The Effects of Deposit Insurance

Across Varying Regulatory Environments

by

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1. Introduction

The bank failures throughout history have had dramatic effects felt by many members of society. Recent banking crises have rippled across the globe affecting multiple nations instead of being isolated incidents. This is due to the way the financial system has become intertwined across countries. Since 1980 there have been at least 117 financial crises that stem from the new problems international banking has induced (LaBrosse & Mayes, 2007). Bank runs have the power to exacerbate existing financial turmoil and have even been known to be the cause of financial crisis. Bank runs occur when depositors withdraw their funds in mass because of the expectation that the bank will become insolvent (Diamond and Dybvig, 1983). Deposit insurance has been instituted by many counties to alleviate the threat of bank runs. Deposit insurance attempts to solve problems caused by bank runs but introduces new complications in the process. The use of deposit insurance policies has been linked to moral hazard in the actions of the banking sector. Insurance policies remove incentives for depositors to monitor the actions of the bank they are investing with because their funds are no longer at risk.

The primary objective of this paper is to explore the impact deposit insurance has had on the stability of banking systems in different regulatory environments. The impacts of moral hazard, which banks experience when investing with funds obtained from insured deposits will be explored. First, a theoretical investigation will be conducted on why deposit taking banks exist and what effects deposit insurance has. The results of the review will be tested empirically to formulate recommendations on the continued use of deposit insurance. The research will be conducted on financial institutions in seven unique countries, which greatly differ in wealth levels.

2. Theoretical Orientation

The banking sectors primary function in the financial system is to act as an intermediary for investors. Diamond and Dybvig (1983) model the banking sector by analyzing liabilities faced when investing. Investment without an intermediary requires small-scale investors to supply their money in period 0 into illiquid investments with a large payoff sometime in the future (period 2). These investments only have a high payoff in period 2, so anyone who requires their money for consumption before this time will receive a low payoff. Pulling investment out of a project early in period 1 will cause liquidation of long-term assets and a low or decreased return to the investor. Banks work to fix this problem by offering a relatively lower return to long-term investors and a higher return to short-term investors. The intermediary's role is to smooth consumption and returns for all investors, given the uncertainty each individual faces about their own consumption needs in the future.

Banks also act to monitor and screen investments. Without an intermediary the act of screening, monitoring, and contracting with potential borrowers would be repeated by each individual. Ramakrishnan and Thakor (1984) suggest that even without scale or scope effects, generating information as a group is superior to individuals collecting the information themselves. Intermediaries also allow small investors to collectively fund many projects and by doing so reduce their overall risk through diversification. Baring intermediation, investors would be forced to select and fund a single undiversified project (Diamond & Dybvig, 1983). A functioning banking sector acts to alleviate these issues and to funnel funds from those who currently wish to save to those requiring funds to generate economic growth. Diamond and Dybvig (1983) describe a banks role as performing the "transformation of illiquid assets into liquid liabilities (pg. 402)".

When a bank is operating normally there is relatively little risk of the bank defaulting. When individuals do not act rationally, speculation can cause a run on a healthy bank. A bank run occurs when depositors rapidly withdraw their funds before the time they had originally planned, based on the belief that the bank will fail (Diamond & Dybvig, 1983). During a run on a bank, long-term assets may need to be liquidated at a loss in order to cover the sudden demand for funds. Due to the liquidation process banks have been known to fail and cause damage to the financial system and the economic environment.

There have been many potential solutions suggested to stabilize the funding in the financial sector. One solution to a bank run caused by imperfect information is to temporarily suspend the withdrawal privileges of depositors (Chari & Jagannathan, 1988). Deposit contracts can be written with a clause allowing banks to temporarily deny the request to withdraw funds. This practice will allow a banks investments to remain intact, while they find ways to restore confidence in the market or liquidate assets at lower levels of losses. This can leave some depositors in a liquidity crisis and may damage the bank's reputation (Chari & Jagannathan, 1988). Another technique that has been used to protect depositors is to have a deposit preference scheme, which protects depositors before other groups in the case of liquidation (Campbell et al. 2007). In the event of a bank's failure the assets will be liquidated and used to reimburse deposits before other creditors. This promotes additional market discipline from large-scale investors because their funds are still at risk while also alleviating depositors concerns surrounding their relatively small deposits. A different option is to run an implicit deposit insurance scheme. This practice hinges on private persons and financial institutions believing that the government will bail out either the entire bank or at least the deposits but not having formal guidelines governing the resolution of the banking

failure (Campbell et al. 2007). This is referred to as implicit protection and keeps depositors and investors more cognizant of what is being done with their money.

Finally, there is the option to impose explicit deposit insurance, which protects depositors up to a predetermined amount in the event of a bank's collapse. Deposit insurance is preferable to the practice of suspending withdrawal privileges, so long as the distortionary effects of the tax that funds the insurance scheme remains relatively small (Bhattacharya et al., 1998). An insurance scheme is usually funded by member institutions that all pay intermittently into a central pool, which is then used in the event one of the intuitions fails (Haber, 2005). Deposit insurance transfers the risk of a bank's default from small investors (depositors) to all members of society. The incentive for a run on a bank is eliminated, as there is no longer a risk that a depositor will not receive their money in the time period they require it.

The first use of deposit insurance was in the United States, in 1934, to the address bank runs that contributed to the Great Depression (Demirguc-Kunt et al., 2008). It took until the 1980's until deposit insurance became a popular choice for addressing the issue of bank runs in many countries (Demirguc-Kunt & Detragiache, 2002). Deposit insurance is now promoted by both the International Monetary Fund and the World Bank during times of financial crisis to countries that have not already implemented the policy (Demirguc-Kunt et al., 2008). Deposit insurance also helps remove the inherent advantages large institutions have over small ones when facing the prospect of attracting deposits. Small firms are less able to absorb losses the way large ones can, which makes it more difficult to acquire funds from depositors due to the risk of losing their deposits (Campbell et al. 2007). With a deposit insurance scheme this advantage is reduced and firms operate on a more even playing field.

Deposit insurance induces moral hazard because the risk of the bank's portfolio no longer factors into the decision of where an individual will supply their deposit (Demirguc-Kunt & Detragiache, 2002). Banks can be thought of as attracting deposits under competitive terms that they set before choosing which investments to make. These deposits are then invested in the projects with the highest expected returns because the banks have no outside incentives to reduce their risks (Bhattacharya et al., 1998). Without depositors monitoring a bank's activities, incentives exist for banks to select projects that have excessively high risks in return for high payoffs. Deposit insurance acts as a wealth transferring mechanism from the insuring institution, funded by tax payers, to the banking sector. If the bank was uninsured the rate that it would be required to pay to obtain deposits would reflect a risk premium as investors would be concerned that their funds will not be available in the time period desired, due to the risk the bank may default before this. The existence of deposit insurance causes these higher rates to not be demanded by depositors, as the period 1 default risk has been eliminated from their perspective. The difference in the rate that should be demanded and the one actually demanded is the wealth transfer the banks are collecting from the insurer (Admati & Hellwig, 2013).

Given that deposits are now attracted primarily by the return that depositors receive, banks seek investment opportunities with higher expected returns and inherently more risk. Greater returns are required so that higher interest rates for deposits can be offered in order to edge out other firms that are also competing for the same deposits. Calomiris and Kahn (1991) developed a model, which gave some depositors the ability to observe a private signal about the choices a bank was making with its assets and then the ability to withdraw their deposit earlier than originally planned if a bank exceeded their risk threshold. This model illustrates the power the general public has in dictating an acceptable level of risk. Deposit insurance has removed market discipline that

previously aligned banks incentives with those of society. It "invites insured banks to seek excessive portfolio risk and keep lower liquid reserves relative to the social optimum (Bhattacharya et al., 1998, pg. 756)".

It can be argued that having depositors monitor banks was never an efficient way to monitor the banking system. Having many small investors acquiring and evaluating complex financial information about the riskiness of multiple bank's assets would be subject to significant complications. The investors capable of performing the assessments would still face disincentive to perform the task due to the desire to free-ride off of others (Stiglitz, 1992). It can also be asserted that financial institutions only receive a portion of their funding though consumer deposits and receive the rest from larger investors, which are usually not covered under insurance schemes. These larger depositors include large businesses, wealthy private investors, and other financial institutions. Enforcement by shareholders is often reduced due to deposit insurance policies. Government guarantees are often set up to protects shareholder equity (Haber, 2005). Regulators become even more heavily relied upon to reduce banking risk despite having incentives that do not perfectly line up with those who should have their funds at risk.

Robert Merton (1977) argues that, "the properties of deposit insurance viewed as a security are isomorphic to those of a put option (pg. 4)". Banks will try to transfer wealth from institutions providing insurance to themselves by minimizing their invested capital relative to their asset holdings. This can be viewed as increasing the risk of their assets (Keeley, 1990). In the early twentieth century, banks had large protective equity holdings, as high as twenty-five percent of their total assets but by 1990 asset ratios had dropped to around 6 to 8 percent in many countries (Admati & Hellwig, 2013). Despite a relatively low failure rate in the banking sector, deposits insurance has been cited as a contributor to many of them (Bhattacharya et al., 1998). Since Canada

instituted deposit insurance in 1967, forty-three banks have collapsed, all of which were covered by the Canada Deposit Insurance Corporation (CDIC, 2014). The damage that banking failures causes should also be stressed. During the late 1980s and early 1990s the United States suffered losses exceeding $200 billion. This amounted to damages of over $2000 per household from banking failures (Bhattacharya et al., 1998).

3. Literature Review

Demirguc-Kunt and Detragiache's (2002) conducted an empirical investigation of the effects of deposit insurance on a large data set spanning sixty-one countries from 1980 to 1997. Findings suggest that explicit deposit insurance causes banking fragility and that the higher the guaranteed amount is the more likely bank failure becomes. Having implicit or partial deposit insurance schemes is a possible way to allow market discipline to have some effect on controlling banks while still protecting small depositors. Large depositors who have a significant portion of their wealth unprotected will have an incentive to monitor the banks and these individuals will likely be better informed than the general public (Bhattacharya et al., 1998). Demirguc-Kunt and Detragiache go on to forecast the probabilities of four historic banking crisis (2002). They compare the computed probabilities to estimates calculated with a reduction in insurance coverage. A coverage level of forty-five percent of deposits is chosen, which is the same as in Switzerland. For the Kenya crisis of 1993 the probability of the crisis occurring dropped from 26.8 to 16.6 percent, a 38.1 percent reduction. In a country were banking is more heavily regulated the change is smaller but the percentage change is just as significant. The United States crisis of 1980 reduced in probability from 4.3 to 2.5 percent, a 41.9 percent reduction when the lower coverage rate is applied.

