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What causes financial system meltdowns in developed countries

In Partial Fulfillment of the Requirements

for the Bachelor of Science in Finance

by

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ABSTRACT

In recent years, financial stability has been a significant issue all over the world, especially among the developed countries. This thesis summarized the signs before financial system meltdown, polices of Developed countries on how to respond to them of the historical literature. Furthermore, this thesis used the sample data of nine representative countries (America, Germany, UK, France, Denmark, Belgium, Singapore, South Korea, and Australia) in past ten years to analysis the influence of different factors in Financial Soundness Indicators of financial stability, which is evaluated by Bank Z-Score. Data analysis's result also provide a new evidence that a higher proportion non-performance loans may be a sign of financial development driven by foreign investment. This empirical study also confirmed the impact degree of factors in Financial Soundness Indicators on financial stability.

Keywords

Financial stability, Financial Soundness Indicators, Bank Z-Score

1. INTRODUCTION

This thesis intends to find out the main elements which influenced the financial system meltdown in developed countries. Different from the developing countries, most of the big financial crises are related to developed countries, although they have a more advanced financial system as well as experienced operation. As the linkage between countries becomes more closer, a slight change in one country's financial system may cause a considerable difference to another country.

The Financial Crisis of 2007–08 was resulted from the mortgage bubble and unregulated financial system. Lehman Brothers, one of the biggest investment banks in the world, even went bankrupt at that time. Accompanying with the mortgage bubble, currency devaluation, and collapse of banks, as well as financial institutions, occurs rapidly from America to all over the world. Almost ten years from now, some countries, for instance, Greece, are still suffering from the aftermath of the financial crisis.

This thesis will talk about the signs before Financial System Meltdown in developed countries, the standards to measure the degree of a Financial System Meltdown, polices of developed countries on how to respond to Financial System Meltdown and impacts of it. In the data analysis part, this thesis will find out the most influential factors which contribute to the financial system meltdown by using the factors from Financial Soundness Indicators, figure out their correlations between each other, provide explanations of the findings and suggestions to the developed countries.

2. LITERATURE REVIEW

2.1 Signs before Financial System Meltdown

When a financial crisis happens, there were always signs behind it. Firstly, comparing to the Anglo-American system, Germany dominates debt finance, which is easier to cause financial risk (Kolb, 2007). Bonds, notes or bills are all approaches for a firm to raise capital, which is called debt finance ("Definition debt financing"). Firms are required to reimburse the principal that they let, and they suffered from cash flow problems due to the low liquidity of cash flow (Johnson, 2019). A firm with a high proportion of debt is considered “high risk,” and the payments needed to regulated by financial disciplines (Demirgüç-Kunt & Huizinga, 1999). The not a balanced debt-equity ratio is a vital sign before the financial system meltdown.

Secondly, many complex derivatives, such as Certificate of Deposit and Collateralized Debt Obligation, are also the main reasons when financial risks happen (Crotty & Epstein, 2009). A Certificate of Deposit is also used as an contract to deposit money to a bank to earn interest in a fixed time period (Amadeo, 2009). Banks with “Borrow short and lend long” make them have assets that have a longer duration than liabilities. A sudden change in interest rate would decrease the time value of money dramatically (Mishkin, 1999). According to Motley Fool Staff, A Collateralized Debt Obligation is “a collection of pooled assets that generate income, such as mortgages, auto loans, or corporate bonds” (Motley Fool Staff, 2017). The price of the Certificate of Deposit was predicted to go up by the assumption that the cost of the mortgage would continually go up. People at that time invested in real estate for speculating

instead of using it as accommodations, and they also trust the Certificate of Deposits that banks gave them. Banks would not worry about investors' default because of the Certificate of Deposits. But when the price of the mortgage drops suddenly, banks refused to lend money to investors anymore because they didn't want more Certificate of Deposits. As a result, investors defaulted because they could not pay back the money. The accumulated Certificate of Deposit and Collateralized Debt Obligation are both vital signs before the financial system meltdown happens.

Furthermore, the breakdown of the Bretton Woods system and oil restriction are signs of a financial system meltdown in developed countries (Ben-David & Papell, 1998). Systemic adjustments could cost tremendous costs, only through international policy cooperation can these actions be managed. There are enormous constraints for developed countries for maneuvering because of the zero-interest-rate policy (Subacchi, 2011). Besides, there are many goods that are made from or depend on oil, such as clothing and transportation. The price of oil reached $146/barrel in 2008, and then the financial crisis happened several months later. Oil restriction is an essential sing before the financial system meltdown (Wilson, 2019). Failure of financial collaboration and constraints of oil are also alerts of the Financial System Meltdown.

