Bank regulation and stock market stability across countries

Dr. Walaa Wahid ElKelish[1]

University of Sharjah, United Arab Emirates

Professor Jon Tucker

Centre of Global Finance, University of the West of England

Abstract

Purpose: This paper investigates whether bank capital strength and external auditing requirements influenced international stock market stability during the 2007/8 global financial crisis.

Design/methodology/approach: Bank mandatory regulation data are obtained from the World Bank database, while stock market stability is gauged for 385 listed banks across 43 countries by means of GLS regression models.

Findings: We find that mandatory capital strength requirements and the existence of mandatory audit increase stock market stability across countries. Further, more profitable banks increase stock market stability. The results are robust to both country institutional settings and economic freedom characteristics.

Originality: Our paper provides evidence of the impact of bank regulations on stock market stability during the global financial crisis, thereby providing a useful insight for stakeholders in order to enhance financial regulation and policy.

Research paper

JEL classification: G21, G28, M48, O16

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[1] Correspondent author: welkelish@sharjah.ac.ae

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1. Introduction

The stream of bank failures across the globe in the past two decades has encouraged both national and international financial institutions to introduce a raft of new bank regulations to strengthen confidence, stability and efficiency in the sector. Many governments and their banking sectors have invested significant resources to ensure compliance with these new regulatory measures in order to attract or maintain international investment flows, to avoid future banking crises, and to underpin broader stock market stability. Empirical studies suggest that successive bank failures have been triggered by both external institutional settings and internal, bank-specific factors. External factors include inappropriate supervision, regulation, macroeconomic policies, and governance structures in relation to the financial system (Delis and Staikouras, 2011; Masciandaro *et al.*, 2013). Other scholars present evidence of the impact of regulation and supervisory policy on bank performance and efficiency (Barth *et al.*, 2004; Beck *et al.*, 2006; Chortareas *et al.*, 2012). However, there is a dearth of research on the impact of bank regulation on stock market stability. To address the shortcomings of the existing literature, the main purpose of this paper is to provide an international study of the influence of bank capital strength and external auditing requirements on stock market stability during the global financial crisis of 2007/8, in so doing highlighting issues and providing some pointers for the development of the international banking industry. Our empirical results show that both mandatory capital strength requirements and the existence of mandatory audit increase stock market stability across countries. In addition, higher bank profitability leads to greater stock market stability.

Our paper contributes to the existing literature in several ways. First, it provides evidence on the impact of capital strength and external auditing regulations on stock market stability during the recent global financial crisis, thereby providing some insight for international financial institutions, governments and regulators as countries seek to enhance their financial regulation and policy. Second, we show that banks need to comply with tighter mandatory capital strength practices in order to legitimise their activities in countries with weak institutions and economic freedom policies, thereby providing support for an agency theory approach (Jensen and Meckling, 1976). Finally, our paper provides some useful practical guidelines for policy-makers and regulators in both developed and developing countries to support improved regulation for the purpose of achieving greater stock market stability and in order to cope with the increasing complexity which characterises the banking business environment.

The remainder of the paper is structured as follows. Section 2 presents the theoretical and empirical literature and sets out the hypotheses to be tested. Section 3 discusses the scope of the data, its collection and formatting, and the statistical and modelling methodology employed. The discussion of the empirical results is given in Section 4. Finally, Section 5 summarises and concludes, and provides recommendations for both policy makers and future research in the field.

2. Background and hypothesis development

2.1 Capital strength

The capital strength of a bank serves a risk-sharing function whereby capital is a buffer against the improper disposal of assets as well as debt-holder losses (Kilinc and Neyaphti, 2012). The rationale underpinning the regulation of capital strength is that banks need to hold an appropriate level of capital in order to reduce the risk of failure and achieve target operational efficiency levels

(Chortareas *et al*., 2012). Building on the agency theory of Jensen and Meckling (1976), Dewatripont and Tirole (1994) argue that capital requirements are employed as an instrument for the delegation of control rights to a regulator on behalf of small depositors who are unwilling, or do not have the resources, to monitor bank activities and assets during a financial crisis. Recently, several scholars highlight the relationship between bank capital requirements, bank behaviour (Borio and Zhu, 2012), bank performance (Beltratti and Stulz, 2012; Berger and Bouwman, 2013; Chortareas *et al*., 2012), bank failure (Cole and White, 2012), output and inflation volatility (Angeloni and Faia, 2013), and the speed of bank capital structure adjustments (Jonghe and Oztekin, 2015). For example, Borio and Zhu (2012) argue that ignoring a minimum capital requirement can affect bank behaviour through reputational costs, unfavourable market responses, and new prudential procedures for bank risk management frameworks. In this context, Berger and Bouwman (2013) study US banks over the period 1984 to 2010 and find empirical evidence that greater capital improves the performance (in terms of both the probability of survival and market share) of small banks, exhibiting the same effect on medium and large bank performance though only in times of banking crises. Similarly, Angeloni and Faia (2013) find that anti-cyclical capital requirement ratios which require banks to increase capital strength in times of expansion, reduce both output and inflation volatility and increase welfare. Other scholars such as Jonghe and Oztekin (2015) find, in a study of banks in 64 countries over the period 1994 to 2010, that banks make more rapid capital structure adjustments in countries with more stringent capital strength requirements, particularly in times of crises.

