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Hometown Investment Trust Funds: An Analysis of Credit Risk

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Abstract

In Asia, small and medium-sized enterprises (SMEs) account for a major share of employment and dominate the economy. Asian economies are often characterized as having bank-dominated financial systems and underdeveloped capital markets, in particular venture capital markets. Hence, looking for new methods of financing for SMEs is crucial. Hometown investment trust funds (HIT) are a new form of financial intermediation that has now been adopted as a national strategy in Japan. In this paper, we explain the importance of SMEs in Asia and describe about HITs. We then provide a scheme for the credit rating of SMEs by employing two statistical analysis techniques, principal components analysis and cluster analysis, and applying various financial variables to 1,363 SMEs in Asia. Adoption of this comprehensive and efficient method would enable banks to group SME customers based on financial health, adjust interest rates on loans, and set lending ceilings for each group. Moreover, this method is applicable to HITs around the world.

JEL Classification: G21, G24, G28

Contents

1. INTRODUCTION

Small and medium-sized enterprises (SMEs) are the backbone of the economies in Asia, accounting for 98% of all enterprises, 66% of the national labor force, and 38% of GDP on average during 2007–2012 (ADB 2014). SMEs influence trade and in Asia accounted for 30% of total export value on average during 2007–2012. In the People's Republic of China (PRC), SMEs accounted for 41.5% of total export value in 2012, up 6.8% year-on-year, while in Thailand they made up 28.8% of total export value, with 3.7% year-on-year growth (ADB 2014). SMEs that are part of global supply chains have the potential to promote international trade and mobilize domestic demand.

Because of the significance of SMEs for Asian economies, it is important to find ways to provide them with stable finance. Asian economies are often characterized as having bank-dominated financial systems and their capital markets, in particular venture capital markets, are not well developed. This means banks are the main source of financing. Although the soundness of the banking system has improved significantly since the 1997–1998 Asian financial crisis, banks have been cautious about lending to SMEs, even though they account for a large share of economic activity. Start-up companies, in particular, are finding it increasingly difficult to borrow money from banks because of strict Basel capital requirements. Riskier SMEs also face difficulty in borrowing money from banks (Yoshino 2012). Hence, an efficient credit rating scheme that rates SMEs based on their financial health would help banks to lend money to SMEs in a more rational way, while at the same time reducing the risk for banks.

Credit rating indexes, such as Standard & Poor's, rate large enterprises. By looking at a large enterprise's credit rating, banks can decide how much to lend them. However, for SMEs the issue is more complicated as there are no comparable ratings. Nevertheless, there is a useful model in Japan. In a government-supported project, 52 credit guarantee corporations collected data from Japanese SMEs. These data are stored at a private corporation called the Credit Risk Database (CRD), which contains data from 14.4 million SMEs, including default data from 1.7 million. If similar systems could be established in other parts of Asia to accumulate and analyze credit risk data, and to accurately measure each SME's credit risk, banks and other financial institutions could use the database to categorize their SME customers based on their financial health. SMEs would also benefit as they could raise funds from the banks more easily and gain access to the debt market by securitizing their claims.

In Section 2, we describe the characteristics of Asian economies, in particular the important role played by SMEs. In Section 3, we explain the advantages of preparing a complete SME database in each country. We then discuss stable ways of financing SMEs in Asia including home town investment trust funds. In Section 4, we propose a way of establishing SME credit ratings using statistical techniques and financial ratios. This captures all the characteristics of SMEs, including leverage, liquidity, profitability, coverage, and activity. The method can be used by banks all around the world, and especially in Asia, to group SMEs based on their financial health, to adjust the interest rates on loans, and to set lending ceilings for each group. Moreover, this method is applicable for hometown investment trust funds. Section 5 contains concluding remarks.

2. CHARACTERISTICS OF ASIAN ECONOMIES

2.1 High Potential Growth

Asian economies have had relatively high economic growth rates over the past 2 decades and further strong growth is expected over the next few years because of the growth of the middle class. Populations are young in most of Asia. If Asian economies continue to expand, the rate of return in the Asia will be higher than in other regions giving huge potential for growth and for financial investment in Asia (Yoshino 2012).

2.2 High Savings Rates and Low Capital Flows in Asia

Asia has very high savings rates, but most of these savings are invested in the United States (US) and Europe. They are not directly invested in the Asian region because of a lack of financial products and transparency. Paradoxically, it is clear that additional long-term investment in the Asian region will be required in future.

2.3 Where do Asian Savings Go?

Table 1 shows savings and investment ratios in Asia. It should be possible to direct some of these high accumulated savings toward infrastructure investments in the region. However, high savings in East Asian economies tend not to be distributed to other Asian economies. Rather, they are typically invested in domestic deposits, domestic stocks, and overseas government bonds such as US Treasury securities.

Table 1: Savings and Investment Ratios in Asia

Economy	Savings/GDP Ratio (%)			Investment/GDP Ratio (%)		
	2007	2010	2011	2007	2010	2011
PRC	51.9	53.4	53.8	41.7	48.2	48.7
Hong Kong, China	33.3	29.9	29.2	20.9	23.7	23.8
Indonesia	27.3	33.3	31.1	24.9	32.5	32.9
Japan	28.5	23.8	23.9	23.7	20.2	21.4
Republic of Korea	31.5	31.9	29.6	29.4	29.2	28.2
Malaysia	37.5	32.9	33.1	21.6	21.4	21.8
Philippines	22.1	24.8	22.3	16.9	20.5	20.5
Singapore	48.4	46.0	45.8	21.1	23.8	26.0
Thailand	32.8	30.6	30.4	26.4	25.9	25.6

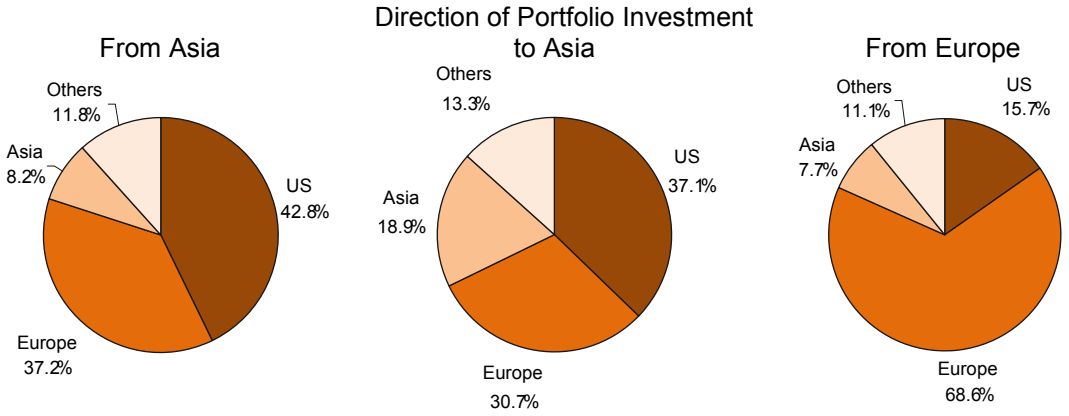
GDP = gross domestic product; PRC = People's Republic of China.

