



# Bank risk and national governance in Asia<sup>☆</sup>

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## ARTICLE INFO

### Article history:

Received 13 May 2013

Accepted 12 August 2014

Available online 26 August 2014

### JEL classification:

G21

G28

G38

C33

### Keywords:

National governance

Bank risk

Asian banks

Asian financial crisis

## ABSTRACT

The role of national governance upon bank-level risk in the Asian region is analysed. Improvements in national governance are risk reducing at the bank level in developed nations in the Asian region, and over the longer run for those nations affected by the Asian Financial Crisis. A U-shaped relationship between bank risk and bank capital is found, and it is argued that the risk reducing impact of increased capital holdings is close to satiation for developed nations in particular. Evidence of risk seeking due to 'too big to fail' effects is observed; with improved national governance able to partially offset some of the moral hazard due to size in developed nations, but not in developing nations. In developing nations increased size interacts with improved national governance to result in increased bank risk.

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## 1. Introduction

Bank risk is an issue that has had its importance re-emphasised by the banking crisis of 2008 and the following moves to re-formulate the nature of global banking regulations in response to the perceived lessons of this crisis. This paper extends the current stream of literature addressing the issue of bank risk by considering the role national regulatory governance plays when modelling bank risk. It would be expected that improved national governance quality will result in lower bank-level risk, *ceteris paribus*. By considering national regulator quality this paper will test an important result of the model of Besanko and Kanatas (1996); that bank

capital effectiveness in reducing bank risk is reinforced by regulatory quality. In contrast to previous studies in this area, this paper will offer the benefit of considering the impact of regulatory quality on bank risk. Previous studies such as Laeven and Levine (2009) and Klomp and de Haan (2011) considered the relationship between the existence of various banking regulations and bank risk.

A distinctive feature of this study is to consider measures of regulatory quality rather than regulatory existence. In this manner the paper is within the tradition of the law and finance approach to national governance La Porta et al., 1998, but with the distinctive feature of considering quality rather than existence of regulatory governance. Further, bank revenue volatility will be modelled using an approach drawn from the market microstructure literature, which will provide a different dimension to the issue of bank risk estimation. Finally, by considering banks from the Asian region, which were less directly affected by the banking crisis of 2008, but in the front line of the Asian financial crisis of 1997, a longer run (post recovery) perspective on bank risk can be adopted which has the potential to inform policy reforms following the 2008 banking crisis.<sup>1</sup> As argued by Tarr (2010), the banking crisis

<sup>☆</sup> The author is grateful for valuable comments from Tom Smith, Gulasekaran Rajaguru and Jan-Egbert Sturm as well as conference participants at the 27th International Conference of the American Committee for Asian Economic Studies (ACAES)-Financial Econometrics Group (FEG) at Deakin University, Melbourne, 2012; the 2nd Conference on Global Financial Stability and Prosperity, ASB Institute of Global Finance, Sydney, July 2013 (especially Mark Humphrey-Jenner) and seminar participants at the Globalisation and Development Center seminar series, Bond University. The comments of Fari Moshirian (editor of the special issue) and an anonymous referee are also gratefully acknowledged. The author is also grateful to Noel Gaston whose comments started me on this topic. All errors and omissions remain the responsibility of the author.

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<sup>1</sup> The Asian region nations also provides a valuable region for this study due to a number of commentators citing shortfalls in national governance as a reason for the Asian financial crisis of 1997–98 (see Lee (2012) as an example).

of 2008 had a number of causal factors and governance failures at both the political and regulatory levels were important amongst those factors. Thus, considering the role governance has to play in bank risk in a region which has previously experienced a financial crisis, has the potential to inform the current policy reform process.

This study will also offer the advantage of considering the roles of bank capital, franchise value and loan growth in explaining bank risk, thus considering the role of conventional variables employed in a bank risk model within the context of the impact of national regulatory governance variables. Measurement of bank risk can encompass a variety of dimensions; this paper considers revenue volatility, loan quality and proximity to default (*z* score). Employing a panel of Asian region nations across the period of 1998 to 2012, the models are estimated using unbalanced panel instrumental variables estimators to control for potential endogeneity, using a fixed effects approach to control for firm heterogeneity. Of considerable interest is the finding that a higher level of national regulatory quality is associated with lower bank risk in developed but not developing nations. However, contrary to the propositions of Besanko and Kanatas (1996), only limited evidence was found that national regulatory quality reinforces the risk reducing features of bank capital holdings. In the case of the nations impacted by the Asian financial crisis the short run relationship between bank capital and bank risk is at best mixed. Some evidence is found suggesting that banks in developing nations in Asia view improvements in national governance as improving the put option value they have with the national regulators in a too big to fail framework and accordingly increase the risk of their portfolios, consistent with Merton (1977).

Bank capital holdings are found to have a U-shaped relationship with bank risk. Thus continuously increasing required bank capital will not continuously reduce bank risk. Further, analysis of the marginal impact of increased capital upon bank risk indicates that increased bank capital holdings are associated with (for the average bank) relatively small reductions in bank risk, with the exception of asset risk which is found to increase as capital holdings increase in some cases. It is argued that the risk reduction benefits of increased bank capital are close to satiation and that requiring large increases in bank capital holdings are likely to result in increased bank risk.

The rest of this paper is structured as follows; the next section will provide a review of the relevant bank risk literature and develop the propositions to be tested. The third section will detail the nature of the sample that will be employed as well as the empirical method that will be employed. The fourth section will present the results of the empirical tests. The final section will provide conclusions as well as some suggestions for policy formulation that are based on these results.

## 2. Literature review

### 2.1. Bank capital

**Proposition 1.** *There is a U-shaped relationship between bank risk and bank capital.*

The role of bank capital in modifying the behaviour of bank management, and in particular, modifying the risk of banks, has an academic and regulatory tradition over five decades long (VanHoose, 2007). Over this time a voluminous literature has developed arguing that requiring banks to hold specified amounts of capital acts to both increase and decrease bank risk.<sup>2</sup> This stream

of research has considered the impact of imperfect information and moral hazard upon the risk preferences of bank management in the presence of capital regulation.<sup>3</sup> Studies such as Koehn and Santomero (1980) and Blum (1999) have demonstrated that increased capital requirements can result in increased bank risk. In the case of Asia, Lee and Hsieh (2013) find increased bank capital is associated with lower bank risk, but their model does not control for potential non-linearities in this relationship. Williams (2013) demonstrated a U-shaped relationship between bank capital and risk in Indonesia. For the purposes of this study, the stream of research that relates the impact of regulatory quality and intensity to bank risk and capital holdings is of most relevance. Shrieves and Dahl (1992) demonstrate that the presence of bank capital regulations will result in increased bank risk unless accompanied by increased regulatory intensity. Both Brimmer and Dahl (1975) and Calem and Rob (1999) argue that lack of regulatory intensity will result in bank risk seeking activity, thus offsetting the risk mitigation impact of bank capital. It is argued that bank capital holding will have a U-shaped relationship with bank risk as both poorly and well-capitalised banks have (differing) incentives to increase bank risk (Calem and Rob, 1999; Jonghe et al., 2007).

### 2.2. Franchise value

**Proposition 2.** *Banks with higher franchise values will have lower risk.*

Franchise or charter value is simply the value that accrues to a bank from its ownership of a banking licence. This value is often considered within the context of the value a bank obtains via its coverage by actual or implied deposit insurance (Craine, 1995). Generally this value is considered to be the present value of economic profits if the bank continues to operate as a going concern. It is conventionally argued that the franchise value of a bank acts to reduce the incentives for morally hazardous risk seeking by bank management (Marcus, 1984). Further, it has been argued that the quasi-monopoly rents generated by increased market power will also act to increase bank franchise value (Keeley, 1990; Besanko and Thakor, 1993).<sup>4</sup> Banks will act to protect this franchise value by electing to invest in a lower risk portfolio of assets.

### 2.3. Bank size

**Proposition 3.** *Larger banks are riskier due to the negative externalities associated with too big to fail.*

The relationship between bank size and bank risk has also resulted in a considerable literature. The failure and government rescue of Continental Illinois bank in 1984 resulted in the term 'too big to fail' becoming part of banking language. Under the concept of too big to fail there is a group of large and important banks who are so central to the national (and global) banking system<sup>5</sup> that the regulatory authorities will seek to intervene to prevent their insolvency. In a recent study of Asian banks, Fu et al., 2014 find that

<sup>2</sup> Relevant surveys of the bank capital literature include VanHoose (2007), Behr et al. (2010), Barrios and Blanco (2003) and Santos (2001).

<sup>3</sup> Important seminal papers considering bank capital holdings in the context of deposit insurance include Merton (1977), Diamond and Dybvig (1983) and Diamond (1984). These papers conclude that bank capital holdings reduce the value of the put option granted to banks with deposit insurance and so reduce risk seeking by bank management.

<sup>4</sup> Repullo and Suarez (2004) argue that risk reducing regulations are more likely to be effective when banks have higher franchise value.

<sup>5</sup> Note that the Bank for International Settlements has introduced guidelines that suggest national regulators should require globally systemically important institutions hold additional capital. See <http://www.bis.org/speeches/sp120120.htm> and <http://www.bis.org/publ/bcbs207.htm>.

smaller banks tend to be less risky, supportive of the moral hazard arising from too big to fail perceptions. In the United States, Hannan and Hanweck (1988) demonstrated that larger banks experience a systemically lower cost of funds due to inferred risk reduction due to too big to fail effects. It is argued by Saunders et al. (1990) that too big to fail generates negative externalities by creating incentives for managers of larger banks to adopt higher risk portfolios of assets, to the potential detriment of other stakeholders, especially taxpayers who would fund government bailouts.

#### 2.4. Revenue composition

**Proposition 4.** *Banks with higher levels of non-interest income are riskier.*

Over the past decades the revenue base of banks has evolved away from its emphasis upon income from traditional borrowing and lending to include a wide range of services resulting in increased non interest income Allen and Santomero, 2001; Lepetit et al., 2008b. This change can be attributed to a number of factors including changes in the regulatory climate, increased competition from non-banks and changes in the general nature of the banking environment (van Lelyveld and Knot, 2009). Arguments in favour of this change include portfolio diversification (see Smith et al. (2003)), as well as economies of scope from co-delivery of financial services (Diamond, 1984). Models such as those of Diamond (1984) and Ramakrishnan and Thakor (1984) argue that bank revenue diversification provides a credible signal of a bank's ability to overcome information asymmetry and provide effective delegated monitoring and screening services. Alternatively, another body of literature has argued that increased non-interest income generates increased agency conflicts (Jensen, 1986; Berger and Ofek 1996) and reduces the ability of a bank to fully exploit its specialised expertise. Further, Stiroh and Rumble (2006) argue that the diversification argument is misstated. It is argued that the negative agency impacts of too big to fail, as well as information asymmetry caused by increased complexity, generates negative externalities and moral hazard. This is seen by bank management using income diversification to pursue absolute levels of return rather than considering risk-return tradeoffs. Elyasiani and Wang (2008) document that higher levels of non-interest income is associated with increased information asymmetry which provides increased scope for morally hazardous behaviour by bank management. Empirical evidence to date such as Lepetit et al., 2008a,<sup>6</sup> DeYoung and Roland (2001) and Stiroh and Rumble (2006) find that banks with higher levels of noninterest income display higher levels of risk, with risk being measured across a variety of dimensions.

#### 2.5. Loan growth

**Proposition 5.** *There is a U-shaped relationship between bank loan growth and bank risk.*

Both the Asian financial crisis as well as the Banking Crisis of 2008 have illustrated the increased levels of bank risk associated with excessive loan growth. This is not a new phenomenon, as exemplified by Cocheo (1991, p48): “If it grows fast it's probably a weed.” Kwan and Eisenbeis (1997) argue that low to medium levels of bank loan growth are essential for asset formation and long run banking viability. They also argue that excessive levels of bank loan

growth are associated with poor loan quality and potential banking failure. Laeven (2002) as well as Foos et al. (2010) have supported this proposition empirically.