Other studies show that bank capital requirements are marginally positively associated with efficiency (Barth *et al.*, 2013), though exacerbate fluctuations in the business cycle (Blum and Hellwig, 1995) and are ineffective in the control of bank risk (Delis and Staikouras, 2011). Delis

and Staikouras argue that a capital strength requirement is viewed as a tool to force banks to share risk and to provide a mechanism to absorb bank losses. They argue further that somewhat contrasting findings of the existing literature with regard to the relative merits of capital strength requirements tend to result from differences in bank-specific characteristics and/or country-level differences such as the degree of information asymmetry between corporate management and investors, and the presence or otherwise of deposit insurance schemes.

On the basis of the existing literature, our first hypothesis therefore states that:

H_1: *There is a positive relationship between bank capital strength and stock market stability across countries.*

2.2. Bank supervision

Bank supervision comprises the continuous monitoring of law-on-the-books and the institution of remedial measures to address violations (Basel Committee on Banking Supervision, 2002). Given that producing mandated regulations may not be enough in itself to ensure effective implementation and enforcement (Beltratti and Stulz, 2012), continuous supervision can discipline bank behaviour to ensure a better understanding, and thus a fair pricing, of bank risk by market participants (Caprio *et al.*, 2008) and can reduce market failure (Beck *et al.*, 2006). Consistent with agency theory (Jensen and Meckling, 1976), bank management and other stakeholders may pursue conflicting goals. As a result of this moral hazard problem, various public and private mechanisms may be instituted to align incentives and to supplement internal bank governance, including external auditing.

External auditors play an important role in the banking industry, acting as a mechanism to align the incentives of stakeholders, thereby providing a supplementary mechanism to bank governance.

Empirical studies investigate the relationship between external audit and stock performance (Mitton, 2002), bank losses (Jin *et al.*, 2011), and information uncertainty (Autore *et al.*, 2009). For example, evidence from Jin *et al.*, in a study of US banks for the year 2006, find that auditor type and auditor industry specialization are predictors of bank failure, as high quality auditing reduces the probability of bank failure by assuring the quality of a bank's financial information. Other scholars highlight the value relevance of audit opinions and their heterogeneous information content (Holder-Webb and Wilkins, 2000; Pei and Hamill, 2013). For example, Chen *et al.* (2000) find in a study of Chinese companies over the period 1995 to 1997 that qualified opinions are associated with significant negative market returns. More recently, in another study of Chinese firms, Pei and Hamill (2013) find that audit opinions possess significant information heterogeneity in a study over the period 1998 to 2005. They present evidence that auditor opinions give rise to significant returns responses as they contain value relevant information for investor pricing decisions. They also argue that in a less competitive information environment, investors value regulated financial statements more highly than in a more competitive information environment.

Thus, our second hypothesis states that:

H_2: There is a positive relationship between bank external mandatory auditing and stock market stability across countries.

2.3. Institutional settings and economic freedom characteristics

Some scholars argue that institutional settings are in theory one of the main factors that can create path dependence towards financial market development (North, 1990). At a country level, several existing studies highlight the relationship between legal institutions and stock market development. For example, La Porta *et al.* (1998) find that the presence of shareholder protection

structures, such as the breadth of the equity market, company access to external finance, and so on, has a significant positive impact on stock market development. Another body of studies illustrates the influence of politicians in the mandating of legal rules and reducing the power of banks and pension funds (Roe, 1990), as well as the influence of political coalition changes on financial development (Rajan and Zingales, 2000). At the firm level, a number of studies highlight the relationship between the external institutional environment, corporate governance mechanisms and firm performance (Chen *et al.*, 2011; Klapper and Love, 2002; Bruno and Classens, 2010). For example, Klapper and Love find that corporate governance practices and performance are poor in countries with a weak legal environment. Bushman *et al*. (2004) find in an international study for the year 1995 that governance transparency is higher in those countries with legal origins in common law, whereas financial transparency is higher in countries with a weak political economy (such as in the case of state ownership). They argue that a government can institute weak accounting and disclosure requirements, relax the enforcement of current disclosure requirements, or exert pressure on the media in order to hold back the distribution of firm specific information for the benefit of specific interest groups. More recently, Aebi *et al*. (2011) find that US banks with independent risk management show significantly higher stock returns and firm return on equity during the global financial crisis.

Therefore, our third hypothesis states that:

H_3: The relationship between bank mandatory regulations and stock market stability is conditional upon the existence of high quality institutional settings and economic freedom characteristics.

2.4. Stock market stability

Stock market movements reflect, amongst other factors, changes in company fundamentals, a position predicated upon conventional agency and signalling theories. Durnev *et al.* (2009) argue

that stock market stability is built upon a foundation of share price accuracy whereby stock markets with a high information content tend to enjoy greater price accuracy, resulting in increased market stability, and vice versa. A stock's share price is considered more accurate if it reflects greater unobservable company-specific information rather than observable market or industry information (Durnev *et al.*, 2003). Many studies in the existing literature show that stock market accuracy conveys informational efficiency (Chen *et al.*, 2007; Durnev *et al.*, 2003; Morck *et al.*, 2000). Consistent with the weight of the existing literature, we employ share price accuracy, as given by the R^2 statistic (Durnev *et al.*, 2003), as a proxy for stock market stability. Furthermore, we implement the methodology of Li *et al.* (2014) to ensure the reliability of the R^2 statistic.