Financially, mortgage meltdown was also a sign of the 2008 financial crisis, and it should also be alerted (Kapadia, 2018). Based on the assumption that real estate prices would go up continually, mortgage investors are considered more likely to default (Shiller, 2013). When the price falls suddenly, the financial market collapses. This was also associated with the "American Dream." People took pride in the real estate they

hosted on hand. At the beginning of 2000, interest rates of lending were low. This allows investors to get a massive loan with a relatively small amount of monthly payment ("What Caused the Mortgage Crisis? " 2008). A mortgage meltdown should be considered a trigger of the financial system meltdown.

2.2 The standards to measure the degree of a Financial System Meltdown

There are different ways to measure a Financial System meltdown in different countries: Emerging markets mainly focus on the balance of payment situation, capital inflows and exchange rate movements, whereas industrial developed countries concentrate on banks' exposure to emerging markets (Gadanecz & Jayaram). Business Dictionary explains that vulnerability means the total amount of unsecured loans and the loans that are granted to investors plus the risk of loss due to devaluation, revaluation, or foreign exchange fluctuations. What is vital about banks' exposure to emerging markets is that a recession in a foreign country could cause a foreign counterparty's bankrupt (Palmer, 2000). Because of the devaluation of the Russian Ruble, Russian banks did not have the ability to pay back the money. American banks' hedging strategy seems to be useless because of the Russian banks' default. In this way, the Russian crisis influenced an American counterparty because of the high banks' exposure to markets in Russia (Palmer, 2000).

Besides that, there are several other ways to measure a Financial System meltdown: interest rates, asset prices, mortgage market indicators, and individual institutions' conditions (Anh et al., 2017). When the recession occurs, people tend to

hold money instead of spending it. The Federal Reserve would change the policy to lower the interest rate to stimulate people's intention to purchase, to prop the business (2015). The rapidly increased real estate price in America in 2008 was an excellent example of asset prices. When prices rise at a rapid pace without underlying fundamentals, the bubble occurs (Brueckner et al., 2012). Besides MBS securities, the duration of fixed-rate mortgages are used to monitor the changes of a mortgage market condition (Loutskina, 2005). The individual institutions' conditions, such as the firm's bankrupt, could be contagious. Creditors should not exit the contract after they have already known that the firm is going to go bankrupt, and their actions should not place the firm in a risky situation (Lumpkin, 2011).

Giordani and Kwan also devise an indicator to measure financial fragility for the US economy by debts from households and corporations as well as collateral assets, such as real estate (Giordani & Kwan, 2019). Data from Dow Jones as well as S&P 500 are combined together by Gutenberg–Richter law from seismology to create a model to measure financial crises magnitude. (Negrea, 2014). These factors are composed of indicators of Financial Soundness Indicators, which are divided into five parts: Capital Adequacy, Profitability, Sensitivity to Market Risk, Asset Quality, and Liquidity (Sundararajan et al., 2002).

2.3 The polices of Developed countries on how to respond to Financial System Meltdown

There are different policies of Developed countries to return to the Financial System Meltdown. Eichengreen and Baldwin demonstrate that the government should restructure banks and provides further guarantees for bank deposits and loans (Eichengreen and Baldwin 2008). With a Bank Guarantee, if the debtor fails to pay back the debt, the bank will give a loan to him (2013). The advantages of bank guarantees do not require specific material resources or either limit turnovers. This will protect the creditor's risks to the maximum extent of the contract (Knezević & Lukić, 2012).

Lin also provided that a fast reaction using advantageous institutional structures to the Financial System Meltdown is a must for developed countries. EU and US government's actions also proved this during the financial crisis (Lin, 2008). South Korea used to lose US$10 billion because of the inadequate response to the economic recession in 1997 (Heo & Kim, 2000).

Furthermore, adjustment of the banking sector, interest rates, and bank loans are also what governments tend to do to respond to the financial system meltdown (Lin, 2012). After the financial crisis in the 1990s, Canadian people advocated that financial institutions and every single investor's soundness require securities regulator in a national level. Canadian government changed the banking sector and reregulated the financial system (Williams, 2009).

Moreover, enforcing tax laws more strictly could also be valid after the financial crisis happened (Crotty & Epstein, 2009). 2008 financial crisis suggests that the

preexisting tax rules do not only meet neutrality benchmarks but also deviate in the wrong direction. The preexist American tax law encouraged citizens to borrow excessive debt as a result of a high debt to credit ratio, which is the sign before the financial crisis happened. In summary, a more strict tax law was needed after the financial system meltdown's alert (Shaviro, 2011).

