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Institutional quality, governance, and financial development

Siong Hook Law · W. N. W. Azman-Saini

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Abstract Using banking sector and stock market development indicators, we examine the effect of institutional quality on financial development in developed and developing countries. Empirical results are based on dynamic system generalized method of moments estimations and demonstrate that a high-quality institutional environment is important in explaining financial development, specifically for the banking sector. However, the stock market development-institution relationship is contingent one, characterized by a non-monotonic pattern. The results are robust to two measurements of institutions and governance indicators, as well as estimation methods.

Keywords Institutions · Governance · Banking sector · Capital market · Panel data analysis

JEL Classification G1 · O43

1 Introduction

Among the fundamental sources of long-run economic development, differences among "institutions" have received considerable attention in recent years. North (1990) defined institutions as the "rules of the game in a society, or, more formally…the humanly devised constraints that shape human interaction. In consequence they structure incentives in human exchange, whether political, social or economic." The most obvious formal institutions are the formal rules (constitutions, laws, and property rights) and informal institutions (conventions and codes of behaviour such as norms,

S. H. Law (✉) · W. N. W. Azman-Saini
Department of Economics, Faculty of Economics and Management, Universiti Putra Malaysia, Selangor, Malaysia
e-mail: lawsh@econ.upm.edu.my

customs, taboos, and traditions). North further stated that institutional change shapes the way societies evolve through time and, hence, the direction of economic performance. Numerous empirical studies have provided convincing evidence to support the view that differences in institutions can have a large effect on output per capita, including Knack and Keefer (1995), Hall and Jones (1999), Acemoglu et al. (2001, 2002), Rodrik (2002), Rodrik et al. (2004), Eicher and Leukert (2009).

Recently, researchers have shown increased interest in relating institutions and financial markets due to the characteristics of financial contracts. Indeed, with imperfect ability to enforce loan contracts, people are tempted to renege on their loans. Large and impersonal financial markets require not only an appropriate legal framework, but also adequate enforcement of the rights and constraints of each of the parties involved in the contract. Otherwise, financial contracts may become unfeasible because of well-known problems such as adverse selection and moral hazards that arise from asymmetry information. Capasso (2004) emphasized that the level of information asymmetry and the nature of information distribution among agents have significant relevance for resource allocation. In economies with informational asymmetries, both the nature of financial contracts and the institutional setting are critical for investment and capital accumulation. For example, if institutions are inadequate, the benefits of reneging on a financial contract can be so pronounced that they prevent the realization of the contract itself. In addition, good institutions are required to ensure the ability of the financial markets to channel resources so as to finance productive activities. Therefore, the link between institutional quality and financial development is clearly important.

Despite its importance, however, empirical evidence regarding this issue remains relatively thin.[1] Although the legal system and political institutions variables are correlated with quality of institution and governance (Zingales 2003), little, if any, direct evidence has confirmed that institutions and governance affect financial development. De Soto (2000) examined related issues, focusing on the role of property rights as a sort of institution, and claimed that the lack of property rights is a serious impediment to financial development. Other empirical studies have also found that better property rights and legal systems tend to improve financial development (see, for example, Claessens and Laeven 2003, and Mishkin 2009). Some authors have argued that general development of legal systems and institutions is crucial in mediating the effect of financial openness on financial development. For instance, Chinn and Ito (2006) argued that financial systems with a higher degree of institutional development, on average, benefit more from financial liberalization than those with a lower degree of development. Their finding suggests that the relationship between openness and financial development is contingent on institutions, where openness promotes financial development after institutions exceed a certain threshold level.

This study examined the effects of institutional quality and governance on financial development across developed and developing countries. While the existing literature is primarily focused on the roles of financial liberalization (McKinnon 1993), legal systems (La Porta et al. 1997, 1998; Roe 2006), government ownership of banks

[1] For more detail on the theoretical and empirical literature on institutions and financial development issues, see Fergusson (2006).