#### 2.6. Specialisation

**Proposition 6.** *Higher income specialisation is associated with lower bank risk.*

As opposed to the propositions generated by those advocating banks diversify their revenue portfolio, the specialisation argument posits that banks should maximise their benefits from their control of specialised employees. Authors such as Stiroh (2004), Berger et al. (2010) and Goddard et al. (2009) argued that focus upon core competencies is a lower risk strategy than diversification of revenue. As argued by Elyasiani and Wang (2008) increased non-interest income is associated with increased information asymmetry, with an associated increased moral hazard risk. Following this line of argument this paper will argue that higher revenue focus is associated with lower bank risk.

#### 2.7. Regulatory quality

**Proposition 7.** *Higher national regulatory quality reduces bank level risk.*

**Proposition 8.** *National regulatory quality reinforces the risk reduction impacts of capital holding and franchise value.*

**Proposition 9.** *National regulatory quality reduces the risk seeking incentives resulting from too big to fail.*

The role of the bank regulator in a system that includes incomplete information has been modelled as that of a representative agent (Dewatripont and Tirole, 1994), acting on behalf of risk averse stakeholders, especially small depositors. Thus, the regulator seeks to constrain the asset and liability decision as well as off balance sheet contingent activity to maintain the ongoing participation of small depositors. In this framework the regulator has the role of risk mitigation via a series of regulations such as capital and liquidity requirements. A number of papers have modelled the impact of bank capital upon managerial risk seeking in the presence of bank regulation. Authors such as Barth et al. (2004), Besanko and Kanatas (1996)<sup>7</sup> and Calem and Rob (1999), p 350<sup>8</sup> indicate the important role regulator quality has upon the risk choice of banks in the presence of capital regulations. Further, Repullo and Suarez (2004) argue that regulatory intervention into the riskiness of bank portfolio choices is more likely to be effective when banks have higher market power (franchise value). Besanko and Thakor (1993) argue regulators must find a “... delicate balance...” between competing objectives (lower interest rates for loans versus bank safety). Williams (2013) attributed a positive relationship between bank capital and risk in Indonesia prior to the Asian financial crisis to poor regulatory governance. Delis and Staikouras (2011) find that supervisory intensiveness reduces bank risk taking and also reinforces the impact of market discipline in reducing bank risk. However, it is found that capital requirements, even when reinforced with supervisory activity are not effective in reducing bank risk (Delis and

<sup>7</sup> Besanko and Kanatas (1996), p 179 argue that if the regulator is unable to commit to enforcement of capital standards they will be ineffective, but if the regulator can commit to enforcement they will motivate “... caution on the part of bank insiders...”

<sup>8</sup> Calem and Rob (1999), p 321 indicate that prompt regulatory intervention is an important element of bank capital regulation.

<sup>6</sup> Lepetit et al. (2008a) find that trading income does generate some portfolio diversification benefits.

Staikouras, 2011). Klomp and de Haan (2011) find that bank regulations act to reduce bank risk conditional upon ownership structure and size, and that these impacts are most apparent for higher risk banks. They do accompany their results with the caveat that they consider the existence rather than implementation of regulations. Likewise, Laeven and Levine (2009) find that the impact of bank regulations on bank risk is conditional on ownership structure. Again, Laeven and Levine (2009) constructed indices that represented the existence of regulations as opposed to the quality of their enforcement. Based on this literature, this paper will argue that national supervisory quality impacts upon bank risk, and further, that national supervisory quality reinforces the risk reducing attributes of capital regulations, franchise value and offsets the negative impact of too big to fail as measured by bank size.

### 2.8. Macroeconomic controls

To date the impact of differing national economic conditions on bank risk has been rarely considered. Models developed by Calem and Rob (1999) and Besanko and Kanatas (1996) adopted a single economy framework. However, some studies such as Bikker and Metzmakers (2005) find that bank loan loss provisions are lower when GDP growth is higher. Both Dietrich and Wanzenried (2011) and Athanasoglou et al. (2008) model the manner in which macroeconomic factors impact upon bank profits. Dietrich and Wanzenried (2011) find that Swiss bank profits are pro-cyclical, while the steepness of the yield curve also impacts upon Swiss bank profits. Athanasoglou et al. (2008) confirm the importance of the business cycle in the case of Greek banks while also demonstrating the relevance of national inflation. As argued by authors such as Buch and DeLong (2004), Berger et al. (2004), Cole et al. (2008) and Sturm and Williams (2010), nations with a higher GDP per capita tend to have more developed financial systems, which is important from the perspective of the national banks being able to manage the various dimensions of risk incurred in providing financial services. Lee and Hsieh (2013) find that banks from nations with higher growth rates of GDP tend to be less risky. Thus, this study will include controls for national macroeconomic factors (as detailed in the following section).<sup>9</sup>

## 3. Sample and method

### 3.1. Method

Unbalanced panel regressions will be estimated for each of the four separate risk measures discussed below, with each model being estimated using both a two year and a four year moving period to estimate bank risk. In each case all the independent variables will be estimated using average values estimated using either two or four year moving averages. As there is potential endogeneity between the explanatory variables, unbalanced panel instrumental variables estimation will be used, to address potential inconsistency of the estimators (Baltagi (2008), p 121). In this case equity holdings, size and fixed assets were treated as endogenous and their lag and lagged value squared were used as instruments, along with Tier One capital holdings, customer deposits to total assets and the three risk measures not included in the model being estimated. Given the nature of sample used, heterogeneity amongst the sample banks is also a cause for possible concern. Hausman tests found

that fixed effects estimators controlling for both time and firm effects is the most appropriate for this data set.<sup>10</sup>

### 3.2. Sample and data

The data used in this study comes from three different sources. First is the Bureau van Dijk *BankScope* database for the details of the individual bank's performance and characteristics. The sample of Asian banks includes the ten member nations of the Association of South East Asian Nations (ASEAN) (Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam), plus China, Hong Kong, India, Pakistan, South Korea, Sri Lanka, Taiwan as well as Australia, New Zealand and Japan, from 1998 to 2012. All variables sourced from *BankScope* are in US dollars, using balance date exchange rates. National governance data comes from the World Bank's *World Governance Index*,<sup>11</sup> while macroeconomic data was obtained from the International Monetary Fund's *International Financial Statistics* with the exception of Taiwan.<sup>12</sup> All data from the *International Financial Statistics* database was converted to US dollars using the exchange rates from the *International Financial Statistics* database (Table 1).

A traditional measure of firm specific risk is the standard deviation of either return on equity or return on assets, with a recent example of this type of measure in banking being provided by De Haan and Poghosyan (2012). However, as argued by authors such as Parkinson (1980) and Alizadeh et al. (2002) measures of this type suffer from imprecision when based upon small samples such as the annual report data used in this study. Parkinson (1980) recommends using Log (high value/low value) to estimate risk, but in the case of this study such a measure would be ill-defined for loss making banks. Instead this study adopts the approach of Alizadeh et al. (2002) and applies Log (high value–low value) to both the return on average assets and return on average equity of the banks in the sample. As discussed in both Alizadeh et al. (2002) and Parkinson (1980) as few as two observations can be used to generate an estimate of bank risk. This study will employ both a two year and a four year window to generate estimates of bank risk, using both return on average assets and return on average equity.

As well as volatility of revenue, the quality of a bank's loan portfolio is an important measure of a bank's risk and its potential for future failure. This study will employ the simple average of the bank-specific ratio of impaired loans to total assets for the relevant time period (either two or four years).<sup>13</sup> An important issue for all stakeholders in the banking system is the bank proximity to default. Proximity to default will be measured by the z-score method applied to banking by Boyd et al. (1993). The z-score measures the distance to default in terms of the number of standard deviations below the average a bank's return on assets must fall in order for that bank's capital reserves to be exhausted.

Defining  $k = -E/TA$  with  $E$  = firm equity and  $TA$  = total assets, then applying averages of the relevant sample period or sub-period:

$$z \text{ Score} = \frac{\text{Average\_ROA} + \text{Average\_}k}{\text{Standard Deviation of ROA}} \quad (1)$$

As discussed previously, the small sample properties of risk measures such as standard deviation can be problematic, thus the

<sup>9</sup> Including these controls will also have the benefit of determining whether national governance versus national macroeconomic performance is relevant to observed bank volatility and risk.

<sup>10</sup> I am indebted to an anonymous referee for his (her) valuable comments in this area. Dummy variables reflecting national attributes (such as socialist nations) were not possible in a fixed effect framework, thus sub sample analysis will be adopted to consider these impacts.

<sup>11</sup> See <http://info.worldbank.org/governance/wgi/index.asp>.

<sup>12</sup> Taiwanese economic data was obtained from the website of the National Statistics of the Republic of China and interest rate data from the website of the Central Bank of the Republic of China.

<sup>13</sup> This variable is used as it is reported in *BankScope* in the most consistent manner.



**Table 1**

Banks from each country in sample 1998 to 2012.

Country	Number of banks	Number of observations	Number of banks with valid total assets	Number with valid total assets
Australia	47	705	38	200
Brunei	1	15	1	15
Cambodia	20	300	20	100
China	179	2670	178	1059
Hong Kong	54	810	50	323
India	78	1170	77	778
Indonesia	130	1950	98	820
Japan	188	2820	179	1970
Laos	6	90	6	27
Malaysia	50	750	47	168
Myanmar	8	120	7	37
New Zealand	18	270	16	91
Pakistan	30	450	30	263
Philippines	62	930	58	296
Singapore	32	480	27	124
South Korea	38	570	28	96
Sri Lanka	18	270	18	41
Taiwan	53	795	52	250
Thailand	29	425	27	285
Vietnam	50	750	50	333
Total	1091	16340	1007	7276

Note: Number of banks represents the number of banks identified by BankScope as being from each nation over the years 1998–2012, with number of observations representing the possible number of observations. Number of banks with valid total assets represents the number of banks for which there was at least one year with a valid number for total assets; number with valid total assets represents the number of observations resulting from the requirement that there is at least one year with a valid number for total assets. The regressions estimated have fewer observations due to the requirement that there is valid data for variables other than total assets.

**Table 2**

Bank specific risk measures.

	All countries					Developed nations				
	N	Mean	Std. dev.	Min	Max	N	Mean	Std. dev.	Min	Max
Range volatility ROAA (2 yr)	6122	−1.52412	1.66955	−6.90776	4.939583	2164	−2.01375	1.702216	−6.90776	4.768649
Range volatility ROAE (2 yr)	6119	1.069165	1.67287	−6.90776	6.97077	2172	0.908067	1.804566	−6.90776	6.686804
Asset quality (2 yr)	5434	3.742037	6.578542	0	100	1978	2.207222	3.46194	0	90.41837
z score (2 yr)	6115	−0.22256	5.02373	−18.9829	386.1518	2163	−0.20814	8.382888	−5.21401	386.1518
Range volatility ROAA (4 yr)	6901	−0.48893	1.433514	−6.90776	4.939583	2365	−0.91761	1.42802	−6.90776	4.768649
Range volatility ROAE (4 yr)	6889	2.112309	1.445891	−6.90776	7.097376	2364	2.053982	1.528156	−6.90776	6.686804
Asset quality (4 yr)	3706	3.463325	5.031707	0	91.46897	1506	2.10381	2.325206	0.023541	46.20333
z score (4 yr)	4347	−0.10222	0.343277	−6.30696	10.3887	1659	−0.16692	0.391115	−1.96578	10.3887
	Excluding socialist nations					Asian financial crisis affected nations				
	N	Mean	Std. dev.	Min	Max	N	Mean	Std. dev.	Min	Max
Range volatility ROAA (2 yr)	4955	−1.49136	1.726607	−6.90776	4.939583	1654	−0.89744	1.66237	−6.90776	4.939583
Range volatility ROAE (2 yr)	4953	1.094347	1.727471	−6.90776	6.97077	1642	1.272159	1.749868	−6.90776	6.97077
Asset quality (2 yr)	4416	4.130689	7.204886	0	100	1577	6.289911	9.930039	0.011609	100
z score (2 yr)	4948	−0.19124	5.578495	−18.9829	386.1518	1648	−0.10032	1.053983	−18.9829	32.87901
Range volatility ROAA (4 yr)	5540	−0.41293	1.487537	−6.90776	4.939583	1963	0.123956	1.495	−6.90776	4.939583
Range volatility ROAE (4 yr)	5527	2.189602	1.488517	−6.90776	7.097376	1951	2.299025	1.596937	−4.71053	7.097376
Asset quality (4 yr)	3137	3.739194	5.400499	0	91.46897	1047	5.720819	7.442479	0.128601	91.46897
z score (4 yr)	3633	−0.09361	0.333207	−1.96578	10.3887	1091	0.012216	0.280339	−1.12205	6.336004

Note: Range volatility of either return on average assets (ROAA) or return on average equity (ROAE) is calculated as  $\log(\text{High value} - \text{Low value})$  over either two year or four year periods. Asset quality is defined as impaired loans divided by total assets in per cent. The z score is calculated as follows:  $z = -E/TA$ , with E = firm equity and TA = total assets, then applying averages of the relevant sample period or sub-period:  $z \text{ Score} = \frac{\text{Average ROAA} - \text{Average } k}{\text{Range volatility of ROAA}}$ .