Note: Savings rate = gross national saving/GDP; investment rate = gross capital formation/GDP.

Source: IMF. World Economic Outlook Database.

Figure 1 contains three pie charts. The left chart shows that 43% of Asian investments are in US securities and stocks, with another 37% invested in European financial instruments. Only 8% are invested in the Asian region (these investments tend to be longer term, such as long-term government securities). The middle chart shows that 37% of the money flowing into Asia is from the US and 31% from Europe (these funds are short term). Only 19% of funds come from within Asia. Thus, Asia's high savings are directed at the US and Europe for long-term investments, while the portfolio investment that comes from overseas is short term and therefore inherently unstable. This lack of stability was one of the causes of the 1997–1998 Asian financial crisis. Unfortunately, the situation has not improved since then. The right chart shows that 69% of European funds invested externally are invested within Europe.

Figure 1: Portfolio Investment from the Asia to the World and Vice Versa



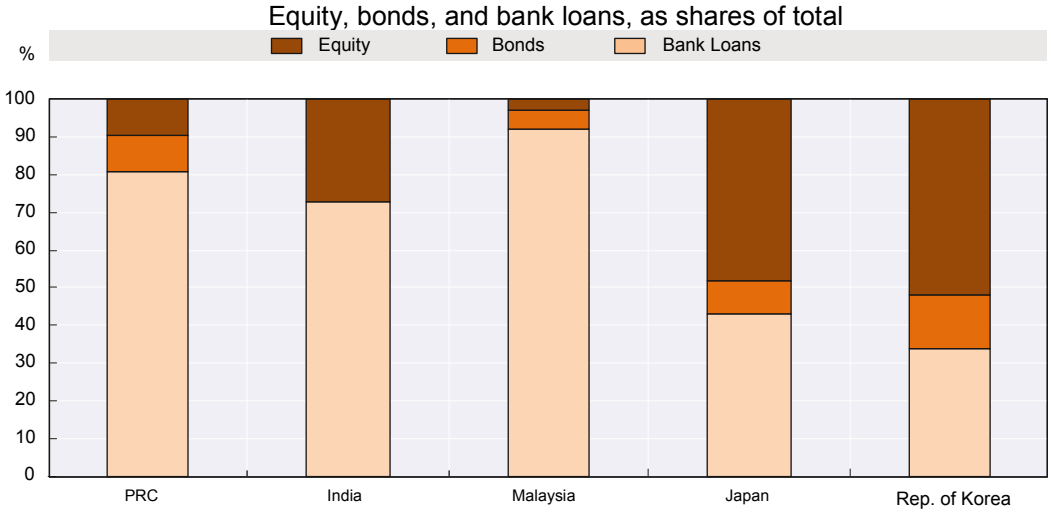
US = United States.

Source: Yoshino (2012).

2.4 Bank-Dominated Financial Systems and the Economic Importance of Small and Medium-sized Enterprises

Figure 2 shows the size of the equity and bond markets and bank loans in Asia.

Figure 2: Size of Financial Markets in Asia

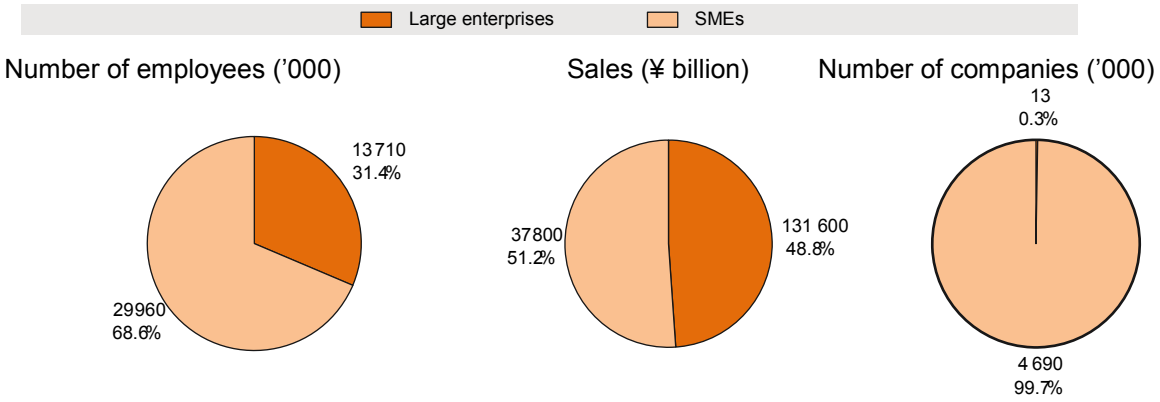


PRC = People's Republic of China.

Source: Kashiwagi, S. 2011. Fostering the Development of an Asian Financial Services Industry. Paper presented at the FSA Financial Research Center International Conference. Tokyo. February.

Figure 3, Table 2, and Figure 4 show the shares of SMEs in the economies of the PRC, Indonesia, and Japan. In all three countries, in terms of the number of firms and the share of employment, SMEs dominate the economy.

Figure 3: Small and Medium-sized Enterprises in Japan



SME = small and medium-sized enterprise.

Source: Government of Japan. Ministry of Economy, Trade, and Industry. 2011. White Paper on SMEs.

As shown in Figure 3, more than 99% of all businesses in Japan are SMEs; they also employ most of the working population and account for a large proportion of economic output.

Table 2: Small and Medium-sized Enterprises in the People's Republic of China

Item	2007	2008	2009	2010	2011[a]	2012[a]
Number of SMEs						
SMEs (number)	333,858	422,925	431,110	449,130	316,498	334,321
SMEs to total (%)	99.1	99.3	99.3	99.2	97.2	97.3
Employment by SMEs						
SME employees ('000)	60,521	68,671	67,877	72,369	59,357	...
SMEs to total (%)	76.8	77.7	76.9	75.8	64.7	...
SME Exports						
SME exports (CNY billion)	4,303	4,773	4,152	4,919	4,142	4,423
SMEs to total exports (%)	58.6	57.9	57.6	54.7	41.6	41.5

SME = small and medium-sized enterprise.