3. METHODOLOGY & DATA

3.1 Data Sources and Description

From this source, we have collected data from 2007 through 2017 on financial stability, which is measured by Bank System Z-score. To represent developed countries, nine countries from three continents are selected. The Bank Z-Score is available on FRED. For Financial Soundness Indicators, liquidity asset ratio and liquidity liabilities are not available for many countries, and some of the years' data are missing. Similarly, Sensitivity to Market Risk has the same problem. In this thesis, the main factors in FSI, which are Profitability, Capital Adequacy, and Asset Quality, are selected as independent variables. Table 3.1 specifies the variables and the sources from which data was collected.

Table 1. Summary of list of variables, their specification and data sources

Variable	Measurement	Legend	Sources
Financial Stability	Bank Z-score	Z-Score	FRED
Profitability	Bank System Return on Equity	ROE	International Monetary Fund
	Bank System Return on Assets	ROA	
Capital Adequacy	Bank System Capital to Assets	CTA	
	Bank System Regulatory Capital to Risk-Weighted Assets	RCTRWA	
Asset Quality	Bank System Non-Performing Loans to Total Loans	NPLTTL	

3. 2. Variables Selection

3.2.1 Dependent Variable

This thesis is going to investigate whether profitability, Capital Adequacy, and Asset Quality could predict financial stability. Thus, we need to find the measurement of financial stability. Although there are many indicators that people create to measure a country's financial system risk to meltdown, Z-Score is chosen because it has the advantage of easy access, compared to those measures that some sophisticated, market-based data are not available (Čihák, 2007). In this case, Z-score could be the proxy to measure financial stability, and many scholars have employed this indicator. (Diaconu & Oanea 2014). A higher Z-score indicates that a country's financial system has lower probability of collapsing, whereas a lower Z-score demonstrates that a country's banking system has higher chance of defaulting by financial institutions (Siddik et al., 2018).

3.2.2 Independent Variable

Since this thesis is going to address whether profitability, Capital Adequacy, and Asset Quality could predict financial stability, the measurement of these three variables are chosen: ROA (profitability), ROE (profitability), Capital to Asset (Capital Adequacy), Capital to RWA (Capital Adequacy), NPL to Loans (Asset Quality). America, Germany, UK, France, Denmark, Belgium, Singapore, South Korea, and Australia are chosen to represent the developed countries. The recent ten years' data of 9 countries are selected as sample data. According to Financial Soundness Indicators, higher profitability would predict a more stable financial system. Likewise, Capita, Adequacy, and Asset Quality both have a positive correlation with financial stability, which is measured by Z-Score.

3.3 The Model

Based on the five independent variables and one dependent variable, the multiple equation model is stated as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

Y (Bank Z-Score) is the dependent variable which represents the risk of financial system meltdown, X_1stands for "bank system return on equity," which means the ability of the bank to generate profits using equity. X_2 stands for "bank system return on asset," which represents the bank's ability to generate profits using assets. X_3 stands for "bank system Capital to Asset," which suggests the ability of a bank's equity to assimilate losses. X_4 stands for "bank System Regulatory Capital to Risk-Weighted Assets," which means the ability to alleviate a rational amount of loss according to statutory Capital requirements. X_5 stands for "bank System Non-Performing Loans to Total Loans," which means the health level of the financial system. Y stands for "bank Z-score," which indicates the level of financial stability. The null hypotheses are stated as follows:

H_0 a: In the presence of the others, financial stability cannot be significantly predicted by "bank system return on equity."

H_0 b: In the presence of the others, financial stability cannot be significantly predicted by "bank system return on asset".

H_0 c: In the presence of the others, financial stability cannot be significantly predicted by “bank system capital to asset”.

H_0 d: In the presence of the others, financial stability cannot be significantly predicted by “bank system regulatory capital to risk-weighted assets”.

H_0 e: In the presence of the others, financial stability cannot be significantly predicted by “bank system non-performing loans to total loans”.

4. DATA ANALYSIS AND FINDINGS

4.1 Descriptive Statistics

Table 1, named descriptive statistics, demonstrates a big picture of sample data of all the independent variables and dependent variables that were collected from nine developed countries during the past 11 years. Since the data was collected by nine representative developed countries in the world, all the observations of variables are consistent, and the number of those are the same. The sample of Bank Z-Score, which is the dependent variable, has a mean of 16.66 and a minimum number of 2.52 and a maximum number of 29.94, which indicates an acceptable fluctuation. Similarly, Bank System Return on Equity has a moderate standardized deviation. Besides these two variables, Bank System Return on Asset, Bank System Capital to Asset, Bank System Regulatory Capital to Risk-Weighted Assets and Bank System Non-Performing Loans to Total Loans all have a standardized deviation lower than 3, which indicates little fluctuation in the sample dataset.