3. Data and Methodology

3.1. The dataset

We collect data on mandatory capital strength and external audit regulation during the global financial crisis of 2007/8 in order to investigate whether they exerted an impact upon stock market stability. The data are obtained from a survey of the World Bank and the US Office of the Comptroller of the Currency (OCC) for the banking industry across 43 countries. Details of the study countries and constituent banks are shown in Table 1. All of the variables in this paper are measured at the country level. This dataset is unique as it provides an expert assessment of the existence, legislative state, and implementation of regulations in practice (Barth *et al.*, 2008). The time period is selected to show the impact of institutional settings across countries during the global financial crisis, and to investigate how regulations were applied within different countries. Stock market stability is measured by means of the R^2 statistic which reflects the 'extent to which a firm's share price moves with the prices of all the other firms in the economy' (Durnev *et al.*,

2003; Morck *et al.*, 2000). The data required to measure the R^2 statistic are obtained from the DataStream financial database, and the final selection of banks is driven by data availability.

[Insert Table 1 here]

3.2. Gauging stock market stability

Stock market stability is proxied by means of the R-square (R^2) statistic which is calculated as observable market risk scaled by the less observable firm-specific risk plus the observable market risk, consistent with Durnev *et al.* (2003). A low R^2 statistic signals greater bank share price accuracy and hence greater stock market stability, that is, a low R^2 signals share price accuracy where a firm's share price relies more on bank-specific financial information disclosure than on market or industry factors. A generalized least squares regression (GLS) modelling approach is employed to estimate the R^2 statistic for each of the 385 banks across the 43 sample countries by means of the following approach, consistent with Durnev *et al.* (2003), and Durnev *et al.* (2009). First, in a GLS model, weekly stock returns for each bank are regressed on the returns of the whole market for a given country and the returns on the banking sector index. Weekly returns are used to control for semi-annual dividends and earnings announcements. Second, the R^2 statistic for each bank is determined as given in Equation 1:

$$R^2 = \sigma_m^2/(\sigma_m^2 + \sigma_\varepsilon^2) \qquad (1)$$

Where:
R^2 = stock market stability
σ_m^2 = variance of market returns
$\sigma^2{}_\varepsilon$ = variance of the generalized multiple regression residuals

Third, an annualised R^2 statistic is computed for each bank which is then aggregated at the country level for the year 2008. Fourth, the asynchronicity measure (ϕ), which is simply the logarithmic inverse of R^2, is computed to facilitate comparison of the results. A high ϕ statistic signals no co-

movement between bank, market and industry returns due to greater bank-specific information transparency, and hence high stock market stability. At the other extreme, a low ϕ statistic signals that all of the movement in bank stock returns is explained by market and industry returns rather than by individual bank-specific information, and hence this implies low stock market stability (Hutton *et al.*, 2009). Finally, we control for the main components of the R^2 statistic: market wide return volatility, beta and idiosyncratic risk. We then check the findings across different institutional settings and economic freedom characteristics, following the methodology of Li *et al.* (2014).

3.3. The modelling approach

We apply a simple multiple regression modelling approach to examine the relationship between stock market stability and its potential drivers such as bank capital strength and auditing requirements. These key variables along with several control variables are given in Equation 2:

$$\phi_{it} = \alpha + \beta_1 ln(SIZE)_{it} + \beta_2 ln(ROE)_{it} + \beta_3 ln(TANG)_{it} + \beta_4 ln(SPC)_{it} + \beta_5 ln(GDPG)_{it} + \beta_6 ln(LIST) + \beta_7 (CAPS)_{it} + \beta_8 (AUD)_{it} + \varepsilon_{it} \quad (2)$$

Where:
ϕ = logarithmic inverse of R^2 measured as [ln ((1-R^2)/R^2)] for bank *i* at time *t*; $ln(SIZE)$ = natural logarithm of company assets; $ln(ROE)$ = natural logarithm of return on equity; $ln(TANG)$ = natural logarithm of tangible assets per share; $ln(SPC)$ = natural logarithm of the change in the Standard and Poor's stock market index; $ln(GDPG)$ = natural logarithm of gross domestic product growth; *ln(LIST)*= natural logarithm of number of listed companies in the stock market*;* $CAPS$= capital strength; AUD = mandatory auditing; ε_{it} = error term.

The capital strength dummy variable (*CAPS*) takes a value of one if the minimum ratio of capital strength is adjusted for bank credit risk, or zero otherwise. The mandatory auditing dummy variable (*AUD*) takes a value of one if there are specific regulatory requirements for the extent or nature of the audit, or zero otherwise. Table 2 provides a list of model variable labels, along with

their definition and the source of the component data items. Finally, consistent with Morck *et al.* (2000), the returns of bank shares which traded for less than 30 weeks (120 days) of the year are excluded from the sample to eliminate the effect of thin trading activity.