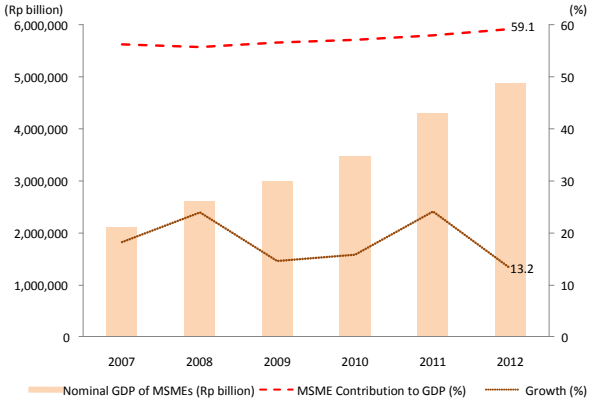
Notes: The data cover industrial enterprises above a certain operational scale. For 2007–2010, "above operational scale" refers to all industrial enterprises that generated a minimum annual income of CNY5 million from their core business. For 2011–2012, it refers to all industrial enterprises that generated a minimum annual income of CNY20 million from their core business. The industry sector includes mining; manufacturing; and electricity, gas, and water production and supply industries. Data for 2007–2010 are based on the number of employees fewer than 2,000, annual sales of CNY300 million or less, or total assets of CNY400 million or less. Medium-sized enterprises must have more than 300 employees, annual sales of more than CNY30 million, and total assets of CNY40 million or more; the rest are small businesses.

[a] Data for 2011–2012 are based on the 2011 SME classification criteria. Industrial micro, small, or medium-sized enterprises are defined as enterprises that employ fewer than 1,000 persons or whose annual turnover does not exceed CNY400 million. A medium-sized enterprise is defined as an enterprise that employs more than 300 persons and whose annual turnover exceeds CNY20 million. A small enterprise is defined as one that employs more than 20 persons and whose annual turnover exceeds CNY3 million. A micro enterprise is defined as an enterprise that employs fewer than 20 persons or whose annual turnover does not exceed CNY3 million. Data on micro enterprises in 2011–2012 are not available.

Source: ADB (2014).

In the PRC, the number of SMEs has expanded steadily since the government introduced the reform and opening-up policy in 1978. As can be seen from Table 2, SMEs play a crucial role in boosting the economy, increasing employment opportunities, and creating industries. According to the Ministry of Commerce, there were 12.5 million enterprises (most of which were SMEs) registered in the PRC and 37.6 million privately or individually owned businesses as of end 2011. SMEs contributed 50% of tax revenue and 60% of GDP. They also provided 80% of urban job opportunities, introduced 75% of new products, and accounted for 65% of patents and inventions in the PRC (ADB 2014).

Figure 4. SME Contribution to GDP in Indonesia



GDP = gross domestic product; MSME = micro, small, and medium-sized enterprise; SME = small and medium-sized enterprise.

Note: Data include micro enterprises.

Source: Ministry of Cooperatives and SMEs of Indonesia.

The Indonesian economy is growing resiliently amid rapid changes in the global economy, backed by strong domestic demand and driven by the micro, small, and medium-sized enterprise (MSME) sector. In Indonesia, there were 56.5 million MSMEs, accounting for 99.9% of total enterprises in 2012. The MSME sector has regularly recorded about 2% year-on-year growth in the number of enterprises, even during and after the 2008–2009 global financial crisis. Primary industries such as agriculture, forestry, and fisheries account for about 50% of MSMEs, followed by wholesale and retail trade and the hotel and restaurant sector (28.8% combined in 2011). The MSME sector absorbs 97% of the total business workforce, employing 107.7 million employees in 2012, 5.8% year-on-year growth. The sectors employing the greatest number of MSME workers are primary industries (42.4% of MSME employees in 2011), followed by trade (21.7%), manufacturing (11.7%), and services (10.5%). These have underpinned the national economy, regularly contributing about 60% of GDP, of which the trade sector contributes the most (26.7% of MSME GDP in 2011) (Figure 4). Indonesian MSMEs accounted for 14.1% of total export values in 2012. Small-scale export-oriented manufacturers, for example, handicrafts and wooden furniture industries, exist all over Indonesia and are often organized in clusters, which helps to make their production processes more efficient. MSME exports were directly affected by the global financial crisis, registering a sharp decrease of 8.9% in 2009. Although the business environment is gradually recovering, the growth of MSME exports remains volatile, as shown by the 11.1% year-on-year decrease in 2012 (ADB 2014).

3. SMALL AND MEDIUM-SIZED ENTERPRISE DATABASE AND STABLE FINANCE

3.1 Small and Medium-sized Enterprise Database

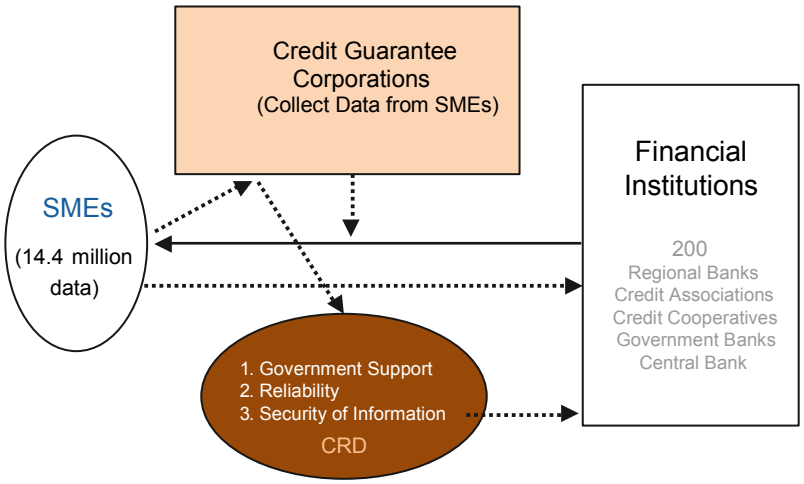
Considering the importance of SMEs to many dimensions of Asian economic activity, further efforts need to be made to offer them access to finance. Their financial and non-financial accounts are often difficult to assess, but the Credit Risk Database (CRD) in Japan shows how SMEs can be rated based on financial and non-financial data. The CRD collected a huge amount of data from SMEs and uses the data to rate SMEs based on statistical analysis.

3.2 Data Provided by the Credit Risk Database

The Japanese Ministry of Economy, Trade and Industry and the Small and Medium Enterprise Agency (SMEA) established the CRD Association in 2001. Its aim is to facilitate fundraising for SMEs and to improve their operational efficiency. The initial membership was 52 credit guarantee corporations and financial and non-financial institutions. The membership increased from 73 institutions at the end of March 2002 to 200 at the end of 2010.