Developed nations are all members of the OECD plus Singapore: Australia, Japan, New Zealand, Singapore, and South Korea.

Socialist nations are China, Laos, Myanmar, and Vietnam.

A wide definition of nations affected by the Asian financial crisis has been adopted: Hong Kong, Indonesia, Laos, Malaysia, the Philippines, South Korea and Thailand.

z-score will also be calculated using the range volatility of return on assets as a denominator. Under the assumption that ROA is always less than the absolute value of k, the z-score will always be negative as it measures the probability of loss.<sup>14</sup> The larger in absolute value the z-score is, the further the firm is from bankruptcy (i.e. the larger the number of standard deviations ROA must fall to eliminate the bank's equity capital base). To ensure consistent interpretation of

coefficients, the z-scores will be multiplied by minus one and inverted (Table 2).

The discussion in the previous section suggests a number of bank specific variables that impact upon bank risk. The most persistent variable of this type in the banking literature is bank capital. This study will employ bank equity to total assets to measure individual bank capital holdings, as it is available from BankScope in a consistent series and is less affected by national differences in regulatory definitions of bank capital over time. To control for the possible non linearities suggested by proposition 1, bank equity to total assets squared will be included in the model. In a similar vein,

<sup>14</sup> It is possible that a firm with a positive *ex post* ROA has a low level of capital to assets, and so a positive z score, reflecting higher returns to a risky leveraged position. This can create some noise when using z scores as an *ex post* risk measure.

**Table 3**

Bank specific measures.

	All countries					Developed nations				
	N	Mean	Std. dev.	Min	Max	N	Mean	Std. dev.	Min	Max
Equity to total assets (%)	6203	9.529821	11.8936	–296.7765	99.9385	2186	5.91576	9.201402	–296.7765	88.012
Tier 1 capital (%)	4109	13.0913	22.13242	–461.72	377.165	1931	10.01929	20.18276	–461.72	341.8
Franchise value (Fixed assets to total assets (%))	6124	1.493139	1.659441	0	36.26613	2151	1.412423	1.007633	0	20.5451
Log total assets	6209	15.44987	2.123875	5.814774	21.68747	2186	16.73106	1.559033	9.495858	21.67051
Non interest income to total revenue (%)	6107	15.46521	110.12	–2513.401	6967.105	2167	18.43732	175.4569	–2513.401	6967.105
Loan growth (%)	6158	55.72106	2095.505	–99.58494	159370.5	2167	83.49344	3425.531	–99.58494	159370.5
Revenue concentration	6107	86969.8	4946419	5000.411	3.84E + 08	2167	218394.5	8298988	5001.563	3.84E + 08
	Excluding socialist nations					Asian financial crisis affected nations				
	N	Mean	Std. dev.	Min	Max	N	Mean	Std. dev.	Min	Max
Equity to total assets (%)	4955	–1.491355	1.726607	–6.907755	4.939583	1665	13.15317	14.47116	–101.1555	99.9385
Tier 1 capital (%)	4953	1.094347	1.727471	–6.907755	6.97077	863	18.1719	23.0667	–72.86	377.165
Franchise value (fixed assets to total assets [%])	4416	4.130689	7.204886	0	100	1651	1.639038	1.844945	0	21.33332
Log total assets	4948	–0.191242	5.578495	–18.98289	386.1518	1671	14.3412	2.086244	7.723471	20.43869
Non interest income to total revenue (%)	5540	–0.412927	1.487537	–6.907755	4.939583	1643	16.75792	17.01119	–52.11394	429.0732
Loan growth (%)	5527	2.189602	1.488517	–6.907755	7.097376	1652	51.91115	967.8593	–92.64982	38890.23
Revenue concentration	3137	3.739194	5.400499	0	91.46897	1643	7940.747	10338.43	5002.026	421338.3

Note: revenue concentration is calculated by considering bank revenue has two components (i) interest revenue and (ii) non interest revenue. The sum of the squared shares of each revenue component reflects revenue concentration. If all revenue comes from one source a bank has a perfectly concentrated revenue stream. While the theoretical upper limit of this value is 10,000 losses in one part of the revenue stream can result in revenue concentration values exceeding this value.

Developed nations are all members of the OECD plus Singapore: Australia, Japan, New Zealand, Singapore, and South Korea. Socialist nations are China, Laos, Myanmar, and Vietnam. A wide definition of nations affected by the Asian financial crisis has been adopted: Hong Kong, Indonesia, Laos, Malaysia, the Philippines, South Korea and Thailand.

**Table 4**

Macroeconomic measures.

	All countries					Developed nations				
	N	Mean	Std. dev.	Min	Max	N	Mean	Std. dev.	Min	Max
GDP per capita (USD)	15,099	13684.81	15986.18	223.6321	65842.85	4522	34203.6	10651.64	9847.377	65842.85
Change in GDP per capita (%)	15,099	8.477214	1.612821	5.410002	11.09503	4522	10.38048	0.369916	9.194961	11.09503
Log GDP per capita	15,099	8.967254	8.337791	–12.04248	59.42724	4522	5.121304	8.586508	–12.04248	30.74704
Inflation rate	15,260	3.926308	5.898798	–3.857802	109.6999	4522	0.956548	1.638879	–1.03325	4.890784
Macronim a	13,432	3.434164	2.048685	–2.49375	24.25	4504	2.228862	1.308038	0.984417	5.258333
Macronim b	9696	3.100381	2.859797	–13.27958	8.96125	4504	2.248967	0.893563	0.788211	4.983334
Macronim c	9956	2.688737	1.920134	–6.222917	19.15208	3164	2.050551	1.347422	1.154208	9.3375
Government effectiveness	16,350	65.83929	21.79429	2.392344	100	4845	88.99384	5.766522	64.39024	100
Regulatory quality	16,350	59.43895	24.39137	0	100	4845	84.17159	9.924736	61.76471	100
	Excluding socialist nations					Asian financial crisis affected nations				
	N	Mean	Std. dev.	Min	Max	N	Mean	Std. dev.	Min	Max
GDP per capita (USD)	11,831	16856.39	16674.73	281.3463	65842.85	5160	7726.286	9809.303	223.6321	35994.3
Change in GDP per capita (%)	11,831	8.790333	1.637508	5.639586	11.09503	5160	8.167422	1.250023	5.410002	10.49112
Log GDP per capita	11,831	7.355877	7.897563	–12.04248	34.07978	5160	9.383741	7.709309	–8.149001	29.02905
Inflation rate	11,872	3.872025	5.311806	–3.857802	39.4381	5166	5.740262	7.759509	–3.857802	109.6999
Macronim a	10,056	3.310239	1.776565	–2.49375	7.999583	5154	4.300647	2.64597	–2.49375	24.25
Macronim b	9696	3.100381	2.859797	–13.27958	8.96125	5082	4.050572	3.44685	–13.27958	8.96125
Macronim c	7280	2.610907	2.000394	–6.222917	9.3375	2634	3.474509	2.145372	–6	19.15208
Government effectiveness	12,720	70.03422	22.18179	13.17073	100	5535	62.21135	20.50874	10.2439	97.57282
Regulatory quality	12,720	65.66508	23.513	18.13725	100	5535	57.64416	22.69449	6.372549	100

Note: with the exception of Taiwan all macroeconomic data is sourced from the IMF International Financial statistics. Taiwanese data is sourced from either the website of the Central Bank of the Republic of China (interest rates) or the website of the National Statistics of the Republic of China (all other data). Macronim a is calculated as national lending – national deposit rate. Macronim b is calculated as national lending rate – national money market rate. Macronim c is calculated as national lending rate – national discount rate. Developed nations are all members of the OECD plus Singapore: Australia, Japan, New Zealand, Singapore, and South Korea. Socialist nations are China, Laos, Myanmar, and Vietnam. A wide definition of nations affected by the Asian financial crisis has been adopted: Hong Kong, Indonesia, Laos, Malaysia, the Philippines, South Korea and Thailand.

the log of individual bank assets and the log of assets squared will be included in the model to control for the size effects discussed in proposition 3 and any possible non linearities in this size effect.

As the banks in this study include a mix of listed and unlisted banks as well as nations with different levels of share market development, franchise value will be measured by the level of the individual bank's retail intensity. A bank has a number of choices when raising liabilities; it can raise funds via the domestic deposit market, or via the domestic capital market (both debt and equity), or alternatively it can source funds via the international capital markets. This study will argue that those banks which have higher levels of domestic deposits, as opposed to capital market raisings, have a higher franchise value due to both the infrastruc-

ture needed for such fund raising as well as the reputation capital associated with an effective domestic deposit base. Accordingly, franchise value will be measured by savings and current deposits divided by total assets. An alternative measure of franchise value is the investment an individual bank has made in the fixed assets it uses to carry out banking activity. Thus, the second measure of franchise value used in this study will be fixed assets divided by total assets.

The evolution of bank income toward an emphasis on non interest sources has also seen a structural change in bank risk, as discussed above. To measure this effect, total non interest operating income as a percent of total revenue will be used. The average of this figure for either two or four years will be used as appropriate

Table 5a

All Asian region nations two year IV fixed effect estimator.

