedings/proceedings16/paafs-10-1-memphis05.pdf#page=14

Cole, R. A. (1998). The importance of relationships to the availability of credit. *Journal of Banking & Finance*, *22*(6-8), 959-977.

Dembe, A. E., & Boden, L. I. (2000). Moral hazard: A question of morality. *A Journal of Environmental and Occupational Health Policy*, *10*(3), pp. 257-279. Retrieved on January 26, 2010 from file:///:/moral hazard reference.htm

Denis, D. J. & Mihov, V. T. (2003). The choice among bank debt, non-bank private debt & public debt: Evidence from new corporate borrowings. *Journal of Financial Economics*, *70*(1), 3-28.

Dennis, S. A. & Sharpe, I. G. (2005). Firm size dependence in the determinants of bank term loan maturity. *Journal of Business Finance & Accounting*, *32*(1&2).

Diamond, D. W. (1985). Optimal release of information by firms. *Journal of Finance, 40*(4), 1071-1094.

Diamond, D. W. & Verrecchia, R. E. (1991). Disclosure, liquidity, and the cost of capital. *The Journal of Finance*, *46*(4), 1325-59.

Dietrich, A. (2010). Explaining loan rate differentials between small and large companies: companies: Evidence from Switzerland. Small Business Economics, Retrieved on July 18, 2010 from http://www.springerlink.com/content/94202v13p51603x8/

Duffy, J. (1993). *Economics.* (1st ed.). (J. Bobrow, Ed.). Lincoln, NE: Cliffs Notes, Inc., p. 119.

Easley, D. & O'Hara, M. (2004). Information and the cost of capital. *Journal of Finance*, *52*, 1553-1583.

Hamilton, R. T. & Fox, M. A. (1998). The financing preferences of small firm owners, *International Journal of Entrepreneurial Behaviour & Research*, *4*(3), 239 – 248

Healy, P.M. & Palepu, G. (2001). Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature. *Journal of Accounting and Economics*. *31*(1-3), 405-440.

Hochberg, F. P. (2010). Small Business Administration: supporting America's engines of growth. Retrieved on July 22, 2010 from http://www.americanprogressaction.org/issues/2008/changeforamerica/pdf/sba.pdf

Hull, R. M. & Pinches, G. E. (1995). Firm size and the information contents of over-the- counter common stock offerings. *Journal of Small Business Finance*. Retrieved on July 21, 2010 from http://www.washburn.edu/sobu/rhull/edw.jsbf.

Inchausti, A. G. (1997). The influence of company characteristics and accounting regulation on information disclosed by Spanish firms. *European Accounting Review*, *6*(1), 45-68.

Leland, H. & Pyle, D. (1977). Informational asymmetries, financial structure and financial intermediation. *Journal of Finance*, *32*, 371-387.

Ortiz-Molina, H. & Penas, M. F. (2008). Lending to small businesses: The role of loan maturity in addressing information problems. *Small Business Economics*, *30*(4), 361-383.

Petersen, M. A., & Rajan, R. G. (1994). The benefits of lending relationships: Evidence from small business data. *Journal of Finance*, *49*, 3-37

Petersen, M. A., & Rajan, R. G. (2002). Does distance still matter? The information revolution in small business lending, *Journal of Finance*, *57*, 2533- 2570

Shen, J. & Reuer, J. J. (2005). Adverse selection in acquisitions of small manufacturing firms: A comparison of private and public targets. *Small Business Economics Journal*, *24*(4), 393-407.

Stein, J. C. (2002). Information production and capital allocation: Decentralized vs. hierarchical firms. *Journal of Finance*, *57*, 1891-1921.

Sufi, A. (2007). Information asymmetry and financing arrangements: Evidence from syndicated loans. *The Journal of Finance*, *62*(2), 629-668. Retrieved on July 15, 2010 from http://faculty.chicagobooth.edu/amir.sufi/Sufi_JF_2007.pdf

U.S. Small Business Administration. (2009). *The small business economy: A report to the president*. Retrieved on July 22, 2010, from http://www.sba.gov/advo/research/sb_econ2009.pdf

Volpe, R. P. & Schenck, N. A. (2008). Small business lending environment in emerging economies: A comparison of Brazil and Russia. *Journal of International Business Research*, *7*(2), 13-30

Welker, M. (1995). Disclosure Policy, information Asymmetry, and liquidity in equity markets. *Contemporary Accounting Research*, *11*(2), 801-827.

Yonghang, Y. F. H. (2006). Enterprise governance, information asymmetry and the financing of small business. *Journal of Financial Research*. Retrieved on July 22, 2010 from http://en.cnki.com.cn/Article_en/CJFDTOTAL-JRYJ200605019.htm

RATING THE ANALYSIS IN THE CURRENT RECESSION: A REVIEW OF MOODY'S AND STANDARD AND POOR'S

Steven Dreibelbis, University of Texas
Jonathan Breazeale, Sam Houston State University*

ABSTRACT

Credit rating agencies, also known as debt rating agencies or bond rating agencies, conduct analysis into the creditworthiness of various securities for a fee paid by the issuer. Moody's and Standard & Poor's, each with comparable histories, dominate the industry. These firms are extraordinarily important to the maintenance of free, efficient markets which is evidenced by a unique relationship with debt issuers, governments, and investors. However, the responsibility and diligence of these firms are debatable. The U.S. Government and its relationship with these quasi-government agencies may be a hindrance to effective, independent analysis. These firms have come under increased scrutiny with questionable ratings on some of Enron's debt and collateralized debt obligations. The purpose of this paper is to provide a comprehensive historical context in which to view Moody's and Standard and Poor's recent role.

INTRODUCTION

For financial markets to be truly efficient, information must be clear, consistent, and available. Most variations of the efficient market hypothesis assume that information is accurate and transparent. Credit reporting agencies, also referred to as debt rating agencies, primarily composed of Standard and Poor's, Moody's, and Fitch Ratings, are essential to the maintenance of efficient markets by assessing the quality of certain investments. When these ratings, which are relied upon by investors and governments alike, are erroneous, the entire economy suffers. The history and purpose of the credit reporting agencies and how these companies operate with limited accountability will provide insight into the responsibility the agencies share in the worst economic disaster since the Great Depression. While there were many organizations and agencies to "blame" for the credit crash, the purpose of this paper is to provide a comprehensive historical context in which to view Moody's and Standard and Poor's recent role.

HISTORICAL BACKGROUND

The credit agencies' primary function is to determine the creditworthiness of the various issuers of securities. These agencies can trace their roots to the early nineteenth century during which the railroads were the first major industry of the United States and perhaps the world (Levich, Majnoni, & Reinhart, 2002). By 1832, the railroad industry began publication of *The American Railroad Journal* which was a highly specialized publication that reported on current events within the industry (Levich et al., 2002). Henry Varnum Poor became editor of the journal in 1849 and began focusing on investors as the target audience (Levich et al., 2002). During his tenure as editor from 1849-1862, Mr. Poor published information about the holdings of the railroads, and their assets, liabilities, and earnings (Levich et al., 2002). After the American Civil War, Henry Poor formed his own company and publication called the *Manual of the Railroads of the United States* (Levich et al., 2002). Poor only obtained and reported on factual information about companies which may be obtained on a company's annual report today. During the twentieth century, financial information about a company was difficult to acquire and very few understood the accounting and meaning of the reported data. It was not until 1916 that the Poor Company entered the bond rating business by analyzing various securities (*History*, 2006). The Poor Company began publishing its U.S. focused ninety-stock composite price index which was computed daily (*History*, 2006). This would become the S&P 500, a market value weighted index, which focused on the value of the five hundred most widely held companies in the U.S. economy (*History*, 2006). During the Great Depression, Poor's Publishing went bankrupt and was refinanced. Poor's Publishing eventually merged with Standard Statistics in 1941 (*History*, 2006). In 1966, The McGraw-Hill Companies, currently a dominant textbook publishing, magazine, and construction company, purchased Standard and Poor's (*History*, 2006).

John Moody also founded a company in 1900 that produced manuals detailing company information and statistics on stocks and bonds (*Moody's History*, n.d., para. 1). Moody fell victim to the 1907 stock market crash and was forced to cease operations (*Moody's History,* n.d., para. 2). Two years later, John Moody returned to the financial markets by offering investors an analysis of security values instead of a compilation of data (*Moody's History,* n.d., para. 3). During the early to mid twentieth century, analysis of companies' securities was expanded. In 1914, Moody's Investors Service was incorporated and expanded rating coverage to include municipal bonds (*Moody's History*, n.d., para 4).

From the first manuals ever published until the 1970s, Moody's and Standard & Poor's charged investors a fee for access to financial information - the only income received from their analysis (*Moody's History*, n.d., para 5). Rated companies were not charged a fee to have an analysis given on securities. Until recently, Standard & Poor's consistently lagged behind Moody's in analysis and ratings of municipalities, money market mutual funds, and bond funds. Standard & Poor's and Moody's now dominate the market for securities analysis with a combined market share of over eighty percent (Leone, 2006). Therefore, the following analysis of the credit agencies will focus on Standard & Poor's and Moody's.

RATINGS – THEIR MEANING AND MARKET

Today, credit ratings are required by individuals and institutional investors seeking to purchase fixed-income securities. All rational investors will undertake a discretionary amount of risk only if they will be adequately compensated. Ratings are now more important because low ratings may preclude institutional investors from even considering a security as a particular investment. Credit ratings are used by everyone because, to most, it signals the financial health of the issuers of securities. Issuers must use credit ratings if they want to have access to the capital markets where investors will buy securities. These ratings are designed to enhance market transparency, efficiency, and investor protection (McDaniel, 2008). Ratings standardize information for all investors and businesses alike and reduce the risk of asymmetric information. Ratings are also used because it reduces the aggregate costs of borrowing for issuers of securities and for lenders who do not have to conduct their own analysis as to the risks of an issuer. The role of these ratings has greatly increased with most investors excessively relying on them to determine which investments are safe.

According to the president of Standard & Poor's, Deven Sharma (2008), ratings on various securities only represent "an opinion about the creditworthiness of issuers and their debt". Some investors may interpret the ratings as being an accurate measure of default risk. Others may treat the ratings as insurance that the investment will not decline in value. Actually, credit ratings are "useful" but they "do not speak to the market value of a security or the volatility or its price, and, critically, ratings are not recommendations or commentary on the suitability of a particular investment" (Sharma, 2008). In other words, the ratings should not be used as a recommendation to purchase – or not to purchase - a particular security. However, some portfolio managers and investors assume that securities with the highest rating are a relatively safe investment. The rating agencies constantly attempt to limit liability by claiming the ratings are an opinion based on current information furnished by obligors (*Ratings*, 2008). All credit agencies make it known that an audit is not performed which may be seen as a way of not claiming responsibility for the quality of the information obtained. Despite a constant attempt to limit liability, credit reporting agencies' services rely upon their reputation of many years of experience.

The market for Moody's and Standard & Poor's analyses is dependent upon the extent to which investors trust that a proper rating was afforded to a security. The rating agencies and most practitioners claim that without the positive reputation of the agencies, the demand for rating services would decline. This is somewhat true because many investors will not demand ratings from questionable companies. Ratings are so important that Standard & Poor's brags that they predicted the collapse of the financial markets in 1929 by warning investors to liquidate all assets (*History*, 2006).

The government has made it extremely difficult for other companies to enter the credit analysis market. In the 1970s, the U.S. government enforced regulations so that a duopolistic ratings market with limited competition could exist (Sinclair, 2005). Rating agencies are indirectly guaranteed existence due to government regulations in a multitude of countries. Most governments, including the United States, regulate the type of investments banks and government agencies may invest in according to a security's particular rating. Since 1931, the U.S. Office of the Comptroller of the Currency has set strict, specific guidelines into what assets national banks may hold (Sinclair, 2005). The Securities and Exchange Commission (SEC) has adopted rules saying that underwriters of debt must maintain a certain percentage of securities in reserves (Sinclair, 2005). However, the rule allowed a smaller percentage for bonds "rated investment-grade by at least two nationally recognized statistical rating organizations." (Sinclair, 2005). The notion of "nationally recognized statistical rating organizations" has been incorporated into many regulations all across the world (Sinclair, 2005). Moody's and Standard & Poor's have little competition to fear and only have to be concerned about the remote possibility of government intervention which may affect operations. Because of the requirements set by governments, rating agencies are all but guaranteed a market for their analysis and should be primarily concerned about their reputation amongst the governments of the world. Some of these governments have securities that are rated by the reporting agencies. This presents a conflict of interest where these agencies rate securities from governments that effectively guarantee their existence with little interference.

POSSIBLE CONFLICT OF INTEREST

Credit rating agencies have potential conflicts of interest with the corporations that they rate. The goal of Moody's and Standard & Poor's is to make a profit and increase shareholder wealth. These companies are not intended to provide a service for the greater good; instead, their goal is to increase their own stock price – just like any other corporation. There may be a conflict of interest because companies pay Moody's and Standard & Poor's directly to render opinions regarding creditworthiness and ability to pay debts. Critics of credit rating agencies claim that these companies have an incentive to inflate the grades of various securities. The likelihood of such an occurrence is potentially fairly low. Moody's and Standard & Poor's are firmly established and would not diminish their reputations amongst the world governments. It would be difficult for the largest issuer to manipulate the reporting agencies because any extra money paid for an investment grade rating would not have an impact on revenue and it would not be worth damage to their reputations (Sinclair, 2005). The only chance for unethical practices to occur would be with very small rating agencies trying to establish themselves (Sinclair, 2005). Standard & Poor's have instituted regulations within the company to ensure that the conflict is manageable. The credit analysts are not involved in the fees that will be collected from the underwriter or the issuer and dependable internal controls exist to ensure independence (Sharma, 2008). Standard & Poor's believes the "issuer pays" model is beneficial because all ratings are available to the market free of charge (Sharma, 2008). Many investors would not be able to afford access to ratings information if the "issuer pays" model were nonexistent because of the breadth of analysis that is conducted (Sharma, 2008). An "investor pays" model would be even more questionable as investors will want lower ratings to maximize returns (Sharma, 2008). It is argued that the "issuer pays" model does not impact the credit process because issuers are not obligated to provide non-public information to the agencies (McDaniel, 2008). All the information needed to ascribe a rating may be found by examining SEC filing statements. The credit reporting agencies are virtually self governing, so the two major agencies contend that the current model is more beneficial and does not cause a conflict of interest.

Bond ratings are designed to aid investors as they seek to minimize risk and maximize return by serving as a standardize source of information for comparing and evaluating the creditworthiness of debt (Moon & Stotsky, 1993). Rational investors will not buy a security from a risky company unless they are compensated to undertake greater default risk. These ratings may have an immense impact on companies and shareholders, which have a goal of obtaining cheap financing. Most debt is accompanied by ratings because investors will demand higher returns if default risk is unknown. Interest rates determine the price that issuers must offer to have their securities bought by investors. The distinguishing item that separates a particular investment from another with the same structure is the creditworthiness of the issuer (Sinclair, 2005). By merely having a rating from a qualified agency, a company may see savings of over six hundred thousand dollars on a two hundred million dollar bond issue over a twenty-year period (Sinclair, 2005). Companies need higher ratings so that there will be a large market for their securities and a low interest rate will be required which will reduce the cost of debt.

FACTORS USED IN THE RATINGS

Despite the importance regarding the meaning of ratings on various securities, it is still somewhat unclear what factors the rating agencies use in determining the creditworthiness of an issuer. Moody's says the issuers are not required to disclose any nonpublic information (McDaniel, 2002). However, disclosure of nonpublic information to Moody's is encouraged because it will allow for more accurate information, timely market evaluations, and less reactive actions (McDaniel, 2002). This is somewhat troubling because a company may be less inclined to disclose harmful information to the rating agencies. Such information may not be publicized so it would appear that the rating agencies may be victims of asymmetric information as well. If the agencies are able to complete their analysis without nonpublic information then its impact in the rating process must be minimal. Issuers are able to discuss confidential information because of an exception created in the Regulation Fair Disclosure Act (McDaniel, 2002). The ratings process is different for corporations and government entities. Generally, ratings are ascribed after careful analysis of all relevant information. After the issuer initiates the ratings process, the rating agency assigns an independent analytical team to conduct basic research on the company (Sinclair, 2005). Items of interest includes the cash flow relative to debt service obligations and the liquidity of a company to determine whether timing problems may affect repayment of the group of securities about to be sold (Sinclair, 2005). The financial statements, financial projections or pro forma statements, analysis of capital spending plans, financing alternatives, and contingency plans are usually requested even if the information is not publicly known (Sinclair, 2005). The rating agencies inspect the legality regarding the potential bond issue to ensure all parts of the contract between the issuer and bondholder have been established (Sinclair, 2005). The analytical process is highly secretive but ratios are very important along with interviews with high ranking managers (Sinclair, 2005). Standard & Poor's has even set criteria for "funds flow interest coverage" and other coverage ratios (Sinclair, 2005). These ratios are used in combination with other qualitative data about the issuer's history and outlook for the future (Sinclair, 2005). For rating municipalities, the future population, proposed budgets and overall quality of life in the jurisdiction are of crucial importance to determine if a steady cash flow from tax revenue may be received (Sinclair, 2005). After a rating is established, the issuer has a chance to appeal the opinion (Sinclair, 2005).

There is not an exact formula to determine the creditworthiness of an issuer of debt. Individual investors are probably not able to know how to use relevant information and they will not be privy to confidential information which may impact ratings. Credit agencies are designed to be the "experts" in determining creditworthiness. Even these "experts" differ in their credit analysis and resulting opinions. A recent study tested the difference between Moody's and Standard & Poor's with respect to ratings on municipalities. It was determined that the differences in the ratings that were given, which were rare, were significant (Moon & Stotsky, 1993). A prior study examined the occurrence of split ratings amongst the agencies and experienced similar results (Ederington, 1986). However, the 1993 study ascribed the small amount of significant differences to varying weights of specific determinants used by both agencies (Moon & Stotsky, 1993). Ederington (1986) believed that the differences reflect divergent interpretations as to what the data describes. The differences in the studies display how the credit rating process is relatively unknown. Both studies agree that Moody's and Standard & Poor's have different ratings for similar bonds. This represents how even the "experts" do not have a specific formula and that ratings are truly opinions. The difference between the two largest, nationally recognized bond rating agencies does not justify the excessive reliance on these opinions by investors and governments.

COMMON CRITICISMS OF THE CREDIT AGENCIES

The ratings process is not perfect because history shows that some bonds are not rated as highly as perhaps they should be. When investors invest in low-grade or junk bonds that do not default then the return will be very high. The best example of such an investor is Michael Milken who consistently bet against the expertise of the rating agencies. Milken was a devout follower of W. Braddock Hickman who claimed that junk bonds promised high yields when held with a diversified portfolio (Fridson, 1994). Hickman found that noninvestment-grade bonds yielded higher returns than investment-grade bonds even after discounting for default losses during 1900 and 1943 (Fridson, 1994). This apparent paradox suggests that investors hold bond ratings in high regard and chose to invest in bonds that the credit reporting agencies believed to have the greatest likelihood of repayment. Milken rightfully believed investors relied too heavily on misguided ratings that tended to overestimate past performance (Sinclair, 2005). The problem is that ratings are entrenched in historical analysis which may not be an accurate predictor of future performance especially if, as Milken argued, the rating agencies were not really interested n the intangibles of a business (Sinclair, 2005). He believed that a rating was not an absolute because a company earning the highest credit rating possible does not guarantee the borrowed funds will be repaid (Sinclair, 2005). Milken made raised billions of dollars by advocating junk bonds to clients because he was willing to challenge the paradigm about securities and their creditworthiness. He believed that the ratings process was judgmental and interpretive rather than being based on a "rational, professional process" (Sinclair, 2005). Despite serving two years in prison on various SEC disclosure violations, Milken is an important figure in finance. He grew the junk bond market and enhanced the significance of rating agencies by making lower grade ratings important as well. Milken displayed how ratings are truly judgmental and that the power investors bestow upon these companies may be unjustified.

Perhaps the most important function of rating agencies is how the issuers are monitored after the bonds have been rated and sold. Monitoring allows the agencies to react to recent events and serves as signals to the market of a company's financial condition, even though sometimes this may not be the case. All of the rating agencies make it known that the monitoring function does not mean they are "watchdogs" (Sharma, 2008). Moody's has a "watchlist" and Standard & Poor's has "credit watch" to signal positive or negative trends associated with the bonds of certain issuers (Sinclair, 2005). The agencies react to various events and will downgrade bonds if they feel the creditworthiness of the issuer is declining. When companies are put on these lists and if bonds are either upgraded or downgraded by a credit reporting agency, there are both bond and stock price effects associated with the news (Hand, Holthausen, & Leftwich, 1992). However, these affects are more drastic with downgrades or negative news than for upgrades or positive news (Hand et al., 1992). A possible explanation may be that the market tends to overreact with negative news dealing with the creditworthiness of an issuer (Hand et al., 1992). The credit reporting agencies have proven to be reactive in their monitoring responsibility so market fluctuations on negative ratings news should be minimal because a ratings decrease after bad news should be anticipated. The cost of debt will increase when a downgrade occurs but if bad news precipitated the ratings change then the markets should have anticipated higher interests costs for a company.

The credit rating agencies have the power to make corporate managers cringe. The power exerted by credit rating agencies is immense because issuers understand the importance of being perceived as a lower risk to obtain cheap financing. General Motors recorded a disastrous four and a half billion dollar loss on operations during 1991 (Sinclair, 2005). The news awakened Moody's and Standard & Poor's who were supposed to monitor the company's situation. Immediately the agencies said the outlook for the company was negative (Sinclair, 2005). Robert Stempel, General Motor's CEO, and his staff were pushed by the rating agencies to speed restructuring plans (Sinclair, 2005). Despite adequate plans, Moody's and Standard & Poor's eventually downgraded the debt of General Motors. It is believed that the downgrade caused the directors to bring in new management (Dobrzynski, 1992). The sinking credit ratings increased the cost of debt and restricted access to equity and commercial paper markets (Dobrzynski, 1992). Instead of selling bonds, General Motors was forced to raise bank funds which were accompanied by intrusive restrictions and covenants (Sinclair, 2005). The case of General Motors is not an outlier. Moody's and Standard & Poor's have extraordinary influence on financial markets and can indirectly affect a company's operations by restricting access to commercial paper markets which is reserved for the highest creditworthy companies. The credit reporting agencies may react slowly in choosing to downgrade or upgrade debt. Others may argue that the agencies act too quickly to lower ratings when bad news emerges, as in the case of General Motors.