[Insert Table 2 here]

3.4. Model control variables

We include several control variables in our models, consistent with the literature, to control for the influence of bank-specific characteristics and differences in the macroeconomic environments of the respective countries. The bank-specific variables are obtained from the DataStream financial database, while the macroeconomic environment indicators are obtained from the World Bank (World Development Indicators). Such variables include bank size (*SIZE*), the return on equity (*ROE*), asset tangibility per share (*TANG*), gross domestic product per capita growth (*GDPG*), and annual percentage change in the global S&P index (*SPC*) to control for differences across countries in stock market reaction to the global financial crisis. A natural logarithm transformation is applied to the control variables to increase the goodness of fit of the regression models.

3.5. Country level institutional settings and economic freedom characteristics

Two institutional variables are obtained from Kaufmann *et al.* (2010): the rule of law (*LAW*) and government effectiveness (*GOV).* The former captures perceptions of the extent to which agents have confidence in, and abide by, the rules of society; while the later captures perceptions of the quality of public services, the quality of the civil service, and the degree of its independence from political pressures. The economic freedom variables are obtained from the Heritage Foundation (2008). Several such variables are included in our models: property rights (*PR*), freedom from

corruption (*FCRP*), and freedom of trade (*FTRD*). Here, all of the five variables above have a score ranging from 0 to 100, with high values representing stronger institutional settings or economic freedom characteristics. The scores are then transformed into indicator variables whereby each country scores a value of 1 if it is above the sample median value, or 0 otherwise.

4. Empirical Results

4.1. Descriptive statistics and correlations

Table 3 presents descriptive statistics for the study variables. It is evident that the variables exhibit high standard deviations in relation to their means which reduces the possibility of sample selection bias.

[Insert Table 3 here]

Table 4 presents a correlation matrix for the main study variables. The dependent variable, the stock market stability (ϕ) statistic, is significantly positively correlated with bank profitability at the 10% level. Significant correlations are checked further by computing the variance inflation factor (VIF) test statistic in each model to control for multicollinearity.

[Insert Table 4 here]

4.2. The models

This paper employs a two-step modelling approach. First, a GLS regression is estimated to provide the dependent variable R^2 statistic for each of the 385 banks in the sample. Table 3 shows that the stock market stability (ϕ) statistic (the inverse indicator of R^2) ranges from a minimum value of -16.36 to a maximum value of 0.94, with a standard deviation of 4.09. Second, we estimate simple multiple regressions for a range of model specifications of stock market stability, as presented in Table 5. Model 1, which includes only firm-specific and external environment control

variables, reveals that the stock market stability (ϕ) statistic has a significant positive relationship with bank profitability at the 1% level, and a significant negative relationship with the growth rate of GDP per capita at the 10% level. The overall model has an adjusted R^2 of 0.22, with a significant *F*-statistic at the 5% level. In the remaining models, the mandatory regulation variables are introduced one variable at a time in addition to the control variables.

[Insert Table 5 here]

Model 2 shows that high capital strength significantly increases stock market stability at the 5% level. The overall model has an adjusted R^2 of 0.29, with a significant *F*-statistic at the 1% level. Therefore, hypothesis H_1 is supported. Market participants value capital strength as an important bank buffer in times of financial crisis in order to ensure the soundness and stability of the banking system (Chortareas *et al.*, 2012). In addition, the result reflects the impact on capital requirements of the development of financial systems and international control systems during the 2007/8 financial crisis across countries (Boot *et al.*, 2001), in contrast to the failure of capital requirements to prevent bank problems during the 1990s in certain developing countries (Ozyildirim, 2010).

In Model 3, the mandatory audit variable is introduced, and it has a significant positive impact on stock market stability at the 1% level, which provides support for hypothesis H_2. The overall model has an adjusted R^2 of 0.37, with a significant *F*-statistic at the 1% level. It is argued that banks facing financial problems can maintain capital requirements up until a point close to failure, and therefore other signals become more important such as supervisory information or market variables (Mayes, 2009). However, since supervisory information may not be valuable to market participants due to secrecy, self-interest or political capture practices, the existence of the external auditor becomes more important, especially in times of crisis, as an expert channel for inside information to the public (Jin *et al.*, 2011; Mitton, 2002). In Model 4, the capital strength and

mandatory audit variables are introduced together to evaluate their relative contribution. Both variables retain their positive relationship with the stock market stability (ϕ) statistic, at the 10% and 1% levels, respectively. The overall model has an adjusted R^2 of 0.42, with a significant *F*-statistic at the 1% level. In Model 5, we introduce two main components of the R^2 statistic*:* market wide return volatility, $Ln(\sigma^2_{rm})$, and beta, $Ln(\beta^2)$. The results indicate that the capital strength and mandatory audit variables maintain their significant impact on the stock market stability (ϕ) statistic. The overall model has an adjusted R^2 of 0.45, with a significant *F*-statistic at the 1% level. Finally, we substitute the stock market stability (ϕ) statistic with idiosyncratic risk, $Ln(\sigma^2_{\varepsilon})$, in Model 6. The results indicate that the mandatory audit variable maintains a significant positive relationship with the stock market stability (ϕ) statistic. The overall model has an adjusted R^2 of 0.52, with a significant *F*-statistic at the 1% level. The models show no sign of significant multicollinearity among the control variables, with variance inflation factors within the acceptable limits of 5 degrees. In addition, there is no significant heteroscedasticity in the residuals in relation to the Goldfeld–Quandt test statistic.