Demirguc-Kunt and Detragiache (2002) obtain results that suggest that deregulating interest rates causes increased risk of bank failure. Having a marketplace where banks are able to set their own interest rates to attract depositors forces the projects that banks decide to invest in to be on the risky side. People with high risk projects will be willing to accept the bank's more expensive loans due to their high potential payoff and lower return but safer investments will go unfunded. The largest impacts of deposit insurance were felt when the countries financial environment was lacking in regulation and supervision. The more freedom banks were given, the higher the risk of instability. Having regulatory institutions, which carefully monitor the banking sector and its activities reduced the moral hazard problem that was observed. Demirguc-Kunt and Detragiache (2002) conclude that on average deposit insurance was having negative effects. Only in countries with very high institutional environments, where moral hazard was properly corrected for, did deposit insurance not cause instability.

4. Empirical Analysis

This paper will conduct an empirical analysis on banks located in Australia, Brazil, Germany, Indonesia, Korea, Malaysia, and Thailand in order to discover the effects deposit insurance has on banking decisions. The company Bureau Van Dijk has assembled a database called Bankscope, which is a collection of banking data from many major countries around the world. The entire database included over 30,000 banks spanning 1985 to 2013.

The focus of this study is to determine the change in riskiness following the change of a deposit insurance policy so a subsection of years are chosen which evenly precede and follow the policy change. The five years before and after the policy change is introduced are used for analysis. There are some holes in the dataset due to the creation or failure of banks so a threshold was set to

only include banks that have observations for at least four of the ten years being examined. As a deposit insurance policy only effects financial institutions that accept consumer deposits as part of their funding some observations are dropped from the dataset. Central and government banks, micro-financing institutions, clearing houses, Islamic banks, and other institutions, which were not operating as traditional banks, are also removed from the study.

The main measure of risk used in analysing a bank's behaviour before and after the removal of the deposit insurance is a bank level Z-Score. The Z-Score ratio was originally developed by Edward Altman and was designed to predict corporate bankruptcy (Altman, 1968). A modified Z-Score that is more applicable to banking solvency will be employed in this paper. The higher a bank's Z-Score the less likely they are to default due to the inverse relationship between the Z-Score and the probability of losses exceeding their capital holdings (McAllister & McManus, 1993). The construction of the Z-Score variable is dependent on three underlying financial variables, the return of average assets (ROAA), its standard deviation (σROAA), and the capital to asset ratio (CAR) (McAllister & McManus, 1993). The return of average assets, its standard deviation, and the capital asset ratio are all calculated as mean values for the five year time period before and then after the policy change.

$$Z\ Score = \frac{ROAA + CAR}{\sigma(ROAA)}$$

To analyze the level of risk banks are taking we will observe not only their Z-Score but also the standard deviation of ROAA, capital asset ratio, and tangible common equity ratio. The standard deviation of ROAA is chosen as a proxy for risk because a bank choosing to select less risky investments should not only reduce their returns but also the variation of their assets. Investments should become more uniform in risk because low risk investments typically do not

provide widely varying returns the way excessively risky investments do. The capital to asset ratio is important in observing if banks are retaining enough capital to cover liabilities and risks. The capital being retained acts as a buffer or safety net in the event a loss occurs. Finally, the tangible common equity ratio is analysed, as it represents how large of a loss the banks can withstand before the shareholders equity has been depleted. The tangible common equity (TCE) ratio is calculated by subtracting intangible assets and preferred stock equity from the bank's total equity and then dividing this by tangible assets.

$$TCE\ Ratio = \frac{Total\ Equity - Intangible\ Assets - Prefered\ Stock\ Equity}{Tangible\ Assets}$$

The tangible common equity ratio is given special attention in *Basel III: A global regulatory framework for more resilient banks and banking systems* (2011). Basel III puts forth guidelines requiring banks to disclose the method in which the reported TCE ratio was calculated due to the importance it holds for shareholders and investors evaluating a banks riskiness. In the United States the Federal Deposit Insurance Corporation Improvement Act (1991) has rules which impose increasingly stringent regulations on banks unable to meet risk ratios. Banks that have their tangible equity ratio fall under two percent are labeled as critically undercapitalized (Aggarwala & Jacques, 2001). These banks are subject to additional regulation and have a conservator appointed to work with the bank (Aggarwala & Jacques, 2001). The capital asset and tangible common equity ratios are similar in what they depict and their method of calculation. The capital asset ratio is useful for regulators while the tangible common equity ratio is more practical for investors. The capital asset ratio helps regulators determine if a bank can absorb significant losses. The tangible common equity ratio removes intangible assets and preferred stock equity from the

equation, as these two groupings cannot be quickly liquidated in the event of an emergency and are therefore inconsequential to an investor. The four regressions take the following form.

$$(1)\ Z\ Score(i,t) = \alpha_1 + \beta_1 Insurance(t) + \gamma_{11} X_1(t) + \gamma_{12} X_2(i,t) + \varepsilon_1(i,t)$$

$$(2)\ \sigma ROAA(i,t) = \alpha_2 + \beta_1 Insurance(t) + \gamma_{21} X_1(t) + \gamma_{22} X_2(i,t) + \varepsilon_2(i,t)$$

$$(3)\ CAR(i,t) = \alpha_3 + \beta_1 Insurance(t) + \gamma_{31} X_1(t) + \gamma_{32} X_2(i,t) + \varepsilon_3(i,t)$$

$$(4)\ TCE(i,t) = \alpha_4 + \beta_1 Insurance(t) + \gamma_{41} X_1(t) + \gamma_{42} X_2(i,t) + \varepsilon_4(i,t)$$

Regressions one through four are run with country level control variables, which help capture the financial environment that the institutions are operating within. The control variables are meant to capture exogenous events along with financial fluctuations, which may be independently affecting the risk taking behaviour of banks. By accounting for these influences it is hoped that the *Insurance* variable will more accurately describe the effect of the deposit insurance policy being introduced by the government. The country level control variables are GDP, inflation rate, and the unemployment rate for each year in the study. The country level control variables were not available in the original data set and so they were obtained from The World Bank (2014). These variables only vary across time and not by individual bank and so they are represented in the regression as $X_1(t)$.

Along with country level control variables a selection of descriptive variables are chosen which help to depict the operations of each bank. The majority of these variables are common measures of a financial institutions stability or success. The variables selected are as follows: total assets, equity, total customer deposits, wholesale deposits, total liabilities, loans, net income, net interest income, and total securities. These variables change across time and by bank so they are represented by $X_2(i,t)$. Each of the four regressions are run with identical independent variables with only the dependent variable changing. The data set was treated as panel because each bank

has multiple observations. This allows the changes each bank experiences to be observed over time. To determine if random or fixed effects should be used a Hausman test was conducted and fixed effects was found to be consistent. Fixed effects is preferable to random effects when both methods are consistent because fixed effects is more efficient. The regressions are also run with robust standard errors.

The seven countries analysed will be grouped by regulation level and legal framework. Demirguc-Kunt and Detragiache (2002) chose to use GDP per capita as a proxy for the regulation level and their assumption will be used in this paper. Regressions will be carried out on each grouping of high, medium, and low regulation countries along with an overall regression, which includes all seven countries. Given the different years each policy is introduced the average year, 1999, is chosen to be the determinant of the groupings. It should be noted that using the year each policy was introduced instead did not change the groupings.

Table 1: GDP per Capita

	GDP per Capita (1999)	
High	Germany	25957
	Australia	20547
	Korea	10432
Middle	Malaysia	3457
	Brazil	3412
Low	Thailand	1990
	Indonesia	680

(The World Bank Group, 2014)

A weighting scheme was applied in the regression analysis to give equal weighting to each country regardless of the number of banks present. For example in the low regulation category Indonesia has 463 observations, while Thailand only has 212. Without the application of a weighting scheme Indonesia would affect the regression results by twice as much as Thailand simply because they have more observations in the given time period. To overcome this problem

a probability weighting is applied which sets one country as the baseline and then scales the effect of the other country by the ratio of their observations. Following the low regulation example, Indonesia is set as the baseline and given a weight of one. Thailand has a weighting attached to its observations of $\frac{463}{212} = 2.18$.

To capture the effect of deposit insurance a dummy variable *Insurance* is created which receives a value of one when an insurance scheme is present and a value of zero when no explicit deposit insurance is provided. The coefficient on *Insurance* should capture the effect the deposit insurance policy has on the risk taking behaviour of financial institutions. The results for the *Insurance* variable in the four groupings is displayed in the table below and will be referenced in the subsequent sections to illustrate the different effects the policy has in economies with varying regulation.

Table 2: Grouped Regression Results

Insurance	(1)	(2)	(3)	(4)
VARIABLES	lnZscore	σROAA	CAR	TCE
All	-0.884***	0.822***	-0.884***	-0.911***
High	-0.627***	0.300***	-1.050***	-1.087***
Middle	-1.096***	1.138***	0.701	0.751*
Low	-2.001***	3.031***	-2.758***	-2.758***

The introduction of a deposit insurance policy is associated with financial instability. In such a time, it is likely that other policy changes are being made, which may cause banks to alter their risk taking behaviour. It is likely that the external polices act to further subsidize banks, which increases their incentive to act riskily. The observed coefficients may be clouded, as they have the potential to pick up the effect of not only deposit insurance but also other government interventions.

4.1 Overall

All seven countries are combined to be examined in a single large regression. The countries are weighted to create regressions that place uniform emphasis on each. The overall regressions fail to capture the different financial environments that banks in each country operate within but instead aim to highlight the general effects deposit insurance has around the world.

Table 3: Overall Fixed Effects Results

Overall	(1)	(2)	(3)	(4)
VARIABLES	lnZscore	sdROAA	CAR	TCE
Insurance	**-0.898*** **	**0.838*** **	**-0.862*** **	**-0.889*** **
	(0.0828)	(0.148)	(0.202)	(0.201)
Country control variables				
GDP	-2.69e-07***	1.20e-08	-5.82e-07	-5.50e-07
	(7.03e-08)	(9.79e-08)	(4.59e-07)	(4.53e-07)
Inflation	0.000109	-0.000115	-7.39e-05	9.48e-05
	(0.000138)	(0.000237)	(0.000443)	(0.000412)
Unemployment	-0.0459***	0.0759***	-0.0866	-0.0977
	(0.0101)	(0.0205)	(0.131)	(0.130)
Bank level variables				
TotalAssets	4.10e-05	-0.000374	-0.00110	-0.00115
	(0.000158)	(0.000391)	(0.000948)	(0.000903)
Equity	-1.14e-05	0.000377	0.00284***	0.00270***
	(0.000167)	(0.000421)	(0.00101)	(0.000960)
TotalCustomerDeposits	-3.70e-06	1.90e-05	-3.61e-05	-3.07e-05
	(9.71e-06)	(1.32e-05)	(7.94e-05)	(7.84e-05)
WholeSaleDeposits	-8.56e-06	1.18e-05	-5.92e-05	-5.62e-05
	(9.01e-06)	(1.15e-05)	(8.87e-05)	(8.74e-05)
TotalLiabilities	-4.78e-05	0.000370	0.000985	0.00103
	(0.000159)	(0.000390)	(0.000954)	(0.000907)
Loans	8.77e-06	-1.50e-05	3.17e-05	4.94e-05
	(8.58e-06)	(1.03e-05)	(9.28e-05)	(9.34e-05)
NetIncome	-1.84e-05	8.09e-05	0.000321***	0.000312***
	(1.86e-05)	(5.82e-05)	(0.000112)	(0.000113)
NetInterestIncome	3.00e-05	-0.000134*	-0.000310	-0.000227
	(3.39e-05)	(6.91e-05)	(0.000264)	(0.000274)
TotalSecurities	1.09e-05	-6.80e-06	6.97e-05	8.80e-05
	(6.99e-06)	(8.75e-06)	(0.000104)	(0.000103)
Constant	3.830***	0.582***	11.29***	11.19***
	(0.0868)	(0.153)	(0.524)	(0.520)
Observations	7,118	7,148	7,148	7,148
R-squared	0.314	0.159	0.036	0.032
Number of Banks	1,068	1,070	1,070	1,070

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The policy change variable *Insurance* is significant and signed in the expected direction in all four regressions. The magnitude of the coefficients on Z-Score and the standard deviation of return on average assets lies between what was found in the high and middle regressions. The immense coefficients from the low regulation grouping are diluted by the other countries, causing a less severe effect to be observed.