Raymond McDaniel, the President and CEO of Moody's, claims that most criticisms are "contradictory" which means the questions are "only influenced by objectives" (McDaniel, 2002). This illogical statement does not address the many concerns that are displayed in the case of General Motors or the profit opportunities in the junk bond market. These two cases suggest that the rating agencies may be too conservative. It was not until markets reacted to the news of the massive loss by the company did either reporting agency put the move the company to a watch list. When this news became public, the agencies may not have truly investigated the company and analyzed the effect of a downgrade on its debt. Instead, the agencies may have already been predisposed to downgrading the bonds with little investigation into the company's problems and plans for the future. These extreme conclusions may not be reached without more solid evidence. No matter what the true answer is the agencies will hide behind the notion that ratings are only "opinions." However, when a rating has such an impact on the market perhaps investors and governments should rethink their reliance on these "opinions" based on the agencies' "reputations." The agencies are now in an awkward position which is compounded from alleged judgmental failures.

Moody's and Standard & Poor's have recently been criticized for not being proactive in their judgments of Enron, WorldCom, and other companies plagued by accounting scandals, which is the antithesis of the previous examples. Less than a week before Enron filed for Chapter 11 bankruptcy on December 2, 2001, Enron's bonds were still listed at investment grade status (Anderson, 2002). Standard & Poor's, Moody's, and Fitch ratings failed to downgrade Enron's credit rating until days before bankruptcy (Oppel, 2002). This is after the stock price dropped to nearly a quarter a share (Anderson, 2002). The senate investigated Moody's decision not to downgrade Enron's rating at a meeting on November 8, 2001 (Oppel, 2003). The Senate report said that Moody's decision not to downgrade Enron's rating below investment grade was "not based on improper influence or pressure, but on new information presented by financial institutions and others that in Moody's view changed Enron's circumstances" (*Report*, 2003). The allegations surrounding Moody's decision was that the agency succumbed to lobbying pressures from Dynagy who sought to acquire Enron (Metzenbaum, 2002). Other explanations into Moody's actions were that they did not adequately monitor Enron's situation. This is probably not the case as committees assigned to Enron met concerning the condition of the company. A more plausible explanation, in addition to an undue influence from external forces, may be that Moody's did not understand the complexity of Enron's business. The credit agencies were united and steadfast in their defense of their apparent failure to downgrade Enron claiming that they were misled because top officials withheld information (Ivanovich, 2002). This situation was similar to the downfall of WorldCom with the agencies failing to downgrade debt days before bankruptcy. The credit reporting agencies do share some of the blame for allowing management of both corporations to continue to deceive investors. Credit analysts should understand the client's business so the notion of being misled suggests a failure to fully understand the client, a failure to exhibit professional skepticism, or a failure in the established techniques used to determine a company's creditworthiness. Even if the analysts were intentionally misled, they probably did not maintain a certain level of professional skepticism by being so willing to accept management's explanations without adequate investigation.

Despite the criticisms, Moody's and Standard & Poor's came away relatively unscathed from the Enron and WorldCom situations. The U.S. government chose to increase regulations on these agencies by passing the Credit Rating Agency Reform Act in late 2006 (Cox, 2008). This bill only slightly increased regulation by giving the SEC authority to make rules governing the qualification for a company to become a nationally recognized statistical rating organization (Cox, 2008). This act decreased the barriers of entry for rating agencies but the magnitude of this act is debatable. Upon passage of the law, the SEC implemented mostly mundane rules that continue to allow the rating agencies to implement their own policies and procedures without government regulation. Much of the blame by government officials went to the management of the failed companies and to their auditors. In response to the Enron failure, the SEC was so confident and trustworthy in the accounts of the rating agencies that a 2007 indictment against Jeffrey McMahon accused the former senior executive at Enron of intentionally misleading

Moody's and Standard & Poor's into "believing that Enron generated cash flow operations by monetizing, or selling the future cash flow streams, of its trading contracts" (*McMahon*, 2007). The indictment appears to be taken exactly from the testimony of the executives at the ratings agencies. Investigators unquestionably believed the ratings agencies. Congress did too.

ROLE IN THE CURRENT RECESSION

Credit reporting agencies are at least partly to blame for the worst economic crisis since the Great Depression. Some believe the current economic situation began when Congress approved and President Jimmy Carter signed The Community Reinvestment Act in 1977 (Baldinucci, 1996). The legislation was designed to provide individuals with greater access to capital by requiring qualified institutions to meet the needs of low- and middle-income neighborhoods. (Baldinucci, 1996). The intentions of the mandate were noble as increasing home ownership is extremely important to most congresses and administrations as it is seen as the epitome of the American Dream. In 1995, the regulatory agencies issued new guidelines that based compliance with the mandate on performance rather than on subjective "good faith" efforts which had been the case (Baldinucci, 1996). The approval of the 1995 regulations, which went into effect in 1997 and 1998 depending on the size of the bank, changed lending entirely and forced banks to comply or face sanctions which may prohibit pending mergers or acquisitions. (Apgar & Duda, 2003). Eventually, banks were allowed to perform additional operations under the Gramm-Leach-Bliley Act of 1999 but this was dependent upon compliance with The Community Reinvestment Act. (Apgar & Duda, 2003). This marked a period of rapid deregulation in the banking industry. Since the Savings and Loan Crisis of the late 1980s, the banking industry has seen rapid changes to its regulatory environment. Almost all financial institutions were allowed to expand operations into areas that were once prohibited, such as investment banking. This made competition even fiercer as many financial institutions, including commercial banks, began lending to individuals for residential purposes because of the growing profit opportunities. The regulatory environment encouraged banks lend to individuals - some of which would not qualify for traditional loans while allowing the entire industry to engage in activities to which they had no experience.

The direct cause of the financial crisis was from a competitive banking industry that did not consider the consequences of their actions. Many of the mortgages that originated in 2005 and 2006 subsequently defaulted (Geardi, Lehnert, Sherland, & Willen, 2009). In the early 2000s, the Federal Reserve and other central banks across the world drastically slashed interest rates because of an imminent recession. This was designed to stave off a recession and allow expansion to occur as the cost of financing dropped considerably. Interest rates went to historic lows and housing prices peaked in mid-2006 as almost all individuals qualified for adjustable rate mortgages (Geardi et al., 2009). Bankers and mortgage companies tried to sell adjustable rates because of the fees borrowers would be forced to pay. Some lenders employed predatory lending practices by manipulating clients into extremely low interest rate loans which would adjust upward over the life of the loan. Some loan officers deliberately lied about a client's income so the approval process will be quick and certain. Some of the potential borrowers lied to the loan officers as no documentation of one's income was necessary in some circumstances. Others refinanced during this historic period and used the extra capital for other needs, such as home improvements or credit card debt. Many individuals assumed home prices would continue to increase so they thought they could refinance their home before the monthly payments increased. In the event refinancing was not an option, most delinquents assumed that they could sell their house at a gain because of continued price appreciation (Geardi et al., 2009). Eventually, interest rates began to increase as the world economy began to stabilize. The Federal Reserve began to pursue a contractionary monetary policy, in part, by increasing interest rates. Individuals with nontraditional loans or adjustable rate mortgages found themselves unable to pay the increased payments. As interest rates increased, home values began to fall because individuals' incomes were not keeping up with the rates at which home prices increased. A recent study concluded that it was housing prices that outweigh other factors as to the rise in foreclosures (Geardi et al., 2009). The housing market was clearly overvalued in 2005 and 2006 (Geardi et al., 2009). The actions from lenders with regard to the rise of nontraditional loans to nontraditional customers during a volatile economy and housing market would not have been as bad if there was not demand for these bad loans.

Securitization refers to the bundling of assets together into negotiable instruments which may be sold to investors. Some attribute the securitization of mortgages and other assets as a cause for the recent economic situation. Securitization has actually existed since the early 1970s though the industry did not flourish until recently (Cowan, 2003). Prior to the economic distress seen today, in 2003, the securitization of assets accounted for over 6.6 trillion dollars (Cowan, 2003). The originator of a mortgage or other assets, where a steady stream of payments are likely, may now sell the asset to third parties (Cowan, 2003). The originator receives a discounted lump sum payment rather than having repayment spread out over time (Cowan, 2003). The loans are sold to an underwriter though a special purpose vehicle (Cowan, 2003). The underwriter, usually investment banks, packages and sells the securities to investors (Cowan, 2003). Securitization consists of three main classes: mortgage backed securities, collateralized debt obligations (CDOs), and asset-backed securities (Vink & Thibeault 2008). The demand for mortgage backed securities is very high because, unlike a debt instrument, the investor receives payments that include interest and part of the principal (Cowan, 2003). Many of the mortgage backed securities were from residential properties. These mortgages were also packaged with other debt obligations such as junk bonds in an attempt to diversify and lower the overall credit risk of the CDO (Lucas, Goodman, & Fabozzi, 2006).

Mortgage backed securities and collateralized debt obligations exposed serious deficiencies with all of the credit rating agencies. Today, most collateralized debt obligations include mortgage backed securities and corporate loans which are considered assets for the investor (Lucas et al., 2006). Since mortgage backed securities are packaged with CDOs, no official name for these complicated instruments have been produced (Lucas et al., 2006). Moody's refers to these instruments as "resecuritizations" and many others use the term "structured finance collateralized debt obligations" (Lucas et al., 2006). It is important to note that these instruments are unique as each has its own asset allocation. Depending on the amount of subordinated debt included in these modified CDOs, a different category and rating is ascribed to each. The categories include senior, mezzanine, and subordinated tranches with the latter being the most risky because of lower priority on claims to assets and earnings (Lucas et al., 2006). This is reflected in the credit ratings given to each instrument with the senior and mezzanine tranches earning investment grade ratings despite the riskiness of the underlying assets (Lucas et al., 2006). Most of the CDO managers actively worked with analysts from at least two of the rating agencies to receive the highest possible rating by having "proper" diversification and "remoteness of bankruptcy" (Lucas et al., 2006). The rating agencies actually assisted and provided clear guidelines into what it takes for a CDO to earn the highest rating. This is important because a high rating would mean that debt in the fund would pay a very low floating rate because it is perceived to be of low risk (Lucas et al., 2006). Many of the CDOs were risky because it included loans to homebuyers with poor credit and undocumented incomes but were packaged with debt obligations in a way that won the highest rating from the credit agencies.

If any institution could have foreseen the collapse of the subprime mortgage market, it should have been the credit reporting agencies. While bankers, mortgage companies, and investors were blinded by the possibility of high profits from the seemingly always prosperous real estate market, the rating agencies should have better monitored the performance of their low risk CDOs. The credit agencies must "perform due diligence" after a rating is attributed to any instrument (Lucas et al., 2006). Standard & Poor's, Moody's, and other credit agencies failed in downgrading the CDOs that earned the highest rating despite holding risky subprime mortgages that were strongly related to fluctuations in interest rates and the housing market. Standard & Poor's actually did a loss projection in late 2005 that assumed the following factors: a 30 percent house price decline over two years for 50 percent of the outstanding mortgages, a "slow" economy but not recessionary, a cut in the Federal Funds rate to 2.75 percent, and an economic recovery in 2008 (Geardi et al., 2009). They concluded that cumulative losses would be 5.82 percent and that none of the investment grade mortgage backed securities or collateralized debt obligations would be affected at all (Geardi et al., 2009). The estimated losses by Standard & Poor's were even lower than most banks who appeared to understand that a major fall in home prices would cause problems with the investment grade securities (Geardi et al., 2009). It is easy to ex-post critique inflated housing prices and their subsequent effects. Based on all available information prior to 2005, it was "genuinely possible" to "be convinced that nominal U.S. house prices would not fall substantially" (Geardi et al., 2009). Housing prices could have fallen especially if Standard & Poor's actually entertained this notion with a study as to its effects.

The credit agencies may not have predicted the fall in home prices, but they failed to downgrade securities whose performance and risk was tied to the subprime market. In 2006, Standard & Poor's updated their scenario to include a recession in 2007 with no recovery the following year (Geardi et al., 2009). The revised scenario saw no downgrades of any 'A' rated bonds or most of the 'BBB' rated bonds (Geardi et al., 2009). Most of the modified CDOs received the highest rating because the credit agencies, unlike with bonds, provided guidelines as to what factors were used. In a recent interview, Richard Gugliada, a former Standard & Poor's managing director, says that the agency eased standards because of a "market-share war" (Smith, 2008). The reporting agencies wanted their piece of the riches others were achieving in the active residential real estate market.

It is unfair to attribute all or even most of the blame to Standard & Poor's, Moody's, and the other credit rating agencies to the current economic crisis. It may be argued that The Community Reinvestment Act and politicians encouraged banks to make misinformed decisions, the Federal Reserve left interest rates too low for too long, lenders manipulated individuals into buying homes that they could not afford, homebuyers may have fraudulently misled lenders as to their income, homebuyers may have purchased a home understanding that they could not afford it, mortgage companies made quick and, often times, bad loans because of the growth of securitization, and investors who demanded these instruments without understanding them. This is not even a comprehensive list of all parties that could be blamed. Certainly, the credit rating agencies played a major role in adding to an already tumultuous situation. The SEC identified Standard & Poor's and Moody's as accessories because it was found that they violated internal procedures and failed to adequately manage conflicts of interest (*Summary Report*, 2008). Interestingly, the SEC is legally barred from "regulating the substance of the credit ratings or the procedures and methodologies" (*Summary Report*, 2008). Although the credit agencies failed to prevent this crisis or even alert investors to any potential troubles in the future, Congress lets these agencies function without much regulation. It is understandable that Congress does not pass laws governing regulation of an independent entity. But the government has regulations in place that protects these entities. If the government requires ratings by these agencies and almost ensures their existence then it should have the power to regulate the industry to ensure that their own guidelines and standards are being followed.

The ratings from the credit agencies hold little value if those ratings are haphazardly ascribed based on arbitrary measures to an extent that an investor cannot rely on them. Perhaps, the credit agencies do not fully understand the new, innovative instruments that have increasingly attracted investment. In one breath, the credit agencies defend themselves by claiming the ratings system should only serve as guide to investors and does not predict future performance. In another breath, these agencies try to justify their outlandish fees by manipulating companies and investors into the importance and the expertise of their analysis. They also pride themselves on how their founders apparently predicted The Great Depression. This tends to mislead investors into holding greater value to ratings by the so called "experts."

The McGraw-Hill Companies yields great power in the financial arena. The multinational corporation dominates the publishing market and produces financial publications. This gives the appearance that the corporation has the ability to mislead the public because of its unyielding power. It is unlikely that McGraw-Hill will publish textbooks or financial articles that will put its subsidiary, Standard & Poor’s, in a bad light. This apparent conflict is probably relatively unknown to most investors. It is probably not even a consideration in the textbook that a college requires its students to use. There is no evidence that the company manipulates its operations for its own gain in any way but it has the capacity to do so at any time.

Since the existence of the credit rating agencies, the United States has seen the Savings & Loan crisis of the late 1980s, the rise of the junk bond market, the massive accounting scandals, and the recent economic crisis. Of course, it is illogical to claim that these agencies caused any of these occurrences. However, in most of the previous circumstances, the credit agencies made the problems worse by giving investors a false sense of security. These agencies failed to alert investors to any potential problems. Therefore, these agencies have certainly failed in their monitoring responsibility. Most importantly, ratings are needed and almost required by the government for markets to be truly efficient and to ensure a free flow of information. As the capital markets have increased exponentially with regard to its size and complexity since the early twentieth century, the size of the analysts at the credit rating agencies have increased only mildly. The credit agencies must be held accountable for its failures. If this happens, maybe the agencies will hire more, better qualified analysts to serve this important function. Standard & Poor’s should probably be its own entity so that it may better perform its duties without any apparent bias in the financial media.

CONCLUSION

The purpose of this paper is to review the history of Standard and Poor's and Moody's and examine their role in the recent recession. Neither company offers their ratings as a recommendation on an investment's suitability, but the ratings have none-the-less been used as the primary measure of default risk in investors' underwriting. The existence of Standard and Poor's and Moody's is effectively required by federal laws that preclude certain investors from buying bonds with low ratings. We do not anticipate either firm's importance in the financial market to wane any in the future.

Both firms dropped the ball on accurate ratings before and during the financial crisis - adding to its severity. If we hope not to repeat a crisis of this magnitude in the future, one can only hope that both investors and the credit rating agencies have learned from the mistakes made by all involved.

REFERENCES

Anderson, J. M. (2002, April 9). *Enron: A Select Chronology of Congressional, Corporate, and Government Activities* [Report to Congress]., from http://fpc.state.gov/documents/organization/9659.pdf , Retrieved March 10, 2009.

Apgar, W., & Duda, M. (2003, June). The Twenty-Fifth Anniversary of The Community Reinvestment Act: Past Accomplishments and Future Regulatory Challenges. *Economic Policy Review, 9*(2), 169-91. Retrieved March 14, 2009, from Academic Search Complete database.

Baldinucci, E. L. (1996, Spring). The Community Reinvestment Act: New Standards Provide New Hope. *Fordham Urban Law School*, 831. Retrieved March 13, 2009, from Lexis-Nexis Academic database.

Dobrzynski, J. H. (1992, November 9). A GM Postmortem: Lessons for Corporate America. *Business Week*. Retrieved March 11, 2009, from http://www.businessweek.com/archives/1992/b329257.arc.htm

Ederington, L. H. (1986, Spring). Why Split Ratings Occur. *Financial Management, 15*(1), 37-47. Retrieved March 11, 2009, from JSTOR database.

Fridson, M. S. (1994, September/October). Fraine's Neglected Findings: Was Hickman Wrong? *Financial Analysts Journal, 50*(5), 43-53. Retrieved March 8, 2009

Gerardi, K. S., Lehnert, A., Sherland, S. M., & Willen, P. S. (2009, February 2). Making Sense of the Subprime Crisis. *Federal Reserve Bank of Atlanta*, (2), 1-74. Retrieved May 2, 2009, from Academic Search Complete database.

Hand, J. R., Holthausen, R. W., & Leftwich, R. W. (1992, June). The Effect of Bond Rating Agency Announcements on Bond and Stock Prices. *The Journal of Finance, 47*(2), 733-52. Retrieved March 11, 2009, from JSTOR database.

Hearing on Accounting and Investor Protection Issues Raised by Enron and Other Public Companies before the Senate Comm. on Banking, Housing and Urban Affairs, 107th Cong. (2002) (http://banking.senate.gov/02_03hrg/032002/metzenbm.htm testimony of Howard M. Metzenbaum, Chairman, Consumer Federation of America),

Hearing on Credit Rating Agencies before the House Comm. on Oversight and Government Reform, 110th Cong. (2008) (testimony of Raymond W. McDaniel, Chairman and Chief Executive Officer, Moody's Corporation), http://oversight.house.gov/documents/20081022125014.pdf

Hearing on Credit Rating Agencies before the House Comm. on Oversight and Government Reform, 110th Cong. (2008) (http://oversight.house.gov/documents/20081022125052.pdf testimony of Deven Sharma, President, Standard & Poor‘s),

Hearing on Oversight of Nationally Recognized Statistical Rating Organizations before the Senate Comm. on Banking, Housing, and Urban Affairs, 110th Cong. (2008) (testimony of Christopher Cox, Chairman, U.S. Securities and Exchange Commission), http://www.sec.gov/news/testimony/2008/ts042208cc.htm

Hearing on Protecting Homeowners: Preventing Abusive Lending While Preserving Access to Credit before the House Sub Comm. on Housing and Community Opportunity, 108th Cong. (2003) (testimony of Cameron L. Cowan, U.S. SEC), http://www.house.gov/financialservices/media/pdf/110503cc.pdf.

Ivanovich, D. (2002, March 21). S&P, Moody's Blast Enron. *Houston Chronicle*. Retrieved March 10, 2009, from http://www.chron.com/disp/story.mpl/special/enron/1302701.html

Leone, M. (2006, October 2). Bush Signs Rating Agency Reform Act. In *CFO.com*. Retrieved February 27, 2009 from http://www.cfo.com/article.cfm/7991492/c_7989907?f=TodayInFinance_Inside

Levich, R., Majnoni, G., & Reinhart, C. (2002). *Ratings, Rating Agencies and the Global Financial System*. New York: Kluwer Academic Publishers.

Lucas, D. J., Goodman, L. S., & Fabozzi, F. J. (2006). *Collateralized Debt Obligations: Structures and Analysis* (2nd ed.). Hoboken: John Wiley & Sons Inc.

McDaniel, R. W. (2002, November). *Written Statement of Raymond W. McDaniel*. Presented at the United States Securities and Exchange Commission. Retrieved February 27, 2009, from http://www.sec.gov/news/extra/credrate/moodys.htm

Moody's History: A Century of Market Leadership. (n.d.). Retrieved February 20, 2009, from http://www.moodys.com/moodys/cust/AboutMoodys/AboutMoodys.aspx?topic=history

Moon, C. G., & Stotsky, J. G. (1993, Spring). Testing the Differences Between the Determinants of Moody's and Standard & Poor's Ratings. *Journal of Applied Econometrics, 8*(1), 51-69 Retrieved March 8, 2009, from JSTOR database.

Oppel, R. A., Jr. (3/21/2002). Enron's Many Strands: Credit Agencies Say Enron Dishonestly Misled Them. *New York Times*. http://query.nytimes.com/gst/fullpage.html?res=9803EEDE1138F932A15750C0A9649C 8B63 Retrieved March 10, 2009.