The CRD covers SMEs exclusively (Figure 5). As of March 2010, it contained data on 14.37 million corporations and 1.737 million sole proprietors, more than 50% of all SMEs in Japan, and is by far the largest database for SMEs in Japan. The database for enterprises in default covered 3,289,000 corporations and sole proprietors. The CRD Association receives support from both private and public sectors, which has contributed to its success. For example, the SMEA nominates representatives of the association to government councils giving the association opportunities to promote its activities and increase its membership. Credit guarantee corporations and private financial institutions use the database when they create a joint guarantee scheme. Before the database was established, the government invested ¥1.3 billion from the supplementary budgets for fiscal years 1999 and 2000 to finance the setting up of the CRD's computer system and other operational costs. The association provides sample data and statistical information as well as scoring services.

Figure 5: Credit Risk Database of Small and Medium-sized Enterprises



CRD = Credit Risk Database; SME = small and medium-sized enterprise.

Source: Yoshino (2012).

Member financial institutions use scoring models to evaluate credit worthiness, check the validity of internal rating systems, and align loan pricing with credit risk. In addition, the CRD Association provides consulting services to support the management of SMEs on the assumption that if SMEs are better managed, this will reduce the credit risk for member financial institutions and strengthen business operations of SMEs. Consulting services have also been offered to member financial institutions to help them promote implementation of Basel II.

If such systems could be established in other parts of Asia to accumulate and analyze credit risk data, and to measure each SME's credit risk accurately, SMEs would not only be able to raise funds from the banking sector, but they could also gain access to the debt market by securitizing their claims.

3.3 Hometown Investment Trust Funds

Due to strict Basel capital requirements, banks have to keep much more capital when lending to risky borrowers such as SMEs and start-up businesses (Yoshino and Hirano 2011; 2013). Asian regions are dominated by bank loans that have to follow stricter Basel capital requirements (Basel

III). Asian economies do not have developed capital markets to provide money to risky borrowers and start-up businesses. Therefore, it is urgent to develop regional funds (or hometown investment trust funds) to provide money to SMEs and start-up businesses in Asia. Then, if these regional trust funds are sold through branch offices to regional banks, post offices, credit associations, and large banks, this would increase the opportunities for regional companies to raise funds.

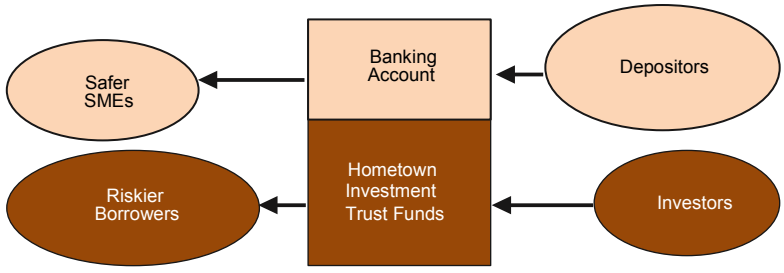
However, such trust funds would not be guaranteed by the Deposit Insurance Corporation and risks would be borne by investors.[1] The terms of a trust fund would have to be fully explained to investors (for example, where their funds would be invested and the risks associated with the investment) in order to strengthen investor confidence and help the trust fund market to grow (Yoshino 2013). Examples of such funds in Japan include wind power generators and musicians' funds. In the first example, in order to construct 20 wind power generators, public–private partnerships were launched and local residents invested between $1,000 and $5,000 in a fund. They receive dividends every year through the sale of electricity from each wind power generator in which they invest. Musicians' funds gather many small investors who buy units for $150–$500. If a musician becomes successful and their music sells well, the sales will generate a high rate of return for the fund.

Examples can be found of both successful and failed funds. Project assessors play a key role in evaluating each project to limit the number of nonperforming investments and losses by investors. Some of Japan's funds are regarded as charities, with some investors seeing them as a way to invest in their region to support new business ventures.

Such new ventures pose a problem for banks, as although some will have high expected rates of return, the high risks involved make it difficult for banks to finance them. However, if the projects are financed by hometown investment trust funds rather than by deposits transformed into bank loans, they will not create nonperforming loans for banks. Banks can still benefit, and compete with each other, by selling hometown investment trust funds through their branch offices. Investors must be advised that their investment is not guaranteed, although they may receive a high rate of return. If a bank sells successful hometown investment trust funds, it will attract more investors; if it sells loss-making funds it will lose investors. Competition will improve the quality of projects and enhance the risk-adjusted returns for investors.

Figure 6 shows how trust funds can increase investment in riskier projects.

Figure 6: Bank-based Small and Medium-sized Enterprise Financing and Hometown Investment Financing to Riskier Borrowers



SME =small and medium-sized enterprise.

Source: Yoshino and Taghizadeh-Hesary (2014).

The hometown investment trust fund has three main advantages. First, it contributes to financial market stability by lowering information asymmetry. Individual households and firms have direct access to information about the borrowing firms, mainly SMEs, to which they lend. Second, it is a stable source of risk capital. The fund is project driven. Firms and households decide to invest by getting to know the borrowers and their projects. In this way the fund distributes risk, but not so that

[1] For more information about Deposit Insurance mechanism, see Yoshino, Taghizadeh-Hesary and Nili (2013).

it renders risk intractable, which was the problem with the "originate-to-distribute" model.[2] Third, it contributes to economic recovery by connecting firms and households with SMEs that are worthy of their support. It also creates employment opportunities at the SMEs as well as for retirees from financial institutions who can help assess the projects.

Introduction of the hometown investment trust fund has huge global implications. The world is seeking a method of financial intermediation that minimizes information asymmetry, distributes risk without making it opaque, and contributes to economic recovery. Funds similar to Japan's hometown investment trust fund can succeed in all three ways—after all, the majority of the world's businesses are SMEs (Yoshino 2013).

3.4 Long-term Finance in Asia

Japan used to have long-term credit banks, which issued bank debentures that were longer term than ordinary bank deposits and offered higher interest rates. Although corporations did not issue bonds, these long-term credit banks lent money to large corporations by issuing long-term bank debentures. In developed economies, long-term credit is financed by issuance of corporate bonds. However, the corporate bond market is limited to larger and established corporations and is not open to small businesses and start-up businesses. Many Asian countries do not have substantial corporate bond markets, so other ways of providing long-term financing must be sought. Otherwise, the newly-created trust funds will be short lived and will be unable to provide long-term funds.

Government banks provide long-term loans to industry, small businesses, and farmers, among others. Such loans are financed (i) through individual deposits such as postal savings accounts or government bank deposits, (ii) through government bonds, and (iii) through tax revenues. On the one hand, government banks are said to lack corporate governance and are perceived as less efficient than private banks. On the other hand, they can provide prompt financing in a crisis when private banks and private bond markets lack liquidity. For example, after Japan's tsunami and earthquake disaster in 2011, government banks played an important role. However, when a crisis passes, government banks need to phase themselves out of the lending market to allow room for loans by private banks and financial institutions (who often raise concerns about lending by government banks even during normal economic conditions, claiming they crowd out private bank loans). A shift from government bank loans to private bank loans is needed when normal conditions resume in the financial markets. One way to do this is for government banks to transfer their loan contracts to private banks.