4.3. Country level institutional settings and economic freedom characteristics

We estimate the model again to test the relationship between stock market stability and bank regulations under different institutional settings and economic freedom characteristics across countries by dividing our overall sample into subsamples which are high or low in relation to a particular dimension. Models 1 and 2 of Table 6 show that capital strength (*CAPS*) has a significant positive influence on stock market stability at the 5% and 1% levels, respectively, across countries with strong institutional settings. The overall models have adjusted R^2 statistics of 0.45 and 0.42, respectively, with significant *F*-statistics at the 5% level. Thus, capital strength requirements

increase stock market stability in countries with a strong rule of law (*LAW*) and strong government effectiveness (*GOV*). Banks should comply with stronger capital strength requirements in order to legitimise their activities and underpin stock market stability, especially in countries with weak property rights institutions, consistent with hypothesis H_3. Furthermore, the t-test for equality of means between the low and high groups for the *LAW* and *GOV* variables shows that *CAPS* is significantly different for the two groups at the 5% and 1% levels, respectively. Thus, banks in countries with high rule of law and government effectiveness measures employed greater capital strength during the financial crisis of 2007/8 and provide support for the results in Models 1 and 2.

[Insert Table 6 here]

Similarly, capital strength (*CAPS*) has a significant positive influence on stock market stability across countries with strong (high) economic freedom characteristics in Models 3, 4 and 5 at the 5%, 5% and 10% levels, respectively. The overall models have adjusted R^2 statistics of 0.44, 0.41 and 0.32, respectively, with significant *F*-statistics at the 5% level. This implies that countries with strong economic freedom variables such as property rights (*PR*), freedom from corruption (*FCRP*), and the freedom of trade (*FTRD*) index demand stronger capital strength requirements in order to increase stock market stability, consistent with hypothesis H_3. Thus, the existence of strong economic freedom characteristics appears to induce greater protection for stakeholders' wealth, which in turn increases stock market stability. The t-test for equality of means between the low and high groups for *PR*, *FCRP* and *FTRD* shows that *CAPS* is significant at the 10%, 5% and 1% levels, respectively. Thus, banks in countries with strong property rights, freedom from corruption, and freedom of trade employed greater capital strength, providing support for the results in Models 3 to 5.

4.4. Robustness checks

A number of additional tests are conducted to ensure the reliability of the models estimated. First, we identify a wider set of potential independent variables to overcome the potential problem of endogeneity due to omitted variable bias. Several additional variables are tested such as: dividend yield, stock turnover, sales growth, dividend pay-out, price to book value, bank concentration, the degree of government ownership of banks, the inflation rate, GDP per capita, and bank stock market capitalization. The control variables are then selected and tested on the basis of the maximum log likelihood function to preserve degrees of freedom given the small sample of countries. However, our empirical results are found to be qualitatively similar to those given in Table 5. Second, the sample countries were divided into two groups using the mean bank concentration ratio (bank market capitalization to stock market capitalization) of 0.12 as a cut-off point. Countries above the mean take a value of 1, and below the mean take the value of 0. The t-test for equality of means between the two groups shows that the stock market stability (ϕ) statistic has an insignificant mean difference of -0.37 which reduces the possibility of measurement error bias in this variable. Third, we test whether the relationship between stock market stability and bank regulation varies with the presence or absence of a banking crisis across countries. The sample countries are initially divided into two groups: countries which did not suffer a banking crisis (dummy variable = 0) and countries which suffered a banking crisis (dummy variable = 1). The t-test for equality of means between the two groups shows that *CAPS* and *AUD* exhibit a mean difference of -0.37 and -0.23, respectively, both significant at the 5% level. This implies that countries not suffering a banking crisis enjoyed greater capital strength and had stricter mandatory auditing requirements. The second group, countries suffering a banking crisis, are further divided

into two sub-groups to represent countries where all bank stock prices moved together (low stock market stability, or low ϕ), and countries where some banks survived and others did not (high stock market stability, or high ϕ). The t-test for equality of means between the two sub-groups shows that capital strength (*CAPS*) exhibits a significant mean difference at the 5% level. This supports the importance of a bank capital strength requirement during banking crises, while mandatory auditing requirements (*AUD*) vary little across the two sub-groups. Fourth, the top and bottom 2% of the sample size were dropped to avoid the impact of outliers. The model (OLS) was then re-estimated and the results were found to be qualitatively similar to those given in Table 5.

Finally, a GLS model with fixed effects is estimated to take into consideration differences between countries in terms of geographical regions and income groups. The countries are divided into seven regions: East Asia and Pacific, Europe and Central Asia, Latin America and Caribbean, Middle East and North Africa, North America, South Asia and Sub-Sahara Africa, consistent with the approach of the World Bank. The countries are also divided into three income groups according to the World Bank classification, sorting them into high income, upper middle income, and lower middle income groups. The empirical results are given in Table 7, and the models which include fixed effects for geographical regions (*WBR*) and income groups (*WBI*), confirm the results presented earlier in Table 5. Therefore, even when we control for country geographical region and country income, the results remain broadly the same.