(La Porta et al. 2002; Andrianova et al. 2008), political institutions (Girma and Shortland 2008; Roe and Siegel 2011; Huang 2010), and trade openness (Beck 2002; Rajan and Zingales 2003; Baltagi et al. 2009; Law 2009) as sources of financial development, this study contributes to the literature by using governance indices that have not before been used in examining the roles of institutional quality and governance on financial development; the World Governance Indicators (WGI) and International Country Risk Guide (ICRG) indices have been employed to capture aspects of institutions and governance. Our empirical approach involved regressing two of the most important indicators of financial development—private sector credit and stock market capitalization—on institutional quality conditioned on variables recommended in the related literature. However, the institutional quality variable is likely to be endogenous, possibly because of feedback from financial development to institutional quality or because of common effects of omitted variables on both financial development and institutional quality. Therefore, this study employed generalized method of moments (GMM) estimations to deal with endogeneity. In addition to providing the linear dynamic model, this study also contributes to the literature by allowing the relationship between institutions and financial development to be nonlinear.

The rest of this paper is organized as follows: Sect. 2 reviews the related literature; Sect. 3 explains the empirical model, econometric methodology, and data employed; and Sect. 4 reports the estimated results and interprets the findings, while the final section concludes the discussion.

2 Review of related literature

Numerous studies in the literature have assessed the role of institutions in financial development, especially studies on the effects of the legal and regulatory environment on the functioning of financial markets. A legal and regulatory system involving protection of property rights, contract enforcement, and sound accounting practices has been identified as essential for financial development. Most notably, this is seen in La Porta et al. (1997, 1998), who argued that the origins of the legal code substantially influence the treatment of shareholders and creditors and the efficiency of contract enforcement. They found that low levels of shareholder rights are associated with poorly developed equity markets (especially in French civil law countries). In contrast, common law countries have high levels of shareholder rights with correspondingly high levels of equity market development; the researchers also found that greater creditor rights are positively associated with financial intermediary development. Levine (1998) also pointed out that countries with legal and regulatory systems that prioritize creditors receiving the full present value of their claims on corporations have better functioning financial intermediaries than countries in which the legal system provides much weaker support to creditors. In addition, they found that contract enforcement and information disclosure are significant determinants of financial development.

While the research has mainly focused on the roles of property rights and the legal system as determinants of financial market development, Rajan and Zingales (2003) questioned the link between legal origins and cross-country differences in financial development and instead stressed the important role of political forces in shaping policies toward financial markets and their development. They argued that in

countries where a narrow elite control political decisions, financial development may be obstructed to deny potential competitors access to finance. This idea was investigated further in Girma and Shortland (2008), who studied the impact of democracy characteristics and regime change on financial development. Using panel regression and GMM, they indicated that the degree of democracy and political stability are significant determinants of the speed of financial development. They argued that the banking sector benefits from regime stability and increasing democracy, while stock market capitalization grows faster in fully democratic regimes. Huang (2010) found a positive effect of institutional improvement on financial development at least in the short run, and this was particularly true for lower income economies, ethnically divided countries, and French legal-origin countries. As with Girma and Shortland (2008), he also demonstrated that a democratic transformation is typically followed by an increase in financial development.

Another significant work in this political economy context is Roe and Siegel (2011). They pointed out that a country's capacity and willingness to build and maintain investor-protection institutions depends largely on the country's political stability. Primary institutions of investor protection—such as legal rules, courts, and regulators—cannot function well in an unstable political environment, and this failure may well be a critical channel connecting political instability to financial backwardness. Using various political stability indicators, cross-section, and panel fixed-effect estimations, they found that variation in political stability indeed has a significant, consistent, and substantial impact on debt and stock market development. Apart from Roe and Siegel (2011); Haber (2008) also examined the role of politics in financial development in the United States and Mexico from 1790 through 1914. He argued that the government is not a disinterested party in financial markets. It has strong incentives to behave opportunistically and use financial repression for its own benefit. However, institutions that encourage political competition reduce the chance for opportunistic behavior and generate larger, more competitive, and more efficient banking systems.

In addition to formal institutions, such as the legal system and enforcement, another strand of the literature has focused on the relationship between informal institutions, specifically, social capital based on trust, and on financial development. Social capital is often defined as shared norms that promote cooperation between two or more individuals (Coleman 1988; Fukuyama 1999; Ostrom 2000). Shared norms facilitate the functioning of a society by fostering trust and reducing the incentive to cheat. Guiso et al. (2004) highlighted that since financial contracts are the ultimate trust-intensive contracts, social capital should have major effects on the development of financial markets. Calderon et al. (2001) examined the link between social capital and financial development and found a positive and economically large effect of trust on the size and activity of financial intermediaries, the efficiency of commercial banks, and the extent of stock and bond market development. They also pointed out that trust appears to be a key complement of formal institutions when a society has little regard for the rule of law, or vice versa.