	Range volatility ROAA	Range volatility ROAE	Asset quality	z score	Range volatility ROAA	Range volatility ROAE	Asset quality	z score
Equity to total assets (%)	−0.105	−0.195***	0.206***	0.0239**	0.00673	−0.197***	0.202***	0.0238**
Equity to total assets (%) squared	0.0005***	0.00033***	0.00094***	4.24e−05	0.00058***	0.00033***	0.00094***	4.20e−05
Franchise value (fixed assets to total assets)	2.910***	0.0785	0.963	−0.0981	0.191	0.0785	0.953*	−0.0966
Franchise value squared (Fixed assets to total assets)	−0.211***	0.0104	0.0283	0.0151*	−0.00623	0.0104	0.0284	0.0150*
Log total assets	−0.122	−0.215	0.308	0.130	−0.0789	−0.221	0.285	0.129
Log total assets squared	0.0157	0.000905	−0.0106	−0.00440	−0.00204	0.00105	−0.00990	−0.00437
Loan growth	−0.00137	−0.00260*	0.00645***	−0.000228	0.000395	−0.00271*	0.00646***	−0.000262
Loan growth squared	4.8e−06***	3.8e−06***	−5.6e−06***	−1.38e−07	1.37e−06	3.8e−06***	−5.6e−06***	−1.13e−07
Non interest income as a % of revenue	−0.000561	−0.00075**	−0.001**	−7.11e−05				
Non interest income as a % of revenue squared	4.3e−07***	3.8e−07***	4.7e−07***	1.11e−07**				
Government effectiveness	−0.0248	−0.0176	0.0720***	0.000776	0.00874	−0.0180	0.0738***	0.000751
Regulatory quality* equity to total assets	0.000903	0.00144***	−0.0034***	−0.000150	−0.000385	0.00146***	−0.0033***	−0.000149
Regulatory quality* Franchise value	−0.0247***	−0.000975	−0.0123**	0.000965	−0.00134	−0.000988	−0.0121**	0.000959
Regulatory quality* log total assets	0.00148	0.000555	0.00104	0.000158	0.000787	0.000543	0.000910	0.000157
GDP growth	0.0213**	0.0246***	0.00318	0.00777**	0.0172***	0.0252***	0.00256	0.00791***
Inflation Rate	−0.0699*	−0.0410*	0.0487	−0.00258	−0.0175	−0.0413*	0.0500	−0.00262
Log GDP per capita	−0.501	−0.138	−1.193***	−0.0212	−0.257**	−0.130	−1.187***	−0.0202
National loan rate – national deposit rate	−0.00906	0.0260	−0.115	0.0397***	0.117***	0.0257	−0.112	0.0397***
Year dummy 2000	0.504**	0.654***	1.241***	0.0510	0.388**	0.660***	1.246***	0.0507
Year dummy 2001	0.993***	1.335***	1.041***	0.278***	1.031***	1.345***	1.028***	0.279***
Year dummy 2002	0.837**	1.253***	1.031***	0.238***	1.029***	1.258***	1.016***	0.238***
Year dummy 2003	0.856***	0.805***	1.235***	0.0862	0.701***	0.805***	1.244***	0.0854
Year dummy 2004	0.413*	0.277*	0.780**	−0.0454	0.129	0.278*	0.782**	−0.0463
Year dummy 2005	0.354*	0.148	0.517***	−0.0181	0.0219	0.153	0.522***	−0.0177
Year dummy 2006	0.577***	0.395***	0.0829	0.0572	0.184	0.402***	0.0902	0.0578
Year dummy 2007	0.600***	0.413**	−0.144	0.0496	0.335**	0.411***	−0.143	0.0490
Year dummy 2008	1.333***	1.057***	−0.104	0.159***	1.053***	1.050***	−0.0851	0.156***
Year dummy 2009	1.059***	1.074***	−0.0848	0.136***	0.861***	1.084***	−0.0637	0.137***
Year dummy 2010	0.260*	0.148	0.171	0.00760	0.164	0.147	0.171	0.00738
Year dummy 2011	0.111	0.0123	0.0263	−0.0401	0.0459	0.00935	0.0271	−0.0409
Revenue concentration					4.80e−07**	5.52e−07**	−4.15e−07	1.26e−07
Revenue concentration squared					−1.60e−14*	−2.02e−14**	2.18e−14*	−4.27e−15
Constant	−0.561	6.176**	4.783	−1.674*	−0.0282	6.202**	4.928	−1.671*
Observations	2,942	2,942	2,942	2,942	2,942	2,942	2,942	2,942
Number of banks	475	475	475	475	475	475	475	475
Overall R <sup>2</sup>	0.0197	0.156	0.104	0.0820	0.154	0.155	0.105	0.0822
Within R <sup>2</sup>	0.117	0.155	0.151	0.0380	0.128	0.156	0.150	0.0390
Wald test	6298	556.0	479.4	203.6	465.3	547.7	471.6	201.6

\*  $p < 0.1$ .\*\*  $p < 0.05$ .\*\*\*  $p < 0.01$ .

for the dependent variable. Proposition 5 argues that there is a non linear relationship between loan growth and bank risk. Loan growth will be measured by the change in gross loans over either two or four years, again as appropriate for the dependent variable being employed. Bank specialisation will be measured by an index of revenue concentration<sup>15</sup> over either a two or four year period as appropriate (Table 3).

The World Governance Index from the World Bank provides six measures of different dimensions of national governance (Kaufmann et al., 2010). As this paper is focussed upon the impact of regulation upon bank risk, two of these six measures will be employed; (i) government effectiveness and (ii) regulatory quality.<sup>16</sup> The World

Governance Index defines government effectiveness as “perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government’s commitment to such policies.”<sup>17</sup> Regulatory quality is defined as: “perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.”<sup>18</sup> This study will employ the index based measures provided by the World Governance Index which ranks each nation on a scale from 0 (lowest) to 100 (highest) for each of the chosen measures.<sup>19</sup>

To control for differences in macroeconomic conditions four measures of economic performance will be used. The log of GDP

<sup>15</sup> The Herfindahl index of revenue concentration will be calculated by considering bank revenue has two components (i) interest revenue and (ii) non interest revenue. Data availability and disclosure issues prevented implementation of further categories of bank revenue.

<sup>16</sup> The other measures consider (a) voice and accountability, (b) political stability and the absence of violence, (c) rule of law and (d) control of corruption. The two measures used in this study were chosen as they are most aligned to the theoretical propositions applied here. As pointed out by Kaufmann et al. (2010) these constructs tend to be highly correlated with each other.

<sup>17</sup> See <http://info.worldbank.org/governance/wgi/pdf/ge.pdf> accessed 10 February 2014.

<sup>18</sup> See <http://info.worldbank.org/governance/wgi/pdf/rq.pdf> accessed 10 February 2014.

<sup>19</sup> Between 1996 and 2002 the World Governance Index was calculated bi-annually, so the averages of the previous and subsequent year were used for 1997, 1999 and 2001.

**Table 5b**

Estimates of marginal effects at sample specific means for two year model estimated using fixed effect instrumental variable estimators.

	Range volatility ROAA	Range volatility ROAE	Asset Quality	z score	Range volatility ROAA	Range volatility ROAE	Asset Quality	z score
<i>Regulatory quality</i>								
Main effect	−0.0248	−0.0176	0.0720	0.0008	0.0087	−0.0180	0.0738	0.0008
Equity to total assets	0.0065	0.0103	−0.0242	−0.0011	−0.0028	0.0104	−0.0239	−0.0011
Franchise value	−0.0347	−0.0014	−0.0173	0.0014	−0.0019	−0.0014	−0.0170	0.0013
Log total assets	0.0244	0.0092	0.0171	0.0026	0.0130	0.0090	0.0150	0.0026
Total	−0.0286	0.0005	0.0477	0.0037	0.0171	0.0000	0.0479	0.0036
<i>Equity to total assets</i>								
Main effect	−0.1050	−0.1950	0.2060	0.0239	0.0067	−0.1970	0.2020	0.0238
Square term	0.0071	0.0047	0.0134	0.0006	0.0082	0.0047	0.0134	0.0006
Regulatory quality	0.0704	0.1122	−0.2634	−0.0117	−0.0300	0.1138	−0.2603	−0.0116
Total	−0.0275	−0.0781	−0.0440	0.0128	−0.0150	−0.0786	−0.0449	0.0128
<i>Franchise value</i>								
Main effect	2.9100	0.0785	0.9630	−0.0981	0.1910	0.0785	0.9530	−0.0966
Squared term	−0.5926	0.0292	0.0795	0.0424	−0.0175	0.0292	0.0798	0.0421
Regulatory quality	−1.9248	−0.0760	−0.9585	0.0752	−0.1044	−0.0770	−0.9429	0.0747
Total	0.3925	0.0317	0.0840	0.0195	0.0691	0.0307	0.0898	0.0203
<i>Log (total assets)</i>								
Main effect	−0.1220	−0.2150	0.3080	0.1300	−0.0789	−0.2210	0.2850	0.1290
Squared term	0.5177	0.0298	−0.3495	−0.1451	−0.0673	0.0346	−0.3265	−0.1441
Regulatory quality	0.1153	0.0433	0.0810	0.0123	0.0613	0.0423	0.0709	0.0122
Total	0.5110	−0.1419	0.0395	−0.0028	−0.0848	−0.1441	0.0295	−0.0029

Countries in sample: Australia, Brunei, China, Hong Kong, Indonesia, Japan, Malaysia, New Zealand, Philippines, Singapore, South Korea, Sri Lanka, Thailand, Taiwan, Vietnam.

per capita and growth of GDP per capital will control for differences in financial system development and economic cycle effects (Cole et al., 2008; Sturm and Williams, 2010; Athanasoglou et al., 2008). Additionally, as inflation has also been found to have a role in bank profit determination (Athanasoglou et al., 2008), national changes in the consumer price index will be included in the model. As a final control, a national measure of the cost of providing intermediation services will be included. This is measured as the national lending rate minus the national deposit rate.<sup>20</sup> This measure will control for differences in national banking systems due to differences in regulation, cost of delivery of financial products and national levels of banking risk.<sup>21</sup> Table 4 summarises the macroeconomic and governance measures used in this study.

Thus the model that will be estimated to test the propositions stated above is:

$$\begin{aligned}
 \text{Bank Risk} = & \alpha + \beta_1 \text{Equity} + \beta_2 \text{Equity}^2 + \beta_3 \text{Franchise Value} \\
 & + \beta_4 \text{Franchise Value}^2 + \beta_5 \text{Log Total Assets} \\
 & + \beta_6 \text{Log Total Assets}^2 + \beta_7 \text{Loan Growth} \\
 & + \beta_8 \text{Loan Growth}^2 + \beta_9 \text{Revenue Composition} \\
 & + \beta_{10} \text{Revenue Composition}^2 \\
 & + \beta_{11} \text{National Governance} \\
 & + \beta_{12} \text{National Governance} * \text{Equity} \\
 & + \beta_{13} \text{National Governance} * \text{Franchise Value} \\
 & + \beta_{14} \text{National Governance} * \text{log Total Assets} \\
 & + \beta_{15} \text{GDP Growth} + \beta_{16} \text{Inflation Rate} \\
 & + \beta_{17} \text{Log GDP per Capita} \\
 & + \beta_{18} \text{National Cost of Intermediation} + \varepsilon_{it} \quad (2)
 \end{aligned}$$

<sup>20</sup> There is some inconsistency in national reporting of this data in the IMF IFS, so the national money market rate and the national discount rate have also been considered as a measure of the national cost of funds.

<sup>21</sup> As discussed by Ho and Saunders (1981), net interest margins reflect a number of factors including interest rate volatility, the risks associated with delivering intermediary services and risk aversion. By employing a national measure of net interest margins, systematic national differences in these factors will be controlled for.

## 4. Results

### 4.1. Full sample results

The results for the full sample model is shown in Tables 5a–d. Including the national governance quality variable (government effectiveness or regulatory quality) in the same model as the same national governance variable interacted with capital holding (or franchise value, or bank size) induced multicollinearity. Accordingly, government effectiveness was used to represent the main effect of national governance, while regulatory quality was interacted with the necessary variable to determine any second order effects.

Of particular note for this paper is the impact of national governance. The main effect of national governance was found to be associated with increased loan impairment, opposite to the initial expectation. As the model of bank risk includes both a main effect and interaction effects, the overall impact of national governance must allow for the marginal contribution of national regulatory quality.<sup>22</sup> The second panel in Tables 5a–d (and the following tables) allow for these marginal effects by taking the first derivative of each estimated model with respect to the relevant variable. The marginal contribution of the interaction variable will depend on the levels of those variables. In each case the marginal contributions of the variables in terms of risk reduction were evaluated at the means as relevant to the specific sample used in that estimation. For both the short and long term cases, improved national regulatory quality, after controlling for interaction effects, results in increased loan impairment charges. Overall, these results do not support the argument that national improvements in governance quality will be reflected in lower bank level risk.

The results for bank equity holdings are supportive of a U-shaped relationship for both the short run (two year) and long run (four year) models, in that increased bank holdings of capital will initially result in lower bank risk, followed by risk increases as capital levels increase. However, the marginal impact of improved national governance upon equity holdings results in some risk seeking at the margins, especially in the short run for

<sup>22</sup> See for example Greene (2008).



Table 5c

Four year model instrumental variable fixed effect estimators.