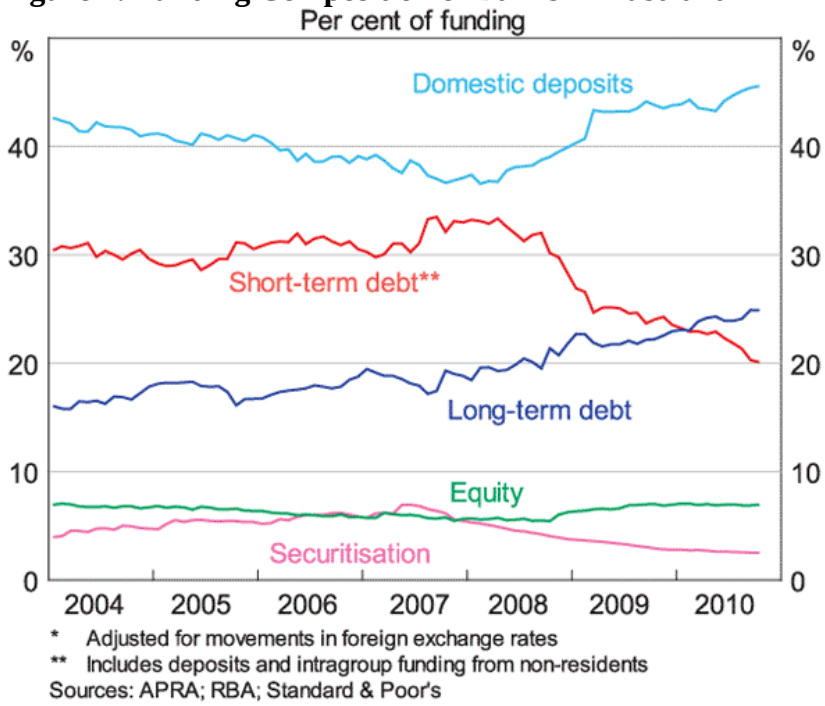
The capital asset and tangible common equity ratio coefficients are both smaller in magnitude than all other regressions including the highly regulated regression. This is due to the results of the middle regulated grouping where the results found were positive and insignificant. On average capital ratios seem to be regulated by government institutions which keep the banks in line on this measure of risk taking.

4.2 High Regulation

4.2.1 Australia

Leading up to the global financial crisis in 2008, Australian institutions obtained a significant portion of their funding from short-term debt. In 2007, short-term debt peaked at around thirty-five percent of the overall funding (Reserve Bank of Australia, 2010). In the same way that the removal of consumer deposits can cause a bank run, short-term debt can quickly evaporate in a financial crisis. Short-term debt was not renewed in Australia at the onset of the 2008 financial crisis. This highlights the risk banks were taking on the funding side of their operation. The rapid decline in short term funding can be observed in the following graph.

Figure 1: Funding Composition of Banks in Australia



Reserve Bank of Australia, 2010

Foreign investment was also a large source of funding for Australian banks because it was found to be more economical. Leading up to 2007 foreign investment accounted for four percent of GDP. After the onset of the financial crisis foreign funding dissipated and was found to only represent one percent of GDP (Reserve Bank of Australia, 2010). Australian banks funding themselves in ways that are prone to drastic reduction in times of financial turmoil shows that even rich economies are susceptible to having their banks operate in an excessively risky manner. The increasingly concentrated banking environment compounds these problems, where the largest banks continue to acquire weaker banks and reduce competition. The four largest Australian banks increased their share of total assets from sixty-five percent to seventy-three percent following mergers in October of 2008 (Senate Economics References Committee, 2009).

Australian banks operated under the assumption that deposits would be guaranteed by the government even though no explicit policy was in place (Gray, 2008). Even in the onset of the

financial crisis banks made little attempt to curb their risky behaviour because they believed that government intervention would take place.

Australia implemented their deposit insurance scheme on October 12, 2008 to promote financial stability and allow authorised deposit taking institutions to maintain fund levels during a time of financial uncertainty (Campbell et al. 2007). The decision to introduce deposit insurance followed the collapse of several major banks including Northern Rock in 2007 and Lehman Brothers in 2008 (Dodd, 2007). Four weeks after Lehman Brothers failed the Australian government observed a sharp increase in demand for cash holdings. By the end of the year, five billion dollars in additional bank notes (twelve percentage points) had been issued as compared too normal (Cusbert & Rohling, 2013). The increase in cash holdings was seen as a decline in confidence in the banking sector.

The Australian deposit insurance scheme protects deposits made at authorised deposit-taking institutions, which include banks, building societies and credit unions (Australian Government, 2012). The policy covered consumer deposits, as well as large and wholesale deposits. The choice to extend coverage to larger funds was made to assist Australian financial institutions in obtaining funding from international markets where their competition was already receiving similar protection (Australian Government, 2012).

4.2.2 Germany

Germany was an early adopter of deposit insurance. The Association of German Banks introduced a public deposit insurance scheme in 1966 (Association of German Banks, 2010). In 1974 a major German bank, Herstatt, failed and was followed by the creation of private deposit insurance in 1975 (Beck, 2001). This privately run banking insurance is funded by member

institutions and offers substantial guarantees, although these are not enforced under a statute the way public guarantees are enforced. The private institution still abides to relevant government regulations. The private insurance is optional but serves the purpose of allowing private banks to compete with banks that are guaranteed by public institutions. In 2001, these public guarantees were removed due to the European Court of Justice finding that the guarantees were acting as a subsidy and violated the anti-subsidy rule (Gropp et al. 2010).

4.2.3 The Republic of Korea

South Korea adopted a deposit insurance scheme along with the creation of the Korea Deposit Insurance Corporation (KDIC) on June 1, 1996 (Campbell et al., 2007). Both agreements were created with the intention of explicitly protecting depositors and to improve confidence in the banking sector (Campbell et al., 2007). The Korean deposit insurance scheme covers deposits made at "banks, securities companies, insurance companies, merchant banking corporations, mutual savings banks, and credit unions (Campbell et al., 2007, pg. 120)." The KDIC was also given the responsibility of managing risk assessments, conducting bank inspections and managing the liquidation of failed banks (Campbell et al., 2007). The KDIC acknowledges the addition incentive for moral hazard under a deposit insurance scheme and monitors the risk taking behaviour of its member financial institutions (Korea Deposit Insurance Corporation, 2014).

The onset of the 1997 Asian financial crisis caused the Korean government to raise the coverage from ₩ 20 million to an unlimited blanket coverage scheme (Korea Deposit Insurance Corporation, 2014). In 2001, the blanket coverage was removed and the new explicit coverage limit was set at the much higher level of ₩ 50 million per depositor per institution (Campbell et

al., 2007). The higher level was chosen in an attempt to keep financial stability without needing to resort to blanket coverage in the future.

Regressions are run on Australian banks for the years 2003 to 2012, German banks for years 1996 to 2005 and South Korean banks for years 1991 to 2000. Each timeframe spans five years before and after the change in policy for the given country.

Table 4: High Regulation Fixed Effects Results

High	(1)	(2)	(3)	(4)
VARIABLES	lnZscore	σROAA	CAR	TCE
Insurance	**-0.642*** **	**0.306*** **	**-1.077*** **	**-1.114*** **
	(0.0874)	(0.0830)	(0.201)	(0.198)
Country control variables				
GDP	-3.27e-07***	8.24e-08	4.73e-07	5.04e-07*
	(7.24e-08)	(7.07e-08)	(3.05e-07)	(2.91e-07)
Inflation	-0.0184**	0.00903	0.0778	0.0771
	(0.00885)	(0.0136)	(0.0591)	(0.0590)
Unemployment	-0.0322***	0.0365***	-0.218***	-0.231***
	(0.0117)	(0.0107)	(0.0792)	(0.0789)
Bank level variables				
TotalAssets	0.000115	-0.000552	-0.000783*	-0.000908**
	(0.000204)	(0.000478)	(0.000431)	(0.000452)
Equity	-6.95e-05	0.000574	0.00160***	0.00154***
	(0.000218)	(0.000526)	(0.000453)	(0.000503)
TotalCustomerDeposits	4.20e-06	2.06e-05	-1.53e-05	-1.68e-05
	(1.25e-05)	(1.94e-05)	(3.80e-05)	(3.65e-05)
WholeSaleDeposits	-2.11e-06	1.14e-05	-1.32e-05	-1.36e-05
	(1.10e-05)	(1.67e-05)	(3.80e-05)	(3.62e-05)
TotalLiabilities	-0.000122	0.000548	0.000750*	0.000865*
	(0.000204)	(0.000476)	(0.000437)	(0.000455)
Loans	3.17e-06	-1.46e-05	-2.45e-05	-6.92e-06
	(9.32e-06)	(1.54e-05)	(3.68e-05)	(3.80e-05)
NetIncome	-1.88e-05	0.000101	4.39e-05	2.46e-05
	(2.33e-05)	(7.38e-05)	(6.35e-05)	(6.25e-05)
NetInterestIncome	-0.000170	-6.39e-05	0.000570	0.000888
	(0.000117)	(0.000188)	(0.000559)	(0.000573)
TotalSecurities	5.48e-06	-4.55e-06	9.75e-06	3.09e-05
	(7.36e-06)	(1.36e-05)	(4.47e-05)	(4.33e-05)
Constant	4.565***	0.0513	7.079***	6.953***
	(0.140)	(0.125)	(0.390)	(0.388)
Observations	5,282	5,291	5,291	5,291
R-squared	0.207	0.110	0.167	0.151
Number of Banks	716	716	716	716

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The negative coefficient (-0.642) on *Insurance* demonstrates that having a deposit insurance policy results in banks having lower Z-Scores, as compared to the period where they operated without the insurance safety net. The Z-Score coefficient is significant at the one percent level and while large in size it is much smaller in magnitude than that observed in the middle and low regulation cases. A drop in Z-Score signifies banks operating closer to insolvency than previously observed. Deposit insurance may not be the only contributing factor to the observed increase in Z-Score. Australian policies, which were introduced at the same time, acted as subsidies to banks. Interest rates were lowered at the overnight rate to make emergency funding easily accessible and stimulus packages were sent out, amounting to 1.7 percent of annual GDP (Cusbert & Rohling, 2013). These federal policies could act to further influence banks as funding has become cheaper to obtain.