[Insert Table 7 here]

5. Conclusion

Following the global financial crisis of 2007/8, a raft of mandatory regulations were drafted and implemented both to strengthen banks and to bolster broader stock market stability. This paper

investigates whether bank mandatory capital strength and external audit requirements, which are intended to help preserve stock market stability in times of crisis, are actually valued by market participants. Our results show that capital strength and the existence of mandatory audit in banks both significantly increase stock market stability, consistent with agency theory, after controlling for bank-specific characteristics and differences in macroeconomic environments across countries. Furthermore, our results show that weak country institutional structures and economic freedom policies necessitate stronger mandatory requirements to ensure legitimate (anti self-dealing) banking activities. Thus, improvements in legal systems should be a key focus for ensuring stock market development within countries, and to some degree banks can institute their own good corporate governance practices (i.e. independent risk management) to overcome shortcomings in laws and their enforcement within a country (Klapper and Love, 2002), in turn hopefully dealing with the negative shock of future financial crises. However, banks need to increase stakeholder awareness and understanding of such initiatives in order to counter unfavourable market reactions which may arise during normal market conditions in response to high implementation costs (Aebi *et al.*, 2011). A limitation of our study results is that we do not take into consideration the impact of different types of banks on stock market stability due to data availability constraints and the differences in the quality of accounting information that exist across countries. Future research might focus on the introduction of other explanatory variables such as bank corporate governance factors, or may usefully investigate other financial crises over recent decades. Further, researchers might assess the relative costs and benefits of bank regulations and their impact on bank performance and risk taking, and longer term issues concerning the implementation and enforcement of international banking regulation, supervision and disclosure.

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Table 1
The countries and number of banks included in the study sample

Country	N	%	Country	N	%	Country	N	%
Argentina	7	2	India	23	6	Portugal	10	3
Australia	6	1	Indonesia	6	1	Romania	3	1
Austria	6	1	Ireland	1	1	Russia	7	2
Belgium	4	1	Israel	5	1	Singapore	3	1
Brazil	7	2	Italy	18	5	Slovakia	2	1
Bulgaria	4	1	Japan	69	18	Slovenia	2	1
Canada	8	2	Luxembourg	2	1	South Africa	6	1
Chile	7	2	Malaysia	11	3	South Korea	6	1
China	6	1	Mexico	3	1	Spain	12	3
Egypt	6	1	Morocco	10	3	Switzerland	19	5
France	12	3	Netherland	2	1	Thailand	11	3
Germany	6	1	Norway	3	1	United Kingdom	5	1
Greece	8	2	Peru	5	1	United States Of America	35	9
Hong Kong	5	1	Philippine	5	1			
Hungary	1	1	Poland	8	2			
Number of study countries						43		
Number of banks in the study						385		

Table 2
Summary of variables and source of data

Panel A: Stock market stability		
ϕ	Logarithmic inverse of R^2 measured as [ln ((1-R^2)/R^2)]	Manually computed
Panel B: Bank regulation		
CAPS	Capital strength (dummy variable which takes a value of one if the minimum ratio of capital strength is adjusted for bank credit risk, or zero otherwise).	Barth *et al.(*2008)
AUD	Mandatory auditing (dummy variable which takes a value of one if there are specific regulatory requirements for the extent or nature of the audit, or zero otherwise).	Barth *et al.(*2008)
Panel C: Control variables		
LnSIZE	Natural logarithm of total assets.	DataStream
LnROE	Natural logarithm of net income to equity.	DataStream
LnTANG	Natural logarithm of tangible assets per share.	DataStream
LnSPC	Natural logarithm of the annual percentage change in the global S&P index.	The World Bank
LnGDPG	Natural logarithm of the annual percentage growth rate of GDP per capita based on constant local currency.	The World Bank
LnLIST	Natural logarithm of number of listed companies in the stock market.	The World Bank
$Ln(\sigma^2_{rm})$	Natural logarithm of market volatility measured as the variance of the stock market return.	Manually computed
$Ln(\beta^2)$	Natural logarithm of beta square measured as covariance of bank stock price return and market return on variance of market return.	Manually computed
$Ln(\sigma^2_{\varepsilon})$	Natural logarithm of idiosyncratic volatility measured as the variance of residuals from a regression of bank stock returns on the market and industry returns.	Manually computed
BC	Bank crisis (dummy variable which takes a value of one if there is a bank crisis in a country for year 2008, or zero otherwise).	The World Bank
WBR	Indicator variable for the seven geographical regions (fixed effects).	The World Bank
WBI	Indicator variable for the three income groups (fixed effects).	The World Bank
Panel D: Country institutional settings		
LAW	Rule of law index captures perceptions of the extent to which agents have confidence in, and abide by, the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, crime and violence (Dummy variable which takes a value of one if there is high rule of law in a country for year 2008, or zero otherwise).	Kaufmann *et al.* (2010)
GOV	Government effectiveness index captures 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 (Dummy variable which takes a value of one if there is high government effectiveness in a country for year 2008, or zero otherwise).	Kaufmann *et al.* (2010)
Panel E: Economic Freedom Characteristics		
PR	Property rights index assesses the ability of individuals to accumulate private property (Dummy variable which takes a value of one if there is high property rights in a country for year 2008, or zero otherwise).	Heritage Foundation
FCRP	Freedom from corruption index which measures the level of corruption that introduces insecurity and uncertainty into economic relationships (Dummy variable which takes a value of one if there is high freedom from corruption in a country for year 2008, or zero otherwise).	Heritage Foundation
FTRD	Freedom of trade index reflects an economy's openness to the flow of world goods and services and the citizen's ability to interact freely as buyer or seller in the international marketplace (Dummy variable which takes a value of one if there is high freedom of trade in a country for year 2008, or zero otherwise).	Heritage Foundation