Table 2. Descriptive Statistics

ID	Variables	UoM	Observations	Mean	Std. Dev.	Minimum	Maximum
Y	Z-Score	Score	99	16.6552	6.9209	2.5231	29.9373
X_1	ROE	Ratio	99	8.1066	7.9198	-35.7059	26.9896
X_2	ROA	Ratio	99	0.5456	0.4818	-1.3094	1.9460
X_3	CTA	Ratio	99	6.8795	2.2065	3.2812	12.7393
X_4	RCTRWA	Ratio	99	15.5379	2.7994	10.1100	22.1461
X_5	NPLTTL	Ratio	99	2.3149	1.3630	0.3500	5.9505

4.2 Correlation Statistics

Table 2 shows the correlation analysis between the independent variables. As Table 2. shown, most of the independent variables (except Bank System Return on Equity and Bank System Return on Assets) are not correlated anymore with a small correlation coefficient between -0.5 and 0.5. However, the correlation coefficient of Bank System Return on Equity and Bank System Return on Assets is incredibly high with the number of 0.9162. This result implies that there would be a certain level of multicollinearity in the model. Based on this, Bank System Return on Assets will be removed from the equation and multicollinearity would not be an issue in the empirical analysis after adjustment.

Table 3. Correlations of the variables

	Return on Equity	Return on Assets	Capital to Assets	Regulatory Capital to RWAs	Non-Performing Loans to Total Loans
Return on Equity	1.0000				
Return on Assets	0.9162	1.0000			
Capital to Assets	0.0353	0.2590	1.0000		
Regulatory Capital to RWAs	-0.2012	-0.1509	0.0234	1.0000	
Non-Performing Loans to Total Loans	-0.3461	-0.4808	-0.1949	0.2885	1.0000

4.3 Regression Interpretation

According to Table 3. Regression Statistics, R is 0.73, which means the independent variables and dependent variables have a strong correlation. Almost 53% of the Bank Z-score was due to the four independent variables. The adjusted R Square does not change a lot, which indicates that the sample size does not influence the result of the equation and since this adjusted R Square number is more reliable, we may say that slightly more than half of the Bank Z-Score resulted from the movement of the independent variables. Furthermore, we could conclude that the independent variables could predict more than half of the financial stability of a country. The standardized deviation is 4.9, which is a little bit high, but it is still within a significant range.

Table 4. Regression Statistics

Regression Statistics	
Multiple R	0.7262
R Square	0.5274
Adjusted R Square	0.5073
Standard Error	4.8582
Observations	99.0

According to Table 4, although the F value is 26, which is not very high, the model is still significant. There is always a certain degree of relationship between independent factors and financial stability. Significance F is 1.30065E-14, which demonstrates that there is an extremely low possibility that the results occur randomly.

Table 5. ANOVA

	F	Significance F
Regression	26.2211	1.30065E-14

According to Table 5., 90% is used as a confidence level to determine if we could reject the null hypothesis. The P-value of Bank System Return on Equity, Bank System Capital to Assets, Bank System Non-Performing Loans to Total Loans and Intercept are all lower than 10%. Based on the result that the P-value is small enough and the corresponding coefficients are valid for each variable., we could reject H_0(a), H_0(c), and H_0(e). There is more than 90% possibility that these three dependent variables could predict Bank Z-Score, which standards for financial stability. The new equation is demonstrated as followed:

$$Y = -7.2587 + 0.1619X_1 + 2.1997X_3 + 0.2616X_4 + 1.4702X_5 + \varepsilon$$

As the equation demonstrates, Bank System Return on Equity (X_1), Bank System Capital to Asset (X_3) and Bank System Non-Performing Loans to Total Loans (X_5) all have a positive correlation to Bank Z-Score. In these three independent variables, Bank System Capital to Asset (X_3) influence a country's stability most with a correlation coefficient of nearly 2.2. Bank System Non-Performing Loans to Total Loans (X_5) also has a stable correlation coefficient of 1.4702, which is the second influential variable. Although the coefficient correlation of Bank System Return on Equity (X_1) is only 0.1619, and there is still a non-ignorable effect of this factor.