Oppel, R. A., Jr. (2003, January 3). Senate Report Says Rubin Acted Legally in Enron Matter. *New York Times*. http://query.nytimes.com/gst/fulllpage. html?res=9803E0DD1E3FF930A35752C0A9659C8B63&sec =&spon= &pagewanted=2 Retrieved March 10, 2009.

Report on the Role and Function of Credit Rating Agencies in the Operation of the Securities Markets [U.S. Securities and Exchange Commission]. (2003, January). Retrieved March 9, 2009, from http://www.sec.gov/news/studies/credratingreport0103.pdf

Sinclair, T. J. (2005). *The New Masters of Capital*. New York: Cornell University Press.

Smith, E. B. (2008, September 25). `Race to Bottom' at Moody's, S&P Secured Subprime's Boom, Bust In *Bloomberg*., http://www.bloomberg.com/apps/news?pid=20601109&sid=ax3vfya_Vtdo&refer=home Retrieved May 2, 2009

Standard and Poor's. (2006). A History of Standard & Poor's. Retrieved from http://www2.standardandpoors.com/spf/html/media/SP_TimeLine_2006.html

Standard & Poor's Ratings Definition. (2008, December 1). [Pamphlet]. The McGraw Hill Companies. Retrieved March 8, 2009, from http://www2.standardandpoors.com/spf/ pdf/fixed income/Ratings_Definitons.pdf

Summary Report of Issues Identified in the Commission Staff's Examinations of Select Credit Rating Agencies [U.S. Securities and Exchange Commission]. (2008, July). Retrieved May 2, 2009, from http://www.sec.gov/news/studies/2008/craexamination070808.pdf

U.S. Securities and Exchange Commission v. Jeffrey McMahon, No. H-07-2051 (U.S. District Court Southern District of Texas June 20, 2007) (LEXIS).

Vink, D., & Thibeault, A. (2007, August 28). ABS, MBS, and CDO Compared: An Empirical Analysis. In *Securitization*. http://www.securitization.net/pdf/Publications/Vink_ABSMBSCDO.pdf Retrieved May 3, 2009,

RELATIONSHIPS BETWEEN LOGO STORIES, STORYTELLING COMPLEXITY, AND CUSTOMER LOYALTY

Long Pham, Minot State University
Ebetuel Pallares-Venegas, University of Texas at El Paso
Jeffrey E. Teich, New Mexico State University

ABSTRACT

Storytelling can be a compelling communication process to illuminate the success or failure of organizations. Banks in particular can benefit from the oral, iconic and written components of storytelling. However, relatively little research has covered this area. This preliminary research explores how customers derive stories from Wells Fargo Bank's logo, and how the dimensions and complexity of storytelling are distilled in the context of this organization. This research contributes to our understanding of the relationship between the logo stories and customer loyalty.

Keywords: Storytelling, Complexity, Logo, Loyalty, Wells Fargo Bank

INTRODUCTION

A business organization is a multi-faceted, complex structure made up of numerous departments or functional activities. Common functions or divisions include finance, marketing, personnel, research and development, information, and operations. Moreover, each of these functions, whether a cost or revenue center, has its distinct role in the smoothing of operations in the company as a whole.

In addition to the functional areas, some scholars argue that there are additional factors that can communicate the successes or failures of a company to internal and external audiences. The storytelling process plays an important role. The communication process of storytelling is a powerful way to support internal and external communication to improve teams and leadership skills, as well as strengthen the relationship with clients and customers (Collison & Mackenzie, 1999). Thus, not only do leaders and professionals utilize storytelling, but other stakeholders are also very likely to live the reality of their own stories that may or may not harmonize with the values and norms of the company (Boje, 2005).

Companies rely on the endurance of their stories to gain a better understanding of where they have come from, where they are and where they are headed (Bartholme, 2002). That is why storytelling acts as a bridge, connecting the past to the present and then building on that foundation to extend to the future with vocal, visual and textual images. It is worth noting that a favorable image is viewed as a critical aspect of a company's ability to maintain its market position. Furthermore, the image of an organization (brand value or goodwill) has been related to core aspects of organizational success including continued customer patronage (Granbois, 1981; Korgaonkar et al., 1985).

Commodities are products or services that can not be easily differentiated. Furthermore, the only way consumers will be able to differentiate between companies that provide commodities, for example, banks provide traditional bank services is through strong image and brand positioning (Heerden & Puth, 1995). There are several important antecedences to the image of a bank; one of these is its logo, which plays an important role in influencing the way customers perceive the bank's image. The logo itself diffuses a variety of stories that can be perceived in different manners depending on their customers' backgrounds and cultural lenses. One way to learn how the brand is perceived in a customer's mind is by asking customers to write a story based on the image of the bank's logo. Although the value of such stories, as well as storytelling process, is well recognized by companies, and banks in particular (Denning, 2004), there is a dearth of research focusing on how stories about the bank's logo are distilled and what the dimensions of storytelling complexity contribute to the customer perspective. This study adopts an explorative and qualitative approach aimed at reducing this gap. Specifically, the objectives of this study are three-fold:

1. To explore the way the Wells Fargo Bank is perceived based on the stories customers share about its logo;

2. To illuminate what dimensions comprise the complexity of storytelling as seen from the customer perspective; and

3. To examine whether or not there is a relationship between the customers' stories and customers' loyalty.

LITERATURE REVIEW

The Role of Stories in Organizations

According to Czarniawska (1997), a story consists of a plot - casually related episodes - that culminate in a solution to a problem. Stories are a way to understand where we have come from, where we are and where we are going (Bartholme, 2002). Ricoeur (1984) posits that a story describes a sequence of actions and experiences done or undertaken by a certain number of people, whether real or fictitious. These people are presented with situations they either adapt to change or react to change. In turn, these changes reveal aspects of the situation yielding a new predicament calling for thought, action, or both. This response or set of responses to the situation is what brings about a story's conclusion.

The role that stories play in organizations is examined from a variety of perspectives (Greco, 1996). From a cultural perspective, stories can be regarded as artifacts useful in understanding the nature of an organization (McCollum, 1992). Stories serve as an instrument with which to perceive the organizational structure and processes with conceptual foundations in sociolinguistics, folklore and communications. From a social perspective, stories can help employees assess behaviors or attitudes that are acceptable or would be expected within an organization (Wilkins, 1984).

Leaders in the political, religious, military and business realms have always used stories to inspire others towards actions (Barnes & Harris, 2006). In some cases, stories are used to predict the future (Gold, 1996). Stories elicit a common vision of the future, portray the journey to reap that vision, specify important stages along the journey, form a clear road for employees to pursue and specifically define the concept of success (Marzec, 2007). Management can utilize stories to help employees understand business decisions, customer characteristics, competitive advantages, and the relationship between and within other stakeholders. In addition, stories can link the company's strategy with individual roles and responsibilities (Bartel & Garud, 2009).

Stories can also help employees work in teams and create a stronger sense of community. They establish an environment that fosters career aspirations and thus make each employee feel more valued (Adamson et al., 2006).

Companies are conducting business in the ever-increasing competitive markets. To be successful in these markets, companies should get closer to their customers (Limehouse, 1999) to gain a better understanding of their needs and how to satisfy them. Customers should be the focus of any strategic business decision companies make. Customers can bring to light a variety of stories derived from various sources, including a company's logo (Whetten & Godfrey, 1998). Thus, the important role that these stories can play cannot be ignored (Driscoll & McKee, 2007).

Company's Logo as a Source of Stories

The identity of an organization is what its members regard as the focal, distinct and lasting features of their company. Companies transmit these features through their behavior, communication and symbols (Whetten & Godfrey, 1998). Symbols, more specifically logos, can be viewed as an effective tool that management can use to orchestrate the desired features that the company wants to convey (Ried et al., 2001). Annually, companies invest a large amount of money and time on logos, and new logos are established as a consequence of mergers and acquisitions. For example, in 1994, over 3,000 new companies in the US were responsible for jointly spending about $120,000,000 to create a new logo (Anson, 1998). These investments are made because management has an expectation that the logo is part of the value and reputation of a company.

Logo selection can be an extremely difficult task for companies, because a number of considerations such as colors, graphics, layouts, and sights, all play an important role. In addition, it is also very likely that the desired responses to the logo are not achieved because a logo's design may make it difficult to associate with the organization, or it seemingly fails to convey the ideas originally intended (Dubberly, 1995). However, if carefully managed, a logo can contribute to the competitive advantage by enhancing a company's reputation (Baker & Balmer, 1997).

Logos increases an organization's recognition. The premise behind this is that pictures convey information faster than words (Edell & Staelin, 1983). That is why the appropriate selection of logo is vital, because they are one of the primary instruments to communicate a company's image - cutting through clutter to gain attention – increasing recognition of the company, thus enhancing customer loyalty. Unfortunately, in spite of their importance and widespread use, some logos evoke negative sentiments, are unrecognizable, and do damage to the corporate image (Henderson & Cote, 1998).

Logos can be expressed as vocal, visual, or textual attributes that customers perceive, and these perceptions can vary depending on the backgrounds of customers. From a company's logo, customers can distill various stories that influence their sentiments about a company's image.

Storytelling Complexity

The storytelling process is related to the signs, symbols, and actions where people find clues on how to interpret events. These clues are viewed in different manners, and depend much on the backgrounds of the participants. The variation of interpretation is how participants make sense of the information. Storytelling complexity is strongly influenced by sensemakings. Weick (1995) lists seven attributes of sensemaking, which he summarizes the following way, "how can I know what I think until I see what I say?" The seven properties of sensemaking are:

(1) grounded in identity construction;
(2) retrospective;
(3) enactive of sensible environments;
(4) social;
(5) ongoing;
(6) is focused on extracted cues; and
(7) is based in plausibility rather than accuracy.

The sense making process can lead to the derivation of different stories from the same phenomenon (Taylor, 1999). This is because the sensibility of environments and the need to extract cues, individuals in different settings are expected to make sense of things differently (Taylor, 1999).

RESEARCH METHODOLOGY

This study was conducted in a student housing complex on the main campus of a university located in the southern US. It draws from the bank customer's perspectives. It used a convenient sample of 25 Vietnamese students studying at the University. By doing so, it controlled for culture, geography, and institution.

This study relies on qualitative research procedures based on interview questions focusing on the bank's logo (https://www.wellsfargo.com/about/history/stagecoach/). It used open-ended, semi-structured questions designed to allow participants to tell their stories and to focus on their personal experiences as Wells Fargo Bank customers. Questions included prompts such as, "What story does the picture tell you?" "What does the picture's story tell you about the Wild West?" "What are men doing with their guns?" and "How safe is your money in the stagecoach?" as well as open discussions about storytelling complexity. The interviewees received a written briefing about the purpose of the research in advance and any questions from the interviewees were answered at the beginning of the interview. Interviews ranged from 30 to 60 minutes in length and were conducted at each participant's home. All conversations were audio-taped and transcribed verbatim. After the transcription of the tape-recorded interview, the interviewees were encouraged to make any corrections, changes or comments to what they had said. Both the tapes and the transcripts remained completely anonymous and confidential.

Among the 25 students, 14 were male (56%) and 11 female (44%), while 96% of the students were graduate and only 4% undergraduate students. With regard to degree levels, 44% were PhD students, 52% Master students, and 4% Bachelor students. In addition, 24% of the students specialized in mathematics, 20% in computer science, 4% in business, 16% in economics, 12% in biology, 12% in electrical engineering, and 12% in construction engineering. In terms of their relationship with the bank, 22 students (88%) had a relationship with the bank by opening accounts and using a variety of services provided by the bank, and 3 students (12%) had accounts with other banks (e.g., Bank of America).

RESULTS OF THE STUDY

Wells Fargo Bank Brief

Wells Fargo growth is characterized by many recent merger and acquisition activities in the banking industry. This characteristic makes the storytelling process at Wells Fargo Bank more complicated because various organizations were combined into one over time. However, the success of Wells Fargo Bank illustrates that a constant identity, based on its rich culture and history in directing the bank's stories are very important.

The following is a brief synopsis of information on Wells Fargo Bank (https://www.wellsfargo.com/downloads/pdf/about/wellsfargotoday.pdf):

Holding company name: Wells Fargo & Co.
Founded: March 18, 1852
Headquarters: San Francisco, California, USA
Industry: Finance and Insurance
Products: checking accounts, Insurance Brokerage, Stock Brokerage, Asset Management, Asset Based Lending, and Consumer Finance
Assets: $1.2 trillion (2010)
Market value of stock: $132 billion (2010)
Q4 net income: $3.4 billion (2010)
Q4 revenue: $21.5 billion (2010)
Team members: 278,000 (2010)
Customers: 70 million (2010)
Stores: more than 9,000 (2010)
ATMs: 12,094 (2010)
Website: www.wellsfargo.com

According to many of the U.S residents, Wells Fargo Bank's logo is a symbol of the Wild West and the Gold Rush era. On March 18, 1852, Henry Wells and William G. Fargo founded a business named Wells Fargo & Company (Hungerford, 1949). At that time, it specialized in banking and forwarding operations. It was involved in a significant number of transactions on gold dust, gold and silver coin, and bullion. Concurrently, it provided banking services, such as deposits, collections and remittances. It also accepted packages, mail and freight for delivery between San Francisco and New York, and other main areas in California. Wells Fargo adopted the image of a stagecoach with horses galloping over bumpy roads transporting passengers and treasure from one town to another, undaunted by weather or the threat of a holdup.

It was the stagecoach that provided the first rapid transit to the American West. Also, Wells Fargo Bank has experienced a set of pivotal events. Many of these events are based on the effects that mergers and acquisitions have had on, as the number of stories increases.

Wells Fargo Bank has been regarded as one of the leading banks in the U.S providing diversified services to its customers, including retail banking, internet services, wholesale banking, and consumer finance. The present business model is embedded in its vision statement (https://www.wellsfargo.com/invest_relations/vision_values): "we want to satisfy all of our customers' financial needs, help them succeed financially, be the premier provider of financial services in every one of our markets, and be known as one of American's great companies."

Although Wells Fargo Bank has experienced many mergers and acquisitions, its identity is mostly unchanged and the logo of six-horse drawn stagecoach, treasure box, and short-gun messengers still conjures a strong sense of the Wild West and Gold Rush era of the U.S. These stories are rich in history, image and a reputation that management has relied on throughout the success of the bank

STUDY RESULTS

Upon arrival at the university, the students found it difficult to choose a bank. All the students who are Wells Fargo customers were encouraged to open accounts by their friends, existing Wells Fargo Bank's customers. They were influenced by the stories and good experiences shared by the pioneering students. The stories were diverse, ranging from the products to the services that the bank offers. These stories influenced new students to open accounts at Wells Fargo Bank.

For those who didn't select Wells Fargo Bank when they arrived at the university for the first time, they were actually unable to compare Wells Fargo Bank to the other banks. The reasons for selecting another bank (e.g., Bank of America) were not different from those who selected Wells Fargo Bank. Hence, all the Vietnamese students in the sample were influenced by the stories about Wells Fargo Bank's employees, customers, and potential customers. When talking to the authors, one Vietnamese student still remembered clearly that:

> I was very afraid of numerous difficulties when coming here at the beginning. Among them was to figure out what bank was suitable to contact with and the way to go to its address. Fortunately, my friend – a second year graduate student with major in economics- came to my house and told many stories and comfortable experiences that she had with Wells Fargo Bank. One of the stories was that she did feel extremely convenient when using the services of Internet banking offered by the bank. At that time, I was still vague with the concept of Internet banking; however, I totally followed her suggestions to open my account in Wells Fargo Bank. So far, I have been satisfied with this bank.

Thus, if used effectively, storytelling plays a powerful role in informing and influencing a target audience. In this respect, Wells Fargo Bank seems to be quite successful.

When asked "What story does the picture tell you?" Surprisingly, 100% students (even those who didn't have any account with the bank) answered this question with consistent and nearly identical responses. They thought that the picture evoked the symbol of Wells Fargo Bank. In spite of not having extensive knowledge about commercial banks, they could, to some extent, perceive some cues about the bank. Actually, this is not the first time they had seen the picture; rather, all the students stated that they have already seen Wells Fargo Bank's logo (e.g., on the roads, in restaurants, at the university, or in supermarkets). Hence, it appears they had no difficulty recollecting the bank. In addition, some cues have also made contributions to the recognition of the bank. The following student's story is quite interesting.

> One day, I went to the University. Suddenly, I needed some cash for small transactions at the University, so I arrived at the first floor of the student center where ATMs are available. At that time, I was wondering about what ATM I would use for the cash withdrawal. Not long afterwards, on the screen of one ATM, a six horse drawn stagecoach with short gun messengers appeared, and promptly I saw the words "Wells Fargo Bank" – it is the very bank that I have opened my account with. Finally, I completed my transactions. Since then, I have had a strong impression with the logo of Wells Fargo Bank. And I often tell my friends about its really nice logo; perhaps, it has been conveying some meaningful image.

Regarding the question, "What does the picture's story tell you about the Wild West?" It seems that there is no discrepancy in this respect. It is noteworthy that the Vietnamese students are familiar with some Wild West films. Thus, from the background of the picture and cues pertaining to riffles, messengers, horses, and treasure boxes, the Vietnamese students all drew the conclusion that this picture is reminiscent of life in the Wild West. However, most of them do not agree with why Wells Fargo Bank uses this picture as its logo. They are left to wonder whether or not there is a relationship between the time the bank was founded and the Gold Rush. Response from a student reflects this issue.

> Well, I have been living in the US for approximately four years. I have seen a number of American films with reference to the Wild West in the 1850s during which, the Gold Rush was occurring. So in this situation, based on signals from the picture, such as guns, riders, horses, treasure boxes and stagecoach, it is quite easy for me to state that the picture is depicting the time of the Wild West in the 1850s. It is noted that this period of time is characterized by the use of horse drawn stagecoaches as the main means of transportation. Nevertheless, I am wondering how such a picture can relate to Wells Fargo Bank's existing business operations.

Besides the above response, the answer of another student also reinforces the ease of recognizing the Wild West.

> I have just come here for three months. Everything seems unfamiliar to me. But, I can perceive a lot from this picture. There is no doubt that this picture evokes the time of the Wild West in which people rushed into gold in the 1850s. I have heard about cowboys in Texas; nevertheless, this is the first time I see cowboys, although I don't know exactly what the men in this picture are doing.

With respect to question "What are the men doing with their gun?", the responses to this question are summarized in table 1 as follows:

Table 1: Dimensions of Answers to "What Are Men Doing with Their Gun?"		
Dimension	Number of Students	Percentage
Protecting gold	7	28%
Protecting money	7	28%
Protecting things other than gold and money	5	20%
Fighting with messengers from other companies	1	4%
Robbing gold mines	1	4%
Keeping their company safe	2	8%
Doing nothing with guns	2	8%
Sum of responses	25	100%

The percentages of students with answers of "Protecting gold", "Protecting money" are highest – 28% for each response. These are followed by 20%, 8%, and 8% for "Protecting things other than gold and money", "Keeping their company safe", and "Doing nothing with guns", respectively. The lowest percentages are 4% for each of the remaining responses – "Fighting with messengers from other companies" and "Robbing gold mines".

It is interesting that the same picture leads to different answers, when perhaps we would expect the exact same response. One reason for different answers is that the picture elicits a story, and a story is never linear, finalized, and coherent (Boje, 2005). Hence, this situation is similar; one picture conjures different stories.

For the question: "How safe is your money in the stagecoach?", the responses are summarized in Table 2.

Table 2: Dimensions of Answers to "How Safe Is Your Money in the Stagecoach?"		
Dimension	Number of Students	Percentage
Very safe	11	44%
Safe	8	32%
Neutral	3	12%
Unsafe	2	8%
Very unsafe	1	4%
Sum of responses	25	100%

The majority of the students contend that thanks to the money put in the stagecoach protected by the messengers, the money's safety is very high. Specifically, the response of "very safe" represents 44% and that of "safe" is 32%. Two students (8%) felt that their money is very unsafe. Their responses are worth noting:

> Although I am very deeply impressed by the logo of the bank, I still think that the picture evoking the Wild West time in the 1850s makes people become hesitate to place their money into the bank due to the fact that appearance of the guns and

> men may be the representation for high risks pertaining to the bank's business operations.

Another student who did not have an account with the bank gave a similar response:

> I don't open any account with Wells Fargo Bank, because I think that the bank's logo is less believable than that of Bank of America. I am wondering why guns are imbedded in the symbol of the bank. So, finally, I made my decision to open an account in Bank of America.

Once again, there is no unanimous consensus of the students' responses. This is because the picture can be seen as a single, or as a facet of the story as interpreted by each person. Recall that the story from the picture and its related stories are really non-linear, unfinalized, and incoherent. Thus, searching for meanings derived from the logo is perhaps rather different given each person's direct experience.

It is common for each student to have different information and different perspectives. That is why when faced with an unfinished, incoherent, unplotted and non-linear story, their narratives will certainly go towards discrete directions in an attempt to search for their own meanings. It should be noted that seniority is not positively related to the perceived level of safety. By the same token, the safety construct varies according to specific situations. The following student's comments help explain this.

> Actually I believe that my money would be safely protected by the bank. Let's look at these guns and messengers, undoubtedly their functions are to protect our money. Further, I don't care a lot about this if someone else argues in another direction because I don't have much money; I am a student.

Besides information gained from these questions mentioned above, additional information was also attained through open discussions between the author and the respondents. These discussions revolved around storytelling complexity and the determinants of this concept. The students expressed interesting ideas about these topics and about Wells Fargo Bank.

Storytelling complexity

Once we discussed the students' perceptions of Wells Fargo Bank's logo, additional information was collected on the topic of storytelling complexity as perceived by the students. It was the view that there are a number of dimensions that contribute significantly to the complexity level of stories and the storytelling process.