All variables are measured at country level.

Table 3
Descriptive statistics for the study variables

	Minimum	Maximum	Mean	Median	Standard Deviation
ϕ	-16.36	0.94	-5.27	-3.83	4.09
LnSIZE	14.00	21.38	17.64	17.69	1.71
LnROE	5.96	30.58	17.04	16.44	5.17
LnTANG	-6.49	6.35	1.37	1.47	2.20
LnSPC	-73.43	-16.96	-52.92	-53.33	12.28
LnGDPG	-10.12	10.28	1.39	1.28	3.36
LnLIST	2.94	8.50	5.77	5.66	1.33
CAPS	0.00	1.00	0.35	.000	0.48
AUD	0.00	1.00	0.84	1.00	0.36
$Ln(\sigma^2_{rm})$	-3.89	16.33	9.77	10.48	4.37
$Ln(\beta^2)$	-8.21	1.63	-0.43	-0.21	1.23
$Ln(\sigma^2_{\varepsilon})$	-8.48	21.18	5.03	5.12	6.06

All variables are defined in Table 2.

Table 4
Correlation matrix for the study variables

	ϕ	*LnSIZE*	*LnROE*	*LnTANG*	*LnSPC*	*LnGDPG*	*LnLIST*	*Ln(σ2rm)*	*Ln(β2)*	$Ln(\sigma^2_{\varepsilon})$
ϕ	1									
LnSIZE	0.04	1								
LnROE	0.24*	-0.14	1							
LnTANG	0.03	0.30**	-0.11	1						
LnSPC	-0.12	0.18	-0.15	0.16	1					
LnGDPG	-0.16	-0.46***	0.14	-0.23	-0.06	1				
LnLIST	0.05	0.45***	-0.28**	0.01	0.26	-0.00	1			
$Ln(\sigma^2_{rm})$	-0.16	0.40***	0.01	0.14	-0.00	-0.15	0.09	1		
$Ln(\beta^2)$	0.13	0.24	0.03	-0.22	-0.22	-0.29**	0.08	-0.03	1	
$Ln(\sigma^2_{\varepsilon})$	0.62***	0.33***	0.18	0.02	-0.11	-0.23*	0.13	0.61***	0.09	1

All variables are defined in Table 2. The table shows Pearson correlation coefficients. The *CAPS* and *AUD* dummy variables are excluded. (***), (**), (*) indicate significance at the 1%, 5% and 10% levels, respectively.

Table 5
Models of the relationship between stock market stability and bank regulation

	ϕ					$Ln(\sigma^2_\varepsilon)$
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	-20.25 (-2.32)**	-21.51 (-2.57)**	-32.41 (-3.71)***	-32.50 (-3.86)***	-36.05 (-4.16)***	-35.78 (-3.27)***
LnSIZE	0.028 (0.15)	0.02 (0.11)	0.15 (0.90)	0.13 (0.84)	0.27 (1.57)	0.21 (1.31)
LnROE	0.52 (3.46)***	0.54 (3.73)***	0.50 (3.71)***	0.51 (3.96)***	0.52 (4.17)***	0.35 (2.98)***
LnTANG	0.16 (1.11)	0.15 (1.14)	0.15 (1.18)	0.15 (1.21)	0.09 (0.72)	-0.06 (-0.53)
LnSPC	-0.09 (-0.68)	-0.07 (-0.53)	-0.16 (-1.24)	-0.13 (-1.07)	-0.16 (-1.31)	-0.11 (-0.99)
GDPG	-0.33 (-1.93)*	-0.22 (-1.28)	-0.16 (-.97)	-0.08 (-0.49)	-0.13 (-0.81)	-0.12 (-0.81)
LnLIST	0.24 (1.51)	0.27 (1.71)*	0.27 (1.83)*	0.28 (2.01)*	0.25 (1.80)*	0.22 (1.68)*
CAPS		0.30 (2.11)**		0.25 (1.92)*	0.25 (2.04)**	0.15 (1.29)
AUD			0.41 (3.13)***	0.38 (2.96)***	0.42 (3.34)***	0.36 (3.01)***
$Ln(\sigma^2_{rm})$					-0.26 (-2.05)**	0.43 (3.58)***
$Ln(\beta^2)$					-0.13 (-0.91)	-0.11 (-0.89)
R^2	0.33	0.40	0.47	0.53	0.58	0.63
Adjusted R^2	0.22	0.29	0.37	0.42	0.45	0.52
Durbin-Watson	1.93	2.14	2.19	2.41	2.16	2.32
F-statistic, (p-value)	3.00**	3.46***	4.60***	4.80***	4.56***	5.59***
Max/Min VIF	1.86/1.10	1.86/1.13	1.97/1.13	1.99/1.13	2.32/1.24	2.32/1.24
Valid N	43	43	43	43	43	43

All variables are defined in Table 2. Standardized beta coefficients are presented. *t*-values are in parentheses and *VIF* is the variance inflation factor. (***), (**) and (*) indicate significance at the 1%, 5% and 10% levels, respectively.