In the standard deviation regression, the *Insurance* variable has a positive and significant coefficient (0.306) with the implication that on average banks respond to the deposit insurance policy by investing in riskier projects with a larger range of returns and more chance of default. The change due to the insurance policy in the highly regulated economy is again much smaller in magnitude than that observed in both the middle and low regulation regressions. The difference between the highly regulated economy and the low regulation one is astoundingly a multiple of ten, as we observe coefficients of 0.306 compared to 3.184.

The negative coefficient on *Insurance* (-0.862) in the capital asset ratio regression signifies a reduction in capital holdings when compared to the assets currently at risk due to the policy introduction. The shrinking of this ratio leaves more opportunity for capital to be depleted in the event of financial downturn or crisis. The tangible common equity ratio similarly suffers a decline

due to the policy introduction. *Insurance* has a negative coefficient of (-0.889). Both the capital asset and tangible common equity ratio regressions display coefficients on *Insurance*, which are smaller in magnitude when compared to the low regulation grouping. The smaller magnitude coefficients in all regressions for the highly regulated grouping can be explained by other preexisting policies forcing financial institutions to behave more in line with societal expectations. Countries with higher GDP per capita likely have a significant financial sector, which has caused a buildup of regulations and guidelines that financial institutions are constrained by. While deposit insurance causes additional risks to be taken there is less room to alter behaviour due to the regulated environment they find themselves operating within. The findings line up with those of Demirguc-Kunt and Detragiache (2002) where they observed the effect of deposit insurance on the banking system to be decreasing with stringent enough regulation.

4.3 Middle Regulation

4.3.1 Malaysia

Before 1998 Malaysia had no explicit mandate that required depositors to be reimbursed upon the failure of a bank but instead operated under implicit coverage for deposits. When a bank would fail, the Bank Negara Malaysia (BNM) would acquire the failed bank and sell off the assets to healthy banks, which remained in the market. During the 1980's this practice was used to reimburse the majority of depositors of the thirty-six financial institutions that failed (Campbell et al., 2007).

Malaysia did not suffer from extensive bank runs during the 1997 Asian financial crisis the way other countries did. Instead, depositors sought out quality investments, which damaged weak banks and financial institutions and resulted in additional liquidity needing to be provided by BNM

(Campbell et al., 2007). The Malaysian government decided to implement an explicit blanket guarantee on deposits in 1998, in order to halt further shifting of deposits.

Since 1998 Malaysia has undergone financial system restructuring, which concluded with the creation of the Malaysia Deposit Insurance Corporation in 2005. This new organization removes the blanket deposit guarantees and replaces them with explicit coverage of RM 60,000 per depositor per institution (Campbell et al., 2007). The new coverage is mandatory for all commercial banks incorporated within Malaysia, which included foreign bank subsidiaries (Perbadanan Insurans Deposit Malaysia, 2008).

4.3.2 Brazil

Brazil suffered from uncontrolled price inflation and economic instability for decades preceding their economic reform in 1994. Brazil's government implemented the Plano Real or "Real Plan" in 1994 that was able to reduce the inflation problem, but also caused a contraction of the banking sector. The altered financial environment caused the banking sector to shrink from 15.61 percent of GDP in 1993 to 6.79 percent in 1995 (Fundo Garantidor de Créditos, 2014). During the financial contraction seven small banks were forced into liquidation and the failure of a large national retail bank exposed the need for regulations that would be able to manage and prevent further banking failures (Fundo Garantidor de Créditos, 2014). On August 31, 1995 the National Monetary Council created an independent organization to protect depositors from financial institutions. This was soon followed by the implementation of a deposit insurance scheme on November 16, 1995 (Fundo Garantidor de Créditos, 2014). The Brazilian deposit insurance scheme is mandatory for all financial institution along with savings and loans associations, which

operate within the country. The insurance covers the first R$250,000 leaving rich depositors exposed to risk and able to assist in monitoring the banks (Fundo Garantidor de Créditos, 2014).

Table 5: Middle Regulation Fixed Effects Results

Middle	(1)	(2)	(3)	(4)
VARIABLES	lnZscore	σROAA	CAR	TCE
Insurance	**-1.099*** **	**1.147*** **	**0.632**	**0.680**
	(0.134)	(0.157)	(0.456)	(0.454)
Country control variables				
GDP	1.37e-07	8.86e-08	-1.06e-05***	-1.06e-05***
	(1.63e-07)	(4.15e-07)	(3.46e-06)	(3.51e-06)
Inflation	0.000131	-9.47e-05	-0.00104*	-0.000926*
	(0.000131)	(0.000192)	(0.000537)	(0.000534)
Unemployment	0.00143	0.0127	-0.447	-0.475
	(0.00759)	(0.00928)	(0.410)	(0.409)
Bank level variables				
TotalAssets	0.000273	9.04e-05	0.00745**	0.00764**
	(0.000619)	(0.000353)	(0.00372)	(0.00362)
Equity	-0.000166	-0.000282	-0.00181	-0.00248
	(0.000621)	(0.000354)	(0.00349)	(0.00338)
TotalCustomerDeposits	-3.78e-05**	5.97e-05***	-0.000245	-0.000231
	(1.60e-05)	(1.85e-05)	(0.000208)	(0.000203)
WholeSaleDeposits	-3.81e-05**	3.12e-05*	-0.000221	-0.000261
	(1.65e-05)	(1.83e-05)	(0.000333)	(0.000327)
TotalLiabilities	-0.000248	-0.000103	-0.00798**	-0.00817**
	(0.000617)	(0.000348)	(0.00378)	(0.00369)
Loans	1.22e-05	-5.84e-05**	0.000148	0.000175
	(1.61e-05)	(2.60e-05)	(0.000293)	(0.000289)
NetIncome	3.21e-05	-3.06e-05	0.00190*	0.00205**
	(6.57e-05)	(5.04e-05)	(0.000976)	(0.000995)
NetInterestIncome	8.07e-05	-0.000121*	0.00131	0.00121
	(0.000114)	(6.72e-05)	(0.000930)	(0.000914)
TotalSecurities	-1.02e-05	-1.58e-05	-8.27e-06	4.81e-05
	(1.69e-05)	(2.16e-05)	(0.000295)	(0.000288)
Constant	3.188***	1.468***	21.01***	21.00***
	(0.109)	(0.225)	(2.727)	(2.738)
Observations	1,204	1,212	1,212	1,212
R-squared	0.485	0.340	0.100	0.094
Number of Banks	221	221	221	221

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The middle tier countries experiences a significant shift in Z-Score due to the deposit insurance policy introduction in 1995 and 1998. The strong coefficient and significance of the

Insurance variable paint a clear picture of the impact deposit insurance has on the financial environment. When the coefficient is compared to the highly regulated grouping it is observed to be larger in magnitude (-1.099) compared to (-0.642). The size of this shift may be related to Brazil's banking sector shrinking. As the financial sector contracts banks decide to increase the risk of their investments as they gamble to maintain their own solvency.

The standard deviation of ROAA also has a much stronger coefficient in the middle regulation economies (1.147), when compared to the highly regulated ones (0.306). Middle tier regulated banks are found to be increasing the risk of their investments by discernibly more, despite a similar policy being introduced. The larger coefficients on both Z-Score and σROAA can likely be attributed to the level of regulation that each country imposes on their financial sectors. The increase may also be due to less stringent screening practices for loan applicants.

Surprisingly, the middle tier does not experience changes to bank level capital asset or tangible common equity ratios that are expected. Both ratios have signs suggesting risk decreases due to the policy introduction but have poor statistical significance with p-values of 0.167 and 0.136 respectively. A possible explanation for these results lies in the reasoning behind the introduction of deposit insurance for these two countries. Malaysia did not suffer through the Asian financial crisis in the way that other countries did and already had a strong implicit scheme in place that had proven its intension to protect depositors. Changing over to an explicit scheme may have had a relatively small effect on financial institutions, which tightened their investments independently of the new policy. Brazil was suffering uncontrollable inflation until the "Real Plan" introduction that added a significant amount of reform and regulation to the financial system. Mandatory capital ratios are a common way government agencies compel banks to act in accordance with social expectations. These new regulations could be the reason the changes to

capital asset and tangible common equity ratios are observed to be insignificant after the insurance policy introduction.

4.4 Low Regulation

4.4.1 Thailand

Thailand had previously been operating under a system where each financial failure was dealt with individually, instead of having a set of guidelines on how failure resolution was to be carried out. Only in 1985, following the failure of multiple large institutions, was the Financial Institutions Development Fund (FIDF) created in an attempt to curb the string of collapses (Campbell et al., 2007). The FIDF was still operating under implicit protection, as they did not set forth the rules surrounding the coverage being provided. In 1997, the Asian financial crisis caused fifty-six Thai financial firms to collapse and blanket guarantees were rolled out to protect depositors and help stabilize the financial system (Campbell et al., 2007).

4.4.2 Indonesia

Indonesia suffered through the Asian financial crisis in 1997 and initially experienced the loss of sixteen banks (Campbell et al., 2007). The immediate response was to implement small-scale coverage on consumer deposits in the amount of Rp 20 million or $6000 US (Campbell et al., 2007). The limited coverage was insufficient to restore confidence in the banking sector; therefore, the president put forth blanked guarantees on deposits for both commercial and rural banks in 1998 (Lembaga Penjamin Simpanan, 2011). Blanket insurance comes with even larger moral hazard problems than schemes that use explicit guarantees with coverage caps (Demirguc-Kunt and Detragiache, 2002). Along with the deposit insurance scheme, the Indonesian Bank

Restructuring Agency (IBRA) was created to manage bank liquidation and restructuring. Initially the deposit scheme was jointly controlled by the Bank of Indonesia and the IBRA; however, full control of the deposit insurance scheme was turned over to the IBRA in June of 2000 (Campbell et al., 2007). Finally in 2005 limited coverage is introduced alongside the creation of the Indonesian Deposit Insurance Corporation (IDIC). The IDIC is allowed to operate independently from external governing bodies and attempts to resolve banking failure in the lowest cost manner from the insurer's perspective (Campbell et al., 2007).