	Range volatility ROAA	Range volatility ROAE	Asset Quality	z score	Range volatility ROAA	Range volatility ROAE	Asset Quality	z score
Equity to total assets (%)	−0.161***	−0.415***	0.269***	−0.0106	−0.160***	−0.415***	0.300***	−0.0107
Equity to total assets (%) squared	0.00554***	0.00706***	0.00308***	0.000235	0.00550***	0.00704***	0.00293***	0.000224
Franchise Value (Fixed assets to total assets)	0.204	−0.0191	−1.537***	−0.00937	0.214	−0.0119	−1.430***	−0.00530
Franchise value squared (Fixed assets to total assets)	0.00894	0.0341	0.0875	0.00233	0.00788	0.0334	0.0781	0.00188
Log total assets	0.217	−0.0801	−2.423***	0.0217	0.211	−0.0849	−2.238***	0.0189
Log Total assets squared	−0.0120	−0.00370	0.0659**	−0.00151	−0.0118	−0.00363	0.0607**	−0.00144
Loan growth	−9.46e−05	−0.000508	−0.00140*	−0.000188	−0.000236	−0.000621	−0.00102	−0.000242*
Loan growth squared	8.45e−08	1.99e−07	8.3e−07**	7.67e−08	1.32e−07	2.36e−07	6.97e−07**	9.53e−08*
Non interest income as a % of revenue	−0.000306	−0.000530	−0.000770	−8.50e−05				
Non interest income as a % of revenue squared	1.2e−06***	1.4e−06***	7.98e−07*	3.5e−07***				
Government effectiveness	0.00412	−0.00454	0.0895***	−0.000412	0.00390	−0.00488	0.0908***	−0.000483
Regulatory quality* equity to total assets	−0.000102	0.00148***	−0.0057***	8.59e−05	−0.000100	0.00149***	−0.006***	9.07e−05
Regulatory quality* Franchise value	−0.00235	−0.000773	0.0155***	0.000204	−0.00240	−0.000822	0.0144***	0.000185
Regulatory quality* log total assets	0.00146***	0.000899*	0.000922	0.000187*	0.00146***	0.000896*	0.00103	0.000184*
GDP growth	0.0295***	0.0314***	0.00608	0.00612***	0.0310***	0.0328***	0.00391	0.00668***
Inflation rate	−0.0541**	−0.0475**	0.00327	−0.00445	−0.0543**	−0.0479**	0.0111	−0.00448
Log GDP per capita	−0.430***	−0.449***	−2.027***	−0.0558**	−0.423***	−0.440***	−1.996***	−0.0532**
National loan rate – national deposit rate	0.137***	0.0541	−0.216**	0.0212**	0.136***	0.0535	−0.212**	0.0211**
Year dummy 2002	1.052***	1.247***	1.469***	0.219***	1.052***	1.250***	1.500***	0.219***
Year dummy 2003	0.748***	0.897***	0.889***	0.175***	0.755***	0.905***	0.914***	0.177***
Year dummy 2004	0.600***	0.704***	0.528***	0.133***	0.602***	0.709***	0.524***	0.133***
Year dummy 2005	0.257***	0.276***	0.470***	0.0488**	0.256***	0.277***	0.511***	0.0482**
Year dummy 2006	−0.0202	−0.00785	0.0323	−0.00372	−0.0208	−0.00556	0.0562	−0.00412
Year dummy 2007	0.173*	0.198**	−0.146	0.0392*	0.175*	0.201**	−0.133	0.0398*
Year dummy 2008	0.717***	0.752***	−0.190	0.146***	0.715***	0.752***	−0.177	0.145***
Year dummy 2009	0.702***	0.754***	−0.166	0.145***	0.698***	0.751***	−0.154	0.143***
Year dummy 2010	0.555***	0.634***	−0.210*	0.106***	0.547***	0.628***	−0.199*	0.103***
Year dummy 2011	0.488***	0.570***	−0.167*	0.103***	0.486***	0.572***	−0.159	0.102***
Revenue concentration					6.31e−07**	6.38e−07**	−5.27e−07	2.1e−07***
Revenue concentration squared					−4.24e−14*	−4.20e−14*	5.01e−14	−1.45e−14***
Constant	0.918	9.014***	37.48***	0.0905	0.907	9.005***	35.22***	0.0919
Observations	2,045	2,045	2,045	2,045	2,045	2,045	2,035	2,045
Number of banks	344	344	344	344	344	344	344	344
Overall R <sup>2</sup>	0.239	0.274	0.173	0.176	0.238	0.274	0.170	0.177
Within R <sup>2</sup>	0.224	0.255	0.333	0.145	0.227	0.256	0.328	0.150
Wald test	594.7	766.3	766.3	386.5	579.6	746.3	752.8	372.5

\*\*\*  $p < 0.01$ .\*\*  $p < 0.05$ .\*  $p < 0.1$ .

revenue volatility, with risk reductions also being observed for asset quality. The implication of these results is that as bank capital holding increases past a critical point then bank risk also increases, consistent with [Koehn and Santomero \(1980\)](#) and [Blum \(1999\)](#). Both of these authors argue that requiring banks to hold higher levels of expensive capital as an input results in banks investing in higher risk assets to earn the correspondingly higher required rate of return on capital. It is noticeable that improvements in national governance will not offset this increased risk seeking, indicating that it is likely that the risk reducing impact of bank capital regulations are close to satiation. Following the arguments of [Shrieves and Dahl \(1992\)](#), increased bank capital is resulting in banks investing in higher risk projects. The marginal impact of banks increasing capital when evaluated at the average level of capital holding is a marginal reduction of bank risk at the bank level in both the short and longer term. However, large increases in bank capital are likely to result in increased bank risk as the quadratic and governance effects start to dominate the first order impact of risk reduction.

These results are intuitive in that banks with low levels of capital are more likely to adopt higher risk profiles due to their

proximity to default. Following [Calem and Rob \(1999\)](#) and [Kwan and Eisenbeis \(1997\)](#), adopting higher risk projects presents bank management with a possibility of earning a higher return which will potentially resolve the problems associated with proximity to financial distress. However, as capital holdings increase, this morally hazardous incentive (from a regulatory perspective) reduces. As discussed above, high levels of capital results in an alternative risk-seeking incentive for bank management, to earn a rate of return from assets sufficient to reward equity investors with an acceptable risk-adjusted rate of return. This again results in banks adopting higher risk profiles, but due to a different incentive set. The important policy implication of these results is that requiring banks (especially Asian region banks) to hold markedly increased capital as compared to the current levels of capital holdings is likely to result in banks increasing the risk profile of their portfolios as opposed to the preferred outcome of lower bank-level risk.

Increased franchise value was found to have some risk increasing properties in the short run, but this is less apparent in the long run. It is argued that the negative externalities associated with incumbency (as measured by franchise value) result in some short

**Table 5d**

Estimates of marginal effects at sample specific means for four year model estimated using fixed effects instrumental variables estimator.

	Range volatility ROAA	Range volatility ROAE	Asset quality	z score	Range volatility ROAA	Range volatility ROAE	Asset quality	z score
<i>Regulatory quality</i>								
Main effect	0.0041	−0.0045	0.0895	−0.0004	0.0039	−0.0049	0.0908	−0.0005
Equity to total assets	−0.0007	0.0098	−0.0375	0.0006	−0.0007	0.0099	−0.0395	0.0006
Franchise value	−0.0034	−0.0011	0.0227	0.0003	−0.0035	−0.0012	0.0211	0.0003
Log total assets	0.0243	0.0150	0.0153	0.0031	0.0243	0.0149	0.0171	0.0031
Total	0.0243	0.0191	0.0901	0.0036	0.0240	0.0187	0.0896	0.0035
<i>Equity to total assets</i>								
Main effect	−0.1610	−0.4150	0.2690	−0.0106	−0.1600	−0.4150	0.3000	−0.0107
Square term	0.0733	0.0935	0.0408	0.0031	0.0728	0.0932	0.0388	0.0030
Regulatory quality	−0.0082	0.1190	−0.4552	0.0069	−0.0080	0.1198	−0.4793	0.0073
Total	−0.0959	−0.2025	−0.1454	−0.0006	−0.0952	−0.2020	−0.1405	−0.0004
<i>Franchise value</i>								
Main effect	0.2040	−0.0191	−1.5370	−0.0094	0.2140	−0.0119	−1.4300	−0.0053
Squared term	0.0262	0.0998	0.2560	0.0068	0.0231	0.0977	0.2285	0.0055
Regulatory quality	−0.1890	−0.0622	1.2465	0.0164	−0.1930	−0.0661	1.1581	0.0149
Total	0.0412	0.0185	−0.0345	0.0139	0.0440	0.0197	−0.0435	0.0151
<i>Log (total assets)</i>								
Main effect	0.2170	−0.0801	−2.4230	0.0217	0.2110	−0.0849	−2.2380	0.0189
Squared term	−0.3995	−0.1232	2.1939	−0.0503	−0.3928	−0.1208	2.0208	−0.0479
Regulatory quality	0.1174	0.0723	0.0741	0.0150	0.1174	0.0721	0.0828	0.0148
Total	−0.0651	−0.1310	−0.1549	−0.0135	−0.0644	−0.1337	−0.1344	−0.0142

run bank risk seeking. It is notable that improved national governance can reduce this morally hazardous risk seeking at the margins, but the overall impact of increased bank franchise value is risk increasing when evaluated at the average level of bank franchise value in Asia.

In the short and long run bank size has no relationship with bank risk. No evidence is found that improved national governance will offset increased risk seeking due to size. The short run relationship between bank loan growth and risk is somewhat mixed, with the results both supporting and rejecting the arguments of Kwan and Eisenbeis (1997) that there is a U-shaped relationship between bank risk and loan growth, depending on the risk measure considered. Bank asset quality demonstrates an inverse U-shaped relationship, in that increases in loan growth are associated with increased loan risk, but at a decreasing rate. In the short run revenue volatility is increased by loan growth squared, indicating that above average levels of loan growth will increase bank risk. In the long run the results somewhat reflect the arguments of Kwan and Eisenbeis (1997), for volatility of ROAE, but the inverse U-shaped relationship between loan growth and asset quality remains.

The impact of non interest income upon bank risk in Asia suggests that noninterest income has a U-shaped relationship with bank risk, in that low to medium levels of non interest income are risk reducing (suggestive of portfolio diversification effects), while higher levels of non interest income is risk increasing (suggesting information asymmetry and moral hazard). This is somewhat supportive of the loss leader arguments of Lepetit et al. (2008b), in that banks are inefficiently sacrificing loan quality in the expectation of increased non interest income.<sup>23</sup> Increased revenue concentration is associated with lower bank risk at a decreasing rate, suggesting that specialisation results in lower risk. However, while statistically significant, the economic value of this effect is small.<sup>24</sup>

The macroeconomic controls provide some slightly mixed outcomes as compared with *a priori* expectations. We would expect that

positive economic circumstance such as GDP per capita and GDP growth would be associated with lower bank risk. This is due to the positive impact these economic circumstances have on financial sector development, such as access to risk management techniques<sup>25</sup> as well as increased availability of the necessary skill base to measure and manage risk. This argument is confirmed for GDP per capita especially for the longer run model. However, increased economic growth is found to be associated with increased bank risk,<sup>26</sup> contrary to Lee and Hsieh (2013). It should be noted that Lee and Hsieh (2013) used different estimators of bank risk. Furthermore, it is likely that the source of GDP growth is an important factor in this relationship. Higher GDP growth driven by high levels of speculative bank-funded lending is more likely to increase bank risk (especially if funded by large external short-term debts (Reinhart and Rogoff, 2009)). In contrast, GDP growth driven by investment in productive industries is more likely to be risk reducing in the long run.<sup>27</sup> This outcome provides a macroeconomic perspective to the arguments of Kwan and Eisenbeis (1997), that high loan growth is associated with increased bank risk. These results indicate that nations with higher economic growth can expect increased problems with individual bank asset quality and revenue volatility.

Negative economic circumstances, such as inflation and higher country level net interest margins have a mixed relationship with bank risk. In the short run these relationships are somewhat mixed, in that inflation is found to have no relationship with bank risk, while higher levels of national net interest margins are risk increasing in some cases. Higher national cost of intermediation services, as measured by the differences between the national loan and money market rates<sup>28</sup>, seems to have the beneficial impact of producing a quality rationing effect in terms of bank loans in the longer run. This may indicate that nations with higher costs of intermediation services are more effective in screening loans and allocating scarce resources at the bank level and so have fewer loan

<sup>25</sup> It is argued that more advanced financial systems have the market liquidity and range of sophisticated products necessary for complex risk management.

<sup>26</sup> Including GDP growth squared into the model did not change this conclusion and tended to induce multicollinearity with other macroeconomic variables.

<sup>27</sup> I am indebted to an anonymous referee for his or her valuable comments on this point.

<sup>28</sup> The national money market rate was used in the presented estimations as it was available for a wider range of nations and showed lower evidence of multicollinearity with the other macroeconomic variables used in the models.

<sup>23</sup> The results are suggestive of the argument that banks in Asia are seeking to use market based solutions to shift risky loans off their balance sheet. A focussed study considering this issue would make a valuable contribution to policy formulation.

<sup>24</sup> This relationship would be worth exploring in more detail within the context of a single nation study.

Table 6a

Asian region nations without socialist economies instrumental variable Fixed Effects estimators.