Table 6
Models of the relationship between stock market stability and bank regulation classified by country institutional settings and economic freedom characteristics

	Φ				
	Institutional settings		Economic freedom characteristics		
	LAW	*GOV*	*PR*	*FCRP*	*FTRD*
	Model 1	Model 2	Model 3	Model 4	Model 5
	High	*High*	*High*	*High*	*High*
Constant	-48.83	-45.25	-51.21	-48.30	-35.05
	(-3.82)***	(-3.62)***	(-3.70)***	(-3.51)***	(-2.66)**
LnSIZE	0.46	0.44	0.44	0.47	0.24
	(2.04)*	(1.93)*	(2.00)*	(1.94)*	(0.94)
LnROE	0.36	0.21	0.38	0.30	0.46
	(1.55)	(1.02)	(1.58)	(1.15)	(2.36)**
LnTANG	-0.00	-0.25	-0.03	-0.02	0.18
	(-0.00)	(-1.41)	(-0.17)	(-0.11)	(0.97)
LnSPC	-0.19	-0.27	-0.11	-0.18	-0.12
	(-0.87)	(-1.30)	(-0.45)	(-0.73)	(-0.52)
LnGDPG	0.14	0.13	0.10	0.12	-0.11
	(0.78)	(0.72)	(0.57)	(0.58)	(-0.50)
LnLIST	0.13	0.15	0.09	0.10	0.20
	(0.53)	(0.64)	(0.35)	(0.38)	(0.85)
CAPS	0.46	0.49	0.42	0.45	0.34
	(2.84)**	(3.01)***	(2.35)**	(2.58)**	(2.03)*
R^2	0.62	0.59	0.63	0.62	0.49
Adjusted R^2	0.45	0.42	0.44	0.41	0.32
Durbin-Watson	1.85	1.87	1.86	1.88	1.61
F-statistic (p-value)	3.60**	3.54**	3.44**	3.03**	2.83**
Max/Min VIF	2.53/1.09	2.49/1.14	2.59/1.24	2.44/1.07	2.37/1.16
T-test (CAPS)	-2.15**	-2.29***	-1.74*	-2.03*	-2.19***
Valid N	23	25	22	21	28

All variables are defined in Table 2. Standardized beta coefficients are presented, *t*-values are in parentheses and *VIF* is the variance inflation factor. A reduced multiple regression analysis model is used to preserve degrees of freedom. Low scoring groups for Models 1 to 5 are insignificant (results not shown for reasons of brevity). The t-test for equality of means between low and high groups is presented. *AUD* is excluded from the analysis models as it has an insignificant mean difference between the low and high groups. (***), (**) and (*) indicate significance at the 1%, 5% and 10% levels, respectively.

Table 7
Models of the relationship between stock market stability and bank regulation with country and income fixed effects

	ϕ			
	Model 1	Model 2	Model 3	Model 4
Constant	-27.72 (-2.28)**	-29.80 (0.01)**	-42.22 (0.00)***	-42.72 (0.00)***
LnSIZE	0.27 (0.48)	0.34 (0.67)	0.72 (1.50)	0.74 (1.73)*
LnROE	0.35 (2.38)**	0.39 (2.94)***	0.31 (2.57)**	0.35 (3.22)***
LnTANG	0.29 (0.46)	0.30 (0.53)	0.14 (0.27)	0.16 (0.36)
LnSPC	-.102 (-1.31)	-0.08 (-1.24)	-0.12 (-2.01)*	-0.11 (-1.98)*
LnGDPG	-.179 (-0.56)	0.04 (0.15)	0.19 (0.70)	0.35 (1.38)
LnLIST	0.84 (1.08)	0.74 (1.04)	0.59 (0.92)	0.53 (0.92)
CAPS		3.45 (2.62)**		2.91 (2.72)**
AUD			6.15 (3.72)***	5.62 (3.78)***
WBR (fixed effects)	*Included*	*Included*	*Included*	*Included*
WBI (fixed effects)	*Included*	*Included*	*Included*	*Included*
R^2	0.50	0.61	0.68	0.75
Adjusted R^2	0.20	0.35	0.46	0.57
F-statistic, (p-value)	1.67*	2.33**	3.16***	4.17***
Valid N	43	43	43	43

All variables are defined in Table 2. A reduced multiple regression analysis model is used to preserve degrees of freedom. Standardized beta coefficients are presented. *t*-values are in parentheses and the *VIF* is the variance inflation factor. (***), (**) and (*) significance at the 1%, 5% and 10% levels, respectively.