Table 6: Low Regulation Fixed Effects Results

Low	(1)	(2)	(3)	(4)
VARIABLES	lnZscore	σROAA	CAR	TCE
Insurance	**-2.070*** **	**3.184*** **	**-2.444** **	**-2.444** **
	(0.470)	(0.949)	(1.008)	(1.008)
Country control variables				
GDP	-3.60e-07	-2.46e-07	-2.28e-05**	-2.28e-05**
	(5.35e-07)	(1.33e-06)	(1.12e-05)	(1.12e-05)
Inflation	0.000380	-0.00288	-0.0186	-0.0186
	(0.00316)	(0.00696)	(0.0206)	(0.0206)
Unemployment	0.0346	-0.0832	-0.324	-0.324
	(0.0424)	(0.0893)	(0.296)	(0.296)
Bank level variables				
TotalAssets	-0.000180	0.00758*	-0.0908***	-0.0908***
	(0.00120)	(0.00434)	(0.00885)	(0.00885)
Equity	0.000110	-0.00724*	0.0991***	0.0991***
	(0.00119)	(0.00436)	(0.00826)	(0.00826)
TotalCustomerDeposits	-6.54e-05	3.92e-05	0.000235	0.000235
	(8.24e-05)	(0.000252)	(0.00149)	(0.00149)
WholeSaleDeposits	-0.000103	1.49e-05	-0.00148	-0.00148
	(8.63e-05)	(0.000248)	(0.00166)	(0.00166)
TotalLiabilities	0.000241	-0.00774*	0.0895***	0.0895***
	(0.00115)	(0.00430)	(0.00878)	(0.00878)
Loans	1.77e-05	0.000124	0.000698	0.000698
	(3.28e-05)	(8.58e-05)	(0.000465)	(0.000465)
NetIncome	0.000224	-0.00133	-0.00297	-0.00297
	(0.000153)	(0.00125)	(0.00271)	(0.00271)
NetInterestIncome	-1.08e-05	9.25e-05	-0.00379***	-0.00379***
	(5.35e-05)	(0.000182)	(0.00123)	(0.00123)
TotalSecurities	2.90e-05	5.48e-05	0.000752	0.000752
	(2.61e-05)	(5.90e-05)	(0.000485)	(0.000485)
Constant	3.271***	0.734*	17.51***	17.51***
	(0.166)	(0.395)	(2.606)	(2.606)

Observations	647	660	660	660
R-squared	0.575	0.360	0.175	0.175
Number of Banks	132	134	134	134

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The low regulation grouping has the largest coefficients on *Insurance* for all four regressions. Each measure of risk taking behaviour is found to be significant at the one percent level and each have a coefficient with immense real world magnitude. As previously mentioned, when comparing the highly regulated countries to the low regulation countries, the Z-Score coefficient has increased in size from (-0.642) to (-2.070). This downward shift demonstrates how a lack of regulation in a country can amplify the moral hazard effects that the deposit insurance policy can have.

Similarly, the change due to the deposit insurance policy almost triples for both the capital asset and tangible common equity ratio regressions. The low regulation *Insurance* variable receives a coefficient of (-2.444) in the capital asset regression, which is much larger than (-1.114) from the highly regulated countries. Tangible common equity ratio has identical results. It appears that in the smallest economies there is little difference between the capital asset and tangible common equity ratio. It is unclear if this is due to intangible assets and preferred stock equity being small in these economies or due to the method of recording for the dataset. On average financial institutions operating in relatively low regulation environments respond to an insurance policy by increasing their risk of default, expanding the range of returns on their investments and keeping lower ratios of backup capital reserves.

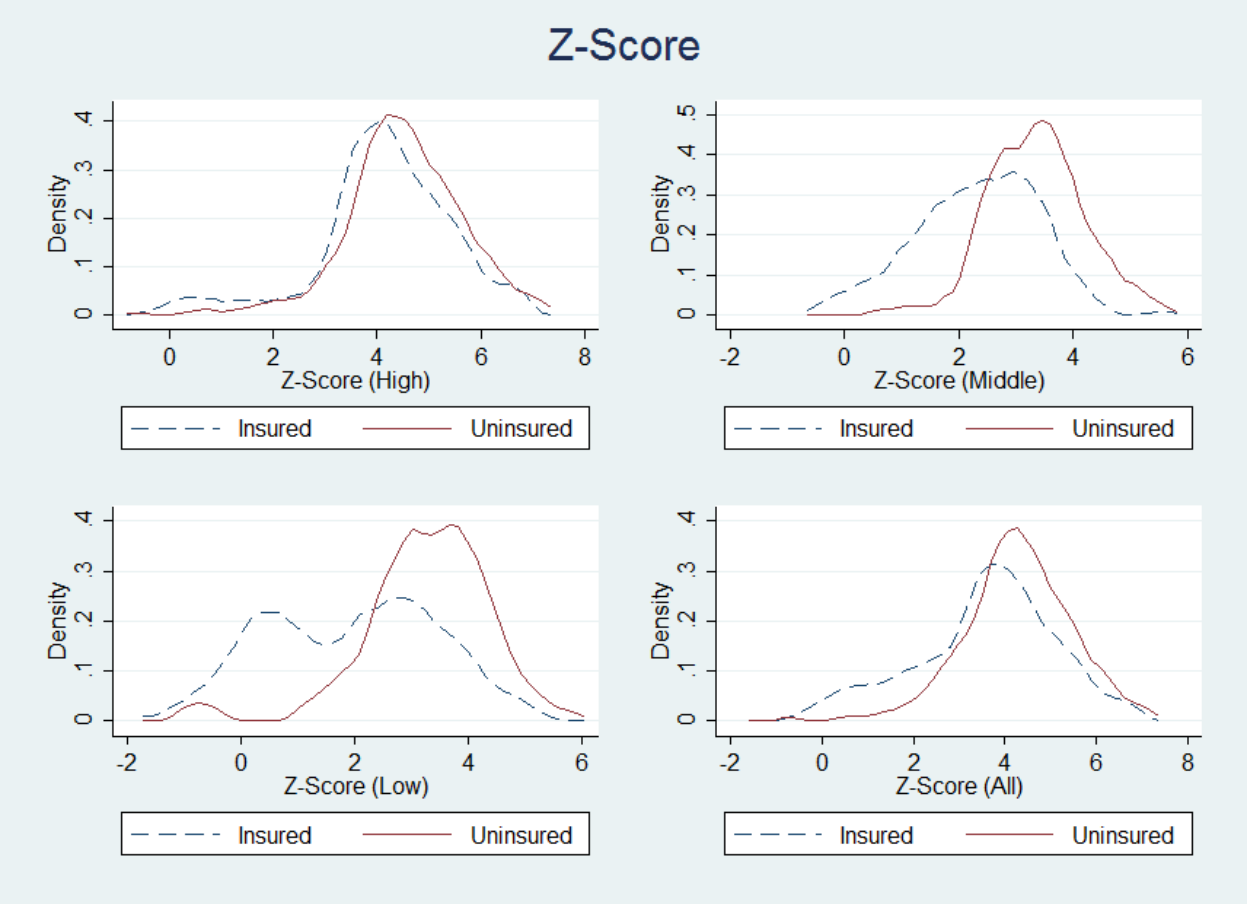
The coefficients observed in the low regulation economies are large in size and this may be due to other policies being introduced alongside deposit insurance. Indonesia and Thailand both adopted deposit insurance amidst the Asian financial crisis so it is likely that multiple policies were

introduced at once to combat its effects. These protective policies often act as subsidies as they attempt to shield weak banks from failure. The combined effect of multiple subsidizing policies would be captured by the *Insurance* variable leading to inflated coefficients being observed.

4.5 Figures

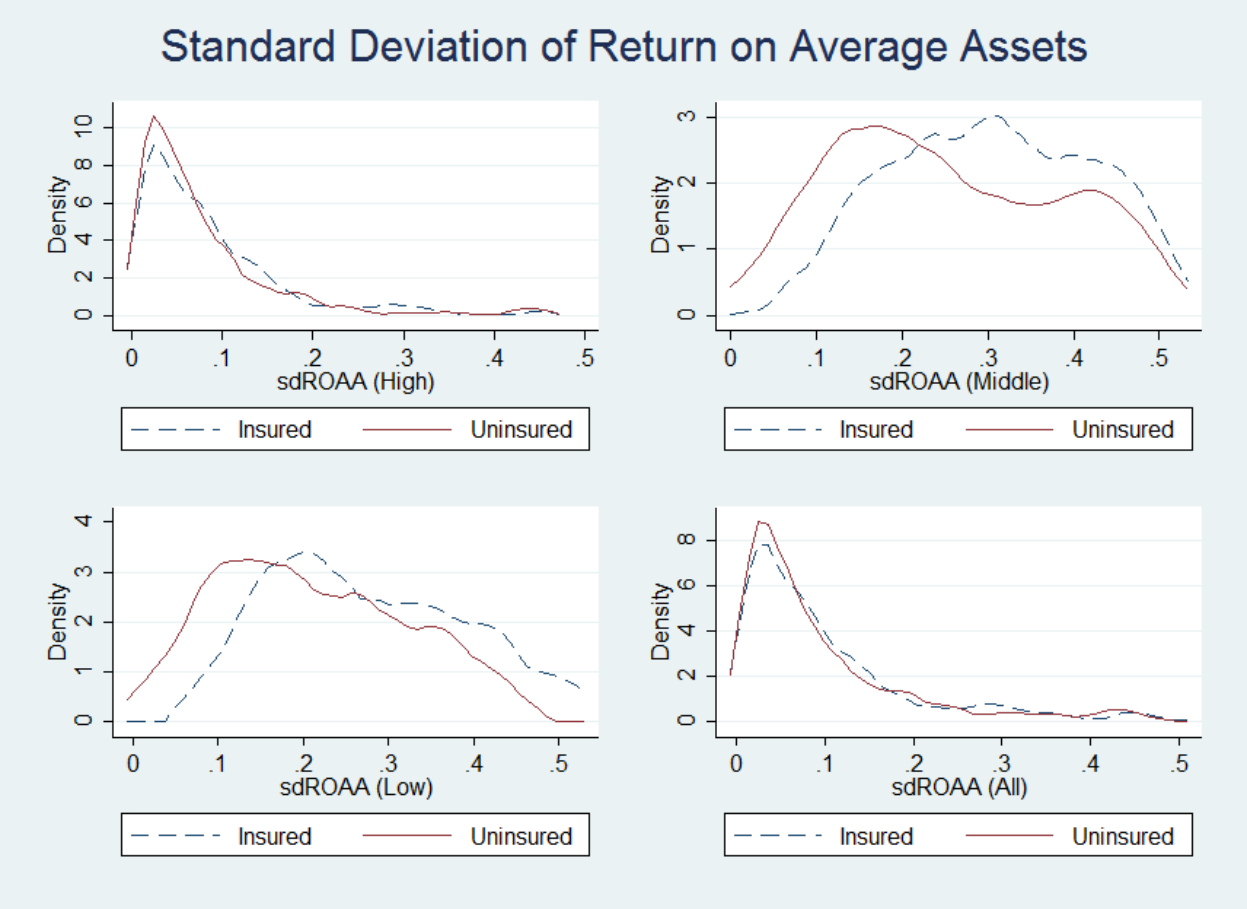
Each variable of interest is graphed for each grouping and displayed in the following section for comparison. The graphs display each variable in the time periods with and without the deposit insurance policies. It should be noted that the axis are not always consistent between groupings. This is intentional as the scales used better demonstrate the shift each grouping experiences.