In another major study, Mishkin (2009) argued that globalization is a key factor in stimulating institutional reforms in developing countries that promote financial development and economic growth. Sound institutions are essential for promoting financial development because such institutions establish and maintain strong property rights,

an effective legal system, and efficient financial regulation. Therefore, institutional quality plays an important role in mediating the effect of globalization on financial development. Law (2009) demonstrated that trade openness and financial openness appear to have positive impacts on financial development in developing countries. He also further analyzed whether the impacts result from fostering competition or upgrading institutional quality, and his findings indicated that the institutional quality channel outperforms the competition channel in promoting financial development.

3 Empirical model, methodology, and data

The empirical specification is aimed at explaining the determinants of financial development by testing the role of institutional quality. Thus, the empirical model employed in the analysis was as follows:

$$\begin{aligned} ln\ FD_{it} = \beta_{0i} + \beta_{1i} ln\ FD_{it\text{-}1} + \beta_{2i} ln\ INS_{it} + \beta_{3i} ln\ RGDPC_{it} \\ + \beta_{4i} ln\ TO_{it} + \beta_{5i} ln\ FO_{it} + \mu_i + \varepsilon_{it} \end{aligned} \quad (1)$$

where *FD* is financial development, *INS* is institutional quality, *RGDPC* is real gross domestic product (GDP) per capita, *TO* is trade openness, *FO* is financial openness, and the subscripts i and t index countries and time, respectively. In addition, the specification also contains an unobservable country-specific effect μ and error-term ε. We controlled for real GDP per capita or demand for financing because it has been found to promote financial development, for instance, by Patrick (1966),[2] Colombage (2009), Demetriades and Hussein (1996), Calderon and Liu (2002), and Yang and Yi (2008). In addition, trade openness and financial openness are also included in the model specification because openness has been found to affect financial development, as shown by Svaleryd and Vlachos (2002), Rajan and Zingales (2003), Chinn and Ito (2006), Braun and Raddatz (2008), Law (2008, 2009) and Baltagi et al. (2009).

The relationship between institutional quality and financial development may be nonlinear. Institutional reforms generally improve financial development, but the magnitude might vary with the level of economic development. We hypothesized that the nonlinear effect is a priori ambiguous and can be determined empirically by adding the squared term of the institutional quality variable into Eq. (1). Consequently, the regression model can be rewritten as follows:

$$\begin{aligned} ln\ FD_{it} = \beta_{0i} + \beta_{1i} ln\ FD_{it\text{-}1} + \beta_{2i} ln\ INS_{it} + \beta_{3i} ln\ INS_{it}^2 \\ + \beta_{4i} ln\ RGDPC_{it} + \beta_{5i} ln\ TO_{it} + \beta_{5i} ln\ FO_{it} + \mu_i + \varepsilon_{it} \end{aligned} \quad (2)$$

The U-shaped nonlinear relationship predicts $\beta_2 < 0$ and $\beta_3 > 0$. Equations (1) and (2) provide the basis for the empirical models estimated in this study. At the margin,

[2] Patrick (1966) pointed out that the lack of financial markets and systems in developing countries indicate a lack of demand for their services—the so-called demand-following phenomenon. As the real side of the economy develops, its demands for various new financial services materialize. This implies that economic growth may increase the real sector's demand for financial services, thus leading to financial market development.

the total effect of increasing institutional quality can be calculated by examining the partial derivatives of financial development with respect to the institutions variable:

$$\frac{\partial \ln FD_{it}}{\partial \ln INS_{it}} = \beta_2 + 2\beta_3 \ln INS_{it} \tag{3}$$

To assess whether the institutions variable, used as a quadratic term, had a significant effect on financial development, we computed the standard error of the marginal effect as suggested by Brambor et al. (2005).[3]