Diversified products and services:

Ninety-two percent (92%) of the students stated that each time they visit the bank, they move from room to room because the employees are located in different rooms, in charge of serving the specific needs of the customers. Furthermore, this is due to the specialization carried out by the bank. Customers will receive many different stories and explanations at each functional unit, because the common target is to motivate customers to utilize the different products and services of the bank.

> Whenever I come into the bank, I am often served by some bank staff who specialize in distinct fields. For example, if it is the first time you come, you will be helped by a general employee; soon after, depending on your needs, you will be directed towards the rooms where your specific needs would be satisfied by functional staff of the bank. At that time, a variety of stories (advertisements) would be given out to help you understand the services and products and motivate you to consume them. That is why you need to move around the bank, from one room to another, to capture what is going on and whether or not your needs are met within and/or outside the bank.

Network of branches:

A majority of the students (88%) agreed that the bank's network of branches would make its storytelling process more complicated. The more branches the bank has, the more complicated the storytelling process become.

> I am really surprised that advertisements of one of Wells Fargo Bank's branches seem to be the same as, and consistent with those, of another branch. The employees' stories between the two branches are all conveying slogans that make customers delighted and curious, and motivate them to buy more services/products of the bank. Thus, I think that to manage effectively the circulation of stories, great efforts would be used to make the stories of branch network identical and consistent with the aim at bringing about benefits for both the bank and its customers.

International geographical involvement:

Before arriving at the university, most of the students only knew some giant banks such as Bank of America due to their global nature. In the case of Wells Fargo Bank, it is quite surprising that all the students were in agreement with the idea that Wells Fargo Bank is a multinational bank (actually not) and they (84%) appeared to think that the bank's international geographical involvement influences the storytelling complexity.

> Since 2001, I have remitted money electrically to my next of kin in Viet Nam. I have been really impressed by the speedy transactions made by Wells Fargo Bank. I know that this bank has been in collaboration with a Vietnamese bank – Industrial and Commercial Bank of Vietnam (even I am not sure whether or not its branches exist in Vietnam) regarding this kind of service. Up to now, I still keep my thought unchanged that Wells Fargo Bank is a multinational bank, and the international geographical involvement is a determinant of the storytelling complexity.

Number of employees:

Most of them (23 out of 25 students) argued that the storytelling complexity stems from the number of employees in the organization. They seemed to agree that the greater the number of employees, the more complicated the storytelling process.

Number of functions:

With regard to the number of functions, 72% of the students believe that the diversification in bank functions is a clear contributor to the storytelling complexity.

> I often observe what is going on within a bank (even a branch) in terms of transaction procedures. I know for sure that basic functions of a bank consist of investment, credit analysis, capital mobilization, customer service relationship, brokerage, cash-flow management, etc. When a customer comes into the bank, depending on what kinds of service he or she needs, at the beginning, each function is in charge of satisfying his or her demand. Nevertheless, it doesn't mean that there is no association between the functions; in fact, to meet customers' requirements, coordination between the functions is necessary.

Stiff competition:

The ever-increasing competition in the financial industry is considered a strong determinant of the storytelling complexity. Out of the 25 students, 18 stressed that nowadays banks are competing not only with each other, but also with non-bank financial institutions. This competitive pressure is leading banks to restructure their business operations periodically responding to the local and global contexts. Furthermore, each restructure can create various stories that stakeholders will perceive differently, depending on their own values and norms.

> I often ask myself where I can put my money. Nobody can deny the fact that banks are still the number 1 priority, although I perceive that some alternatives are existent, such as trust funds, pension funds, and treasury bonds, etc. The rationale that I am loyal to my bank relies on the fact that it is aggressively expanding beyond its traditional products and services. This move will multiply customers' stories.

Logo meanings:

In discussions about the meanings of the bank logo, all the respondents agreed that they have been deeply impressed by the logo of Wells Fargo Bank. In their opinion, the logo itself is a rich source of stories about the bank. People with various perceptions will touch different contents of the same story. The stories are very likely to bring about good impressions for the bank.

> I am a MBA student, so I understand why the bank has been utilizing its logo for a long time without being changed. This strategy depicts the long history of the bank originally coming from Gold Rush era. From my point of view, it is quite obvious that customers would feel safer in dealing with banks with long business histories.
>
> Well, the critical reason you open your account with a bank is that you feel more assured than keeping cash. Let's look at the picture containing the bank's logo, you will see the messengers with guns who are in charged of keeping your money safe. There is nothing more truthful than Wells Fargo Bank as the symbol of the safest address for your money.

Leadership:

According to 19 out of the 25 respondents, the role of leaders in any organization is very important. Leaders of an organization are responsible for establishing a clear sense of mission and vision. Also, through a variety of directed stories, leaders can be the catalyst that forms the distinct identity of the organization. That is why the storytelling complexity level is likely influenced by changes in leadership. Such changes can create new business strategies with revised stories that require time for the employees to perceive and convey effectively to customers in a consistent manner.

> So far, I haven't witnessed whether changes in leadership in Wells Fargo Bank can impact the storytelling complexity level; however, I used to experience such feelings in Vietnam. At that time, I was a customer of a Vietnamese bank. At the beginning of 2002, most of the executive directors of the bank were replaced by younger ones. So, the change in philosophy was unavoidable. The emergence of new stories with vital strategies made its customers believe more in the bank and maintained loyalty. It is noteworthy that this is not the case for every situation, because sometimes changes in leadership tend to give rise to turbulence that may have negative impacts on customers' perceptions.

In addition to the above dimensions, *diverse cultures (72%), and perceptions on bank risks and incomes (64%) are also regarded as important antecedents of the storytelling complexity.*

DISCUSSION AND IMPLICATIONS

Discussion

It is interesting to note that 22 students (88%) have a relationship with the bank based on opening accounts and enjoying various services and products offered by the bank, while three students (12%) have accounts with other banks (e.g., Bank of America). It is noteworthy that when they arrived at the university, everything seemed to be unfamiliar to them and they didn't know exactly what kind of bank would be their optimal choice. At that time, suggestions from their friends (senior Vietnamese students or Vietnamese expatriates leaving around the university) played an important role in their choice. Most of the Vietnamese students were strongly influenced by the stories being exchanged between the bank employees and the senior students, and between the senior students and the newcomers, with respect to the selection of Wells Fargo Bank. In this case, the storytelling process is viewed as a significant factor in bridging the gap between the bank and the Vietnamese students, and in assuring the Vietnamese students on their choice of bank. Furthermore, they can have many opportunities to discover more stories about Wells Fargo Bank after the initial relationship is established.

Regarding recognition of the logo, it is also quite interesting, and a bit surprising, that all the students - including those who didn't open accounts with the bank – could easily recognized the bank's logo. Perhaps they see it whenever they have contact with the bank, and the logo appears in many places that make customers pay attention to it. We can say that the bank's image is crystalized in the minds of the Vietnamese students and in part driven by the bank's logo. In addition, the students did go beyond the logo recognition. All the students felt confident in concluding that the picture elicits some cues relating to the Wild West and Gold Rush era. This proves that some American films about the American West in the 1850s are a familiar genre to the Vietnamese students. That is why some cues such as guns, messengers, horses, and bumpy roads reminded them of the time period of 1850s of the US. However, although recognizing the Wild West is relatively easy, most of them were still wondering whether or not there is a relationship between the time at which Wells Fargo Bank was founded and the time at which the Gold Rush was occurring. Thus, the bank management needs to make Wells Fargo Bank's long history clearer to facilitate this association.

Interestingly, the stories were not restricted to the picture or the bank's logo. They ranged, in particular, to the actions of the messengers on the picture. Despite the lack of unanimous converge on answers to "What are men doing with their gun?", the combined responses of "protecting gold", "protecting money", "protecting things other than gold and money, and "keeping their company safe" accounted for 84% of the respondents. That is to say that messengers on the bank's logo and their contributions to security conjure a good image in the minds of the customers. Furthermore, the Vietnamese students also expressed their stories in terms of the degree of money safety. Specifically, the responses of "very safe" and "safe" gained the agreement of 76% of the students, followed by "neutral" 12%, "unsafe" 8%, and "very unsafe" 4%. By the same token, the stagecoach as a component of the bank logo also plays an important role in forming a good image in the minds of customers.

In addition to the data gathered from the four questions, data pertaining to the storytelling complexity was also gathered. The dimensions of the storytelling complexity are summarized in Table 3.

Table 3: Dimensions of the Storytelling Complexity

Dimension	Number of Students	Percentage
Diversified products and services	23	92%
Number of employees	23	92%
Network of branches	22	88%
Logo meanings	22	88%
International geographical involvement	21	84%
Leadership	19	76%
Number of functions	18	72%
Stiff competition	18	72%
Diverse culture	18	72%
Perceptions on bank risks and incomes	16	64%

It is remarkable that 92% of the students agreed that "diversified products and services" is a significant determinant of the storytelling complexity. The Vietnamese students have been using a variety of products and services offered by Wells Fargo Bank, and each service encounter can bring about a web of stories. These stories depend on the level of customer satisfaction. For example e-customer satisfaction (when customers use online services) is related to three kinds of service quality comprised of banking service product quality, customer service quality, and e-systems quality (Jun & Cai, 2001). Hence, stories about satisfaction with various services and products are unlimited, depending on how the customers' perceptions and on their expectations in terms of service quality.

For the dimensions of "number of employees", "network of branches", international geographical involvement, and number of functions, the Vietnamese students identified them as determinants of the storytelling complexity because these dimensions are interconnected and form the story network architecture. A network is a map of nodes and links that interconnect. These dimensions are supported by Boje (2001) with his arguments that stories can link to names, such as people, organizations or places, and can be mapped as node clusters to other story node clusters by their linking themes, as well as can be connected in time sequence to other stories, past, present and future. In this case, each function, geographical location, branch, or employee of Wells Fargo Bank, can be viewed as a node that is a component of the story network architecture, making the storytelling process more complex.

The "logo meanings", "diverse culture", and "perceptions on bank risks and incomes" are intertwined with each other based on the central position of "diverse culture". Thus, "diverse culture" would lead the customers of Wells Fargo Bank to perceive the bank logo, risks, or incomes in different manners. For example, the bank risk is an abstract construct and not easily measured. Risks can be regarded as high, low, or neutral depending on the customer views, and these views are strongly influenced by various backgrounds and cultures. Specifically, someone still wants to deposit his or her money in the bank with high risks, because he or she thinks that the higher the risk the better the income yield. In contrast, someone else will not place funds in the bank on the grounds that the chance of losing her money increases as risk escalates. The customers tend to try to make sense of something whenever they have to make some decision pertaining to it. This sensemaking process is not merged as a whole (Boje, 2006; Weick, 1995), making the storytelling process complex for every customer.

For the "leadership" and "stiff competition" dimensions, we find that they are also interconnected. We have witnessed the ever-increasing competition throughout many industries. To gain a competitive advantage, leadership can play an important role. Leadership can bring about a rich source of stories relating to organizational strategies. By looking more closely at these stories, we can identify the types of leadership. However, the way people understand the type of leadership and the decisions made by the leaders depend on their sensemaking process. That is why the customers (the Vietnamese students) contended that "leadership" and "stiff competition" are determinants of the storytelling complexity based on sensemaking theories (Boje, 2005; Weick, 1995).

Implications

This study confirms the importance of stories and the storytelling process using the context of the Vietnamese student perceptions of Wells Fargo Bank's logo as its backdrop. Bank managers and employees should consider the storytelling process as a powerful tool, or a business function in the bank's organizational structure, and weave it into others such as marketing, operations, finance, research and development, information, and personnel.

The benefits that stories can bring about are substantial, and the bottom-line benefit is perhaps measured in increased customer loyalty and improved bank financial performance. In the case of Wells Fargo Bank, the evidence is that the Vietnamese students are strongly influenced by such stories circulating between the bank employees and the senior students, and between the senior students and the newcomers. For instance, as one respondent noted "I was very afraid of a significant number of difficulties when coming here at the beginning and my friend told me many stories and comfortable experiences that she has with Wells Fargo Bank. I totally followed her suggestions to open my account in Wells Fargo Bank. So far, I have been satisfied with this bank." In addition, among the 25 Vietnamese students interviewed, 22 have their accounts in the bank. Thus, if effectively utilized, stories can be the antecedents of customer loyalty which contributes to bank performance.

Another important concept is that logo management (regarding the storytelling process) should be carefully considered by bank managers, because from the logo, the customers can conceive the history of the bank with important events, its business operations, and shape their feelings towards the bank.

In the case of Wells Fargo Bank, 100% of the students could recognize its logo and perceive the Wild West of the US in the 1850s, while 84% of the students thought that the messengers in the logo picture are doing the right things. Similarly 76% support the idea that the logo is an overall advantage for Wells Fargo Bank. The logo depicts its advantages. Hence, the logo adds value to Wells Fargo Bank (Ried et al., 2001).

Bank managers should understand the attributes of the storytelling complexity from the customer perspective, because these attributes are influenced by the sensemaking process (Boje, 2006; Weick, 1995) which influences the different ways that customers perceive the bank logo. The premise is that the different stories derived from the customer perceptions would be useful for bank managers to revise the logo and elicit as much as positive feedback from the customers. By so doing, a good image would be rooted in the minds of the customers acting as the basis for customer loyalty which contributes to bank performance. All the dimensions of the storytelling complexity should be carefully considered in the context of the bank. Dimensions like "diversified products and services", "number of employees", "network of branches", and "logo meanings" need to be given special priority due to the large percentage of consensus reached by the Vietnamese students.

CONCLUSION AND DIRECTIONS FOR FUTURE RESEARCH

Little research has focused on logo stories and storytelling complexity from the perspective of the customer. This study is an explorative one aimed at investigating the customer perceptions of Wells Fargo Bank's logo, the associated stories and the dimensions of storytelling complexity. Furthermore, this study also examined the latent relationship between the stories and customer loyalty.

The findings show that the customers can derive various stories from the bank logo, depending on their different backgrounds. In general, all the stories distilled by the customers are in support of Wells Fargo Bank.

Additionally, the ten dimensions of the storytelling complexity are filtered as follows:

(1) Diversified products and services;
(2) Number of employees;
(3) Network of branches;
(4) Logo meanings;
(5) International geographical involvement;
(6) Leadership;
(7) Number of functions;
(8) Stiff competition;
(9) Diverse culture; and
(10) Perceptions on bank risks and incomes.

These dimensions can contribute to theorists and practitioners in the fields of storytelling process and logo management.

No research is without limitations. This study was carried out based on the small size of sample – 25 Vietnamese students. The sample was not random, and its external generalization is limited.

Future additional studies should be implemented with an expanded sample size. It would also be interesting to statistically test the various dimensions of storytelling complexity not only at Wells Fargo Bank, but also others as well. This may give us a more comprehensive understanding of the role stories play as well as storytelling complexity.

REFERENCES

Adamson, G., Pine, J., Steenhoven, T.V., & Kroupa, J. (2006). How storytelling can drive strategic change. *Strategy & Leadership*, *34*(1), 36-41.

Anson, W. (1998). Determining your identity's asset value. *The 1998 Identity Management Conference*, Dallas,TX.

Baker, M.J., & Balmer, J.M.T. (1997). Visual identity: trappings or substance. *European Journal of Marketing*, *31*(5/6), 366-383.

Barnes, B.K., & Harris, J. (2006). Leadership storytelling. *Industrial and Commercial Training*, *38*(7), 350-353.

Bartel, A.C., & Garud, R. (2009). The role of narratives in sustaining organizational innovation. *Organization Science*, *20*(1), 107-117.

Bartholme, P. (2002). Leading with stories. *CCM Communicator*, *19*(2), 1-10.

Boje, D.M. (2005). Antenarrative in Management. *Sage Dictionary*, 1-4.

Brief information on Wells Fargo Bank. Retrieved February 3, 2011, from https://www.wellsfargo.com/downloads/pdf/about/wellsfargotoday.pdf

Collison, C., & Mackenzie, A. (1999). The power of story in organizations. *Journal of Workplace Learning*, *11*(1), 38-40.

Czarniawska, B. (1997). Narrative the organization: dramas of institutional identity. University of Chicago Press.

Denning, S. (2004). Telling tales. *Harvard Business Review*, *82*(5), 122-129.

Driscoll, C., & McKee, M. (2007). Restorying a culture of ethical and spiritual values: a role for leader storytelling. *Journal of Business Ethics*, *73*, 205-217.

Dubberly, J. (1995). Protecting corporate identity. *Communication Arts*, *36*(1), 14-18.

Edell, J.A., & Staelin, R. (1983). The information processing of pictures in print advertisements. *Journal of Consumer Research*, *10*(1), 45-61.

Gallie, W.B. (1968). Philosophy and the historical understanding. New York: Schocken Books.

Gold, J. (1996). Telling stories to find the future. *Career Development International*, *1*(4), 33-37.

Granbois, D. (1981). An integrated view of the store choice/patronage process. *Advances in Consumer Research*, *8*, 693-695.

Greco, J. (1996). Stories for executive development: an isotonic solution. *Journal of Organizational Change Management*, *9*(5), 43-74.

Heerden, C.H.V., & Puth, G. (1995). Factors that determine the corporate image of South African banking institutions: an exploratory investigation. *International Journal of Bank Marketing*, *13*(3), 12-17.

Henderson, P. & Cote, J.A. (1998). Guidelines for selecting or modifying logos. *Journal of Marketing*, *62*(2), 14-30.

Jun, M., & Cai, S. (2001). The key determinants of Internet banking service quality: a content analysis. *International Journal of Bank Marketing*, *7*, 276-291.

Korgaonkar, P.K., Lund, D., & Price, B. (1985). A structural equations approach toward examination of store attitude and store patronage behavior. *Journal of Retailing*, *61*, 39-60.

Limehouse, D. (1999). Know your customer. *Work Study*, *48*(3), 100-102.

Marzec, M. (2007). Telling the corporate story: vision into action. *Journal of Business Strategy*, *28*(1), 26-36.

McCollum, M. (1992). Organizational Stories in a family owned business. *Family Business Review*, *5*(1), 3-24.

Ricoeur, P. (1984). Time and narrative. University of Chicago Press.

Ried, C.B.M.V., Ban, A.V.D., & Heijmans, E.J. (2001). The added value of corporate logos: an empirical study. *European Journal of Marketing*, *35*(3/4), 428-440.

Taylor, S.S. (1999). Making sense of revolutionary change: differences in members' stories. *Journal of Organizational Change Management*, *12*(6), 524-539.

Wells Fargo Bank's logo. Retrieved February 3, 2011, from https://www.wellsfargo.com/about/history/stagecoach/

Wells Fargo Bank's vision statement. Retrieved February 3, 2011, from https://www.wellsfargo.com/invest_relations/vision_values

Whetten, D., & Godfrey, P.C. (1998). Identity in organizations: building theory through conversations. *Sage Publications*, Thousand Oaks, CA.

Wilkins, A.L. (1984). The creation of company cultures: the role of stories and human resource systems. *Human Resource Management*, *23*(1), 41-60.

IMPROVING THE ART, CRAFT AND SCIENCE OF ECONOMIC CREDIT RISK SCORECARDS USING RANDOM FORESTS: WHY CREDIT SCORERS AND ECONOMISTS SHOULD USE RANDOM FORESTS

Dhruv Sharma, Independent Scholar

ABSTRACT

This paper outlines an approach to improving credit score modeling using random forests and compares random forests with logistic regression. It is shown that on data sets where variables have multicollinearity and complex interrelationships random forests provide a more scientific approach to analyzing variable importance and achieving optimal predictive accuracy. In addition it is shown that random forests should be used in econometric and credit risk models as they provide a powerful too to assess meaning of variables not available in standard regression models and thus allow for more robust findings.

Key words: credit scoring, logistic regression, random forests

INTRODUCTION

The aim of this paper is to outline an approach to improving credit risk scorecards using Random Forests. We start with the benefits of random forests compared to logistic regression, the tool used most often for credit scoring systems. We then compare performance of random forests and logistic regression out of the box on a credit card dataset, a home equity loan dataset and a proprietary data set. We outline an approach to improving logistic regression using the random forest. We conclude by demonstrating how power random forests can be used to develop a model using 8 variables which is almost as good as the FICO® score. Thus highlighting the fact that data sets with complex interaction terms and contents can benefit from random forest models in 2 ways: 1) clear insight into the most predictive and valuable variables 2) generating robust models which maximize predictive interactions and relationships in the data not detectable by traditional regression techniques.

For the purpose of this study, model performance will be compared using Receiver Operating curves which plot the proportion of bad loans detected vs. incorrectly classified good loans for each model cut off. Numerically this will be represented by the area under the curve of the ROC plot. All performance discussed will be out of sample performance of a 30% hold out sample while the models generated are built on 70% of the dataset. All investigations into data are conducted using R and Rattle tool.

TRADITIONAL CREDIT SCORING PITFALLS

The biggest problem with traditional credit scoring based on logistic regression techniques is that as a scientist or economist one cannot interpret the importance of underlying variables to the probability of a borrower experiencing financial difficulty.

The p values of the regression are not reliable as regression assumes no multi-collinearity. As such variables which might make sense from a theoretical point of view, such as cash flow surrogates, and may have strong predictive power would not appear to be statistically significant based on p value statistics. This is a problem because credit data is notoriously correlated and biased. It is well known that 'biased estimation in data ...[which] has been shown to predict and extrapolate better when predictor variables are highly correlated...' as this is common to credit scoring (Overstreet, 1992) .

Although modelers have used skill and judgment to work past this short coming there is no way in traditional scorecards to assess the predictive value variables in a robust and reliable manner. Thus there might be many opportunities of variables and variable interactions which might be lost given the use of the current tool.

Also from a human factors and organizational point of view people are biased to test theories they have and not try things that might not make sense. Our ability to develop causal models is biased and arbitrary despite the meanings we attach to things after the fact.