3.5 How to Develop Long-term Investors in Developing Economies

Pension funds and insurance companies both provide long-term finance. As Asia's aging population increases, developing countries will need to establish pension funds. Japanese pension funds are pay-as-you-go style and pension contributors cannot control how their funds are invested. Instead, they let the government decide how funds should be allocated to various financial products. By contrast, most US pensions are 401k-style, meaning that pension contributors decide what percentage can be invested in risky assets and what percentage in safe assets (Yoshino and Taghizadeh-Hesary 2014). In this case, if all the funds are aggregated, *x*% will be invested in risky assets and *1-x*% will be allocated to safe assets. In Japan, there is complete reliance on asset managers' decisions. There is no self-responsibility with regard to pension funds and insurance companies. Hence, asset managers want to invest in government bonds as they are the safest assets. If developing countries use a 401(k)-style and asset allocation relies on an individual's portfolio allocation, then stock market investment and overseas investment in stocks will become much easier because they will all be based on individuals' decisions (Yoshino and Taghizadeh-Hesary, forthcoming).

[2] In the "originate-to-distribute" model, lenders make loans with the intention of selling them to other institutions and/or investors, as opposed to holding the loans through maturity.

4. ANALYSIS OF SMALL AND MEDIUM-SIZED ENTERPRISE CREDIT RISK USING ASIAN DATA

In this section we present an efficient and comprehensive scheme for credit rating SMEs. First, we examine various financial ratios that describe the characteristics of SMEs and that will enable banks to categorize their SME customers into different groups based on their financial health; this method is also applicable for hometown investment trust funds. The data for this statistical analysis were provided by one Asian bank for 1,363 SMEs.

4.1 Selection of the Variables

A large number of possible ratios have been identified in the credit rating literature as useful in predicting firms' likelihood of default. Chen and Shimerda (1981) show that out of more than 100 financial ratios, almost 50% were found useful in at least one empirical study. Some scholars have argued that quantitative variables are not sufficient to predict SME default and that including qualitative variables (such as the legal form of the business, the region where the main business is carried out, and industry type) improves the models' predictive power (for example, Lehmann 2003; Grunert, Norden, and Weber 2005). However, the data used here are based on firms' financial statements, which do not contain such qualitative variables.

We have followed Altman and Sabato (2007), who proposed five categories to describe a company's financial profile: liquidity, profitability, leverage, coverage, and activity. For each of these categories, they created a number of financial ratios identified in the literature. Table 3 shows the financial ratios selected for this survey.

Table 3: Examined Variable

No.	Symbol	Definition	Category
1	Equity_TL	Equity (book value)/total liabilities	Leverage
2	TL_Tassets	Total liabilities/total assets	
3	Cash_Tassets	Cash/total assets	Liquidity
4	WoC_Tassets	Working capital/total assets	
5	Cash_Sales	Cash/net sales	
6	EBIT_Sales	Ebit/sales	Profitability
7	Rinc_Tassets	Retained earnings/total assets	
8	Ninc_Sales	Net income/sales	
9	EBIT_IE	Ebit/interest expenses	Coverage
10	AP_Sales	Account payable/sales	Activity
11	AR_TL	Account receivable/total liabilities	

Note: Retained earnings = the percentage of net earnings not paid out as dividends, but retained by the company to be reinvested in its core business or to pay debt. It is recorded under shareholders' equity in the balance sheet. Ebit = earnings before interest and taxes. Account payable = an accounting entry that represents an entity's obligation to pay off a short-term debt to its creditors. The accounts payable entry is found on a balance sheet under current liabilities. Account receivable = money owed by customers (individuals or corporations) to another entity in exchange for goods or services that have been delivered or used, but not yet paid for. Receivables usually come in the form of operating lines of credit and are usually due within a relatively short-time period, ranging from a few days to a year.

The firms considered as being in default in this study are those whose risk-weighted assets are greater than their shareholders' equity.

In the next stage, two statistical techniques are used: principal component analysis (PCA) and cluster analysis. The underlying logic of both techniques is dimension reduction (that is, summarizing information on multiple variables in just a few variables), but they achieve this in different ways. PCA reduces the number of variables into components (or factors). Cluster analysis reduces the number of SMEs by placing them in small clusters. In this survey, we use components (factors) which are the result of PCA and then run the cluster analysis to group the SMEs.

4.2 Principal Component Analysis

Principal component analysis (PCA) is a standard data reduction technique that extracts data, removes redundant information, highlights hidden features, and visualizes the main relationships that exist between observations.[3] PCA is a technique for simplifying a data set, by reducing multi-dimensional data sets to lower dimensions for analysis. Unlike other linear transformation methods, PCA does not have a fixed set of basis vectors. Its basis vectors depend on the data set, and PCA has the additional advantage of indicating what is similar and different about the various models created (Bruce-Ho and Dash-Wu 2009). Through this method we reduce the 11 variables listed in Table 3 to determine the minimum number of components that can account for the correlated variance among the SMEs.

In order to examine the suitability of these data for factor analysis, we performed the Kaiser–Meyer–Olkin (KMO) test and Bartlett's test of sphericity. KMO is a measure of sampling adequacy that indicates the proportion of common variance that might be caused by underlying factors. High KMO values (larger than 0.60) generally indicate that factor analysis may be useful, which is the case in this study: KMO = 0.71. If the KMO value is less than 0.5, factor analysis will not be useful. Bartlett's test of sphericity indicates whether the correlation matrix is an identity matrix, indicating that variables are unrelated. A level less than 0.05 indicates that there are significant relationships among the variables, which is the case in this study: significance of Bartlett's test <0.001.

Next, we determine how many factors to use in our analysis. Table 4 reports the estimated factors and their eigenvalues. Only those factors accounting for more than 10% of the variance (eigenvalues >1) are kept in the analysis. As a result, only the first four factors were finally retained.

Taken together, Z1 through Z4 explain 71.03% of the total variance of the financial ratios.

Table 4: Total Variance Explained

Component	Eigenvalues	% of Variance	Cumulative Variance %
Z1	3.30	30.00	30.00
Z2	2.19	19.90	49.88
Z3	1.25	11.38	61.26
Z4	1.08	9.78	71.03
Z5	0.94	8.56	79.60
Z6	0.75	6.79	86.37
Z7	0.56	5.09	91.47
Z8	0.48	4.36	95.82
Z9	0.32	2.87	98.69
Z10	0.13	1.14	99.84
Z11	0.09	0.17	100.00

In running the PCA, we used direct oblimin rotation. Direct oblimin is the standard method to obtain a non-orthogonal (oblique) solution—that is, one in which the factors are allowed to be correlated. In order to interpret the revealed PCA information, the pattern matrix must then be studied. Table 5 presents the pattern matrix of factor loadings by use of the direct oblimin rotation method, where variables with large loadings, absolute value (>0.5) for a given factor, are highlighted in bold.