Table 6. Estimated Results

	Coefficients	P-value
Intercept	-7.2587	0.0337
Return on Equity	0.1619	0.0168
Capital to Assets	2.1997	9.583E-16
Regulatory Capital to RWAs	0.2616	0.1603
Non-Performing Loans to Total Loans	1.4702	0.0004

5. CONCLUSIONS

According to the data analysis result, Capital to Asset, which stands for Capital Adequacy predict the movement of Bank Z-Score most; Non-Performing Loans to Total Loans, which represents Asset Quality ranks the second, Return on Equity, which stands for Profitability, predicts the least movement of Financial stability. To lower the risk level, companies should focus on increasing Capital Adequacy ratio first, adjusting Tier I Capital (Actual contributed equity plus retained earnings), and Tier II Capital (Preferred shares plus 50% of subordinated debt) to a higher level, or lowing the proportion of risk-weighted assets (Ozili, 2019).

Second, a higher Non-Performing Loans should predict lower financial stability, while from the empirical test, Non-Performing Loans to Total Loans has a positive correlation coefficient with the Bank Z-Score. The small sample size could influence the result. Another explanation is that non-performing loans have a positive correlation with financial development because a more substantial proportion of foreign bank and financial intermediation issued lax loans, which may not be realized until maturity. Whereas, a more significant financial system development could result in higher capital adequacy and profitability, which contribute to financial stability. So Non-Performing Loans itself may be a bad sign of financial system meltdown, but it could also indicate a financial development, which is a sophisticated factor to measure financial stability.

Third, return on equity, which stands for profitability, contributes the least on determining financial stability. High profitability doesn’t always indicate high financial

stability. The mortgage bubble is a good example when a financial system collapses when having high profitability but did not regulate well.

Finally, we could draw a conclusion that Capital Adequacy determines the movement of Bank Z-Score most, while profitably and Non-Performing Loans are not decisive indicators of financial stability. But there are some limitations: first, only nine countries are chosen as representatives of developed countries, and the past ten years of data are limited. Second, as for independent variables, liquidity and Sensitivity to Market Risk are also important components of Financial Soundness Indicators (FSI), but some measurements are indirect as well as the date range for the last ten years are not available. These two missing variables may explain the rest of the movement of Bank Z-Score and increase the R square from 0.5 to a higher level.

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8. APPENDIX

Appendix A (Raw data of dependent variables and independent variables)

	Description	Ticker	Field ID	Field Mnemonic	Data Stat	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	
Bank System Return on Equity (%)	USA	FSI REUS Index	PR005	PX_LAST	Dynamic		2.9328	3.1581	3.0323	2.9173	3.2604	2.7174	2.2533	1.9078	1.8132	-1.6000	11.2000
Bank System Return on Assets (%)	USA	FSI RAUS Index	PR005	PX_LAST	Dynamic		0.3417	0.3659	0.3551	0.3284	0.3839	0.3251	0.2756	0.2303	0.2144	-0.1000	1.2000
Bank System Capital to Assets (%)	USA	FSI NAUS Index	PR005	PX_LAST	Dynamic		11.6500	11.5855	11.7111	11.6566	11.7760	11.9634	12.2239	12.7393	12.8749	9.3000	10.2000
Bank System Regulatory Capital to RWAs (%)	USA	FSI RCUS Index	PR005	PX_LAST	Dynamic		14.5330	14.1911	14.1374	14.3854	14.4050	14.5066	14.6852	14.7891	13.8572	12.8000	12.8000
Bank System Non-Performing Loans to Total Loans (%)	USA	BNPLNPUS Index	PR005	PX_LAST	Dynamic		1.1268	1.2205	1.4734	1.9507	2.4524	3.3173	3.7815	4.2877	4.9599	3.0000	1.4000
Bank Z-Score for United States, Z-score, Annual, Not Seasonally Adjusted							29.7986	29.5835	29.9373	29.6984	29.5257	29.3846	29.2992	28.9571	26.9327	22.9642	26.5905