The history of credit scoring literature is rife with contradictory studies from the Durand's first study in the 1930s on whether income is predictive. Yet mortgage risk models have shown the debt ratio (monthly expenses/income) to be predictive as well as month's reserves (liquid assets/monthly payment). The successes of credit scoring in the mortgage industry show that financial worth and ability to pay variables can be used effectively in models along with loan to value (loan amount/property value) to assess risk. If we step back we can see that interaction variables of affordability and credit risk have proven to be valuable predictive tools. This is also consistent with the judgment theory of credit of: credit (willingness to pay), capacity (ability to pay) and collateral, and character.

The next leap in improvement to credit scoring is to find ways to test interaction terms in a meaningful and principled way. It stands to reason econometrically that if any variable should have impact on human behavior in spending, consumption, and financial distress it should be ability to pay. The measures of this are income, current debt usage, and reserves and assets one has saved to absorb shocks or life events.

Is there a statistically reliable way to test out the importance of variables, relative to their predictive power?

Importance of Random Forests to Credit Risk and Economics in general

To date the majority of credit scorecards used in industry are linear models despite the known issues of the flat maximum and multicollinearity (Wainer, 1978; Overstreet etal 1997;). Random Forests are a powerful tool for economic science as they are able to successfully deal with correlated variables with complex interactions (Breiman, 2001).

A simple example of the power of Random Forests was shown by Breiman in the binary prediction case of hepatitis mortality in which Stanford medical school had identified variables 6, 12, 14 and 19 as most predictive of risk using logistic regression. Subsequently using the bootstrap technique Efron showed that none of these variables were significant in the random resampling trials he ran. The Random Forest variable importance measure, created by Breiman, showed variables 7 and 11 to be critical and improved the logit regression results simplifying the model and by reducing error from 17% to 12% (Breiman, 2002).

As Random Forests are non parametric the linear restrictions of the flat maximum do not come into play as such. That said predictive models tend to perform well with regards to pareto optimal trade offs in true positive and false positive rates which look like an asymptote like the flat maximum effect. The complex interactions of economic variables such as macroeconomic forces and affordability are too complex to be studied for simple linear regression anymore. Random Forests serve as good estimate for asymptote of possible predictive power in this regards and help us get past the psychological limit we may believe to exist for predictive power as Roger Banister was able to do with preconceived limit on minimum time for completing the mile run. The way Random Forests work by building large quantities of weak classifiers with random selection of variables grown with out of sample testing is analogous to the way humans make decisions in a market place (See Gigerenzer's work on "Fast and Frugal trees" on human judgment models). Humans each look at the data available to them and make quick inferences and take actions based on these data. Random Forests then take votes from these large quantities of predictors and use decisions of all the predictors to make the final decision. The fact that diverse models built on different variables and samples of data when combined outperform other simple linear models is profound.

That said the critical aspects of Random Forests of interest to economic scientists are the features Breiman intended such as:

- Random Forests never overfit the data as they are built with out of sample testing for each submodel
- Variable importance (a measure based on the importance in accuracy each variable provides to the overall model based on permutation tests of removing variables)

- Being able to see the effects of variables on predictions (2002).

- Handling thousands of variables efficiently by sampling variables.

Random Forests help us see the true impact of complex interrelated variables. As Breiman mentioned in his Wald lecture, complex phenomenon cannot be modeled well with goodness of fit models with simplifications. A more scientific approach is to build as complex a model to fit the phenomenon being studied and then to have tools like variable importance to understand the relationship inside the phenomenon being studied (Breiman, 2002). This is an important point as economics is based more and more complex realities.

Comparison of Random Forests to Logistic Regression

We now examine random forest performance out of the box on 3 data sets. The first dataset is a private label credit card data set from the 2010 KDD contest in Pacific Asia, the second data set is the widely used home equity loans, and the third data is a proprietary dataset.

1. Random Forest vs. Logistic Regression on Credit Card Data Set

Credit Card Dataset

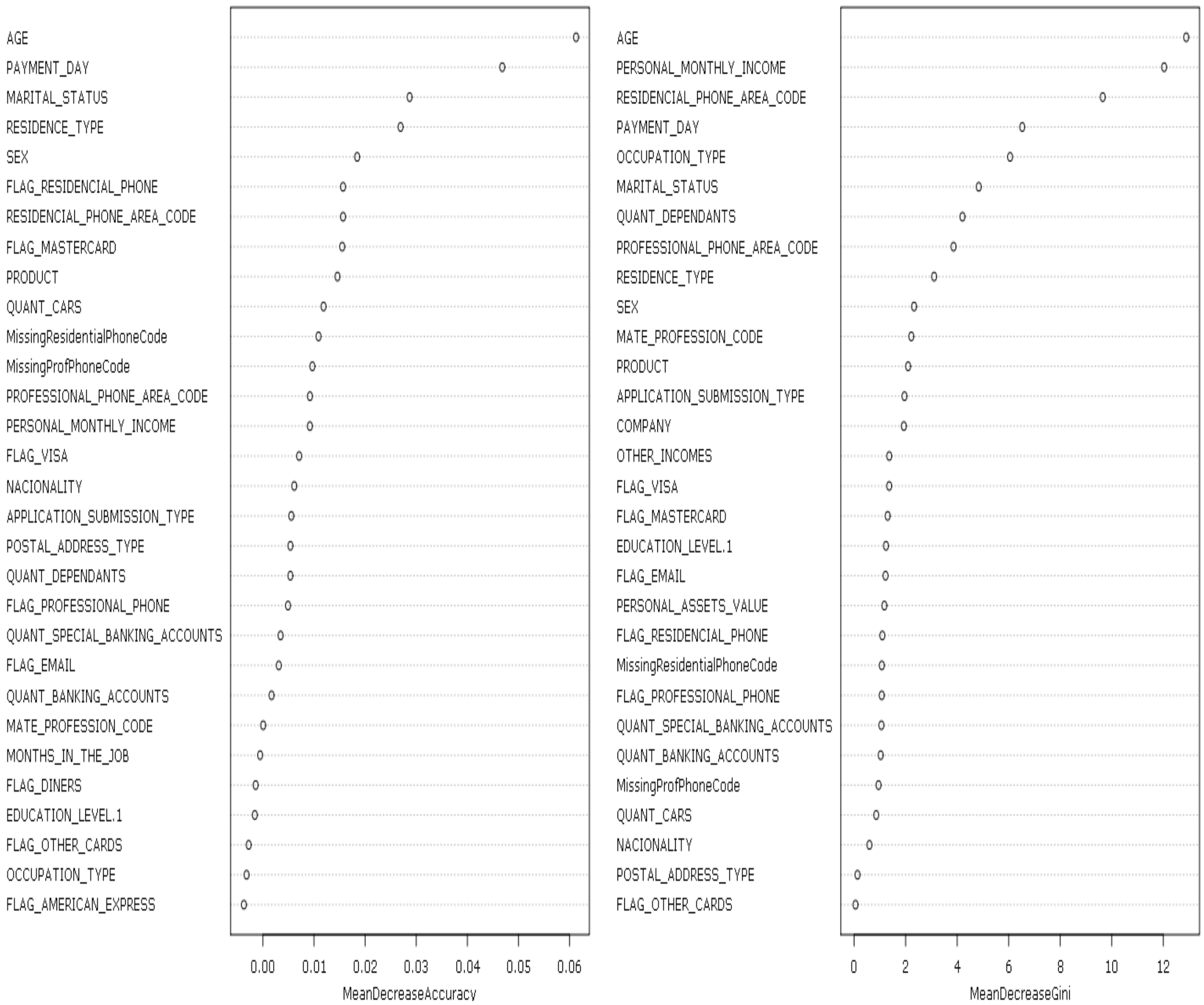
The credit card data set has 50,000 loans of which 13000 are bad (serious delinquency). Using this data set a random forest model and logistic regression scorecard were compared out of the box. The source for the data is http://sede.neurotech.com.br/PAKDD2010/ Pacific-Asian Knowledge Discovery and Data Mining conference.

Models

Random Forest Variable Importance: The variable importance plot for random forests showed the following variables to be predictive in rank order.

According to the random forest plot the majority of predictions of borrower delinquency on the card can be predicted by age, monthly income, phone, payment day, type of occupation, marital status, number of dependents, area code of profession, and type of residence. In addition additional variables can add to predictive power in some fashion through some interaction effects.

Variable Importance



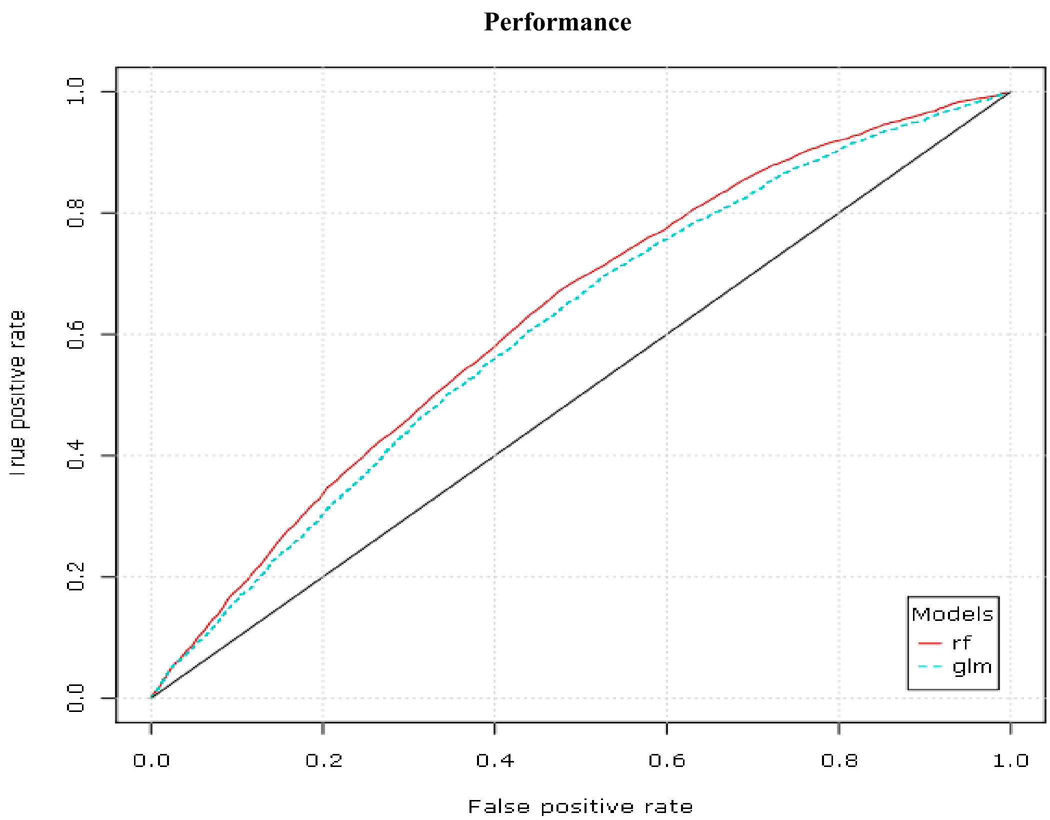
Logistic regression model

Logistic regression model					
Variable	Coefficient Estimate	Std. Error	z value	Pr(>|z|)	Significance
(Intercept)	0.367793	1.008929	0.365	0.715457	
PAYMENT_DAY	0.019525	0.001859	10.505	< 2e-16	***
APPLICATION_SUBMISSION_TYPECarga	-0.30733	0.093499	-3.287	0.001012	**
APPLICATION_SUBMISSION_TYPEWeb	-0.09412	0.059745	-1.575	0.115164	
POSTAL_ADDRESS_TYPE	0.028979	0.151555	0.191	0.848362	
SEXF	-1.01841	0.611657	-1.665	0.095913	.
SEXM	-0.83388	0.611716	-1.363	0.172827	
SEXN	-0.96122	0.717716	-1.339	0.180481	
MARITAL_STATUS	-0.01168	0.009773	-1.195	0.231949	
QUANT_DEPENDANTS	0.020479	0.010485	1.953	0.050805	.
NACIONALITY	0.06682	0.071782	0.931	0.351919	
FLAG_RESIDENCIAL_PHONEY	-0.82105	0.720136	-1.14	0.254232	
RESIDENCIAL_PHONE_AREA_CODE	0.000984	0.000398	2.473	0.013386	*
RESIDENCE_TYPE	-0.01853	0.010731	-1.727	0.084166	.
FLAG_EMAIL	0.017635	0.046639	0.378	0.705338	
PERSONAL_MONTHLY_INCOME	5.77E-07	1.48E-06	0.39	0.69655	
OTHER_INCOMES	1.78E-05	1.83E-05	0.971	0.331516	
FLAG_VISA	0.074469	0.042835	1.738	0.082123	.
FLAG_MASTERCARD	-0.2261	0.046838	-4.827	1.38E-06	***
FLAG_DINERS	0.284333	0.33461	0.85	0.395467	
FLAG_AMERICAN_EXPRESS	-0.06287	0.303154	-0.207	0.835701	
FLAG_OTHER_CARDS	-0.05443	0.299613	-0.182	0.85585	
QUANT_BANKING_ACCOUNTS	-0.00642	0.058358	-0.11	0.912419	
QUANT_SPECIAL_BANKING_ACCOUNTS	NA	NA	NA	NA	
PERSONAL_ASSETS_VALUE	-4.4E-08	3.3E-07	-0.134	0.893551	
QUANT_CARS	-0.02769	0.101239	-0.274	0.784451	
COMPANYY	-0.06863	0.031724	-2.163	0.030512	*
FLAG_PROFESSIONAL_PHONEY	0.714282	0.617823	1.156	0.247629	
PROFESSIONAL_PHONE_AREA_CODE	-0.00056	0.000721	-0.782	0.434309	
MONTHS_IN_THE_JOB	-0.06383	0.055293	-1.154	0.24833	
OCCUPATION_TYPE	0.026602	0.007269	3.66	0.000252	***
MATE_PROFESSION_CODE	-0.00679	0.004226	-1.606	0.108175	
EDUCATION_LEVEL.1	0.000307	0.019259	0.016	0.987279	
PRODUCT	0.034652	0.011976	2.894	0.00381	**
AGE	-0.01968	0.000975	-20.193	< 2e-16	***
MissingResidentialPhoneCodeY	-0.17667	0.720139	-0.245	0.806201	
MissingProfPhoneCodeY	0.804464	0.619538	1.298	0.194119	

Logistic regression model
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
(Dispersion parameter for binomial family taken to be 1)
Residual deviance: 39312 on 34964 degrees of freedom
AIC: 39384
Number of Fisher Scoring iterations 4
Log likelihood: -19655.757 (36 df)
Null/Residual deviance difference: 906.696 (35df)
Chi-square p-value: 0.00000000

Insights

Note how the regression makes the personal income appear statistically insignificant although we know from the random forest that it has a great deal of predictive power.



The AUC (area under the curve) for the random forest model was .629 while for the regression model was .60. Thus random forests had a 5% improvement in performance over the logistic regression. By adding interaction terms suggested by variables in the random forest the logistic regression performance can be enhanced to match or slightly exceed random forest performance.

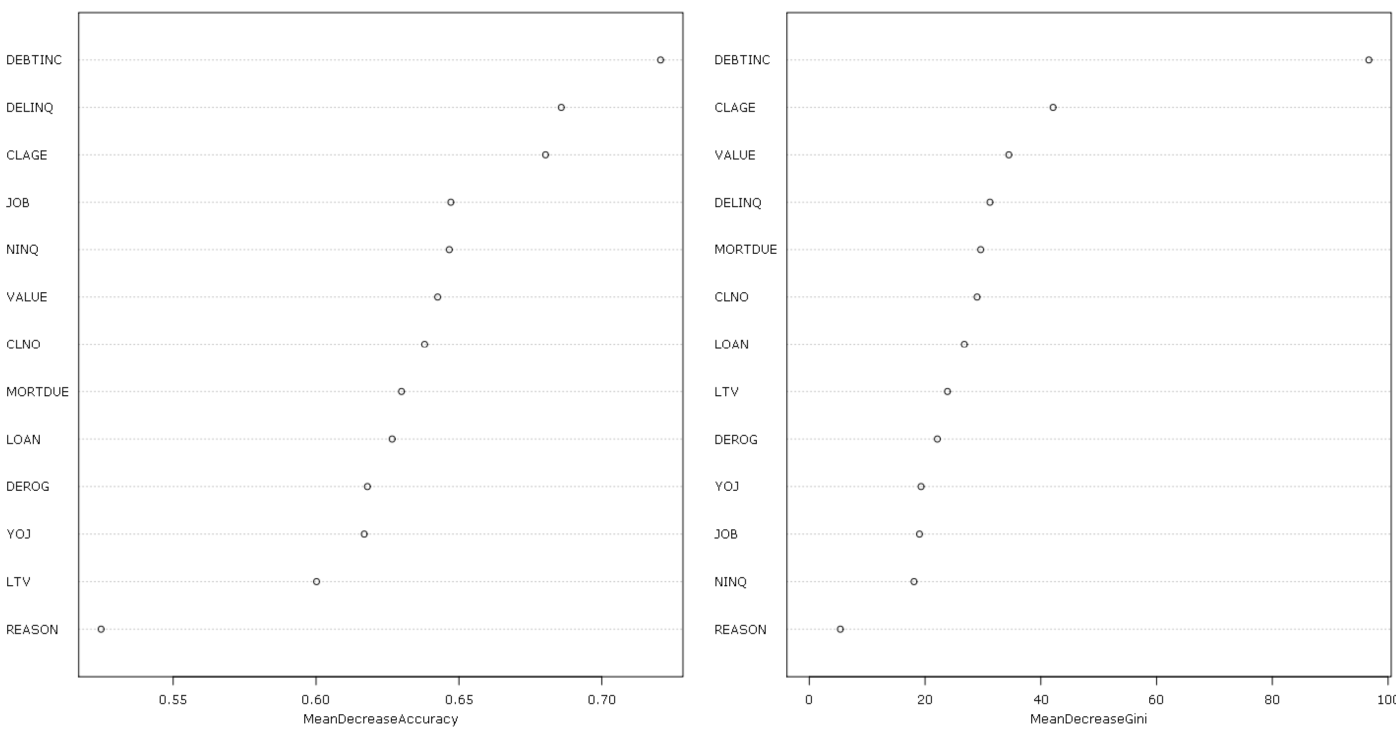
2. Random Forest vs. Logistic Regression on Home Equity Data Set

Home Equity Dataset

The home equity data set has approximately 5,960 loans of which 1189 are bad (serious delinquency). Using this data set a random forest model and logistic regression scorecard were compared out of the box. The source for the data is the popular SAS data set: www.sasenterpriseminer.com/data/HMEQ.xls

Models

Random Forest Variable Importance: The variable importance plot for random forests showed the following variables to be predictive in rank order. The debt ratio, age of credit history, value of the home, and delinquency history had the most predictive power according to the random forest.



Home Equity Logistic Regression

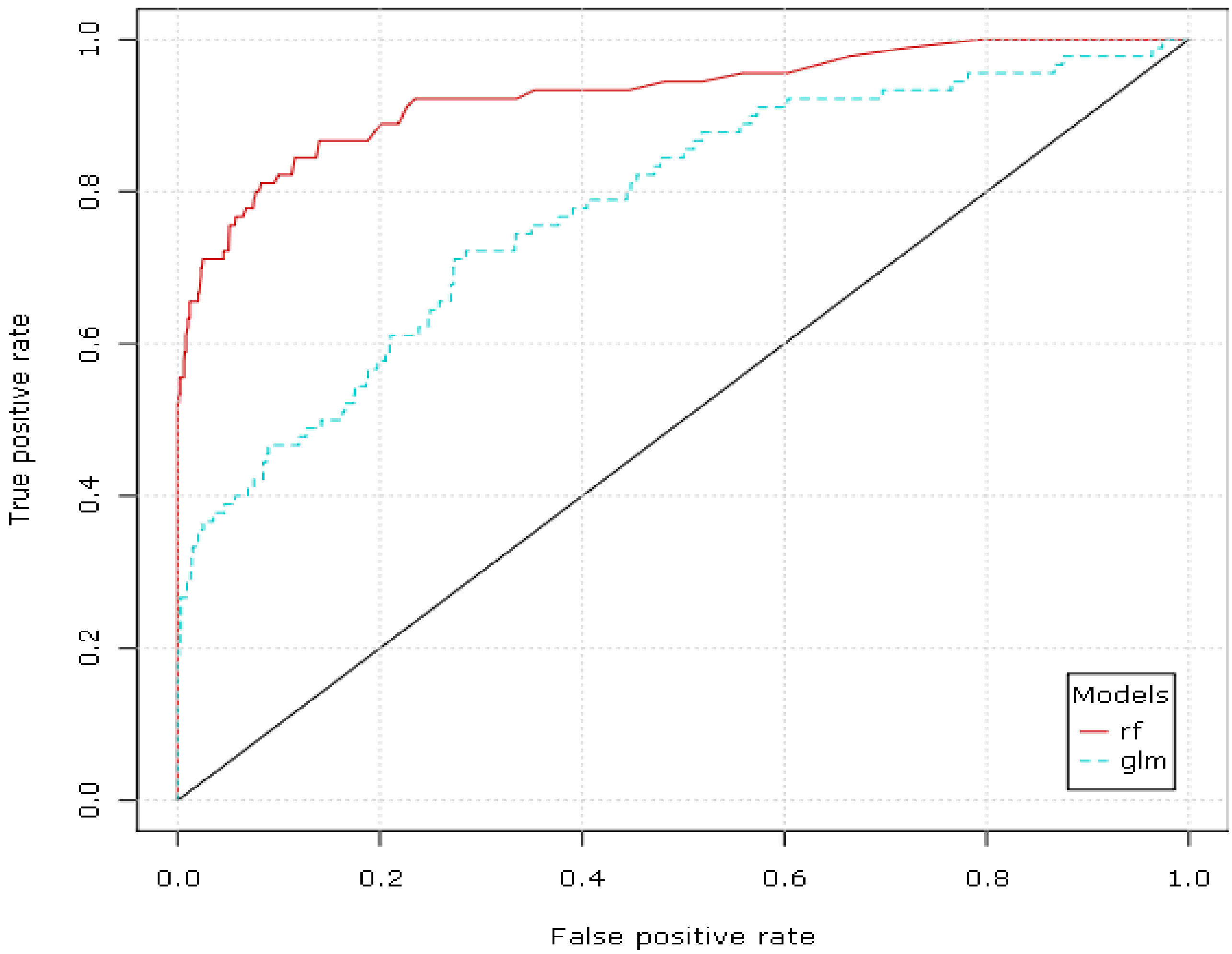
Variables	Coefficient Estimate	Std. Error	z value	Pr(>|z|)	Significan
(Intercept)	-17.07851715	524.8953	-0.033	0.974044	
LOAN	0.000001803	1.58E-05	0.114	0.909386	
MORTDUE	0.000019897	1.26E-05	1.576	0.115104	
VALUE	-0.000016881	1.13E-05	-1.501	0.133474	
REASONDebtCon	-0.621936258	0.635508	-0.979	0.327756	
REASONHomeImp	-0.753124539	0.647779	-1.163	0.244982	
JOBMgr	14.79633915	524.8937	0.028	0.977511	
JOBOffice	14.22345444	524.8938	0.027	0.978382	
JOBOther	14.67559173	524.8937	0.028	0.977695	
JOBProfExe	14.83695589	524.8937	0.028	0.97745	
JOBSales	15.91157826	524.8939	0.03	0.975817	
JOBSelf	15.92432142	524.8939	0.03	0.975797	
YOJ	-0.005838696	0.012261	-0.476	0.63394	
DEROG	0.802276888	0.123378	6.503	7.89E-11	***
DELINQ	0.817538124	0.085566	9.554	< 2e-16	***
CLAGE	-0.00580995	0.001307	-4.445	8.79E-06	***
NINQ	0.155918992	0.042991	3.627	0.000287	***
CLNO	-0.027956215	0.009666	-2.892	0.003827	**
DEBTINC	0.101303396	0.012958	7.818	5.38E-15	***
LTV	-0.020306186	0.011472	-1.77	0.076707	.