[3] PCA can be also called the Karhunen–Loève transform (KLT), named after Kari Karhunen and Michel Loève.

Table 5: Factor Loadings of Financial Variables after Direct Oblimin Rotation

Variables (Financial Ratios)	Component			
	Z1	Z2	Z3	Z4
Equity_TL	0.009	0.068	0.113	0.705
TL_Tassets	–0.032	–0.878	0.069	–0.034
Cash_Tassets	–0.034	–0.061	0.811	0.098
WoC_Tassets	–0.05	0.762	0.044	0.179
Cash_Sales	–0.937	0.021	0.083	0.009
EBIT_Sales	0.962	0.008	0.024	–0.004
Rinc_Tassets	0.014	0.877	0.015	–0.178
Ninc_Sales	0.971	–0.012	0.015	0.014
EBIT_IE	0.035	0.045	0.766	–0.098
AP_Sales	–0.731	–0.017	–0.037	–0.016
AR_TL	0.009	–0.041	–0.104	0.725

Note: The extraction method was principal component analysis. The rotation method was direct oblimin with Kaiser normalization. For definitions of the variable please refer to Table 3.

As can be seen in Table 5, the first component, Z1, has four variables with an absolute value (>0.5), of which two are positive (ebit/sales and net income/sales) and two are negative (cash/net sales and account payable/sales). For Z1, the variables with large loadings are mainly net income and earnings, hence Z1 generally reflects the net income of an SME. As this factor explains the most variance in the data, it is the most informative indicator of an SME's overall financial health. Z2 reflects short-term assets. This component has three major loading variables: (i) liabilities/total assets, which has a negative value, meaning an SME has few liabilities, and mainly relies on its own assets; (ii) working capital/total assets, which is positive, meaning an SME has short-term assets; and (iii) retained earnings/total assets, which is positive, meaning an SME has some earnings that are kept in the company or in the bank. These three variables indicate that an SME, whose reliance on borrowings is small and that is rich in working capital and retained earnings, has plenty of short-term assets. Z3 reflects the liquidity of SMEs. This factor has two variables with large loadings (cash/total assets and ebit/interest expenses), both with positive values, which show an SME that is cash-rich and has high earnings, hence it reflects an SME's liquidity. The last factor, Z4, reflects capital. This factor has two variables with large loading, both with positive values (equity (book value)/total liabilities and account receivable/total liabilities), meaning an SME with few liabilities that is rich in equity.

Table 6 shows the correlation matrix of the components and shows there is no correlation between these four components. This means we could have used a regular orthogonal rotation approach to force an orthogonal rotation, although in this survey we used an oblique rotation method that still provided an orthogonal rotation factor solution, because these four components are not correlated with each other and are distinct entities.

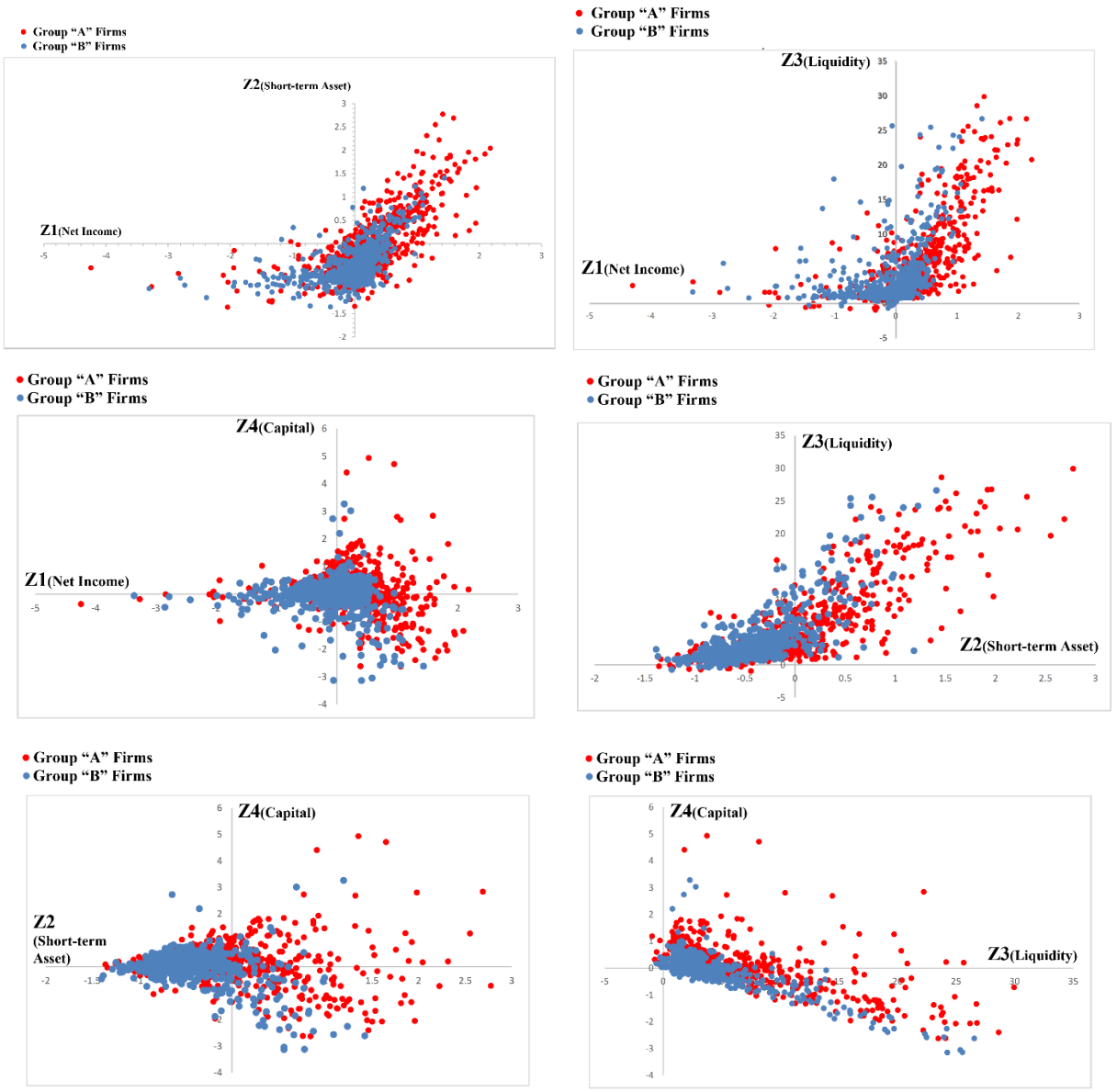
Table 6: Component Correlation Matrix

Component	Z1	Z2	Z3	Z4
Z1	1	0.037	–0.031	–0.005
Z2	0.037	1	0.106	0.102
Z3	–0.031	0.106	1	0.033
Z4	–0.005	0.102	0.033	1

Note: The extraction method is principal component analysis. The rotation method is direct oblimin with Kaiser Normalization.