Figure 2: Z-Score Kernel Density by Regulation Grouping



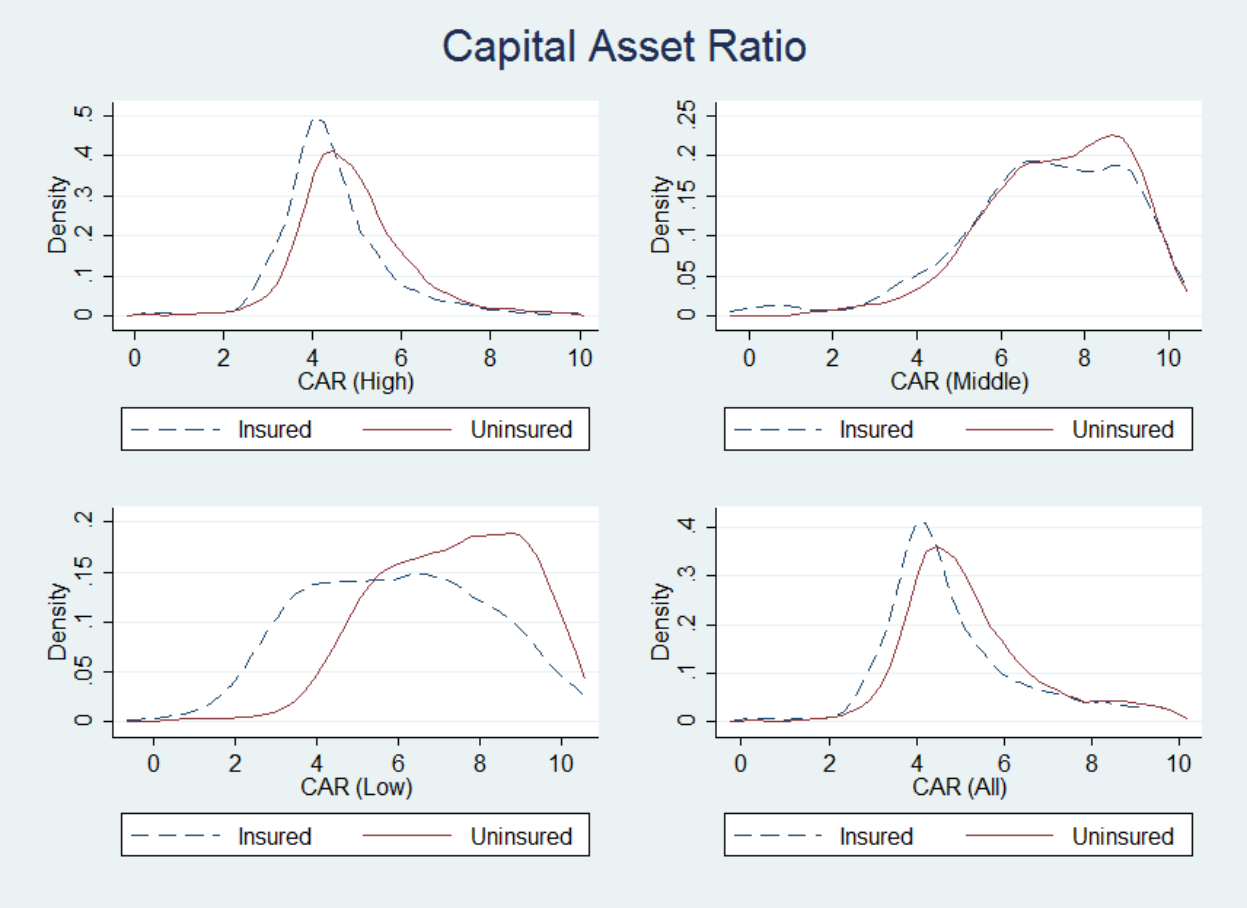
The uninsured Z-Score line is observed to be concentrated further right in all the graphs. This rightward shift signifies larger Z-Scores being maintained in periods where no insurance policy is present or conversely lower Z-Scores after insurance is introduced.

Figure 3: Standard Deviation of ROAA by Regulation Grouping



The standard deviation of the turn on average assets appears to increase with the insurance policy introduction. In the high and overall groupings the shift is difficult to observe but still noticeable by inspecting the peak of each line and also noticing the way the dotted blue line maintains a rightward position on the solid red line. In the middle and low groupings the shifting effect is more prominent.

Figure 4: Capital Asset Ratio Kernel Density by Regulation Grouping



The capital asset ratio graphs demonstrate that lower levels of capital are being held when an insurance policy has been introduced; however, this trend is limited to the upper and lower groupings. In the middle regulator grouping there appears to be relatively little movement between periods. The insignificant change of the middle groupings CAR is mirrored in the regression results.

4.6 Germany

Germany is unique in the countries that are analyzed in this study because instead of introducing deposit insurance they removed the policy. Germany is a useful country for analysing the effect of deposit insurance because the decision to remove deposit insurance occurred

independently from the economic environment. The removal was exogenously enforced by a court ruling in 2001. The exogenous nature of the policy change provides an opportunity to conduct analysis while avoiding the complicated effects of a financial crisis (Gropp et al. 2010). The years 1996 to 2005 are kept for the analysis, which is five years before and after Germany changed their policy.

Along with dividing the time period into before and after the removal of deposit insurance, we also divide banks into public savings banks and all other types of banks. Savings banks are the area of interest as they are the ones affected by the change in policy. Other financial institutions should be relatively unaffected when the policy is introduced, as they were never covered by the public policy in the first place. The control group consists of bank holding companies, commercial banks, and cooperative banks. These banks pick up variations, which effected the entire financial system. The German market is primarily composed of control group banks that do not identify in the data set as savings banks.

A difference in differences approach is used for the regression analysis. This technique requires the creation of a new variable, which is the product of the group and the treatment dummy variables (Imbens & Wooldridge, 2009). This approach takes advantage of the fact that we have two clear groups along with treatment date that separates our time periods. The six other countries did not have a significant amount of financial institutions that were not affected by the deposit insurance policy making a control group unavailable. The new variable is the dummy variable for insurance status crossed with a dummy variable for savings banks (*InsurancexSB*). This dummy variable is only turned on (receives a value of one) when public deposit insurance exists and the bank belongs to the financial group of saving banks.

$$InsurancexSB = Insurance * SavingBank$$

Each regression is again run with robust standard errors and fixed effects as the panel data treatment. The four regressions run are as follows:

$$(1)\ Z\ Score(i,t) = \alpha_1 + \beta_1 Insurance(t) + \beta_2 InsurancexSB(t) + \gamma_{11}X_1(t) + \gamma_{12}X_2(i,t) + \varepsilon_1(i,t)$$

$$(2)\ \sigma ROAA(i,t) = \alpha_2 + \beta_1 Insurance(t) + +\beta_2 InsurancexSB(t)\gamma_{21}X_1(t) + \gamma_{22}X_2(i,t) + \varepsilon_2(i,t)$$

$$(3)\ CAR(i,t) = \alpha_3 + \beta_1 Insurance(t) + +\beta_2 InsurancexSB(t)\gamma_{31}X_1(t) + \gamma_{32}X_2(i,t) + \varepsilon_3(i,t)$$

$$(4)\ TCE(i,t) = \alpha_4 + \beta_1 Insurance(t) + +\beta_2 InsurancexSB(t)\gamma_{41}X_1(t) + \gamma_{42}X_2(i,t) + \varepsilon_4(i,t)$$

Table 7: Difference in Differences Results for Germany

Germany	(1)	(2)	(3)	(4)
VARIABLES	lnZscore	σROAA	CAR	TCE
InsurancexSB	**-0.251*** **	**0.0443*** **	**0.0949**	**0.0901**
	(0.0765)	(0.0149)	(0.0624)	(0.0622)
Insurance	0.221***	-0.0673***	-0.407***	-0.408***
	(0.0514)	(0.0126)	(0.0535)	(0.0536)
Country control variables				
GDP	1.98e-08	-9.08e-09*	1.24e-06***	1.21e-06***
	(2.13e-08)	(5.09e-09)	(1.40e-07)	(1.40e-07)
Inflation	-0.00390	-0.000299	0.0528**	0.0520**
	(0.00253)	(0.000718)	(0.0257)	(0.0260)
Unemployment	-0.00650	0.000823	-0.186***	-0.185***
	(0.00526)	(0.00122)	(0.0428)	(0.0424)
Bank level variables				
TotalAssets	2.23e-05	-3.27e-06	-0.000124	-0.000237**
	(9.79e-05)	(1.80e-05)	(9.02e-05)	(9.90e-05)
Equity	-0.000108	2.06e-05	0.000380**	0.000473***
	(0.000103)	(1.98e-05)	(0.000148)	(0.000150)
TotalCustomerDeposits	1.80e-05**	-3.38e-06***	-8.28e-06	-8.98e-06
	(7.03e-06)	(1.26e-06)	(9.11e-06)	(8.97e-06)
WholeSaleDeposits	1.25e-05**	-2.09e-06*	4.43e-06	5.68e-06
	(4.92e-06)	(1.11e-06)	(7.88e-06)	(7.32e-06)
TotalLiabilities	-2.26e-05	3.43e-06	0.000121	0.000233**
	(9.79e-05)	(1.80e-05)	(8.83e-05)	(9.69e-05)
Loans	-6.46e-06	1.29e-06	1.19e-06	1.56e-06
	(4.41e-06)	(9.88e-07)	(4.29e-06)	(4.66e-06)
NetIncome	7.58e-05*	-1.18e-05	-9.35e-05	-7.73e-05
	(4.31e-05)	(1.34e-05)	(0.000126)	(0.000125)
NetInterestIncome	0.000135	-5.66e-05**	-0.000788	-0.000826
	(8.62e-05)	(2.36e-05)	(0.000611)	(0.000614)
TotalSecurities	-1.10e-05*	1.16e-06	-8.89e-06	-9.94e-06
	(6.54e-06)	(1.12e-06)	(5.41e-06)	(6.12e-06)
Constant	4.370***	0.200***	4.638***	4.677***
	(0.0326)	(0.00854)	(0.154)	(0.161)

Observations	13,601	13,601	13,601	13,601
R-squared	0.017	0.028	0.045	0.043
Number of Banks	1,879	1,879	1,879	1,879

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In the difference in differences regression the variable of interest is now *InsurancexSB* and due to the policy not effecting financial institutions without public insurance the effect of the policy is isolated. The average reduction of a banks Z-Score when using a control group is (-0.251), which is a smaller change than what was observed in the highly regulated grouping where only deposit taking institutions were considered (-0.642).