Signif. codes:	0 '***' 0.00	1 '**' 0.01 '	'*' 0.05 '	.' 0.1 '	' 1
(Dispersion pa	rameter for bi	nomial fam	taken to	be 1)	
Null devia	nce: 1472.1 o	n 2431 de	es of fre	edom	
Residual devia	nce: 1090.8 o	n 2412 de	es of fre	edom	
(1740 observ	ations deleted	due to mis	ngness)		
AIC: 1130.8					
Number of Fish	er Scoring ite	rations: 16			
Log likelihood	: -545.408 (20	df)			
Null/Residual	deviance diffe	rence: 381	3 (19 df)		
Chi-square p-v	alue: 0.000000	0			

Insights

The regression shows Debt ratio and other variables suggested by random forests to be statistically significant.

Performance Random Forest vs. Logistic Regression Home Equity Data



The random forest however greatly outperforms the logistic regression scorecard on the home equity data set. Thus showing that logistic regression is not exploiting the maximum predictive value of the variables.

The AUC of the random forest was .92 while for the logistic regression was .78. Thus out of the box random forests had an 18% advantage in performance over the logistic regression. A recent study of tuning logistic regressions with neural network transformations had a performance of logistic regression to have an AUC of .86 (Wallinga, 2009). Thus Wallinga's approach of general additive neural network logistic regression though a powerful well thought enhancement improved performance by 28% but still did not match the out of performance of random forests.

3. Random Forest vs. Logistic Regression on Proprietary Data set

Proprietary Dataset

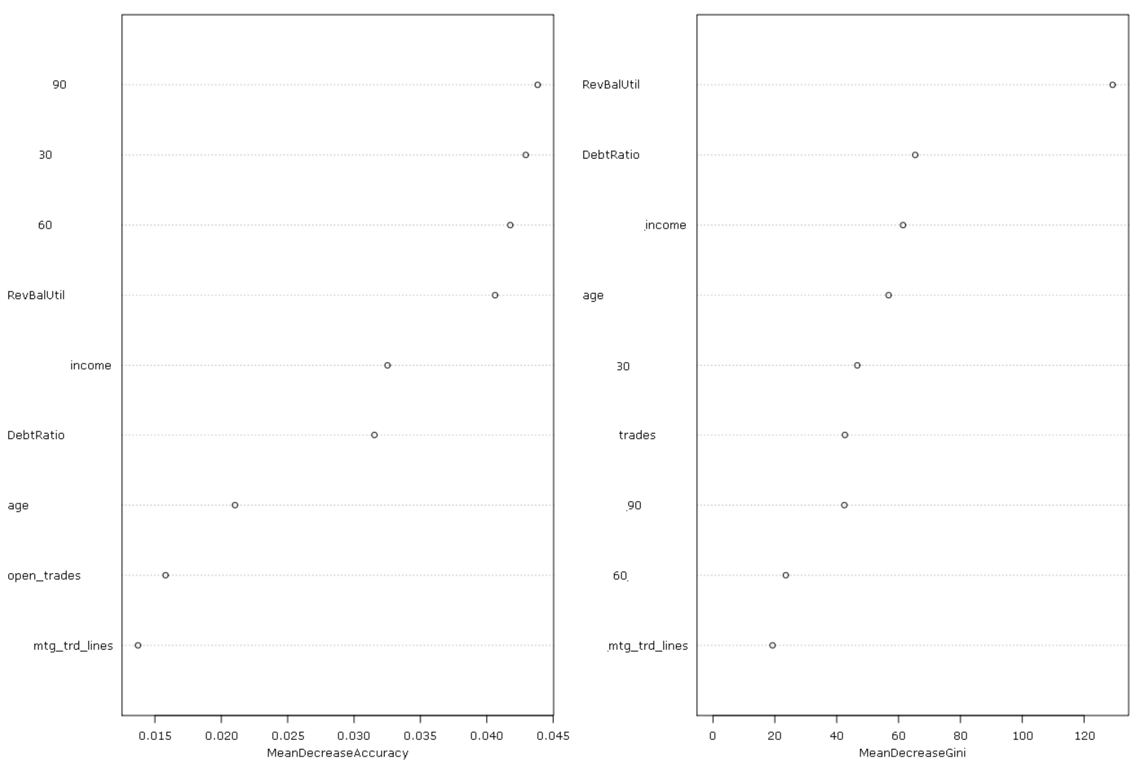
The proprietary data set comprises of credit data from 2008 and the bad loans are those defined as loans which go 90 days past due or worse within 2 years on any account tradeline or loan. The data has 293,421 loan applicants and 19,449 bad loans.

Models

Random Forest Variable Importance: The variable importance plot for random forests showed the following variables to be predictive in rank order.

The revolving line of credit utilization, debt ratio, income, age of applicant, number of 30 days delinquencies in 2 years, number of tradelines active/open (had activity within 6 months), number of 90 day delinquency tradelines in 2 years, number of 60 day tradelines in 2 years, and number of mortgage tradelines have the most predictive power in predicting serious delinquency for a borrower for up 2 years. The attributes excluded duplicate or invalid status tradelines.

Variable importance



Logistic regression Model

Variable	Estimate	Std. Error	z value	Pr(>|z|)	Significance
(Intercept)	-1.33216	0.031749	-41.959	< 2e-16	***
trades	-0.00552	0.001959	-2.819	0.00482	**
30 number dlq (not worse)	0.501922	0.008535	58.807	< 2e-16	***
60 number dlq (not worse)	-0.94516	0.014058	-67.233	< 2e-16	***
90 day number dlq (not worse)	0.478619	0.012085	39.605	< 2e-16	***
mtg_trd_lines	0.095229	0.00804	11.844	< 2e-16	***
monthly income	-3.6E-05	2.29E-06	-15.642	< 2e-16	***
age	-0.02729	0.000655	-41.631	< 2e-16	***
revolving balance util	2.55E-05	2.95E-05	0.865	0.38731	
DebtRatio	-0.00015	3.61E-05	-4.222 0	2.42E-05	***

Signif. codes: 0	'***' 0.001 '	'*' 0.01 '*'	0.05 '.'	0.1 ' '	1
(Dispersion parame	ter for bino	al family ta	ken to be	1)	
Null deviance:	118040 on 235272 degrees of freedom				
Residual deviance:	108889 on 235263 degree degrees of freedom				
(58148 observations					
AIC: 108909					
Number of Fisher S	coring itera	ons: 6			
Log likelihood: -5	4444.557 (	f)			
Null/Residual devi	ance differ	e: 9151.24	(9 df)		
Chi-square p-value	: 0.00000000				

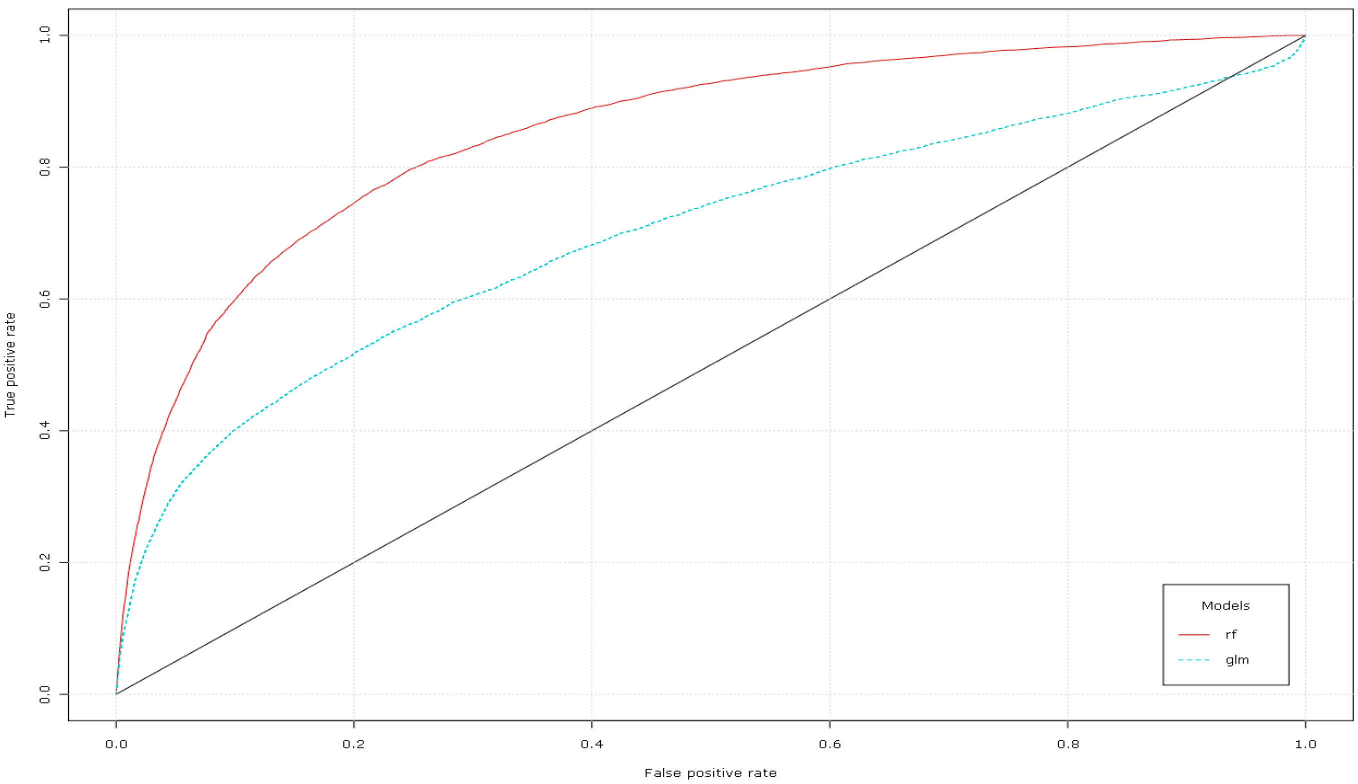
Insights

Regression does not show revolving utilization to be statistically significant while random forests correctly identify it as a very predictive variable and obtain maximal predictive value from the data.

Performance

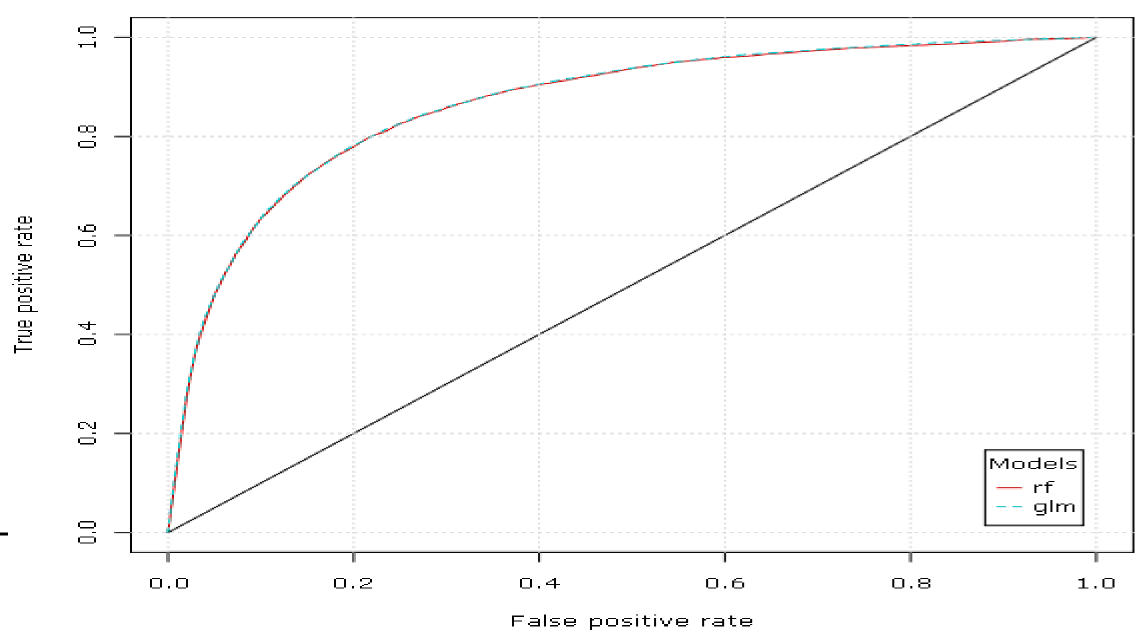
Using these 8 variables the AUC of the random forest exceed that of logistic regression by a large margin. Random forest has an area under the curve of 0.8522 while logistic regression has an AUC of 0.6964.

Performance of Random Forest vs. Logistic Regression on Proprietary Data Set



In addition results of the performance were also computed for a popular credit score known as FICO®. Performance of the credit score was superior to both regression and random forest as it had an AUC of .865.

FICO® ROC curve on Data



IMPLICATIONS

The fact that random forests with 8 variables can produce a model which is competitive with FICO® out of the box is remarkable. Logistic regression does not achieve that level of performance out of the box.

This example clearly shows random forest's superiority in scientifically rank ordering predictive variables and optimally extracting predictive value from data with multi-collinearity and interactions. The advantage of random forests depends on strength of relationships between variables. In data sets with little interaction effects random forests may not outperform. On large credit data sets, behavioral models, application scoring random forests can improve existing credit models by 5-10% by tuning regression. Once tuned logistic regression can outperform random forests with judgment and careful testing of logistic regression. The example of building a random forest that is almost as predictive as a FICO® score, with an AUC of .85 vs. .865, but with 8 variables dramatically shows the power of random forests for scientists and credit risk modelers to maximize predictive value of data using random forests.

All 8 variables conform to theoretical soundness as they relate to borrower cash flow surrogates. Econometrically credit scoring variables can be segmented into: cash flow variables, stability variables, and payment history variables (Overstreet, 1992). Removing the revolving utilization and delinquency behavior variables greatly reduced the random forest performance to be more in line with logistic regression. Implying that the most predictive value is in the interaction of the utilization and delinquency behavior attributes with the other variables. Random forests will outperform when there are complex relationships and interactions between the variables a typical regression might miss.

Explaining the Advantage of Random Forests over Logistic Regression

An explanation of how such a simple data set can be competitive with the FICO® is the fact the credit models are thought to suffer from the flat maximum effect which implies that models with smaller data can perform close to larger more sophisticated linear models like logistic regression because these regressors are insensitive to large variations in the size of regression weights. Random forest advantage also seems to correlate with variables with interaction effects and multi-collinearity as the technique is able to determine complex relationships in the data using a bootstrap of variables and samples to build ensembles of models.

The power of random forests has profound implications for taking credit risk scorecards to the next level by optimizing credit score performance and leading to better and more robust scientific inferences about factors and how they impact phenomenon ranging from financial risk to consumer behavior modeling to medical science and perhaps even mimicking know humans think or behave in swarm intelligence.

Optimizing Credit Scorecards Using Random Forests: An approach

Updated Credit Card Random Forest Variable Importance with interaction terms

Main stream credit scorers can benefit from random forest models as well. One approach to optimizing existing models is to test interaction terms with variables identified to be most predictive by random forests. For example using the credit card data set discussed initially one can improve the AUC of the logistic regression to match random forests by adding interaction terms to the credit card data set to achieve an AUC of .626. Thus logistic regression can be tuned to match performance of random forests out of the box and yield almost the same performance as the random forest model (and on some data sets after tuning logistic regression performs better than random forest).

Overall process for Optimizing Existing Credit Scorecard

- SOAR (Specify data, observe data, analyze, and recommend) (Brown, 2005)
- Run Random Forest
- Take top predictive fields and create interactions terms with regression one at a time and retain statistically significant interactions
- Rerun regression and compare until regression outperforms or closely matches random forest out of sample performance
- Run conditional inference trees to identify interactions and re-run random forest and logit models until maximal performance is achieved.
- Convert fields to factors for logit as binned data improves logit in general
- Multiply the score from Random forest and logistic, sum, take max, and compare area under curve. As predicted Hand's Superscorecard literature multiplying the 2 scores resulted in improved performance as well (Hand etal, 2002).

The method of using random forests, affordability and logistic regression in combination with conditional inference trees iteratively to improve logistic regression to match and outperform random forests is dubbed the Sharma method. For the most comprehensive review of credit scoring literature and this approach see (Sharma, Overstreet & Beling, 2009). Also the methods are detailed in the Guide to Credit Scoring in R as well (Sharma, 2009). The pioneering work behind this was Overstreet etal in 1992 which was the first theory based free cash flow model for credit scoring and Breiman's work on random forests which allowed the importance of affordability data to be more clearly seen. Prior to this most logistic regression scorecards showed income and cash flow data to be marginally predictive as the p values were too high and erroneous due to multicollinearity. For details on checkered history of credit scoring see Sharma, Overstreet and Beling, 2009.

In terms of implementation R was used along with Rattle data mining software. Rattle greatly facilitated the speed and ease of running the algorithms and credit scoring once the interaction terms were added by hand code and run through rattle (See Graham for Rattle, 2008).

Extensions

In large data sets I have been able to improve logistic regressions to match the performance of random forests using trial and error, judgment and using random forest variable importance as a base to add interaction terms. This approach is painful, and time consuming. A more viable approach will be to use random forest performance as a benchmark to automatically optimize logistic regression using out of sample error by testing out interactions among most predictive variables and formulas using a genetic algorithm approach.

Credit scoring is a search for meaningful interaction terms and all financial ratios are interaction terms. Hand has shown multiplying scores always produce a better or equivalent score, and this itself is again an example of interaction term of multiplying variables (Hand, 2002). By viewing financial ratios as interactions one can widen the lens and search for optimal interactions to obtain optimal predictive power from the affordability data. Traditional regression, with it's failure to handle multi-collinearity, has made searching for fruitful interaction terms in credit data problematic. Also attempting too many interactions can overfit logits. Thus, a careful knowledge based approach is needed which random forest variable importance measures provide. For an in depth discussion of this, as well as the most comprehensive literature review of credit scoring, and the overall approach see Sharma, Overstreet and Beling, 2009.

CONCLUSIONS

The best of both worlds can be achieved by finding ways to optimally enhance logistic regression using insights from random forest variable importance which are more reliable gauges for variable importance and relationship given the multi-collinearity in all credit models and data. To date, the random forests I have tuned logistic regressions scorecards judgmentally using random forest variable importance to outline interactions terms to be added to the model but the home equity dataset shows that this might not be enough as more transformations and binning of variables might be needed to optimally squeeze performance into logistic regression to explore interaction terms and transformations via stochastic search optimization using genetic algorithms within a bounded variable space using random forest performance as a stopping criterion. This would best be accomplished via an automated algorithm which iterates through variable interaction and combination mining using a sample set of meaningful variables identified by random forest as being predictive which regression p values might miss. A common example of this oversight by traditional scorecards since the time of Durand in the 1930s is that of income and affordability data which standard regressions have shown to not be predictive while flying in the face of common sense. The most successful predictive variables using the mortgage industry are all interaction terms (loan to value, month's reserves, and debt ratio; for example of mortgage scoring see Avery et al 1996). The history of credit scoring shows finding optimal interaction terms is crucial to optimal predictive accuracy and random forests play a vital role in being able to test out meaningful variables which traditional scoring technologies such as regression failed to identify using p value tests of significance.

Human Values perspective

Credit scoring should be integrated with normative models to ensure borrower wellbeing instead of maximizing profit as evidenced by the recent global recession in the 21st century. Credit score models no matter how sophisticated built to predict two years of data fail to assess the long term impact of borrower wellbeing and that is a challenge worth studying; such knowledge will surely lead to sustainable credit markets which do not threaten democracy and have a robust micro-foundation for macro-markets in credit. In the aggregate picture proprietary models to predict behavior are all more suboptimal than a white box credit policy which ensures borrower financial wellbeing by ensuring constraints on borrower reserves, consumption, and expenses to income over time. Competition in credit modeling will not lead to better consumer welfare as credit is a commodity and financial institutions should not compete on credit policy for sustainable advantage but instead should compete on convenience, safer products, and customization to fit borrower life stages.