	Description	Ticker	Field ID	Field Mnemonic	Data Stat	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	
Bank System Return on Equity (%)	UK	FSI REGB Index	PR005	PX_LAST	Dynamic		7.6239	3.7736	4.4173	5.5836	3.8217	3.2432	6.1056	6.8747	-0.0683	-2.4514	6.2000
Bank System Return on Assets (%)	UK	FSI RAGB Index	PR005	PX_LAST	Dynamic		0.4927	0.2501	0.2756	0.3305	0.2239	0.1702	0.2944	0.2165	-0.0027	-0.0821	0.4000
Bank System Capital to Assets (%)	UK	FSI NAGB Index	PR005	PX_LAST	Dynamic		6.7947	7.0252	6.9282	5.6213	6.2455	5.5090	5.0996	5.2661	5.2930	4.4123	5.5000
Bank System Regulatory Capital to RWAs (%)	UK	FSI RCGB Index	PR005	PX_LAST	Dynamic		20.4956	20.9014	19.6157	17.3134	19.6142	17.0676	15.7317	15.9859	14.8004	12.9184	12.6000
Bank System Non-Performing Loans to Total Loans (%)	UK	BNPLNPGB Index	PR005	PX_LAST	Dynamic		0.7347	0.9402	1.0145	1.6544	3.1117	3.5863	3.9619	3.9548	3.5087	1.5570	0.9000
Bank Z-Score for United Kingdom, Z-score, Annual, Not Seasonally Adjusted							9.9634	12.7237	12.7690	9.3507	7.7440	7.0336	7.3329	6.8434	5.2358	3.9693	6.4167

	Description	Ticker	Field ID	Field Mnemonic	Data Stat	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	
Bank System Return on Equity (%)	France	FSI REFR Index	PR005	PX_LAST	Dynamic		6.3927	6.6707	6.8339	4.3947	8.4401	5.9986	9.2509	12.0172	7.1965	3.5768	9.8000
Bank System Return on Assets (%)	France	FSI RAFR Index	PR005	PX_LAST	Dynamic		0.4216	0.3963	0.3960	0.2322	0.4911	0.3115	0.3922	0.5862	0.2949	0.1333	0.4000
Bank System Capital to Assets (%)	France	FSI NAFR Index	PR005	PX_LAST	Dynamic		6.5940	5.9415	5.7940	5.2824	5.8183	5.2013	4.7536	4.8778	4.0984	3.7277	4.1000
Bank System Regulatory Capital to RWAs (%)	France	FSI RCFR Index	PR005	PX_LAST	Dynamic		18.9077	17.7519	17.1002	16.3486	15.3844	14.4967	12.3243	12.6707	12.3560	10.4691	10.2000
Bank System Non-Performing Loans to Total Loans (%)	France	BNPLNPFR Index	PR005	PX_LAST	Dynamic		3.0904	2.6370	2.9829	4.1625	4.4954	4.2945	4.2914	2.7596	4.0219	2.9194	2.7000
Bank Z-Score for France, Z-score, Annual, Not Seasonally Adjusted							25.5208	21.3748	20.5031	16.5291	19.2622	16.8309	15.0491	16.5382	15.7550	10.2544	13.6012

	Description	Ticker	Field ID	Field Mnemonic	Data Stat	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	
Bank System Return on Equity (%)	Germany	FSI REDE Index	PR005	PX_LAST	Dynamic		6.3200	6.5700	7.5300	7.1700	7.5300	10.8200	13.0500	8.8400	5.0200	-2.5100	6.5400
Bank System Return on Assets (%)	Germany	FSI RADE Index	PR005	PX_LAST	Dynamic		0.3700	0.3700	0.4000	0.3700	0.3600	0.4500	0.5300	0.3700	0.2100	-0.1000	0.2500
Bank System Capital to Assets (%)	Germany	FSI NADE Index	PR005	PX_LAST	Dynamic		6.3200	5.9800	5.9400	5.6100	5.4500	4.7300	4.3600	4.3000	4.8100	4.4900	4.2700
Bank System Regulatory Capital to RWAs (%)	Germany	FSI RCDE Index	PR005	PX_LAST	Dynamic		19.3800	18.7900	18.2600	17.9600	19.1600	17.9400	16.4000	16.0500	14.8200	13.5900	12.9000
Bank System Non-Performing Loans to Total Loans (%)	Germany	BNPLNPDE Index	PR005	PX_LAST	Dynamic		1.5000	1.7100	1.9700	2.3400	2.7000	2.8600	3.0300	3.2000	3.3100	2.8500	2.6500
Bank Z-Score for Germany, Z-score, Annual, Not Seasonally Adjusted							26.3974	24.5791	23.4733	22.1253	20.8231	17.1652	15.3656	16.6569	14.2364	9.4817	16.2629