3.1 Econometric methodology

The econometric method employed to estimate the equations was based on the dynamic panel GMM estimators suggested by Arellano and Bond (1991) and further developed by Arellano and Bover (1995) and Blundell and Bond (1998). Since the estimator has been widely applied in the literature, only a brief explanation is presented here.[4] This estimator was selected because of the need to address country-specific effects and simultaneity bias. To explain its application in relation to our dataset, consider the baseline Equation (1). Arellano and Bond (1991) suggested transforming Equation (1) into a first-difference to remove the country-specific effect and using lagged levels of the regressors as instruments to eliminate simultaneity bias. However, several recent papers have illustrated that this type of modelling strategy may lead to incorrect inferences if the explanatory variables are persistent (Arellano and Bover 1995). This is particularly relevant for institutions, as such a strategy has a strong tendency to persist once it becomes established in society (Acemoglu and Robinson 2008). To overcome this problem, Arellano and Bover (1995) and Blundell and Bond (1998) proposed a system GMM estimator in which the level and difference equations are combined. The lagged differences of the regressors are then used as additional instruments for a level equation. They illustrated that this type of modelling strategy can reduce biases and imprecision linked to the difference estimator.

There are two variants of GMM estimators, the one- and two-step estimator. Theoretically, the two-step estimator is more efficient than the one-step estimator because it uses optimal weighting matrices. However, it should be noted that its application to a sample with a small cross-section dimension, as in the present study, may lead to biased standard errors, biased estimated parameters (Windmeijer 2005), and a weakened over-identification test (Bowsher 2002). In a recent paper, Roodman (2009) illustrated that the cause of these problems is instrument proliferation. The author then proposed an innovative solution that reduces the dimensionality of the instrumental variable matrix. For example, for the dataset used in Table 3 with N = 63 countries and T = 6,

[3] For example, in the case where the model is $Y = \beta_0 + \beta_1 X + \beta_2 X^2 + \beta_3$, the marginal effect is $\frac{\partial Y}{\partial X} = \beta_1 + 2\beta_2 X$. Using the covariance matrix, the variance (i.e., standard error) is calculated as $\sigma^2_{\frac{\partial Y}{\partial X}} = var(\hat{\beta}_1) + 4X^2 var(\hat{\beta}_2) + 4X cov(\hat{\beta}_1 \hat{\beta}_2)$.

[4] Interested readers may refer to Beck et al. (2000) and Azman-Saini et al. (2010) for detailed explanations of the empirical application of the system GMM estimator.

we restricted the moment conditions to a maximum of two lags on the dependent variables. This yielded a Hansen statistic that was asymptotically distributed as Chi-squared with 63 degrees of freedom (i.e., sixty-three over-identification restrictions).

This research applied the two-step system GMM estimator to examine the impact of institutional quality on financial development. Following Roodman (2009), the dimensionality of the instrumental variable matrix was reduced. The consistency of the GMM estimator depends on two specification tests, the Hansen (1982) J test of over-identifying restrictions and a serial correlation test in the disturbances (Arellano and Bond 1991). Failure to reject the null of the Hansen J test would imply that the instruments are valid and the model is correctly specified. With respect to the serial correlation test, one should reject the null of the absence of the first order serial correlation (AR1) and not reject the absence of the second order serial correlation (AR2).

3.2 Data

In this study, to estimate the above equations, we used two datasets corresponding to two financial development measures. For private sector credit as a measure of financial development, the number of countries was sixty-three, whereas for stock market capitalization as a proxy of financial development, the number of countries was fifty-one. The sample period for both datasets spanned from 1996 through 2004, but with gaps[5] where the institutions and governance dataset came from the WGI, and from 1984 through 2004 where the institutions dataset came from the ICRG.[6] The list of countries is presented in Tables 1 and 2.

Two financial development indicators were employed in the analysis: private sector credit and stock market capitalization. These two financial development indicators were expressed as ratios to GDP. The source of the annual data was the World Development Indicators (World Bank). Annual data on real GDP per capita (based on 2000 U.S. dollar constant prices) and trade openness (sum of exports and imports of goods and services) were obtained from the World Development Indicators. The financial openness indicator came from Lane and Milesi-Ferretti (2007). This indicator is defined as the volume of a country's foreign assets and liabilities as a percentage of GDP. This measure provides a useful summary of a country's history of capital account openness.

Two datasets of institutions and governance were employed in the analysis: (i) the WGI by Kaufmann et al. (2008) and (ii) the ICRG, a monthly publication of Political Risk Services (PRS). Both datasets have been widely used in the literature.[7]

The WGI dataset was constructed based on information gathered through a wide variety of cross-country surveys and expert polls. Kaufmann et al. (2008) used a model of unobserved components, which enabled them to achieve levels of coverage

[5] The sample period ran from 1996, then 1998, 2000, 2002, 2003, and 2004.