Let's hope in the future we won't need proprietary models and can live in an enlightened world where borrowers can choose safe products and know the implications of their behavior on their ability to obtain more credit in a open white box world where behavior is then regulated by a desire to conform to standards which will make the borrowers more fiscally responsible. Credit data should be democratized and not for profit entities as it is a social good.

REFERENCES

Avery, Robert B., Raphael W. Bostic, Paul S. Calem, and Glenn Canner, (1996) "Credit risk, credit scoring, and the performance of home mortgages," *The Federal Reserve Bulletin,* Vol. 82, No. 7, , pp. 621-648

Breiman,L. (2002) Wald 2: Looking Inside the Black Box. Retrieved from www.stat.berkeley.edu/users/breiman/wald2002-2.pdf

Brown, Don (2005) *Linear Models* Unpublished Manuscript at University of Virginia.

Overstreet, GA; Kemp, RS; (1986) Managerial control in Credit Scoring Systems. *Journal of Retail Banking*

Overstreet, G.A.J., Bradley, E.L., Kemp, R.S., 1992. The flat-maximum effect and generic linear scoring models: a test, IMA *Journal of Mathematics Applied in Business & Industry*, 4 (1) 97 -109

Sharma, D (2009) Guide to Credit Scoring in R. Retrieved from http://cran.r-project.org/doc/contrib/Sharma-CreditScoring.pdf

Sharma, D; Overstreet, George; Beling, Peter (2009) Not If Affordability data adds value but how to add real value by Leveraging Affordability Data: Enhancing Predictive capability of Credit Scoring Using Affordability Data. CAS (Casualty Actuarial Society) Working Paper. Retrieved from http://www.casact.org/research/wp/index.cfm?fa=workingpapers

See Williams, Graham Desktop Guide to Data Mining http://www.togaware.com/datamining/survivor/

Wielenga, D., Lucas, B. and Georges, J. (2009), Enterprise MinerTM: Applying Data Mining Techniques, SAS Institute Inc., Cary, NC. http://www.crc.man.ed.ac.uk/conference/archive/2009/presentations/Paper-11-Paper.pdf

APPENDIX OF DATA DESCRIPTIONS AND OPEN DATA SETS

Credit Card Dataset Original Variable Descriptions

Var_Title	Var_Description	Field_Content
ID_CLIENT	Sequential number for the applicant (to be used as a key)	1-50000, 50001-70000, 70001-90000
CLERK_TYPE	Not informed	C
PAYMENT_DAY	Day of the month for bill payment, chosen by the applicant	1,5,10,15,20,25
APPLICATION_SUBMISSION_TYPE	Indicates if the application was submitted via the internet or in person/posted	Web, Carga
QUANT_ADDITIONAL_CARDS	Quantity of additional cards asked for in the same application form	1,2,NULL
POSTAL_ADDRESS_TYPE	Indicates if the address for posting is the home address or other. Encoding not informed.	1.2
SEX		M=Male, F=Female
MARITAL_STATUS	Encoding not informed	1,2,3,4,5,6,7
QUANT_DEPENDANTS		0, 1, 2, ...
EDUCATION_LEVEL	Edducational level in gradual order not informed	1,2,3,4,5
STATE_OF_BIRTH		Brazilian states, XX, missing
CITY_OF_BIRTH		
NACIONALITY	Country of birth. Encoding not informed but Brazil is likely to be equal 1.	0, 1, 2
RESIDENCIAL_STATE	State of residence	
RESIDENCIAL_CITY	City of residence	
RESIDENCIAL_BOROUGH	Borough of residence	
FLAG_RESIDENCIAL_PHONE	Indicates if the applicant possesses a home phone	Y,N
RESIDENCIAL_PHONE_AREA_CODE	Three-digit pseudo-code	
RESIDENCE_TYPE	Encoding not informed. In general, there are the types: owned, mortgage, rented, parents, family etc.	1,2,3,4,5,NULL
MONTHS_IN_RESIDENCE	Time in the current residence in months	1,2,... , NULL
FLAG_MOBILE_PHONE	Indicates if the applicant possesses a mobile phone	Y,N
FLAG_EMAIL	Indicates if the applicant possesses an e-mail address	0.1
PERSONAL_MONTHLY_INCOME	Applicant's personal regular monthly income in Brazilian currency (R$)	
OTHER_INCOMES	Applicant's other incomes monthly averaged in Brazilian currency (R$)	
FLAG_VISA	Flag indicating if the applicant is a VISA credit card holder	0.1
FLAG_MASTERCARD	Flag indicating if the applicant is a MASTERCARD credit card holder	0.1
FLAG_DINERS	Flag indicating if the applicant is a SINERS credit card holder	0.1
FLAG_AMERICAN_EXPRESS	Flag indicating if the applicant is an AMERICAN EXPRESS credit card holder	0.1
FLAG_OTHER_CARDS	Despite being label "FLAG", this field presents three values not explained	0,1,NULL
QUANT_BANKING_ACCOUNTS		0,1,2
QUANT_SPECIAL_BANKING_ACCOUNTS		0,1,2
PERSONAL_ASSETS_VALUE	Total value of the personal possessions such as houses, cars etc. in Brazilian currency (R$).	
QUANT_CARS	Quantity of cars the applicant possesses	
COMPANY	If the applicant has supplied the name of the company where he/she formally works	Y,N
PROFESSIONAL_STATE	State where the applicant works	
PROFESSIONAL_CITY	City where the applicant works	
PROFESSIONAL_BOROUGH	Borough where the applicant works	
FLAG_PROFESSIONAL_PHONE	Indicates if the professional phone number was supplied	Y,N
PROFESSIONAL_PHONE_AREA_CODE	Three-digit pseudo-code	
MONTHS_IN_THE_JOB	Time in the current job in months	
PROFESSION_CODE	Applicant's profession code. Encoding not informed	1,2,3,...
OCCUPATION_TYPE	Encoding not informed	1,2,3,4,5,NULL
MATE_PROFESSION_CODE	Mate's profession code. Encoding not informed	1,2,3,...
EDUCATION_LEVEL	Mate's educational level in gradual order not informed	1,2,3,4,5
FLAG_HOME_ADDRESS_DOCUMENT	Flag indicating documental confirmation of home address	0.1
FLAG_RG	Flag indicating documental confirmation of citizen card number	0.1
FLAG_CPF	Flag indicating documental confirmation of tax payer status	0.1
FLAG_INCOME_PROOF	Flag indicating documental confirmation of income	0.1
PRODUCT	Type of credit product applied. Encoding not informed	1,2,7
FLAG_ACSP_RECORD	Flag indicating if the applicant has any previous credit delinquency	Y, N
AGE	Applicant's age at the moment of submission	
RESIDENCIAL_ZIP_3	Three most significant digits of the actual home zip code	
PROFESSIONAL_ZIP_3	Three most significant digits of the actual job zip code	
TARGET_LABEL_BAD=1	Target Variable: BAD=1, GOOD=0	

Source: http://sede.neurotech.com.br/PAKDD2010/

HOME EQUITY DATA SET ORIGINAL VARIABLES			
Name	Model Role	Measurement Level	Description
BAD	Target	Binary	1=defaulted on loan, 0=paid back loan
REASON	Input	Binary	HomeImp=home improvement, DebtCon=debt consolidation
JOB	Input	Nominal	Six occupational categories
LOAN	Input	Interval	Amount of loan request
MORTDUE	Input	Interval	Amount due on existing mortgage
VALUE	Input	Interval	Value of current property
DEBTINC	Input	Interval	Debt-to-income ratio
YOJ	Input	Interval	Years at present job
DEROG	Input	Interval	Number of major derogatory reports
CLNO	Input	Interval	Number of trade lines
DELINQ	Input	Interval	Number of delinquent trade lines
CLAGE	Input	Interval	Age of oldest trade line in months
NINQ	Input	Interval	Number of recent credit inquiries
Source: www.**sas**enterpriseminer.com/data/**HMEQ**.xls			

APPENDIX OF R CODE

<u>Credit Card Data Set and interactions</u>

```
cc<-read.csv("C:/Documents and Settings//My Documents/cckdd2010.csv")
cc$TARGET_LABEL_BAD<-as.factor(cc$TARGET_LABEL_BAD)
cc$QUANT_DEPENDANTS<-ifelse(cc$QUANT_DEPENDANTS>=13,13,cc$QUANT_DEPENDANTS)
#cc$ZipDist<-as.numeric(cc$RESIDENCIAL_ZIP_3)-as.numeric(cc$PROFESSIONAL_ZIP_3)
#cc$StateDiff<-as.factor(ifelse(cc$RESIDENCIAL_STATE==cc$PROFESSIONAL_STATE,'Y','N'))
#cc$CityDiff<-as.factor(ifelse(cc$RESIDENCIAL_CITY==cc$PROFESSIONAL_CITY,'Y','N'))
#cc$BoroughDiff<-as.factor(ifelse(cc$RESIDENCIAL_BOROUGH=cc$PROFESSIONAL_BOROUGH,'Y','N'))
cc$MissingResidentialPhoneCode<-
as.factor(ifelse(is.na(cc$RESIDENCIAL_PHONE_AREA_CODE)==TRUE,'Y','N'))
cc$MissingProfPhoneCode<-as.factor(ifelse(is.na(cc$PROFESSIONAL_PHONE_AREA_CODE)==TRUE,'Y','N'))
cc<-subset(cc,select=-ID_CLIENT   )
cc<-subset(cc,select=-CLERK_TYPE )
cc<-subset(cc,select=-QUANT_ADDITIONAL_CARDS)
cc<-subset(cc,select=-EDUCATION_LEVEL)
#cc<-subset(cc,select=-STATE_OF_BIRTH )
cc<-subset(cc,select=-CITY_OF_BIRTH )
#cc<-subset(cc,select=-RESIDENCIAL_STATE)
cc<-subset(cc,select=-RESIDENCIAL_CITY)
cc<-subset(cc,select=-RESIDENCIAL_BOROUGH)
```

```
cc<-subset(cc,select=-PROFESSIONAL_STATE)
cc<-subset(cc,select=-PROFESSIONAL_CITY)
cc<-subset(cc,select=-PROFESSIONAL_BOROUGH)
cc<-subset(cc,select=-FLAG_MOBILE_PHONE)
cc<-subset(cc,select=-FLAG_HOME_ADDRESS_DOCUMENT)
cc<-subset(cc,select=-FLAG_RG   )
cc<-subset(cc,select=-FLAG_CPF )
cc<-subset(cc,select=-FLAG_INCOME_PROOF)
cc<-subset(cc,select=-FLAG_ACSP_RECORD)
cc<-subset(cc,select=-TARGET_LABEL_BAD.1)
cc<-subset(cc,select=-RESIDENCIAL_ZIP_3)
cc$PROFESSIONAL_ZIP_3<-as.numeric(cc$PROFESSIONAL_ZIP_3)
cc$RESIDENCIAL_PHONE_AREA_CODE[is.na(cc$RESIDENCIAL_PHONE_AREA_CODE)] <- 0
cc$PROFESSIONAL_PHONE_AREA_CODE[is.na(cc$PROFESSIONAL_PHONE_AREA_CODE)] <- 0
cc$PROFESSION_CODE<-as.numeric(cc$PROFESSION_CODE)
cc$OCCUPATION_TYPE<-as.numeric(cc$OCCUPATION_TYPE)
cc$MATE_PROFESSION_CODE<-as.numeric(cc$MATE_PROFESSION_CODE)
cc$EDUCATION_LEVEL.1<-as.numeric(cc$EDUCATION_LEVEL.1)
cc$RESIDENCE_TYPE<-as.numeric(cc$RESIDENCE_TYPE)
cc$MONTHS_IN_RESIDENCE<-as.numeric(cc$MONTHS_IN_RESIDENCE)
cc$TotIncome<-cc$PERSONAL_MONTHLY_INCOME+cc$OTHER_INCOMES
cc$OthIncomePct<-cc$OTHER_INCOMES/cc$PERSONAL_MONTHLY_INCOME
cc$MnthsSavings<-cc$PERSONAL_ASSETS_VALUE/(.01+cc$MONTHS_IN_THE_JOB*cc$TotIncome)
cc$Afford<-cc$TotIncome+cc$PERSONAL_ASSETS_VALUE
cc$IncomeToAssets<-cc$TotIncome/(cc$PERSONAL_ASSETS_VALUE+.01)
cc$i1<-cc$QUANT_DEPENDANTS*cc$AGE
cc$i2<-cc$AGE*cc$PROFESSIONAL_ZIP_3
cc$i4<-cc$PROFESSION_CODE*cc$AGE
cc$i5<-cc$RESIDENCIAL_PHONE_AREA_CODE*cc$AGE
cc$i6<-cc$RESIDENCIAL_PHONE_AREA_CODE*cc$PROFESSIONAL_PHONE_AREA_CODE
cc$i7<-cc$RESIDENCIAL_PHONE_AREA_CODE*cc$OthIncomePc
cc$i8<-cc$RESIDENCIAL_PHONE_AREA_CODE*cc$IncomeToAssets
cc$i9<-cc$RESIDENCIAL_PHONE_AREA_CODE*cc$i1
cc$i10<-cc$RESIDENCIAL_PHONE_AREA_CODE*cc$i2
cc$i11<-cc$RESIDENCIAL_PHONE_AREA_CODE*cc$i5
cc$i12<-cc$RESIDENCIAL_PHONE_AREA_CODE*cc$OTHER_INCOMES
cc$i13<-cc$QUANT_DEPENDANTS*cc$RESIDENCIAL_PHONE_AREA_CODE
cc$i14<-cc$RESIDENCIAL_PHONE_AREA_CODE*cc$RESIDENCE_TYPE
cc$i15<-cc$RESIDENCIAL_PHONE_AREA_CODE*cc$PROFESSIONAL_ZIP_3
cc$i16<-cc$PERSONAL_MONTHLY_INCOME*cc$PROFESSIONAL_ZIP_3
cc$i17<-cc$OTHER_INCOMES*cc$PROFESSIONAL_ZIP_3
cc$i18<-cc$PROFESSIONAL_ZIP_3*cc$IncomeToAssets
cc$i19<-cc$PROFESSIONAL_ZIP_3*cc$i2
cc$i20<-cc$PROFESSIONAL_ZIP_3*cc$i5
cc$j1<-cc$MONTHS_IN_RESIDENCE*cc$EDUCATION_LEVEL.1
cc$j2<-cc$MONTHS_IN_RESIDENCE*cc$QUANT_CARS
cc$j3<-cc$MARITAL_STATUS*cc$MONTHS_IN_RESIDENCE
```

```
cc$j4<-cc$QUANT_CARS*cc$i12
cc$j5<-cc$FLAG_MASTERCARD*cc$i5
cc$j6<-cc$QUANT_CARS*cc$i2
cc$j7<-cc$FLAG_MASTERCARD*cc$i10
cc$j8<-cc$QUANT_CARS*cc$i19
cc$j9<-cc$QUANT_CARS*cc$OthIncomePct
cc$j10<-cc$NACIONALITY*cc$QUANT_CARS
cc$j11<-as.factor(ifelse(cc$FLAG_RESIDENCIAL_PHONE=='Y',cc$FLAG_MASTERCARD,'O'))
cc$j12<-cc$QUANT_CARS*cc$i7
cc$j13<-cc$MARITAL_STATUS*cc$j3
cc$j14<-cc$PAYMENT_DAY*cc$j5
cc$j15<-cc$PAYMENT_DAY*cc$j7
cc$j16<-cc$QUANT_CARS*cc$OCCUPATION_TYPE
cc$j17<-cc$OCCUPATION_TYPE*cc$j9
cc$j18<-as.factor(ifelse(cc$j11=='1',cc$OCCUPATION_TYPE,'O'))
cc$j19<-cc$AGE*cc$i2
cc$j20<-cc$OthIncomePct*cc$i2
cc$j21<-cc$i2*cc$i7
cc$j22<-cc$i2*cc$i10
cc$j23<-cc$i2*cc$i15
cc$j24<-cc$i2*cc$j1
cc$j25<-cc$i2*cc$j2
cc$j26<-cc$RESIDENCE_TYPE*cc$AGE
cc$j27<-cc$RESIDENCE_TYPE*cc$i4
cc$j28<-cc$RESIDENCE_TYPE*cc$i7
cc$j29<-cc$RESIDENCE_TYPE*cc$PROFESSION_CODE
cc$j30<-cc$PROFESSION_CODE*cc$PRODUCT
cc$j31<-cc$PRODUCT*cc$i6
cc$k1<-as.factor(ifelse(cc$AGE<=18 & cc$PAYMENT_DAY<=15,'Y','N'))
cc$k2<-as.factor(ifelse(cc$AGE>18 & cc$PAYMENT_DAY<=15,'Y','N'))
cc$k3<-as.factor(ifelse(cc$AGE>21 & cc$PAYMENT_DAY>15,'Y','N'))
cc$k4<-as.factor(ifelse(cc$AGE<=21 & cc$PAYMENT_DAY>15,'Y','N'))
cc$k5<-as.factor(ifelse(cc$AGE<=46 & cc$AGE>32 & cc$j11!='O' & cc$PAYMENT_DAY<=10 & cc$SEX!='F','Y','N'))
cc$k6<-as.factor(ifelse(cc$AGE<=46 & cc$AGE>32 & cc$j11!='O' & cc$PAYMENT_DAY<=10 & cc$SEX=='F','Y','N'))
cc$k7<-as.factor(ifelse(cc$AGE<=46 & cc$AGE>32 & cc$j11!='O' & cc$PAYMENT_DAY>10 & cc$SEX!='F','Y','N'))
cc$k8<-as.factor(ifelse(cc$AGE<=46 & cc$AGE>32 & cc$j11!='O' & cc$PAYMENT_DAY>10 & cc$SEX=='F' & cc$j30<=40,'Y','N'))
cc$k8a<-as.factor(ifelse(cc$AGE<=46 & cc$AGE>32 & cc$j11!='O' & cc$PAYMENT_DAY>10 & cc$SEX=='F' & cc$j30>40,'Y','N'))
cc$k9<-as.factor(ifelse(cc$AGE<=46 & cc$AGE>32 & cc$j11=='O' & cc$MissingProfPhoneCode!='N','Y','N'))
cc$k10<-as.factor(ifelse(cc$AGE<=46 & cc$AGE>32 & cc$j11=='O' & cc$MissingProfPhoneCode=='Y','Y','N'))
cc$k11<-as.factor(ifelse(cc$AGE>46  & cc$j11=='O' & cc$FLAG_PROFESSIONAL_PHONE=='Y','Y','N'))
cc$k12<-as.factor(ifelse(cc$AGE>46  & cc$j11=='O' & cc$FLAG_PROFESSIONAL_PHONE=='N' & cc$j16<=0 & cc$PAYMENT_DAY<=20,'Y','N'))
```

```
cc$k13<-as.factor(ifelse(cc$AGE>46  & cc$j11=='O' & cc$FLAG_PROFESSIONAL_PHONE=='N' & cc$j16<=0 & cc$PAYMENT_DAY>20,'Y','N'))
#cc$k14<-as.factor(ifelse(cc$AGE>46    & cc$j11=='O'  & cc$FLAG_PROFESSIONAL_PHONE=='N' & cc$j16>0,'Y','N'))
cc$k15<-as.factor(ifelse(cc$AGE>46  & cc$AGE<=52 & cc$j11!='O' ,'Y','N'))
cc$k16<-as.factor(ifelse(cc$AGE>52    & cc$j11!='O' & cc$PAYMENT_DAY<=15 &  cc$i11<=271633 & cc$j5<=1220 ,'Y','N'))
cc$k17<-as.factor(ifelse(cc$AGE>52    & cc$j11!='O' & cc$PAYMENT_DAY<=15 &  cc$i11<=271633 & cc$j5>1220 ,'Y','N'))
cc$k18<-as.factor(ifelse(cc$AGE>52  & cc$j11!='O' & cc$PAYMENT_DAY<=15 & cc$i11>271633 ,'Y','N'))
cc$k18<-as.factor(ifelse(cc$AGE>52  & cc$j11!='O' & cc$PAYMENT_DAY>15  ,'Y','N'))
#logit
m<-glm(TARGET_LABEL_BAD~.,data=cc,family=binomial)
cc<-subset(cc,select=-j1)
cc<-subset(cc,select=-j2)
cc<-subset(cc,select=-j3)
cc<-subset(cc,select=-j4)
cc<-subset(cc,select=-j5)
cc<-subset(cc,select=-j6)
cc<-subset(cc,select=-j7)
cc<-subset(cc,select=-j8)
cc<-subset(cc,select=-j9)
cc<-subset(cc,select=-j10)
cc<-subset(cc,select=-j11)
cc<-subset(cc,select=-j12)
cc<-subset(cc,select=-j13)
cc<-subset(cc,select=-j14)
cc<-subset(cc,select=-j15)
cc<-subset(cc,select=-j16)
cc<-subset(cc,select=-j17)
cc<-subset(cc,select=-j18)
cc<-subset(cc,select=-j19)
cc<-subset(cc,select=-j20)
cc<-subset(cc,select=-j21)
cc<-subset(cc,select=-j22)
cc<-subset(cc,select=-j23)
cc<-subset(cc,select=-j24)
cc<-subset(cc,select=-j25)
cc<-subset(cc,select=-j26)
cc<-subset(cc,select=-j27)
cc<-subset(cc,select=-j28)
cc<-subset(cc,select=-j29)
cc<-subset(cc,select=-j30)
cc<-subset(cc,select=-j31)
cc<-subset(cc,select=-i1)
cc<-subset(cc,select=-i2)
cc<-subset(cc,select=-i3)
```

```
cc<-subset(cc,select=-i4)
cc<-subset(cc,select=-i5)
cc<-subset(cc,select=-i6)
cc<-subset(cc,select=-i7)
cc<-subset(cc,select=-i8)
cc<-subset(cc,select=-i9)
cc<-subset(cc,select=-i10)
cc<-subset(cc,select=-i11)
cc<-subset(cc,select=-i12)
cc<-subset(cc,select=-i13)
cc<-subset(cc,select=-i14)
cc<-subset(cc,select=-i15)
cc<-subset(cc,select=-i16)
cc<-subset(cc,select=-i17)
cc<-subset(cc,select=-i18)
cc<-subset(cc,select=-i19)
cc<-subset(cc,select=-i20)
```

Most work done in Rattle.