	Two year				Four year			
	Range volatility ROAA	Range volatility ROAE	Asset quality	z score	Range volatility ROAA	Range volatility ROAE	Asset quality	z score
Equity to total assets (%)	−0.287**	−0.481***	0.119	−0.00732	−0.323***	−0.628***	0.272**	−0.0457***
Equity to total assets (%) squared	0.000389**	0.000135	0.000960***	3.42e−05	0.00660***	0.00795***	0.00376***	0.00048***
Franchise value (fixed assets to total assets)	3.626***	−0.0549	2.176***	−0.213*	0.489	−0.0159	−1.283**	−0.00460
Franchise Value squared (fixed assets to total assets)	−0.265***	0.0189	−0.0698	0.0252**	−0.0178	0.0312	0.0595	0.00159
Log total assets	−0.738	−1.347***	1.191	0.0197	0.0485	−0.535	−0.711	−0.0230
Log total assets squared	0.0226	0.0383***	−0.0438	−3.53e−05	−0.00640	0.0129	0.0116	0.000295
Loan growth	−0.00172	−0.00225	0.00703***	−4.24e−06	0.000474	−0.000282	−0.000903	−0.000114
Loan growth squared	6.1e−06***	5.1e−06***	−4.71e−06**	−1.70e−07	−9.62e−08	1.57e−07	6.70e−07*	5.63e−08
Non interest income as a % of revenue	−0.000542	−0.00070*	−0.00101*	−7.12e−05	−0.000270	−0.000499	−0.000743	−8.18e−05
Non interest income as a % of revenue squared	4.2e−07***	3.52e−07**	4.70e−07***	1.05e−07*	1.2e−06***	1.3e−06***	7.28e−07*	3.4e−07***
Government effectiveness	−0.0603**	−0.0310**	0.0917***	0.000355	−0.00498	−0.0120	0.0839***	−0.00164
Regulatory quality* equity to total assets	0.00288**	0.0046***	−0.00230*	0.000195	0.00152**	0.00372***	−0.0058***	0.00043***
Regulatory quality* Franchise value	−0.0301***	5.56e−05	−0.0226***	0.00187*	−0.00482*	−0.000827	0.0129**	0.000154
Regulatory quality* log total assets	0.00149	−0.000934	0.00226*	−0.000185	0.00150**	−4.50e−05	0.00226*	8.63e−05
GDP growth	0.0312***	0.0363***	0.0149*	0.0126***	0.0485***	0.0499***	0.0343***	0.0105***
Inflation rate	−0.175***	−0.101***	−0.123**	−0.0206	−0.133***	−0.109***	−0.120*	−0.0185**
Log GDP per capita	−0.536	−0.227*	−2.452***	−0.0395	−0.665***	−0.607***	−3.038***	−0.0991***
National loan rate – national deposit rate	−0.0378	0.0547	−0.213**	0.0466***	0.121**	0.0511	−0.322***	0.0179
Year dummy 2000	0.0304	0.472***	1.045***	−0.000177				
Year dummy 2001	0.484	1.183***	0.818***	0.262**				
Year dummy 2002	0.176	0.928***	0.683***	0.161**	1.176***	1.203***	1.741***	0.235***
Year dummy 2003	0.288	0.532**	0.801***	−0.0107	0.812***	0.925***	0.886***	0.189***
Year dummy 2004	0.0418	0.0852	0.516**	−0.117*	0.643***	0.717***	0.446**	0.140***
Year dummy 2005	0.0693	0.132	0.366*	−0.0146	0.306**	0.317**	0.339*	0.0606**
Year dummy 2006	0.373	0.394**	−0.142	0.0679	0.0851	0.0680	−0.000517	0.0183
Year dummy 2007	0.240	0.338**	−0.396*	0.00486	0.309***	0.310***	−0.102	0.0683***
Year dummy 2008	1.138***	1.056***	−0.187	0.139*	0.824***	0.845***	−0.204	0.166***
Year dummy 2009	0.832***	1.009***	−0.132	0.104*	0.775***	0.800***	−0.200*	0.157***
Year dummy 2010	−0.0817	−0.0829	−0.0379	−0.0924	0.601**	0.631**	−0.269**	0.109**
Year dummy 2011	−0.166	−0.142	0.0706	−0.127**	0.562***	0.590***	−0.0932	0.114***
Constant	11.51	18.99***	9.056	−0.283	5.321	15.61***	33.40***	1.034
Observations	2,522	2,522	2,522	2,522	1,844	1,844	1,844	1,844
Number of banks	358	358	358	358	275	275	275	275
Overall R <sup>2</sup>	0.0612	0.148	0.146	0.0756	0.255	0.289	0.245	0.193
Within R <sup>2</sup>	0.117	0.154	0.180	0.0384	0.242	0.255	0.386	0.159
Wald test	5217	531.6	521.6	174.7	609.2	751.7	846.1	397.7

\*\*\*  $p < 0.01$ .\*\*  $p < 0.05$ .\*  $p < 0.1$ .

defaults. It is currently unclear if this outcome has a second order effect of seeing lower quality loans move to a different portion of the financial system, such as the shadow banking sector, as suggested by the negative relationship found between non interest income and loan quality. As expected, higher national costs of intermediation are associated with increased revenue volatility, consistent with the [Ho and Saunders \(1981\)](#) model of bank net interest margins.

#### 4.2. Robustness tests

As the focus of this paper is upon the impact of national level governance upon bank level risk in the Asian region, the first issue to be considered is the potential impact of national level differences in governance and legal structures. Several nations in the sample are considered to operate as socialist rather than capitalist economies (China, Laos, Myanmar, and Vietnam), and it is possible this difference has caused a systematic bias in the estimated coefficients shown in [Tables 5a–d](#). Accordingly, the models shown in [Tables 5a–d](#) were re-estimated without the socialist nations, with

the results shown in [Tables 6a and b](#). In order to focus upon the key issues of interest to this paper, the results including the revenue concentration measure will no longer be shown, as these remained positive and statistically significant in the longer run, but economically small. Importantly, this stratification provided some clarity to the issue of the effect of national governance upon bank level risk. In particular, improved national governance now has the impact of reducing short term bank revenue volatility, but the morally hazardous reduction in bank loan quality (increased impaired assets) remains apparent in both the short and longer run. This moral hazard result is reinforced by the results for the interaction variables, which indicate that increased national governance interacts with franchise value, equity holdings and bank size to result in increased risk seeking at the bank level, especially in the long run.

The sample in this study includes a mix of both developed and developing nations. It is possible that developed nations banking systems have a different risk pattern as compared to banks in developing nations. [Tables 7a and b](#) shows the results of the model estimated for the sub-sample of regional developed nations (OECD

**Table 6b**

Estimates of marginal effects at sample specific means for two and four year models estimated using instrumental variable fixed effects estimators.

	Two year				Four year			
	Range volatility ROAA	Range volatility ROAE	Asset quality	z score	Range volatility ROAA	Range volatility ROAE	Asset quality	z score
<i>Regulatory quality</i>								
Main effect	−0.0603	−0.0310	0.0917	0.0004	−0.0050	−0.0120	0.0839	−0.0016
Equity to total assets	0.0204	0.0323	−0.0163	0.0014	0.0100	0.0244	−0.0378	0.0028
Franchise value	−0.0450	0.0001	−0.0338	0.0028	−0.0073	−0.0013	0.0196	0.0002
Log total assets	0.0245	−0.0154	0.0372	−0.0030	0.0249	−0.0007	0.0375	0.0014
Total	−0.0604	−0.0140	0.0788	0.0015	0.0226	0.0104	0.1033	0.0029
<i>Equity to total assets</i>								
Main effect	−0.2870	−0.4810	0.1190	−0.0073	−0.3230	−0.6280	0.2720	−0.0457
Square term	0.0055	0.0019	0.0136	0.0005	0.0867	0.1044	0.0494	0.0063
Regulatory quality	0.2343	0.3709	−0.1871	0.0159	0.1261	0.3085	−0.4777	0.0360
Total	−0.0472	−0.1081	−0.0545	0.0090	−0.1103	−0.2151	−0.1563	−0.0034
<i>Franchise value</i>								
Main effect	3.6260	−0.0549	2.1760	−0.2130	0.4890	−0.0159	−1.2830	−0.0046
Squared term	−0.7924	0.0565	−0.2087	0.0753	−0.0542	0.0950	0.1813	0.0048
Regulatory Quality	−2.4486	0.0045	−1.8385	0.1521	−0.3997	−0.0686	1.0699	0.0128
Total	0.3851	0.0061	0.1288	0.0145	0.0350	0.0106	−0.0319	0.0130
<i>Log (total assets)</i>								
Main effect	−0.7380	−1.3470	1.1910	0.0197	0.0485	−0.5350	−0.7110	−0.0230
Squared term	0.7443	1.2614	−1.4426	−0.0012	−0.2126	0.4286	0.3854	0.0098
Regulatory quality	0.1212	−0.0760	0.1838	−0.0150	0.1244	−0.0037	0.1874	0.0072
Total	0.1276	−0.1615	−0.0677	0.0035	−0.0397	−0.1102	−0.1382	−0.0060

Note socialist nations of China, Laos, Myanmar and Vietnam excluded to determine if socialist economic systems impact upon governance results. Countries in sample: Australia, Brunei, Hong Kong, Indonesia, Japan, Malaysia, New Zealand, Philippines, Singapore, South Korea, Sri Lanka, Thailand, Taiwan.

members plus Singapore). It is worth noting that the majority of developed nations in the Asia regions have English origin legal systems or legal systems with an arguably substantial English-origin influence, thus when considering these results it should be borne in mind these results could reflect the impact of either (i) developed nation status or (ii) English origin legal systems.<sup>29</sup>

The developed nation results show an important point of departure from the previous results, in that increases in national governance now has the expected relationship with bank-level risk. In the short run this relationship is only apparent for the volatility of return on average assets, but in the long run it is apparent for all risk measures with the exception of asset quality. Further, the previous morally hazardous increase in bank-level loan risk is no longer apparent. In contrast to the previous results, improved national governance now has an additional risk reducing impact on bank level risk by interacting with size and franchise value. Those banks with higher franchise values are more likely to respond to increased national governance by adopting lower risk profiles, especially in the short run. It is particularly notable that improvements in national governance now interact with size effects to result in lower bank risk. This result is suggestive that the increased regulatory intensiveness imposed upon large banks in developed nations (due to too big to fail effects) has the beneficial impact (from a regulatory perspective) of lower risk for larger banks. Given the current debate regarding the issue of too big to fail in both developed and developing nations (Kaufman, 2014), the relationship between bank size and risk is an important one. It is found that increases in size are accompanied by increased bank risk, supporting the existence of too big to fail effects resulting in increased bank risk. The marginal analysis indicates that the overall impact of size increases are risk increasing. As discussed

previously, improved national governance can partially, but not fully, offset this increased risk seeking incentive.

The previous U-shaped relationship between bank risk and equity holdings is not apparent for this sub-sample, with the estimations suggesting that the non linear impact of capital holdings reinforces the risk reducing attributes of equity holdings. However, it is also notable that improved regulatory quality will result in increased risk seeking as capital holdings increase, suggesting that the previous U-shaped relationship now may be reflected in the regulatory quality channel rather than via the quadratic term. When evaluated at the sample means, increased capital requirements will result in lower bank level risk, but the results do confirm the previous outcome; that continuously increasing required bank capital holding will not continuously reduce bank-level risk.

A distinctive feature of the Asian banking system is the experience of the Asian financial crisis of 1997. A sub-sample of banks from the Asian financial crisis nations was analysed and the results shown in Tables 8a and b. A wider definition of affected nations is applied, thus in addition to the five most affected nations of Indonesia, South Korea, the Philippines, Thailand and Malaysia (Radelet and Sachs, 2000)<sup>30</sup>; Laos and Hong Kong are also included in this sub-sample.<sup>31</sup> Improved national governance has no impact upon bank risk in the short run. However, improvements in national governance are associated with lower bank revenue volatility in the longer run. The reform process in these nations after the AFC is reflected in improvements in both government effectiveness and regulatory quality as measured by the World Governance Index. Thus, these changes were not simply introduction of new laws and regulations but were accompanied by perceptions of improved national governance. It is worth noting that the interaction effects support the existence of a morally hazardous too big to fail effect

<sup>29</sup> It is argued that Japan, classified by La Porta et al. (1998) as having a German origin legal system has a substantial American influence in the regulation of its banking system. Hoshi and Kashyap (2000) argue that Japanese banking regulations have been converging toward the US model since the late 1940s.