Figure 7 shows the distribution of the four components (Z1, Z2, Z3, and Z4) for Group A, financially healthy SMEs, and Group B, bankrupt SMEs. It is clear from all six graphs in this figure that Group A SMEs are found in the positive areas of the graphs and Group B SMEs in the negative areas.

Figure 7: Distribution of Factors for Group A and B SMEs



Note: Group A = healthy SMEs; Group B = bankrupt SMEs. The firms considered to be bankrupt in this study have risk-weighted assets greater than their shareholders' equity.

4.3 Cluster Analysis

In this section we take the four components that were used in the previous section and identify those SMEs that have similar traits. We then generate clusters and place the SMEs in distinct groups. To do this, we employ cluster analysis that organizes a set of data into groups so that observations from a group with similar characteristics can be compared with those from a different group (Martinez and Martinez 2005). Cluster analysis techniques can themselves be broadly grouped into three classes: hierarchical clustering, optimization clustering, and model-based

clustering.[4] We used the method most prevalent in the literature, hierarchical clustering. This produces a nested sequence of partitions by merging (or dividing) clusters. At each stage of the sequence, a new partition is optimally merged (or divided) from the previous partition according to some adequacy criterion. The sequence of partitions ranges from a single cluster containing all the individuals to a number of clusters (*n*) containing a single individual. The series can be described by a tree display called the dendrogram (Figure 8). Agglomerative hierarchical clustering proceeds by a series of successive fusions of the *n* objects into groups. By contrast, divisive hierarchical methods divide the *n* individuals into progressively finer groups. Divisive methods are not commonly used because of the computational problems they pose (Everitt, Landau, and Leese 2001; Landau and Chis Ster 2010). Below, we use the average linkage method, which is a hierarchical clustering technique.

4.3.1 The Average Linkage Method

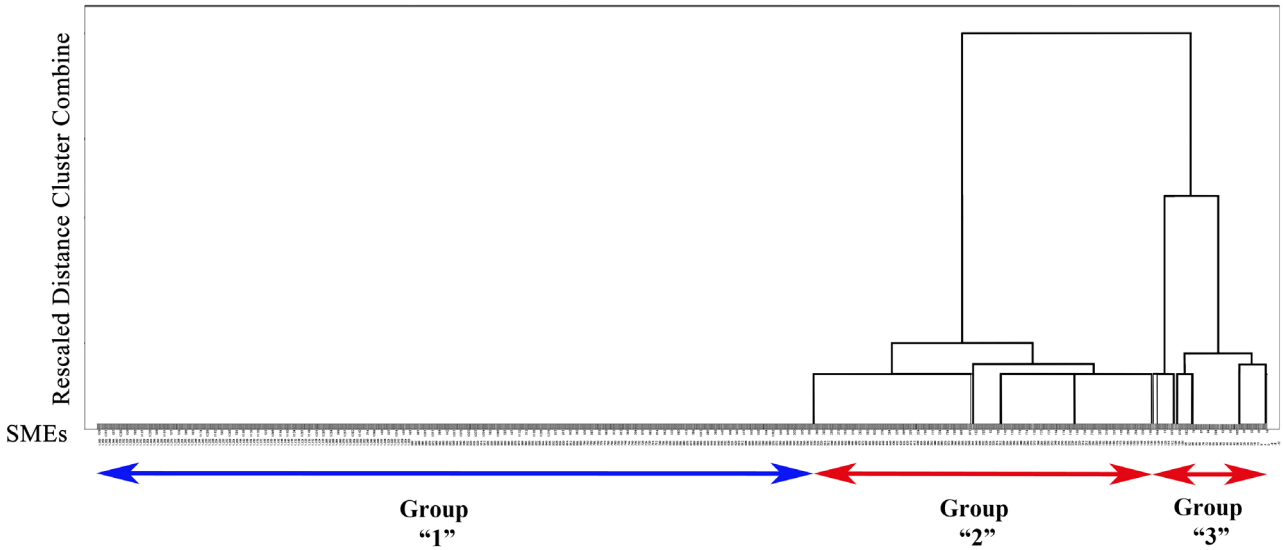
The average linkage method defines the distance between clusters as the average distance from all observations in one cluster to all points in another cluster. In other words, it is the average distance between pairs of observations, where one is from one cluster and one is from the other. The average linkage method is robust and also takes the cluster structure into account (Martinez and Martinez 2005; Feger and Asafu-Adjaye 2014). The basic algorithm for the Average Linkage method can be summarized in the following manner:

• N observations start out as N separate groups. The distance matrix D = (dij) is searched to find the closest observations, for example, Y and Z.

• The two closest observations are merged into one group to form a cluster (YZ), producing N – 1 total groups. This process continues until all the observations are merged into one large group.

Figure 8 shows the dendrogram that results from this hierarchical clustering.

Figure 8: Dendrogram Using Average Linkage Method



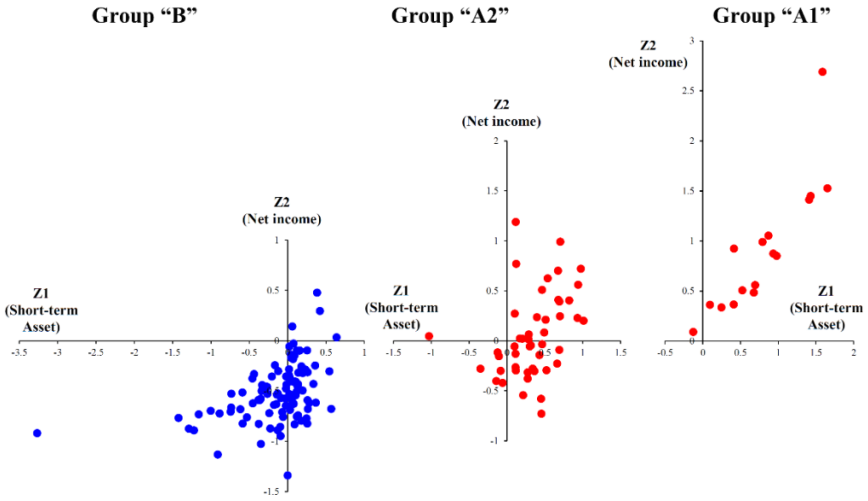
SME = small and medium-sized enterprise.