Home Equity Data Set R

```
#sas home equity data set
#www.sasenterpriseminer.com/data/HMEQ.xls
#Wielenga, D., Lucas, B. and Georges, J. (1999), Enterprise MinerTM: Applying Data Mining Techniques Course Notes, SAS Institute Inc., Cary, NC.
cc<-read.csv("C:/Documents and Settings/ My Documents/HMEQ.csv")
cc$BAD<-as.factor(cc$BAD)
cc$LTV<-(cc$LOAN+cc$MORTDUE)*100/cc$VALUE
cc$JOB<-as.factor(cc$JOB)
```

A MODEL FOR PREDICTING THE PERFORMANCE OF A BANK'S MORTGAGE LOAN PORTFOLIO

Morsheda Hassan, Wiley College
Chang Liu, Southern West University of Finance and Economics, China
Raja Nassar, Louisiana Tech University

ABSTRACT

The health index of a mortgage loan portfolio may be viewed as a measure of the performance associated with that portfolio. Models to measure and predict the behavior of the health index of a mortgage portfolio over time are useful for the management of a bank in its decision making. In a previous study by the authors, a Markov chain model was used to calculate the transition probabilities among the states of a mortgage loan and to define and measure a health index of the loan portfolio. For forecast purposes, it is useful to be able to predict the behavior of a mortgage loan portfolio for a given bank from national and/or regional macroeconomics factors. In this paper, we extend our previous study by developing an empirical model, based on mortgage data from a major bank in China and on national and regional economics factors in China, for predicting the health index of a mortgage portfolio. This and similar models may be used by the bank management for assessing the health of a loan and for decision making.

INTRODUCTION

It is essential for sound operations of banks and lending institutions to have models and analytic tools available by which they can measure the performance (or health status) associated with a certain loan portfolio as well as predict this status over time from prevailing macroeconomic factors. A Markov chain defined on different payment states of a mortgage loan allows one to define and calculate a health index on the loan portfolio which can be used as a performance measure of that portfolio.

A performance measure, such as a health index measure, for a mortgage portfolio will be useful for a bank or lending institution in its loan or credit policy. It will help the management to monitor the performance of its portfolio over time. Furthermore, an empirical model that can relate a health index to macroeconomic factors will be useful in forecasting performance level.
In a previous study (Liu et al, 2010) a Markov chain approach was developed to determine the transitions among payment states of a mortgage loan. Based on the probabilities of transitions among states, a loan health index was defined as a measure of its performance. In this paper, we

will build on the previous study and develop an empirical model relating certain macroeconomic factors to the health index of the loan for forecasting purposes.

LITERATURE REVIEW

Soyer and Feng (2010) considered reliability models for assessing mortgage default risk. White (1993) presented several models employed in the banking industry. These included discriminant analysis, decision tree, expert system for static decision, dynamic programming, linear programming, and Markov chains for dynamic decision making. Markov chain modeling is a common approach used in the analysis of credit risk. As discussed by White (1993), Markov decision models have been used extensively to analyze real world data in (1) Finance and Investment, (2) Insurance, and (3) Credit area.

Cyert, Davidson and Thompson (1962) developed a finite stationary Markov chain model to predict uncollectible amounts (receivables) in each of the past due category. The states of the chain were defined as normal payment, past due, and bad-debt states.

Grinold (1983) used a finite Markov chain model to analyze a firm's market value.
Lee (1997) used an ARMA model to analyze the linkage between time-varying risk premia in the term structure and macroeconomic state variables.

Esbitt, (1986) provided empirical evidence that a bank's portfolio quality has close relationship with the macroeconomic situation. Examples include the state-chartered banks' failure and the Great Depression in Chicago between 1930 and 1932.

McNulty, Aigbe, and Verbrugge (2001) proposed an empirical regression modeling approach to study the hypothesis that small community banks have an information advantage in evaluating and monitoring loan quality.

Hauswald & Marquez (2004) studied the relationship between the current regulative policy and the loan quality, or risks encountered by a financial institute.

Gambera (2000) used a vector-autoregressive (VaR) model to predict the loan quality in business cycles. D'Amico et al. (2005) applied Semi-Markov reliability models to the study of credit risk management. Douglas et al. (1996) proposed the use of non-stationary Markov and logistic modeling approaches to predict the performance of credit home mortgage portfolios. Pennington-Cross (2008) used a multinomial logit model to study the duration of foreclosure in the subprime mortgage market. Burkhard and De Giorgi (2006)used a non-parametric approach to model the probability distribution of defaults in residential mortgage portfolios. Hayre et al. (2008) presented a model that forecasts default rates as a function of economic variables and mortgage and borrower characteristics. Green and Shoven (1986) used a proportional hazard model to study the effects of interest rates on mortgage prepayment.

Deng et al (2000) used the option theory approach to predict mortgage termination by prepayment or default. They showed that the model performed well, but was not sufficient by itself. Heterogeneity among homeowners must be taken into account in estimating or predicting the prepayment behavior. Schwartz and Tourous (1993) applied a poisson regression to estimate the proportional hazard model for prepayment and default decisions in a sample of single-family fixed rate mortgages.

THE MODEL

In this model, we consider the pool of mortgage loans in the portfolio of a commercial bank in china. Based on the bank data and loan policy, each loan is classified into three states according to the mode of payment. State S1 is the normal state, which is 0-30 days past due. State S2 is 30-90 days past due, and state S3 is more than 90 days past due. If a loan is in state S1, it can stay in S1 or transit to S2. A loan in state S2 can remain in S2 or transit to S1 or to S3. A loan in state S3 can remain in S3 or transit to S2.

Given the transition probability matrix of the Markov chain, one can calculate the expected duration of stay in each of the three states (S1, S2, and S3). A health index of the portfolio can be calculated by taking into consideration the expected duration of stay in each state and the transitions from S2 and S3 to the normal or health state, S1.

Loan Health Index

Let H be the health index of a portfolio (population or collection of all mortgage loans held by the bank), which at time t has the three states , S1, S2 and S3.

The health index over a given time interval (0, t) is defined as

$$H = e_2\theta_{2,1} + e_3\theta_{3,1} + e_1\theta_{1,1} \quad (1)$$

where, e_j refers to the expected duration of stay in state j: $j = 1,2,3$ and $\Theta_{j,1}$ is an intensity function measuring the transitions to the normal or health state, S1.

It is clear from Eq. (1) that the health of the portfolio depends on the time the process stays in each state and the transitions from each of the S2 and S3 sub-health states to the S1 health state. Clearly, the larger the health index, the healthier is the portfolio.

The expected duration of stay in a specific state is based on the Markov transition intensity matrix , V, shown below, Fig. 1.

Figure. 1: Transition intensity matrix, V

a

$$\begin{array}{cccc} & S1 & S2 & S3 \\ S1 & v_{11} & v_{12} & v_{13} \\ S2 & v_{21} & v_{22} & v_{23} \\ S3 & v_{31} & v_{32} & v_{33} \end{array} \qquad (2)$$

Here, $v_{11} = -(v_{12} + v_{13})$, $v_{22} = -(v_{21}+v_{23})$, and $v_{33} = -(v_{31}+v_{32})$

The transitions intensities are defined as (Chiang, 1980):

$v_{ij}\Delta t$= Pr {an individual in state S_i at time τ will be state S_j at time $\tau+\Delta t$}, where $i\neq j, j = 1,2,3$

Furthermore, we assume that the intensities v_{ij} are independent of time τ ($0\leq\tau\leq t$). Thus, we are concerned here with a time homogenous Markov chain.

If an individual stays in its original state, its intensity is defined by $v_{ii} = -\sum_{j=1}^{3} v_{ij}$,$i \neq j$. By this definition, it is obvious that $1+v_{ii}\Delta t$= Pr {an individual in state S_i at time τ will remain in state S_i at time $\tau+\Delta t$}.

Let $P_{ij}(\tau,t)$ be the probability that an individual in state S_i at time τ will be in state S_j at time t, $i,j=1,2.3$ and $e_j(t)$ be its expected duration of stay in state *j*. It can be shown (Chiang, 1980) that

$$e_j(t) = \sum_{i=1}^{3}\sum_{l=1}^{3}(e^{\rho_l t} - 1)\pi_i A'_{ij}\ (\rho_l)/\prod_{m=l,m\neq l}^{3}(\rho_l - \rho_m)\rho_l \qquad (3)$$

and

$$P_{ij}(0,t) = \sum_{l=1}^{3} e^{\rho_l t} A'_{ij}(\rho_l)/\prod_{m=l,m\neq l}^{3}(\rho_l - \rho_m) \qquad (4)$$

where, π_i,$i= 1,2,3$, is the proportion of individuals in the portfolio pool who are initially in S_i, $i=1,2,3$ and e_j is the expected duration of stay in state *j* irrespective of the initial starting state. Here, $A'_{ij}(\rho_l)$ is the *ij* co-factor of $A'(\rho_l)$, defined as

$$A'(\rho_l)=(\rho_l\text{-}V'), \quad (5)$$

where ρ_l = the lth eigenvalue of the characteristic matrix , (ρ_l-V').

In the health index of Eq. (1), it can be seen that $\Theta_{j,1}$ measures an individual's ability to recover from the sub-health state Sj, $j=2,3$ to the health state, $S1$. For a given time period, the Maximum Likelihood estimate (Chiang, 1980) of $\Theta j_{,1}$ is given as

$$\theta_{j,1} = \sum_{r=1}^{N} n_{j,1,r} / \sum_{r=1}^{N} t_{j,r}, \qquad j = 1,2,3 \quad (6)$$

where, $n_{j,1,r}$ is the number of transitions from S_j: $j= 1,2,3$ to $S1$ by the rth individual. As such, $\sum_{r=1}^{N} n_{j,1,r}$ is the total number of transitions made by all N individuals in the portfolio.

By the same reasoning, $\sum_{r=1}^{N} t_{j,r}$ is the total length of time that all individuals in the portfolio stay in Sj: $j= 1,2,3$. Therefore, from Eqs. (1) ,(3) and (6), the portfolio health index is given as

$$H = \sum_{j=1}^{3}\sum_{i=1}^{3}\sum_{l=1}^{3} \pi_i A'_{ij}(\rho_l)(e^{\rho_l t} - 1) \sum_{r=1}^{N} n_{j,1,r} / \prod_{m=1,m\neq l}^{3} (\rho_l - \rho_m)\rho_l \sum_{r=1}^{N} t_{j.r} \quad (7)$$

Let c_i be the number of loans in state i at the initial starting date. Thus, π_i can be estimated as

$$\pi_i = \frac{c_i}{\sum_{i=1}^{3} c_i}, i = 1,2,3 \quad (8)$$

APPLICATION

Table 1: Macroeconomics factors, at the national and regional levels in China, used for developing the empirical model

	National	Regional
GDP rate of increase	×	
M1 Currency rate of increase	×	
CPI Index	×	×
CPI-Living index	×	×
Construction Material Price Index	×	×
Housing Sales Index	×	
Housing Development Index	×	
Housing Sale Amount	×	
HPI	×	×
Housing Rental Index	×	×

Table 1: Macroeconomics factors, at the national and regional levels in China, used for developing the empirical model

Community Management Fee Index	×	
Export Rate of Increase	×	
Metro Family Monthly Income	×	×
Metro Family Disposable Income	×	×
One-year mortgage Prime Rate		
GDP		×
CPI-Food Index		×
Food Sale Index		×
Living Material Sales Amount		×
Number Employed		×
Construction Investment Price Index		×
Metro Family Living Expenditures		×

Mortgage data are difficult to obtain from any bank. For this study, we were able to obtain data over 23 one-month periods of retail mortgage loans, provided by a large commercial Bank in China. This was used to estimate the health index of the loans (Eq. (7)) and to analyze its relationship to macroeconomic factors at the national and regional level. The source for the economics factors was http://www.cnki.net/.

Our interest in this study is to demonstrate the applicability of this modeling approach to a given bank. Hence, data from one bank is deemed adequate for this purpose.

A practical method for estimating $\Theta_{j,1}$ in Equation (1) from the data over a given time period 0, t is

$$\hat{\theta}^{t}_{j,1} = \frac{p_{j,1} N_t}{30 N_t \delta_j}, j = 1,2,3, t = 1,2,...,23 \quad (9)$$

Where $\acute{\theta}_{j,t}$ is the intensity function for period *t*, N_t is the total number of retail mortgages for period *t*, $\mathrm{N}_t = \sum_{s=1}^{3} \mathrm{N}_{s,t}$. Thus, N_t represents all individuals in the three states. Also, $p_{j1} N_t$ is the expected number of transitions from state S_j to state *S1* made by all individual loans during period t, where, $p_{j,1}$ is the transition probability from S_j to *S1*.

In equation (9), δ_j is defined as

$$\delta_j = \begin{cases} 1, \text{ if an individual is in state } S_j \\ 0, \text{ otherwise} \end{cases}$$

We use $30N_t \delta_j$ to approximate the total length of time that all individuals in the portfolio stay in S_j, $j= 1,2,3$. As a result, $30N_t\delta_j$ gives the length of time for all individuals staying in state S_j during the one month period.

Regression Model

Macroeconomics factors play an important role in relation to the performance of a mortgage loan portfolio. The health index, as a measure of performance, will be more useful if it is linked to some macro-factors which will enable bank management to forecast the quality or performance of its mortgage portfolio..

There are several studies in the literature that have considered the use of macro-factors to predict future health status of different industries. Liu et al. (2011) used the state space time series model to analyze the sensitivities of industrial production indices (including banking) to the macro-factors such as GDP, interest rate, unemployment, inflation, and disposable personal income. Ludvigson & Ng, (2009) used regression and Principle Component methodology, to analyze the relationship between bond risk and macro-factors. Studies along this line were also undertaken by Bai & Ng (2008), Forni et al. (2005), and Boivin & Ng, (2005).

In the present study, we have a pool of candidate regressors or independent variables (Table 1) and the problem is to determine the subset of regressors that significantly affect the health index for inclusion in the model. Finding an appropriate subset of regressors to include in the model is called variable selection. The stepwise and backward elimination procedures are two recommended procedures for determining the subset regression model (Montgomery et al., 2001). The final model chosen should satisfy the following criteria:

Have a fairly high R-squared value, a normal distribution for the residuals, no outliers, no multicollinearity (Variance inflation factor, VIF, is less than 10) among the regressors, and a fairly good model predictive performance.

Using the software package SAS, we ran stepwise and backward elimination on the national and regional data separately because of the large number of independent variables relative to the sample size. We combined the significant national and regional variables from the stepwise and backward elimination to come up with one model. Applying the above criteria for model selection, the following subset model was selected as being the best model for the available data:

$$H_i = 5.572 + 0.01819\, X_1 + 0.00396\, X_2 - 0.04162\, X_3 \qquad (10)$$

Here, H_i is the health index of the mortgage portfolio, X_1 is the GDP rate of increase, X2 is the Chinese currency rate of increase, and X_3 the housing rental index. All three independent variables have the expected sign. For this model, the distribution of residuals was normal, there were no outliers or influential observations and multicolliearity was not significant (VIF less than 7 for all three variables. All independent variables were highly significant (p values less than 0.002). The R-square value is 0.9173, which is fairly high. Also, the adjusted R-square is 0.9043.

Mortgage data are difficult to obtain. For this analysis we had 23 monthly observations (December 2006 to October 2008) from a large commercial bank in China. In order to check on the predictive performance of the model it was not possible (because of the small sample size) to split the data into two samples since one would need 15- 20 observations for a reliable assessment of predictive performance . In this case, an alternative splitting technique is to use the Press statistic (Montegomery et al., 2001).

$$Press = \sum_{i=1}^{n} (\mathrm{Y_i} - \mathrm{Y_{(i)}})^2 \tag{11}$$

Here, $\mathrm{Y_i}$ = the ith observation

$\mathrm{Y_{(i)}}$ = the predicted value of the ith observation from the model when the model was obtained by fitting it to the remaining n-1 observations (ith observation is deleted).

The predictive R-square for this model was calculated as:

$$\mathrm{R}^2_{\mathrm{pred}} = 1 - (\text{Press/Total Sum of Squares}) \tag{12}$$

The R-square predicted value, from Eq. (12), for the model in Eq. (10) was 0.86, which means that this model explains 86% of the variability of new observations. The predictive performance of the model is fairly good. Such a model may be updated as more data become available in order to predict future portfolio performance.

This modeling approach is useful for any bank to use in order to gauge the effect of economics factors on the health index, used as an indicator for performance of its mortgage portfolio or other portfolios.

CONCLUSION

The modeling approach in this study provides the bank with a health index to assess the performance of its mortgage portfolio. The mortgage health index was related to economics factors in order to predict its behavior. Among all of the factors studied, only three had significant effects on the health index. These were the GDP rate of increase, the currency rate of increase and the house rental index at the national level in China. These three variables explained more than 90% of the variability in the sample data of 23 monthly observations. The model predictive performance was fairly good. It could explain 86% of the variability in predicting new observations not included in the original data.

This modeling approach to measure and predict the behavior of the health index of a mortgage loan portfolio is useful for the management of a bank in assessing the risk of a portfolio.

REFERENCES

Bai J & S. Ng (2008). Forecasting economic time series using targeted predictors. *Journal of Econometrics*, 2008, vol. 146, 304-317 .

Boivin J. & S. Ng (2005), Undertanding and Comparing Factor Based Forecasts*, International Journal of Central Banking* 1, 117–152.

Burkhard, J. & E. De Giorgi (2006). An Intensity-Based Non-parametric Default Residential Mortgage Portfolios, Journal of Risk, 8, 57-95.

Chiang, C.L. (1980*). An Introduction to Stochastic Processes and Their Application,* R.E. Krieger Publishing .

Cooper, D. & E. Wood (1981). Estimation of the parameters of the Markovian representation of the autoregressive-moving average model. *Biometrika* 68, 320-322.

Cyert, R., J. Davidson, & G. Thompson (1962). Estimation of the Allowance for Doubtful Accounts by Markov Chains. *Management Science* 8, 3-19.

D'Amico,G. J. Janssen, and R. Manca (2005) "Homogeneous semi-Markov reliability models for credit risk management," *Decisions in Economics and Finance,* vol. 28 79–93

Deng , Y., J M Quigley & R van Order (2000). Mortgage Termination, Heterogeneityand the Exercise of Mortgage Options. *Econometrica*, 68, 275–307.

Douglas, S., S Sanchez & L. Edward (1996). A Comprehensive Model for Managing Credit Home Mortgage Portfolio. *Decision Sciences*, 27, 291-317.

Esbitt, M. (1986). Bank Portfolios and Bank Failures During the Great Depression. *The Journal of Economic History,* Vol. 46, 455-462

Forni, M., M. Hallin., M. Lippi , & L. Reichlin (2005). The Generalized Dynamic Factor Model: One-Sided Estimation and Forecasting. *Journal of the American Statistical Association,* 100 830–840.

Gambera, M. (2000). Simple Forecasts of Bank Loan Quality in the Business Cycle, Emerging Issues from Federal Reserve Bank of Chicago , April 2000 (S&R-2000-3)

Green J & J. Shoven (1986). The Effects of Interest Rates on Mortgage Prepayments. *Journal of Money,* 18, 41-59.

Grinold, R. (1983), Market value maximization and markov dynamic programming, *Management Science*, 14, 23-145

Hauswald, R. & R. Marquez (2004), Loan-Portfolio Quality and the Diffusion of Technological Innovation, FDIC Working Paper No. 2004-02

Hayre S. , M. Saraf, R. Young,& J Chen (2008). Modeling of Mortgage Default. *Journal of Fixed Income,* 17, 6-31.

Lee, Lung-Fei (1997). Simulation estimation of dynamic switching regression and dynamic disequilibrium models - some Monte Carlo results. *Journal of Econometrics*, 78, 179-184

Liu, C., M. Hassan, & R. Nassar (2010) A Markov Chain Modeling Approach for Predicting A Retail Mortgage Health Index, *Academy of Accounting & Financial Studies Journal,* 14 (3), 101-112.

Liu, C., M. Hassan, & R. Nassar (2011). Time Series Analysis of the Sensitivity of Net Incomes of Industrial Sections to Macroeconomics Factors. *International Journal of Business and Economics Perspectives.* In Press.

Ludvigson S. & S. Ng (2009). Macro Factors in Bond Risk Premia. *Review of Financial Studies,* 22 . 5027-5067.

McNulty, J., A. Aigbe, and J. Verbrugge (2001). Small bank loan quality in a deregulated environment: the information advantage hypothesis. Journal of Economics and Business. volume 53, 325-339

Montgomery, D. E. Peck & C.Vining (2001). *Introduction to Linear Regression Analysis.* John Wiley, New York.

Pennington-Cross, A (2008).The Duration of Foreclosures in the Subprime Mortgage Market: A competing Risk Model Mixing. *Journal of Real Estate, Finance and Economics*,40, 109-129.

SAS Online Doc, 2005 version, SAS/ETS User's Guide. Schwartz, E & T. Walter (1993). Mortgage Prepayment and Default Decision: Poisson Regression Approach. *Journal of American Real Estate and Urban Association*, 21, 31-44.

Soyer, R, & Feng X. (2010). Assessment of Mortgage Default Risk via Reliability Models.Applied *Stochastic Models in Business and Industry*, 26, 308-330.

Wei, W. (1990). *Time Series Analysis: Univariate and Multivariate Methods.* Addison-Wesley Publishing.

White, J. (1993). A Survey of Applications of Markov Decision Process. *The Journal of the Operational Research* Society, 44, 11-20.