<sup>30</sup> Thailand, Indonesia, South Korea and the Philippines all received IMF aid programs, while Malaysia, Laos and Hong Kong were all affected by contagion effects.

<sup>31</sup> Sub samples applying narrower definitions of AFC affected nations were also analysed with results substantially the same as those for the wider sample.



Table 7a

Region developed nations instrumental variables fixed effects estimators.

	Two year model				Four year model			
	Range volatility ROAA	Range volatility ROAE	Asset Quality	z score	Range volatility ROAA	Range volatility ROAE	Asset Quality	z score
Equity to total assets (%)	−6.113***	−3.931***	−2.196***	−0.454***	−9.621***	−11.56***	−0.676	−1.950***
Equity to total assets (%) squared	−0.0021***	−0.0024***	−0.0011***	−0.0002***	−0.009***	−0.0187***	0.0266***	−0.004***
Franchise value (fixed assets to total assets)	6.162**	1.692	0.746	1.073*	2.195*	1.542	−0.785	0.317
Franchise Value squared (Fixed assets to total assets)	−0.464***	−0.153**	−0.0102	0.00387	0.0238	0.0453	−0.0766	0.00298
Log Total assets	3.673	3.323***	2.755***	0.595**	4.635***	5.152***	1.037	0.885***
Log total assets squared	−0.0819	−0.0684***	−0.0630**	−0.0139**	−0.0909***	−0.0971***	−0.0178	−0.0166***
Loan growth	−0.00632	−0.00795*	−0.0525***	−0.0047***	0.00470	0.00536***	0.00200	0.000753*
Loan growth squared	1.69e−05	5.8e−05***	0.00038***	1.9e−05***	−1.10e−06*	−1.18e−06	5.21e−07	−1.48e−07
Non interest income as a % of revenue	6.19e−05	−0.000371	−0.0012***	1.65e−05	−0.000314	−0.000422	−0.00119***	−4.93e−05
Non interest income as a % of revenue squared	2.36e−07	2.20e−07	4.9e−07***	6.92e−08	9.09e−07*	9.98e−07*	1.1e−06***	2.53e−07**
Government effectiveness	−0.178	−0.188**	−0.138*	−0.0235	−0.418***	−0.524***	0.100	−0.0879***
Regulatory quality* equity to total assets	0.0689***	0.0417***	0.0231***	0.00510***	0.109***	0.131***	0.00423	0.0227***
Regulatory quality* franchise value	−0.0534**	−0.0137	−0.00554	−0.0127**	−0.0257**	−0.0190	0.0130*	−0.00347
Regulatory quality* log total assets	−0.00864**	−0.0102***	−0.0067***	−0.000991	−0.0138***	−0.0175***	−0.0054***	−0.0029***
GDP growth	0.0407*	0.0530***	0.0352***	0.0139***	0.0607**	0.0568*	0.00867	0.0124**
Inflation rate	−0.0846	0.216	0.0991	0.0459	−0.522**	−0.701***	0.0150	−0.108**
Log GDP per capita	1.804	−0.141	−0.404	−0.0774	0.933	0.850	0.841	0.222
National loan rate – national deposit Rate	0.830*	−0.0516	0.192	0.000973	−1.401***	−1.477***	−0.452*	−0.302***
Year dummy 2000	−0.0623	0.214	−0.0602	−0.0814				
Year dummy 2001	1.272	0.971**	0.504	0.0913				
Year dummy 2002	1.295	0.241	0.624	−0.0860	4.533***	5.095***	1.501**	1.017***
Year dummy 2003	0.219	0.179	1.012***	0.0540	2.222***	2.239***	1.706***	0.506***
Year dummy 2004	0.0315	0.00800	0.561*	−0.0869	3.112***	3.396***	1.188***	0.675***
Year dummy 2005	−0.0269	0.206	0.470*	0.0754	1.349***	1.298***	1.238***	0.282***
Year dummy 2006	0.817	0.756**	1.047*	0.251*	1.120***	1.132***	0.897***	0.235***
Year dummy 2007	0.921	0.371	1.194***	0.166*	1.219***	1.274***	0.585***	0.271***
Year dummy 2008	1.071*	0.519**	−0.134	0.128	1.563***	1.688***	0.341*	0.342***
Year dummy 2009	1.026**	0.909***	0.154	0.274***	1.823***	2.009***	0.0462	0.399***
Year dummy 2010	0.279	0.229	1.170***	0.0576	2.054***	2.428***	−0.274	0.438***
Year dummy 2011	−0.336	−0.323	0.332	−0.122	1.459***	1.753***	−0.283*	0.331***
Constant	−33.33	−1.714	−0.394	−2.212	−3.869	8.487	−19.88	−0.516
Observations	1,724	1,724	1,724	1,724	1,349	1,349	1,349	1,349
Number of banks	200	200	200	200	159	159	159	159
Overall R <sup>2</sup>	0.0708	0.220	0.433	0.0952	0.175	0.237	0.422	0.0627
Within R <sup>2</sup>	0.0460	0.190	0.516	0.0881	0.134	0.140	0.428	0.0884
Wald test	4087	568.0	1827	221.1	416.2	442.1	1215	283.5

\*\*\*  $p < 0.01$ .\*\*  $p < 0.05$ .\*  $p < 0.1$ .

in both the short run (worsening asset quality) and long run (increased z scores). It is possible that the improvements in national governance are interpreted by managers of larger banks as improving the likelihood of their being rescued by the national regulators in times of crisis. Accordingly, managers of larger banks adopt higher risk activities, consistent with Merton (1977) and Diamond and Dybvig (1983).

The U-shaped relationship between capital holdings and risk found previously are also found for the Asian financial crisis nations in the long run, with exception of asset quality, which was found to have no relationship with bank equity. Too big to fail effects are also found for the AFC nations, and as noted above, improvements in national regulatory quality do not ameliorate this effect, which differs from the developed nation findings, indicating that moral hazard incentives related to size are relatively stronger in this sub-sample. Again, the short run relationship between bank risk and non interest income is U-shaped, but insignificant in the long run.

#### 4.3. Measures of the extent of regulation

As an alternative to measuring the quality of the regulatory infrastructure, the database of Barth et al. (2013) provides a survey of the existence of banking regulations across a large sample of nations. This survey provides a snapshot of the regulatory structure in place in 180 nations in 1999, 2003, 2007, and 2011 across a variety of dimensions. These dimensions include restrictions on bank activities, restrictions on financial conglomerations, capital regulations, supervisor power and independence, and external governance (particularly financial reporting requirements). In each case a higher value indicates increased regulation of higher independents.

To test the robustness of the previous regulatory quality results, variables drawn from Barth et al. (2013) are employed as replacements for the World Governance Index (WGI). The bank regulation surveys are conducted less frequently than the WGI is constructed. Further, some nations in the Asian region sample of this study have

**Table 7b**

Estimates of Marginal effects at sample specific means for two year model (first four columns) and four year model (last four columns), instrumental variables Fixed Effects estimators.

	Two year				Four year			
	Range volatility ROAA	Range volatility ROAE	Asset quality	z score	Range volatility ROAA	Range volatility ROAE	Asset quality	z score
<i>Regulatory quality</i>								
Main effect	−0.1780	−0.1880	−0.1380	−0.0235	−0.4180	−0.5240	0.1000	−0.0879
Equity to total assets	0.3614	0.2187	0.1212	0.0268	0.5556	0.6678	0.0216	0.1157
Franchise value	−0.0771	−0.0198	−0.0080	−0.0183	−0.0383	−0.0284	0.0194	−0.0052
Log total assets	−0.1467	−0.1732	−0.1139	−0.0168	−0.2342	−0.2969	−0.0915	−0.0495
Total	−0.0404	−0.1622	−0.1387	−0.0319	−0.1349	−0.1815	0.0495	−0.0269
<i>Equity to total assets</i>								
Main effect	−6.1130	−3.9310	−2.1960	−0.4540	−9.6210	−11.5600	−0.6760	−1.9500
Square term	−0.0222	−0.0249	−0.0114	−0.0023	−0.0912	−0.1906	0.2712	−0.0404
Regulatory quality	6.1090	3.6973	2.0482	0.4522	9.6872	11.6424	0.3759	2.0174
Total	−0.0262	−0.2585	−0.1593	−0.0041	−0.0250	−0.1082	−0.0289	0.0271
<i>Franchise value</i>								
Main effect	6.1620	1.6920	0.7460	1.0730	2.1950	1.5420	−0.7850	0.3170
Squared term	−1.3402	−0.4419	−0.0295	0.0112	0.0710	0.1352	−0.2286	0.0089
Regulatory Quality	−4.7347	−1.2147	−0.4912	−1.1260	−2.2840	−1.6886	1.1554	−0.3084
Total	0.0871	0.0354	0.2253	−0.0419	−0.0180	−0.0114	0.1418	0.0175
<i>Log (total assets)</i>								
Main effect	3.6730	3.3230	2.7550	0.5950	4.6350	5.1520	1.0370	0.8850
Squared term	−2.7807	−2.3224	−2.1390	−0.4719	−3.0847	−3.2951	−0.6041	−0.5633
Regulatory quality	−0.7661	−0.9044	−0.5949	−0.0879	−1.2265	−1.5553	−0.4790	−0.2595
Total	0.1262	0.0963	0.0210	0.0352	0.3238	0.3016	−0.0461	0.0622

Note: the regions developed nations are those Asian region nations that are members of the OECD (Australia, Japan, New Zealand, South Korea) plus Singapore.

**Table 8a**

Asian financial crisis nations, 7 nations, instrumental variables fixed effects estimators.

	Two year model				Four year model			
	Range volatility ROAA	Range volatility ROAE	Asset quality	z score	Range volatility ROAA	Range volatility ROAE	Asset quality	z score
Equity to total assets (%)	−0.0291	−0.182***	0.342**	−0.00629	−0.112***	−0.333***	0.117	−0.0107**
Equity to total assets (%) squared	0.000284	0.00145***	0.00129	−0.0005***	0.00225**	0.00585***	−0.00114	0.000314**
Franchise value (fixed assets to total assets)	1.987***	−0.0368	−0.101	−0.0388	−0.143	−0.363	−1.618	−0.00466
Franchise value squared (fixed assets to total assets)	−0.147**	0.00690	0.150*	0.00818	0.0316	0.0578*	0.121	0.00337
Log total assets	0.188	0.274	6.143***	−0.0446	1.326**	1.235**	1.764	0.290***
Log total assets squared	0.0130	−0.0121	−0.184**	0.00262	−0.0476***	−0.0460**	−0.0562	−0.0105***
Loan growth	0.000751	0.000311	0.00155	4.40e−05	0.000635	0.000264	−0.000179	−6.24e−05
Loan growth squared	2.55e−06	2.29e−06	−4.30e−06	−2.05e−07	−1.67e−07	−1.36e−07	−7.59e−08	2.83e−08
Non interest income as a % of revenue	−0.0533***	−0.0301**	−0.0295	−0.00667	0.00332	0.000916	0.00513	−0.00171
Non interest income as a % of revenue squared	0.00116***	0.000802**	0.00168***	0.000186	−2.29e−05	1.92e−05	0.00172	3.02e−05
Government effectiveness	−0.0208	−0.0239	−0.0426	−0.0107	−0.0504***	−0.0257*	0.0202	−0.0058***
Regulatory quality* equity to total assets	0.000716	0.000504	−0.00441**	0.000651**	0.000826*	0.000787	−0.00122	5.39e−06
Regulatory quality* Franchise value	−0.0147*	0.00204	−0.000300	0.000133	0.00320	0.00545	0.0229	0.000113
Regulatory quality* log total assets	−0.000613	−0.001000	0.00657**	−0.000391	0.000407	−0.000517	0.000487	0.000236**
GDP growth	−0.0407**	−0.0162	0.0565**	0.0101	−0.0306**	−0.0235	0.0541	−0.00204
Inflation rate	0.117	−0.0288	−0.0738	−0.0250	−0.141***	−0.0968***	−0.146	−0.0207***
Log GDP per capita	3.232**	0.541**	−2.464***	0.170	0.237	0.217	−3.080***	−0.0119
National loan rate – national money market rate	−0.196	−0.0471	−0.200	−0.00992	−0.0781	−0.0490	−0.385	−0.0108
Year dummy 2000	6.422***	2.205***	2.656**	0.323				
Year dummy 2001	5.612***	1.738***	1.342	0.420*				
Year dummy 2002	5.212***	1.622***	2.463**	0.262	1.979***	1.785***	2.213	0.194***
Year dummy 2003	5.081***	1.280***	3.236***	0.165	1.330***	1.098***	1.289	0.115***
Year dummy 2004	4.604***	1.243***	2.668**	0.205	1.216***	0.960***	1.274	0.102***
Year dummy 2005	3.566***	0.898***	1.842**	0.177	0.892***	0.591**	1.682*	0.0588**
Year dummy 2006	2.632***	0.917***	1.019	0.131	1.058***	0.798***	1.111	0.0818***
Year dummy 2007	2.365***	1.045***	0.626	0.0727	1.159***	1.022***	0.831	0.110***
Year dummy 2008	2.289***	1.132***	0.828	0.197	0.944***	0.833***	0.797	0.0915***
Year dummy 2009	1.502***	0.791***	0.773*	−0.0622	0.650***	0.642***	0.694*	0.0564***
Year dummy 2010	1.518***	0.495**	0.651	0.0173	0.632***	0.626***	0.646**	0.0625***