The standard deviation of the return on average assets decreased for savings banks when deposited insurance was removed. The average savings bank with insurance coverage had a (0.0443) higher standard deviation on their returns, due to the isolated effect of the policy. This effect was found to be statistically significant at all traditional significance levels due to a p-value of 0.000. The results imply that due to the removal of deposit insurance, savings banks altered their decision-making and reduced the variation in the payoffs of their investments. Again, the results are smaller in magnitude than that of the highly regulated group regression in which Germany is included.

Lastly, the measures of how risky and leveraged a bank is (capital asset and tangible common equity ratio) are found to be insignificant at the ten percent level. Other regulations are likely keeping capital levels at sufficiently high levels despite the change in insurance policy. Given that Germany has the highest GDP per capita for the year chosen it is assumed they also have the most stringent regulations and so this finding is in line with the literature. The literature suggests that the most regulated countries should be the least exposed to default risk brought on

through moral hazard because of additional regulations that keep the banks in check (Demirguc-Kunt and Detragiache, 2002).

5. Recommendations

From the findings of this empirical investigation, it is recommended that countries take careful consideration before employing a deposit insurance policy to solve their issues with bank runs. Countries with weak regulatory environments are the most in need of addressing this problem; however, they are also at the most risk of the associated moral hazard problems. The primary recommendation is to avoid introducing the policy all together. Countries should also consider removing deposit insurance if the economy is stable enough to permit such a significant change.

If deposit insurance is going to be employed, a set of guidelines should be put forward to assist policy makers. Policies that offer bailouts should be removed and even large banks must be allowed to fail. Institutions that operate with the understanding that they will be saved even when they have acted negligently are only encouraged to disregard risk in their search for profit (LaBrosse & Mayes, 2007). Deposit insurance should be priced based upon how likely a bank is to fail. The majority of deposit schemes have uniform prices for coverage, which contrasts with how insurance is traditionally priced (Demirguc-Kunt & Detragiache, 2002). Charging variable rates based on the riskiness of a bank would offer a financial incentive to reduce risk. Coverage should be explicitly limited, as to expose large depositors and investors to risk. Large investors will impose market discipline, while small depositors are protected. Furthermore, rules governing failure resolution need to be established. These rules should force surviving member institutions to absorb the majority of the damage instead of the public (Demirguc-Kunt et al., 2008). Market

disciplinarians need to be encouraged to act upon risk taking banks. These market disciplinarians are large depositors that should remove their deposits from the bank, shareholders that can act to remove bank managers and government agencies that can audit and enforce regulations (Haber, 2005). Strict regulations should be implemented that take control away from financial institutions. These regulations would need to be designed to promote an economic environment, which is both resistant to fluctuations and financially profitable. International regulation should be improved to assist domestic regulators. Large banks now operate in multiple countries and sorting out which regulations apply has become more difficult in recent years. A centralized body of regulators would help alleviate the problem of banks diverting investments and funds to countries where the regulation environment best suits their current interests.

6. Conclusion

With deposit insurance becoming so popular around the world there is reason to continue to investigate the potential benefits along with the costs it carries. We see evidence that deposit insurance causes significant moral hazard and incentivizes insured banks to take on excessive risks on their investment portfolios. Banks also keep lower reserve ratios than socially optimal in order to maximize their profits (Bhattacharya et al., 1998).

Demirguc-Kunt and Detragiache (2002) find that on average, deposit insurance has adverse effects on the economy and the stability of the financial system. While their findings suggest that deposit insurance is on average undesirable, there may be some countries that can make use of the policy. Countries with strong regulation in their banking sector may be able to combat the effects of moral hazard and enjoy the benefits of eliminating the threat of a bank run.

The results from the empirical investigation support the literatures opinion that deposit insurance causes an increase in the risk taking behaviour of the banking sector. The effect of changing the deposit insurance policy was found to be in the direction the literature suggests, except for the case of the middle regulation economies. The middle regulated economies, Malaysia and Brazil, showed insignificant changes to their capital ratios demonstrating the potential to control risk given certain circumstances or additional policy choices. Future research could improve upon this study by conducting empirical analysis using monthly data that captures details of banks decisions and fluctuations in the economy.

Financial instability has drastic effects on the welfare of society. Policies that have the ability to destabilize the banking sector require continued investigation due to their potential to cause widespread harm. Deposit insurance requires further investigation, as it has been shown to have direct effects on the risk taking behaviour of banks and the probability of financial crisis.

7. Appendix

Table 8: Australia Fixed Effects Results

Australia	(1)	(2)	(3)	(4)
VARIABLES	lnZscore	sdROAA	CAR	TCE
Insurance	**-0.769*** **	**0.328**	**0.227**	**0.0689**
	(0.180)	(0.205)	(0.407)	(0.395)
Country control variables				
GDP	5.20e-08	-1.96e-07*	-1.13e-06	-8.97e-07
	(1.12e-07)	(1.03e-07)	(8.80e-07)	(8.37e-07)
Inflation	-0.0208	0.0122	0.131	0.114
	(0.0205)	(0.0241)	(0.137)	(0.130)
Unemployment	-0.0364	-0.0463	-0.0309	-0.0738
	(0.0596)	(0.0613)	(0.443)	(0.441)
Bank level variables				
TotalAssets	5.05e-05	-0.000621	-0.000586*	-0.000774*
	(0.000197)	(0.000534)	(0.000336)	(0.000395)
Equity	-5.60e-05	0.000700	0.00127***	0.00123**
	(0.000213)	(0.000591)	(0.000404)	(0.000477)
TotalCustomerDeposits	-4.01e-06	3.02e-05	-1.74e-06	-8.22e-06
	(1.14e-05)	(2.02e-05)	(2.49e-05)	(2.50e-05)
WholeSaleDeposits	-7.14e-06	2.23e-05	-1.23e-05	-1.73e-05
	(1.03e-05)	(1.57e-05)	(2.25e-05)	(2.34e-05)
TotalLiabilities	-5.28e-05	0.000613	0.000570*	0.000747*
	(0.000196)	(0.000531)	(0.000339)	(0.000393)
Loans	6.94e-06	-2.38e-05	-2.74e-05	-4.92e-06
	(1.05e-05)	(1.50e-05)	(2.03e-05)	(2.17e-05)
NetIncome	-4.27e-05***	0.000178***	1.33e-06	-3.46e-05
	(1.53e-05)	(4.46e-05)	(4.37e-05)	(3.98e-05)
NetInterestIncome	-2.78e-05	-2.94e-06	-0.000133	0.000429
	(0.000130)	(0.000204)	(0.000479)	(0.000497)
TotalSecurities	6.51e-06	-1.62e-05	-1.87e-06	2.46e-05
	(8.11e-06)	(1.10e-05)	(2.47e-05)	(2.53e-05)
Constant	4.256***	0.794**	8.364***	7.787***
	(0.409)	(0.339)	(2.775)	(2.732)
Observations	370	370	370	370
R-squared	0.343	0.120	0.147	0.097
Number of Banks	80	80	80	80

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Brazil Fixed Effects Results

Brazil	(1)	(2)	(3)	(4)
VARIABLES	lnZscore	sdROAA	CAR	TCE
Insurance	**-1.182*** **	**1.817***	**1.439**	**1.520**
	(0.305)	(0.984)	(3.193)	(3.139)
Country control variables				

GDP	2.15e-07**	-2.43e-07**	-1.11e-05**	-1.13e-05**
	(9.79e-08)	(1.11e-07)	(4.41e-06)	(4.47e-06)
Inflation	9.71e-05	0.000136	-0.000435	-0.000374
	(9.80e-05)	(0.000227)	(0.000974)	(0.000957)
Unemployment	0.00629	0.0148	-0.543	-0.547
	(0.00946)	(0.0163)	(0.450)	(0.450)
Bank level variables				
TotalAssets	0.000924	-0.000724	-0.00505	-0.0102
	(0.000795)	(0.00113)	(0.0277)	(0.0257)
Equity	-0.000845	0.000590	0.0136	0.0177
	(0.000753)	(0.00114)	(0.0279)	(0.0259)
TotalCustomerDeposits	-3.16e-05	4.93e-05*	-0.000640	-0.000580
	(2.57e-05)	(2.96e-05)	(0.000442)	(0.000435)
WholeSaleDeposits	-1.69e-05	3.08e-05	5.02e-05	5.39e-06
	(2.43e-05)	(2.85e-05)	(0.000365)	(0.000354)
TotalLiabilities	-0.000922	0.000737	0.00406	0.00917
	(0.000800)	(0.00114)	(0.0276)	(0.0256)
Loans	1.97e-05	-0.000106	0.000628	0.000649
	(3.26e-05)	(7.30e-05)	(0.000706)	(0.000705)
NetIncome	2.90e-05	7.34e-05	0.00359*	0.00361*
	(6.67e-05)	(9.54e-05)	(0.00204)	(0.00201)
NetInterestIncome	0.000142	-0.000225	0.000547	0.000516
	(0.000123)	(0.000141)	(0.00138)	(0.00130)
TotalSecurities	-4.85e-06	-5.46e-05	0.000168	0.000264
	(2.35e-05)	(4.43e-05)	(0.000483)	(0.000488)
Constant	3.093***	1.870**	28.82***	28.57***
	(0.274)	(0.884)	(4.727)	(4.720)
Observations	597	597	597	597
R-squared	0.505	0.257	0.114	0.102
Number of Banks	121	121	121	121

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Germany Fixed Effects Results

Germany	(1)	(2)	(3)	(4)
VARIABLES	lnZscore	sdROAA	CAR	TCE
Insurance	**-0.0830**	**-0.0191****	**-0.301*****	**-0.301*****
	(0.0606)	(0.00871)	(0.0149)	(0.0149)
Country control variables				
GDP	1.41e-07***	-7.16e-09	6.88e-07***	6.87e-07***
	(5.18e-08)	(6.87e-09)	(3.97e-08)	(3.98e-08)
Inflation	0.00858**	-0.000424	0.0485***	0.0482***
	(0.00407)	(0.000597)	(0.00453)	(0.00452)
Unemployment	-0.0420***	0.00103	-0.0975***	-0.0984***
	(0.0131)	(0.00127)	(0.00889)	(0.00893)
Bank level variables				
TotalAssets	0.00434	0.000722	-0.000378	-0.000184