[6] The dataset was averaged over a four-year period representing the business cycles relationship (i.e., 1984–1987, 1988–1991, 1992–1995, 1996–1999, 2000–2004) and, therefore, a maximum of five observations was available for each variable per country.

[7] The WGI has been described in a series of papers, including Kaufmann et al. (2009), Meon and Weill (2005), Easterly (2002), Al-Marhubi (2004), Bjornksov (2006) and Langbein and Knack (2010).

Table 1 Summary of data set financial development proxy: private sector credit (annual data: 1996–2004; N = 63)

Variable	Source	Unit of measurement	Mean	SD	Max	Min
Private sector credit	WDI	% of GDP	58.50	48.57	196.65	0.85
Institutions						
$\text{Institutions}_{\text{WGI}}$	World governance indicators (WGI)	Percentile 0–100	55.38	27.29	99.51	1.37
$\text{Institutions}_{\text{ICRG}}$	International Country risk guide (ICRG)	Index 1–50	30.63	10.06	49.17	11.5
Real GDP Per Capita	WDI	US$ at 2000 prices	8, 576.55	10,932.09	37, 375.9	149.10
Financial openness	Lane and Milesi-Ferretti (2007)	% of GDP	214.80	215.16	1, 346.50	47.79
Trade openness	WDI	% of GDP	71.60	37.23	209.67	21.41

Algeria, Argentina, Australia, Bangladesh, Belgium, Bolivia, Brazil, Burkina Faso, Cameroon, Canada, Chile, Colombia, Democratic Republic of Congo, Denmark, Dominican, Ecuador, Egypt, Finland, France, Gabon, Gambia, Ghana, Greece, Guatemala, Honduras, Hungary, India, Indonesia, Ireland, Italy, Jamaica, Japan, Jordan, Kenya, Korea, Malawi, Malaysia, Malta, Mexico, Morocco, Netherlands, Nigeria, Norway, Pakistan, Paraguay, Peru, Philippines, Portugal, Senegal, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Syria, Thailand, Tunisia, Turkey, UK, Uruguay, US, Venezuela, Zambia, Zimbabwe

of approximately 212 countries for each of their indicators. They constructed six different indicators, each representing a different dimension of institutional quality and governance: (i) voice and accountability, (ii) political stability and lack of violence, (iii) government effectiveness, (iv) regulatory quality, (v) rule of law, and (vi) control of corruption. These WGI indicators, however, have been criticized, especially for their lack of theoretical foundation.

Langbein and Knack (2010) used a confirmatory factor and path analysis to test both the measurement and causal models of the six WGI indicators. They found that the WGI indicators appear to measure the same broad concept. In addition, their findings also supported those of other researchers (Easterly 2002; Al-Marhubi 2004; Bjornksov 2006) who have averaged together the six indicators into a single broader index due to the indicators having high inter-correlations. Therefore, in this study, the institutions indicator was measured by averaging these six indicators.

The second institutional quality and governance dataset from the ICRG was constructed using five PRS indicators to measure economic institutions: (i) corruption, (ii) law and order, (iii) bureaucratic quality, (iv) government repudiation of contracts, and (v) risk of expropriation. Higher values for these indicators, the first three of which are scaled from 0 to 6 and the other two from 0 to 10, imply better institutional quality. Since all these aspects of the institutional environment are likely to be relevant to the security of property rights, we bundled them into a single summary measure by summing them (after appropriate re-scaling). Thus, the theoretical range of this index

Table 2 Summary of data set financial development proxy: stock market development (annual data: 1996–2004; N = 51)

Variable	Source	Unit of measurement	Mean	SD	Max	Min
Stock market capitalization Institutions	WDI	% of GDP	54.51	49.04	227.76	1.44
$\text{Institutions}_{\text{WGI}}$	World governance indicators (WGI)	Percentile 0–100	60.01	26.35	99.51	5.62
$\text{Institutions}_{\text{ICRG}}$	International Country risk guide (ICRG)	Index 1–50	33.46	8.56	49.17	14.30
Real GDP per capita	WDI	US$ at 2000 prices	9,872.99	11,429.05	37,375.9	255.47
Financial openness	Lane and Milesi-Ferretti (2007)	% of GDP	224.47	227.68	1,346.50	47.79
Trade openness	WDI	% of GDP	71.88	39.56	209.67	21.41

Argentina, Australia, Bangladesh, Belgium, Bolivia, Brazil, Canada, Chile, Colombia, Denmark, Ecuador, Egypt, Finland, France, Ghana, Greece, Hungary, India, Indonesia, Ireland, Italy, Jamaica, Japan, Jordan, Kenya, Korea, Malaysia, Malta, Mexico, Morocco, Nigeria, Norway, Pakistan, Paraguay, Peru, Philippines, Portugal, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Thailand, Tunisia, Turkey, UK, Uruguay, US, Venezuela, Zambia, Zimbabwe

ran from 0 to 50. The descriptive statistics of the variables are summarized in Tables 1 and 2.