	Description	Ticker	Field ID	Field Mnemonic	Data Stat	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	
Bank System Return on Equity (%)	Denmark	FSI REDK Index	PR005	PX_LAST	Dynamic		14.0621	12.4658	8.9780	-1.6378	1.0954	1.4804	-0.6498	-0.0417	-3.2000	7.0000	16.1000
Bank System Return on Assets (%)	Denmark	FSI RADK Index	PR005	PX_LAST	Dynamic		0.8279	0.7327	0.5257	-0.0883	0.0596	0.0936	-0.0315	-0.0019	-0.2000	0.3000	0.7000
Bank System Capital to Assets (%)	Denmark	FSI NADK Index	PR005	PX_LAST	Dynamic		6.9962	7.3863	7.7908	7.3109	7.0498	5.2656	5.0537	5.4322	5.4929	5.5164	6.2408
Bank System Regulatory Capital to RWAs (%)	Denmark	FSI RCDK Index	PR005	PX_LAST	Dynamic		22.1461	20.7706	19.7924	18.2095	19.2353	18.8772	17.1921	16.0065	16.1000	12.4000	10.6000
Bank System Non-Performing Loans to Total Loans (%)	Denmark	BNPLNPDK Index	PR005	PX_LAST	Dynamic		2.2943	3.2101	3.6962	4.4008	4.6191	5.9505	3.6603	4.0686	3.3000	1.2000	0.6000
Bank Z-Score for Denmark, Z-score, Annual, Not Seasonally Adjusted							17.4398	21.9011	21.6542	18.2316	18.1138	15.9532	14.4497	13.6600	12.1365	11.2753	15.4579

	Description	Ticker	Field ID	Field Mnemonic	Data Stat	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	
Bank System Return on Equity (%)	Belgium	FSI REBE Index	PR005	PX_LAST	Dynamic		8.9373	9.3704	10.2165	7.9206	16.0172	3.3918	1.1716	10.5841	-2.5025	-35.7059	13.3445
Bank System Return on Assets (%)	Belgium	FSI RABE Index	PR005	PX_LAST	Dynamic		0.6418	0.6362	0.6700	0.5111	0.9639	0.1722	0.0581	0.4923	-0.0974	-1.3094	0.4548
Bank System Capital to Assets (%)	Belgium	FSI NABE Index	PR005	PX_LAST	Dynamic		7.5496	7.0533	6.7830	6.6272	6.3899	5.7606	4.5998	4.9652	4.6283	3.2812	4.2046
Bank System Regulatory Capital to RWAs (%)	Belgium	FSI RCBE Index	PR005	PX_LAST	Dynamic		18.9626	18.8097	18.6887	17.5773	18.7426	18.1920	18.5366	19.3048	17.2623	16.4262	11.3068
Bank System Non-Performing Loans to Total Loans (%)	Belgium	BNPLNPBE Index	PR005	PX_LAST	Dynamic		2.9248	3.4320	3.7894	4.1757	4.2450	3.7283	3.3023	2.7986	3.0754	1.6522	1.1571
Bank Z-Score for Belgium, Z-score, Annual, Not Seasonally Adjusted							19.0364	17.4288	16.3975	15.7114	15.4966	13.7283	10.9809	11.9501	9.2193	5.1315	10.5263

	Description	Ticker	Field ID	Field Mnemonic	Data Stat	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	
Bank System Return on Equity (%)	Singapore	FSI RESG Index	PR005	PX_LAST	Dynamic		13.9662	11.2594	13.6076	13.2118	15.2864	16.3718	13.8243	15.4884	13.7544	11.7156	12.9000
Bank System Return on Assets (%)	Singapore	FSI RASG Index	PR005	PX_LAST	Dynamic		1.2935	1.0544	1.2005	1.1069	1.2448	1.4416	1.1436	1.3934	1.2515	0.8588	1.3000
Bank System Capital to Assets (%)	Singapore	FSI NASG Index	PR005	PX_LAST	Dynamic		9.1800	9.2300	9.0000	8.4100	8.2200	8.9200	8.2200	8.9700	9.1700	7.2000	9.2000
Bank System Regulatory Capital to RWAs (%)	Singapore	FSI RCSG Index	PR005	PX_LAST	Dynamic		17.0800	16.4700	15.8600	15.9200	16.3900	18.0600	16.0500	18.5800	17.2700	14.6600	13.5000
Bank System Non-Performing Loans to Total Loans (%)	Singapore	BNPLNPSG Index	PR005	PX_LAST	Dynamic		1.4000	1.2200	0.9200	0.7600	0.8700	1.0400	1.0600	1.4100	2.0300	1.4300	1.5000
Bank Z-Score for Singapore, Z-score, Annual, Not Seasonally Adjusted							22.2063	22.4277	22.0707	21.8843	21.5825	25.4517	23.9712	26.6419	25.5952	23.2418	23.3988