	(0.00603)	(0.000892)	(0.00199)	(0.00192)
Equity	-0.00511	-0.000741	0.0181***	0.0179***
	(0.00627)	(0.000875)	(0.00224)	(0.00219)
TotalCustomerDeposits	0.000405	-3.17e-06	-0.000276*	-0.000275*
	(0.000264)	(3.09e-05)	(0.000152)	(0.000152)
WholeSaleDeposits	0.000706**	4.23e-05	-2.51e-05	-2.97e-05
	(0.000335)	(5.03e-05)	(0.000256)	(0.000257)
TotalLiabilities	-0.00454	-0.000743	-0.000636	-0.000822
	(0.00607)	(0.000894)	(0.00200)	(0.00194)
Loans	-0.000382	4.05e-05	5.80e-05	4.97e-05
	(0.000312)	(4.35e-05)	(0.000148)	(0.000149)
NetIncome	0.00836	-0.00371**	0.00206	0.00197
	(0.00602)	(0.00186)	(0.00332)	(0.00332)
NetInterestIncome	0.00346	-0.000360	0.00125	0.00125
	(0.00381)	(0.000526)	(0.00138)	(0.00138)
TotalSecurities	-0.000171	2.97e-05	0.000261**	0.000258**
	(0.000224)	(3.52e-05)	(0.000105)	(0.000105)
Constant	4.839***	0.102***	4.352***	4.363***
	(0.147)	(0.0200)	(0.136)	(0.135)
Observations	4,538	4,538	4,538	4,538
R-squared	0.023	0.042	0.629	0.627
Number of Banks	566	566	566	566

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11: Indonesia Fixed Effects Results

Indonesia	(1)	(2)	(3)	(4)
VARIABLES	lnZscore	sdROAA	CAR	TCE
Insurance	**-1.922*** **	**2.684*** **	**-3.854** **	**-3.854** **
	(0.347)	(0.937)	(1.881)	(1.881)
Country control variables				
GDP	-7.01e-07	8.80e-07	-3.79e-05***	-3.79e-05***
	(7.11e-07)	(1.12e-06)	(1.43e-05)	(1.43e-05)
Inflation	-0.000853	0.00135	-0.0267	-0.0267
	(0.000697)	(0.00214)	(0.0223)	(0.0223)
Unemployment	0.00404	-0.0298	-0.324	-0.324
	(0.0123)	(0.0457)	(0.396)	(0.396)
Bank level variables				
TotalAssets	-0.00156	0.0143**	-0.0760***	-0.0760***
	(0.00220)	(0.00550)	(0.0143)	(0.0143)
Equity	0.00152	-0.0139**	0.0845***	0.0845***
	(0.00219)	(0.00565)	(0.0140)	(0.0140)
TotalCustomerDeposits	-5.25e-05	8.00e-06	0.000170	0.000170
	(7.82e-05)	(0.000243)	(0.00147)	(0.00147)
WholeSaleDeposits	-9.37e-05	-1.56e-05	-0.00154	-0.00154
	(8.23e-05)	(0.000235)	(0.00165)	(0.00165)
TotalLiabilities	0.00161	-0.0144***	0.0748***	0.0748***

	(0.00217)	(0.00540)	(0.0145)	(0.0145)
Loans	2.81e-05	9.30e-05	0.000734	0.000734
	(2.98e-05)	(9.13e-05)	(0.000485)	(0.000485)
NetIncome	0.000233	-0.00141	-0.00337	-0.00337
	(0.000158)	(0.00128)	(0.00287)	(0.00287)
NetInterestIncome	-3.08e-05	0.000125	-0.00391***	-0.00391***
	(5.35e-05)	(0.000184)	(0.00130)	(0.00130)
TotalSecurities	3.52e-05	3.54e-05	0.000722	0.000722
	(2.38e-05)	(6.04e-05)	(0.000496)	(0.000496)
Constant	3.948***	0.193	23.78***	23.78***
	(0.190)	(0.388)	(3.739)	(3.739)
Observations	444	448	448	448
R-squared	0.654	0.317	0.233	0.233
Number of Banks	91	92	92	92

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 12: Korea Fixed Effects Results

Korea	(1)	(2)	(3)	(4)
VARIABLES	lnZscore	sdROAA	CAR	TCE
Insurance	**-1.438*** **	**0.725*** **	**-1.342***	**-1.340***
	(0.242)	(0.156)	(0.700)	(0.700)
Country control variables				
GDP	-1.09e-06**	1.03e-06***	-1.25e-05***	-1.26e-05***
	(5.17e-07)	(3.80e-07)	(3.34e-06)	(3.35e-06)
Inflation	-0.0121	-0.00407	-0.155*	-0.162*
	(0.0167)	(0.0161)	(0.0913)	(0.0917)
Unemployment	-0.0588*	0.0221	-1.109***	-1.113***
	(0.0337)	(0.0251)	(0.221)	(0.222)
Bank level variables				
TotalAssets	-3.28e-05	-0.00103	-0.0158***	-0.0158***
	(0.000657)	(0.00105)	(0.00435)	(0.00433)
Equity	0.000167	0.000992	0.0184***	0.0183***
	(0.000654)	(0.00101)	(0.00439)	(0.00438)
TotalCustomerDeposits	5.96e-06	-5.96e-05	-0.000634***	-0.000634***
	(3.51e-05)	(5.11e-05)	(0.000153)	(0.000153)
WholeSaleDeposits	7.26e-06	-7.11e-05	-0.000662***	-0.000659***
	(3.56e-05)	(5.69e-05)	(0.000154)	(0.000155)
TotalLiabilities	6.06e-07	0.00104	0.0159***	0.0158***
	(0.000656)	(0.00105)	(0.00432)	(0.00430)
Loans	3.00e-05	3.27e-05	0.000415***	0.000417***
	(2.62e-05)	(3.90e-05)	(0.000148)	(0.000147)
NetIncome	-2.90e-05	-0.000329**	-0.00145***	-0.00145***
	(4.57e-05)	(0.000147)	(0.000455)	(0.000457)
NetInterestIncome	-0.000280	-0.000131	0.00132	0.00119

	(0.000198)	(0.000262)	(0.000890)	(0.000894)
TotalSecurities	3.70e-05	7.34e-05	0.000662***	0.000650***
	(3.50e-05)	(5.50e-05)	(0.000192)	(0.000193)
Constant	4.003***	0.148	16.76***	16.81***
	(0.407)	(0.273)	(2.123)	(2.128)
Observations	359	368	368	368
R-squared	0.600	0.467	0.383	0.380
Number of Banks	69	69	69	69

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 13: Australia Fixed Effects Results

Malaysia	(1)	(2)	(3)	(4)
VARIABLES	lnZscore	sdROAA	CAR	TCE
Insurance	**-1.146*** **	**1.195*** **	**1.271*** **	**1.257*** **
	(0.164)	(0.170)	(0.682)	(0.684)
Country control variables				
GDP	-6.56e-06***	8.13e-06***	0.000117**	0.000113**
	(2.16e-06)	(2.37e-06)	(5.33e-05)	(5.29e-05)
Inflation	-0.00506	0.00346	0.0323	0.0349
	(0.00428)	(0.00372)	(0.0546)	(0.0553)
Unemployment	-0.0615	0.0581	1.917**	1.815*
	(0.0901)	(0.0959)	(0.932)	(0.923)
Bank level variables				
TotalAssets	0.000205	2.73e-05	0.00576	0.00637*
	(0.000615)	(0.000327)	(0.00369)	(0.00371)
Equity	-6.23e-05	-0.000305	-0.00277	-0.00342
	(0.000614)	(0.000324)	(0.00361)	(0.00363)
TotalCustomerDeposits	-4.09e-05*	6.27e-05**	-2.47e-05	-2.72e-05
	(2.10e-05)	(2.74e-05)	(0.000141)	(0.000141)
WholeSaleDeposits	-5.36e-06	3.14e-05	-0.000572	-0.000652
	(4.36e-05)	(4.01e-05)	(0.000513)	(0.000516)
TotalLiabilities	-0.000175	-6.59e-05	-0.00601	-0.00661*
	(0.000613)	(0.000324)	(0.00372)	(0.00375)
Loans	4.73e-06	-2.30e-05	-0.000268	-0.000277
	(2.01e-05)	(1.73e-05)	(0.000214)	(0.000215)
NetIncome	0.000311**	-0.000243	0.00156	0.00170
	(0.000128)	(0.000148)	(0.00157)	(0.00157)
NetInterestIncome	-8.32e-06	-0.000222	0.00452*	0.00440*
	(0.000137)	(0.000140)	(0.00236)	(0.00236)
TotalSecurities	6.92e-07	1.74e-05	-0.000366	-0.000342
	(2.36e-05)	(2.85e-05)	(0.000290)	(0.000295)
Constant	4.083***	-0.119	-4.593	-3.887
	(0.407)	(0.460)	(7.073)	(7.012)
Observations	603	611	611	611
R-squared	0.486	0.440	0.167	0.165

Number of Banks	99	99	99	99

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 14: Thailand Fixed Effects Results

Thailand	(1)	(2)	(3)	(4)
VARIABLES	lnZscore	sdROAA	CAR	TCE
Insurance	**-2.188****	**3.528****	**-1.695****	**-1.695****
	(0.872)	(1.453)	(0.688)	(0.688)
Country control variables				
GDP	4.15e-06	-9.45e-06	1.42e-05	1.42e-05
	(3.18e-06)	(7.83e-06)	(1.89e-05)	(1.89e-05)
Inflation	-0.00765	0.0125	-0.193**	-0.193**
	(0.00903)	(0.0164)	(0.0768)	(0.0768)
Unemployment	0.206	-0.313	0.796	0.796
	(0.123)	(0.254)	(0.668)	(0.668)
Bank level variables				
TotalAssets	-0.00934	0.0248	-0.0521	-0.0521
	(0.00931)	(0.0202)	(0.0489)	(0.0489)
Equity	0.0142	-0.0363	0.211***	0.211***
	(0.0125)	(0.0291)	(0.0488)	(0.0488)
TotalCustomerDeposits	0.00687	-0.0139	0.0450**	0.0450**
	(0.00609)	(0.0159)	(0.0205)	(0.0205)
WholeSaleDeposits	0.00557	-0.00458	0.0104	0.0104
	(0.00635)	(0.0178)	(0.0319)	(0.0319)
TotalLiabilities	-0.000911	-0.00388	-0.0117	-0.0117
	(0.00775)	(0.0146)	(0.0417)	(0.0417)
Loans	0.00132	-0.00215	0.0159	0.0159
	(0.00267)	(0.00599)	(0.0107)	(0.0107)
NetIncome	0.00398	-0.00948	0.0454**	0.0454**
	(0.00252)	(0.00586)	(0.0204)	(0.0204)
NetInterestIncome	0.0336	-0.0559	0.0855	0.0855
	(0.0236)	(0.0574)	(0.0545)	(0.0545)
TotalSecurities	-0.00219	0.00532	-0.00168	-0.00168
	(0.00305)	(0.00754)	(0.0111)	(0.0111)
Constant	2.548***	0.875	8.053**	8.053**
	(0.404)	(0.879)	(3.179)	(3.179)
Observations	203	212	212	212
R-squared	0.548	0.487	0.272	0.272
Number of Banks	41	42	42	42

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

8. References

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