[4] The main difference between the hierarchical and optimization techniques is that in hierarchical clustering, the number of clusters is not known beforehand. The process consists of a sequence of steps where two groups are either merged (agglomerative) or divided (divisive) according to the level of similarity. Eventually, each cluster can be subsumed as a member of a larger cluster at a higher level of similarity. The hierarchical merging process is repeated until all subgroups are fused into a single cluster (Martinez and Martinez 2005). Optimization methods, on the other hand, do not necessarily form hierarchical classifications of the data as they produce a partition of the data into a specified or predetermined number of groups by either minimizing or maximizing some numerical criterion (Feger and Asafu-Adjaye 2014).

The resultant dendrogram (hierarchical average linkage cluster tree) provides a basis for determining the number of clusters by sight. In the dendrogram, the horizontal axis shows 1,363 SMEs. Because of the large number of SMEs in this survey, they have not been identified by number in the dendrogram, although this is how they are identified in the survey. Rather, the dendrogram categorizes the SMEs in three main clusters (Groups 1, 2, and 3), but it does not show which of these three clusters contains the financially healthy SMEs, bankrupt SMEs, or the intermediate SMEs, hence there is one more step to go.

Using the components that were derived from the principal component analysis in Section 4.2, we can plot the distribution of factors for each member of the three major clusters. Figure 9 shows the distribution of Z1–Z2 for these three cluster members separately.[5]

Figure 9: Grouping Based on Principal Component Analysis (Z1–Z2) and Cluster Analysis



Interestingly, when we do this grouping using the other components (Z1–Z3, Z1–Z4, Z2–Z4, Z2–Z3, and Z3–Z4), in most cases the grouping is similar. This implies that this analysis is an effective way of grouping the SMEs.

5. CONCLUDING REMARKS

SMEs play a significant role and are responsible for very high shares of employment and output in all Asian economies. However, they find it difficult to borrow money from banks and other financial institutions. Using accumulated data on SMEs, we can carry out a statistical analysis on the quality of the SMEs in a way that can facilitate bank financing to SMEs, or financing through the regional funds (that is, hometown investment trust funds).

In this study we applied 11 financial variables to 1,363 SMEs who are customers of an Asian bank, and subjected them to principal component analysis and cluster analysis. The results showed that four variables (net income, short-term assets, liquidity, and capital) are the most important for describing the general characteristics of SMEs. Three groups of SMEs were then differentiated based on their financial health. The policy implications of this statistical analysis are that if governments were to apply similar techniques, financially healthy SMEs could borrow more money from banks, at lower interest rates, because of their lower default risk, while SMEs in poor financial health would have to pay higher interest rates and would have a lower borrowing ceiling than healthy SMEs. By using such a credit rating mechanism, banks could reduce the amount of their

[5] The dendrogram shows the major and minor clusters. One useful feature of this tree is that it identifies a representative SME of most of the minor groups, which has the average traits of the other members of the group. Hence for simplification, in Figure 9, we have only used data from these representative SMEs, which explains the whole group's traits. This is why the total number of observations in Figure 9 is lower than the 1,363 observations in this survey.

accumulated nonperforming loans to SMEs. In addition, if the hometown investment trust funds were sold through regional banks, post offices, credit associations, or large banks, these financial institutions could apply the abovementioned credit rating analysis and decide on the closure or continuation of such funds.

REFERENCES

Asian Development Bank (ADB). 2014. *Asia SME Finance Monitor 2013.* Manila: Asian Development Bank.

Altman, E. I., and G. Sabato. 2007. Modelling Credit Risk for SMEs: Evidence from the U.S. Market. *ABACUS.* 43 (3): 332–357.

Bruce-Ho, C.-T., and D. Dash-Wu. 2009. Online Banking Performance Evaluation Using Data Envelopment Analysis and Principal Component Analysis. *Computers & Operations Research.* 36: 1835–1842.

Chen K. H., and T. A. Shimerda. 1981. An Empirical Analysis of Useful Financial Ratios. *Financial Management*. 10 (1): 51–60.

Everitt, B. S., S. Landau, and M. Leese. 2001. *Cluster Analysis*. *4th ed*. London: Edward Arnold Publishers.

Feger, T., and J. Asafu-Adjaye. 2014. Tax Effort Performance in Sub-Sahara Africa and the Role of Colonialism. *Economic Modelling*. 38. 163–174.

Grunert, J., L. Norden, and M. Weber. 2005. The Role of Non-financial Factors in Internal Credit Ratings. *Journal of Banking and Finance*. 29 (2): 509–531.

Landau, S. and I. Chis Ster. 2010. Cluster Analysis: Overview. In *International Encyclopedia of Education. 3rd ed*. Oxford: Elsevier. pp. 72–83.

Lehmann, B. 2003. Is it Worth the While? The Relevance of Qualitative Information in Credit Rating. Working Paper presented at the EFMA 2003 Meetings. Helsinki.

Martinez, W. L., and A. R. Martinez. 2005. *Exploratory Data Analysis with Matlab*. Florida: Chapman and Hall/CRC Press.

Yoshino, N., and T. Hirano. 2011. Pro-cyclicality of the Basel Capital Requirement Ratio and Its Impact on Banks*. Asian Economic Papers*. 10 (2): 22–36.

Yoshino, N., and T. Hirano. 2013. Counter-Cyclical Buffer of the Basel Capital Requirement and Its Empirical Analysis. In *Current Developments in Monetary and Financial Law*. 6: 417–429.

Yoshino, N. 2012. Global Imbalances and the Development of Capital Flows among Asian Countries. *OECD Journal: Financial Market Trends*. 2012 (1).

Yoshino, N. 2013. The Background of Hometown Investment Trust Funds. In N. Yoshino and S. Kaji, eds. *Hometown Investment Trust Funds: A Stable Way to Supply Risk Capital.* Tokyo: Springer. pp. 1–13.

Yoshino, N., F. Taghizadeh-Hesary, and F. Nili. 2013.Optimal Premiums for the Deposit Insurance System: An Empirical Work on the Deposit Insurance System of Japan. Keio Economic Studies. Discussion Paper. KESDP No. 13-1.

Yoshino, N., and F. Taghizadeh-Hesary. 2014. Three Arrows of “Abenomics” and the Structural Reform of Japan: Inflation Targeting Policy of the Central Bank, Fiscal Consolidation, and Growth Strategy. ADBI Working Paper 492. Tokyo: Asian Development Bank Institute.

Yoshino, N., and F. Taghizadeh-Hesary. Forthcoming. An Analysis of Challenges Faced by Japan’s Economy and Abenomics. *Japanese Political Economy Journal.*