	Description	Ticker	Field ID	Field Mnemonic	Data Stat	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	
Bank System Return on Equity (%)	Australia +	FSI REAU Index	PR005	PX_LAST	Dynamic		16.7457	12.0513	23.8098	22.9095	26.9896	23.0230	22.5530	0.4600	15.1950	22.2660	18.1190
Bank System Return on Assets (%)	Australia+	FSI RAAU Index	PR005	PX_LAST	Dynamic		1.1513	0.7797	1.4209	1.1955	1.2839	1.1800	1.1940	0.0250	0.9040	1.2540	1.1500
Bank System Capital to Assets (%)	Australia	FSI NAAU Index	PR005	PX_LAST	Dynamic		6.8800	6.5500	5.9700	5.2200	5.1200	5.1300	5.2900	5.4300	5.9500	5.6100	6.2500
Bank System Regulatory Capital to RWAs (%)	Australia	FSI RCAU Index	PR005	PX_LAST	Dynamic		14.5500	13.6500	13.8000	12.2100	11.6000	11.9200	11.5800	11.4000	11.9100	11.3400	10.1100
Bank System Non-Performing Loans to Total Loans (%)	Australia	BNPLNPAU Index	PR005	PX_LAST	Dynamic		0.9900	0.9900	0.9200	1.0500	1.4000	1.7500	1.9700	2.1500	2.0200	1.3600	0.5600
Bank Z-Score for Australia, Z-score, Annual, Not Seasonally Adjusted							15.4924	14.9753	14.0687	14.1468	14.4081	14.5669	15.0909	16.0750	15.5613	14.3726	15.5470

	Description	Ticker	Field ID	Field Mnemonic	Data Stat	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	
Bank System Return on Equity (%)	South Kore	FSI REKR Index	PR005	PX_LAST	Dynamic		8.46359	24.27667	6.63708	5.99409	4.00029	8.20074	12.16980	9.67787	8.64944	9.91066	14.60000
Bank System Return on Assets (%)	South Kore	FSI RAKR Index	PR005	PX_LAST	Dynamic		0.67347	1.94599	0.53134	0.48704	0.32602	0.66081	1.04953	0.71000	0.58080	0.67379	1.10000
Bank System Capital to Assets (%)	South Kore	FSI NAKR Index	PR005	PX_LAST	Dynamic		7.99000	7.87000	8.03000	8.13000	8.27000	8.23000	8.11000	7.60000	7.29000	6.30000	9.00000
Bank System Regulatory Capital to RWAs (%)	South Kore	FSI RCKR Index	PR005	PX_LAST	Dynamic		15.24000	14.82000	13.91000	14.00000	14.47000	14.30000	13.97000	14.32000	14.37000	12.31000	12.30000
Bank System Non-Performing Loans to Total Loans (%)	South Kore	BNPLNPKR Index	PR005	PX_LAST	Dynamic		0.35000	0.47000	0.46000	0.49000	0.57000	0.59000	0.48000	0.59000	0.58000	0.57000	0.70000
Bank Z-Score for Republic of Korea, Z-score, Annual, Not Seasonally Adjusted							10.52180	10.38450	10.26720	11.22110	11.50600	11.60220	11.71380	11.82770	6.12523	2.52213	2.52313

Appendix B (Initial Regression result)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.726198092
R Square	0.527363669
Adjusted R Square	0.507251484
Standard Error	4.858180539
Observations	99

ANOVA

	df	SS	MS	F	Significance F
Regression	4	2475.473364	618.8683411	26.2211036	1.30065E-14
Residual	94	2218.580306	23.60191815		
Total	98	4694.053671			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 90.0%	Upper 90.0%
Intercept	-7.258724908	3.36752049	-2.155510243	0.033675862	-13.94501578	-0.572434035	-12.85293701	-1.664512802
Bank System Return on Equity (%)	0.161871888	0.066492253	2.434447324	0.016802643	0.02984996	0.293893815	0.051413238	0.272330538
Bank System Capital to Assets (%)	2.199737283	0.227653619	9.662650183	9.58257E-16	1.747725686	2.65174888	1.821553205	2.577921361
Bank System Regulatory Capital to RWAs (%)	0.26163	0.184885302	1.41509356	0.160345431	-0.105464101	0.628724101	-0.045506244	0.568766244
Bank System Non-Performing Loans to Total Loans (%)	1.470208691	0.404015433	3.638991411	0.000447222	0.668026577	2.272390804	0.799047807	2.141369574