(continued on next page)

Table 8a (continued)

	Two year model				Four year model			
	Range volatility ROAA	Range volatility ROAE	Asset quality	z score	Range volatility ROAA	Range volatility ROAE	Asset quality	z score
Year dummy 2011	0.528**	0.214	0.668**	−0.0279	0.414***	0.393***	0.593**	0.0464***
Constant	−34.76**	−1.152	−30.58	−0.754	−7.442	−3.039	15.27	−1.528**
Observations	734	734	734	734	449	449	449	449
Number of banks	153	153	153	153	104	104	104	104
Overall R <sup>2</sup>	0.000893	0.227	0.0688	0.0391	0.278	0.451	0.192	0.268
Within R <sup>2</sup>	0.153	0.187	0.330	0.0314	0.447	0.446	0.470	0.431
Wald test	993.9	186.4	266.0	31.64	295.7	370.6	227.3	261.0

\*\*\*  $p < 0.01$ .\*\*  $p < 0.05$ .\*  $p < 0.1$ .

Table 8b

Estimates of marginal effects at sample specific means for two and four year models, instrumental variables fixed effects estimators.

	Two year				Four year			
	Range volatility ROAA	Range volatility ROAE	Asset quality	z score	Range volatility ROAA	Range volatility ROAE	Asset quality	z score
<i>Regulatory quality</i>								
Main effect	−0.0208	−0.0239	−0.0426	−0.0107	−0.0504	−0.0257	0.0202	−0.0058
Equity to total assets	0.0081	0.0057	−0.0498	0.0073	0.0089	0.0085	−0.0132	0.0001
Franchise value	−0.0229	0.0032	−0.0005	0.0002	0.0051	0.0086	0.0363	0.0002
Log total assets	−0.0094	−0.0154	0.1012	−0.0060	0.0064	−0.0081	0.0076	0.0037
Total	−0.0450	−0.0304	0.0084	−0.0092	−0.0300	−0.0166	0.0509	−0.0019
<i>Equity to total assets</i>								
Main Effect	−0.0291	−0.1820	0.3420	−0.0063	−0.1120	−0.3330	0.1170	−0.0107
Square term	0.0064	0.0327	0.0291	−0.0119	0.0487	0.1266	−0.0247	0.0068
Regulatory quality	0.0460	0.0323	−0.2830	0.0418	0.0537	0.0512	−0.0793	0.0004
Total	0.0233	−0.1169	0.0881	0.0236	−0.0096	−0.1552	0.0130	−0.0036
<i>Franchise value</i>								
Main effect	1.9870	−0.0368	−0.1010	−0.0388	−0.1430	−0.3630	−1.6180	−0.0047
Squared term	−0.4574	0.0215	0.4667	0.0254	0.1003	0.1834	0.3840	0.0107
Regulatory quality	−0.9435	0.1309	−0.0193	0.0085	0.2080	0.3543	1.4886	0.0073
Total	0.5862	0.1156	0.3464	−0.0048	0.1653	0.1747	0.2546	0.0134
<i>Log (total assets)</i>								
Main effect	0.1880	0.2740	6.1430	−0.0446	1.3260	1.2350	1.7640	0.2900
Squared term	0.4005	−0.3728	−5.6683	0.0807	−1.4873	−1.4374	−1.7561	−0.3281
Regulatory quality	−0.0393	−0.0642	0.4217	−0.0251	0.0265	−0.0336	0.0317	0.0153
Total	0.5491	−0.1629	0.8964	0.0110	−0.1349	−0.2360	0.0396	−0.0228

Note the seven nations in this sub sample are Indonesia, South Korea, the Philippines, Thailand, Malaysia, Laos and Hong Kong. Other definitions of the crisis affected nations yielding smaller sub samples did not impact upon the results.

chosen to not complete the survey (Laos) or have provided partial or incomplete data (e.g. China, Myanmar and Vietnam). Following the approach adopted previously, eq. (2) is estimated with both a main governance effect and three interaction variables. Given the range of possible regulatory variables available in the (Barth et al., 2013) dataset, the interaction measures were selected to be as closely focussed as possible to the proposition underlying that variable's main effect. Accordingly, intensiveness of capital regulations is interacted with equity to total assets; external governance is interacted with franchise value (fixed assets to total assets) and supervisor power is interacted with log of total assets. As the bank regulation data is not available for each year, the average value of the relevant available data was employed. Thus, the observations for 2004 to 2006 represent the average of the results from the 2003 and 2007 surveys.

Some caution must be taken when interpreting results from this data as the smaller sample and averaging process has introduced multicollinearity problems. To somewhat ameliorate these problems, Eq. (2) was initially estimated without the interaction variables, with results suggesting that external governance (increased financial reporting requirements) and higher capital

regulations both act to reduce bank-level risk in Asia. When the interaction variables are included in the models, the results suggest that increased external governance interacts with franchise value to reduce bank risk. However, those models with interaction variables do not find evidence of a significant main effect due to national regulatory intensiveness. This result was not affected by alternative measures of national regulatory intensiveness.<sup>32</sup> Conducting the sub-sample analysis as above generally confirmed the above results, again some of the long run results suggested that increased regulation is accompanied by increased bank-level risk. Given the increased potential for multicollinearity due to smaller sample size, this possibility should be considered tentative. However, the results do suggest that increased regulations generate the perception by bank management in Asia that the put option component of the bank's equity (Merton, 1977) has been increased in value,

<sup>32</sup> Several alternative measures of national regulatory intensiveness have been considered, including activity restrictions, conglomerate restrictions, capital regulation, external governance, supervisor power, supervisor independence, and additive measures combining different combinations of these measures.

generating increased risk seeking by bank management, as previously discussed.<sup>33</sup>

## 5. Conclusions

Improved national governance results in lower bank level risk in Asian developed nations, particularly in the longer run. In the case of those nations affected by the Asian Financial Crisis, this risk reduction occurs over the longer run, with no evidence of a short run effect. However, improved national governance interacts with equity holdings to result in increased bank risk in developed nations. This increased bank risk via the governance channel nearly offsets the first order and quadratic risk reduction effects of increased bank equity holdings in developed nations. This paper argues that this result indicates the risk reducing impacts of capital holdings are close to satiation. The overall short and long run impacts of improved national governance are increased bank risk in developing nations. This paper argues that this developing nation effect reflects the impact of increased moral hazard is offsetting the positive effects of improved national governance. It is argued that bank management act in a manner consistent with [Diamond and Dybvig \(1983\)](#) and [Merton \(1977\)](#). Accordingly, increased national governance increases the likelihood of a bailout in times of financial crisis, creating a morally hazardous incentive to increase bank risk and so increase the put option component of the return to bank shareholders. In the case of the developed nations increased national governance is able to offset this moral hazard. The results for the AFC affected nations indicate that they are in a transition process, whereby national governance is now offsetting the first order effects of this moral hazard, but some residual moral hazards exist via too big to fail effect, which are also found in developed nations. As the developed nations in this sample largely share English legal origins for their banking systems, it is not entirely clear if improved national governance is risk reducing for banks via the developed nations channel or via the legal origins channel.

Increased capital regulations are increasing the cost of equity capital at the bank level to the point of increasing risk-seeking incentives (despite increased regulatory intensiveness), in both developing and AFC affected nations, as well as for long run loan quality in developed nations. This indicates that the risk reducing impact of increased capital regulations are close to or at the point of satiation. Increasing bank capital at first results in lower bank risk and then results in increased bank risk as bank management seek riskier (higher returning) projects to earn sufficient revenue to cover the higher cost of capital ([Koehn and Santomero, 1980](#); [Blum, 1999](#)). The long run results for increased asset risk in developed nations may reflect either of (i) the underlying stickiness of loan quality over time or (ii) the first indicators of the negative impact of increased capital regulations in developed nations. In contrast, improved national governance is able to offset the risk seeking incentives resulting from increased size (too big to fail effects) in developed nations. This indicates that banking regulators must expand their armoury of regulations beyond capital based measures to reduce bank-level risk in an increasingly complex banking system. The results for the developing nations indicates that national governance improvements and (to a lesser extent) bank capital regulations retain some potential for risk reductions at the bank level.

The bank policy debate following the financial crisis of 2008 has given considerable attention to the issue of too big to fail (see, for

example, [Kaufman, 2014](#)). The size results in this paper generally support the existence of morally hazardous risk seeking resulting from too big to fail effects in the Asian region. For developed nations this risk seeking is offset by the risk reducing impact of national governance when interacted with size. It is argued that this effect reflects the increased regulatory intensiveness paid to larger banks in developed nations, which partially (but not fully) offsets this risk seeking incentive. In the case of developing Asian region banking systems, the opposite effect is observed, in that improved national governance interacts with bank size to result in increased bank risk in the longer run. It is argued that in the developing nations improved national governance results in a higher probability being attached to the likelihood of bailout for larger banks. Thus, large banks find the risk seeking incentives from being too big to fail reinforced.

This paper also finds some evidence that higher growth rates at the bank level, (especially above average loan growth, as represented by loan growth<sup>2</sup>) is associated with increased bank risk. In the case of developing nations this result is most apparent for loan quality. In a similar vein increased GDP growth is also associated with increased bank level risk, which is contrary to [Lee and Hsieh \(2013\)](#). This difference may be explained by differences in the source of GDP growth, (speculative bank lending versus productive investment) or the different risk measures used in this study. Higher inflation is generally associated with lower bank risk, which is contrary to expectations. However, this difference may be explained by the role higher inflation-driven capital gains play in reducing loan defaults. Higher national costs of intermediation are associated with higher bank revenue volatility (consistent with [Ho and Saunders, 1981](#)), but also improved asset quality. It seems that (at least in Asia), higher costs of providing intermediation services at the national level have a beneficial credit rationing impact on loan quality at the bank level.

Overall, these results provide some valuable insights for the policy debate following the financial crisis of 2008. Regulators must consider the possibility that the risk reducing impacts of increased required capital holdings are close to exhaustion, and other instruments must be considered as an important part of the regulators risk reducing armoury. This is reflected in the reforms to the global benchmark capital adequacy framework, which now considers operational, market and liquidity risk as well as mandating the roles of supervisory review and market discipline. As found in this paper, national governance improvements have a role to play in bank risk reduction, but this role must be considered against the backdrop of the existing systematic factors in each banking system, particularly the moral hazard incentives associated with too big to fail effects. The distinct differences found in the risk reducing attributes of capital, national governance and size across developed, developing and Asian financial crisis nations should be considered when implementing a global regulatory system.

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<sup>33</sup> This paper argues that increased regulation can be seen as a signal to bank management that bail outs are more likely in times of a financial crisis. This increases the value of the put option component of bank equity. Bank management seek to maximise this put option component via increased volatility of their revenue portfolio.



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