4 Empirical results

Table 3 presents the empirical results of the linear model (Eq. 2) using the dynamic panel GMM approach. The financial development indicators employed in the estimations were private sector credit and stock market capitalization. In Models 1a and 2a, the institutional quality measure came from the WGI, whereas the quality measure for Models 1b and 2b came from the ICRG.

The lagged dependent variable is statistically significant, which implies that the dynamic GMM is an appropriate estimator and the empirical results can be relied upon for statistical inference. The findings indicate that all institutional quality indicators improve financial development, when both the institutional and governance indicators are measured by WGI or ICRG. However, the institutions indicator is only a statistically significant determinant of banking sector development, where financial development is measured by private sector credit in Models 1a and 2a. Surprisingly, the institutional quality variable is an insignificant determinant of stock market development in Models 1b and 2b. This finding suggests that different financial development indicators respond differently to the institutions and governance variables, where the

Table 3 Results of dynamic panel GMM estimations. Dependent variable: financial development (FD) linear model

	FD: private sector credit		FD: stock market capitalization	
	Model 1a (Institutions: WGI)	Model 1b (Institutions: ICRG)	Model 2a (Institutions: WGI)	Model 2b (Institutions: ICRG)
Constant	0.16	−1.62	0.63	−0.06
	(0.26)	(−2.10)	(0.69)	(−0.04)
FD_{it-1}	0.72	0.76	0.66	0.60
	(10.36)***	(12.02)***	(7.56)***	(5.99)***
RGDPC	0.27	0.25	0.31	0.28
	(2.78)***	(2.24)**	(2.13)**	(2.23)**
Trade openness	0.07	0.08	0.06	0.06
	(0.30)	(0.57)	(0.38)	(0.25)
Financial openness	−0.18	−0.14	−0.42	−0.41
	(−3.35)***	(−2.79)***	(−1.65)	(−1.91)
Institutions	0.22	0.78	0.02	0.39
	(2.13)**	(3.86)***	(0.14)	(0.83)
Hansen test of over identifying restrictions	58.06	58.38	43.94	47.06
	(0.823)	(0.815)	(0.983)	(0.962)
Arellano-bond test for AR(1)	−3.09	−3.02	−2.75	−2.57
	(0.002)***	(0.003)***	(0.006)***	(0.010)***
Arellano-bond test for AR(2)	−0.46	−0.67	−0.92	−0.93
	(0.648)	(0.504)	(0.360)	(0.352)
Sample period	1996−2004	1984−2004	1996−2004	1984−2004
Number of countries (N)	63	63	51	51
Number of time periods (T)	5	5	5	5

All models are estimated using the Arellano and Bond dynamic panel system GMM estimations (Stata xtabond2 command). Figures in parentheses are t-statistics, except for Hansen test and Arellano-Bond test for serial correlation, which are *p* values. ** and *** indicate the respective 5 and 1 % significance levels

effect of institutional quality on financial development is robust for banking sector development, while this is not the case for stock market capitalization. As the sample consisted of developing countries, many of which are severely underdeveloped, the use of stock market measures might not be a good representative of financial development.[8]

[8] The literature suggests that most developing countries' development progress is related to banking systems as their choice for channelling funds from savers to investors. Their capital markets are allowed to develop further only when the economy reaches a certain development stage. For example, the market capitalization in middle- and low-income countries does not exhibit much variation as compared with that

In terms of other control variables in the financial development specification, the coefficient of real GDP per capita is positive and a statistically significant determinant of financial development throughout the four models. In contrast, the coefficient of financial openness is negative and a significant determinant of private sector credit at conventional levels in Models 1 and 2. The insignificant results of trade openness may be due to the measurement used in the study, which was the sum of exports and imports divided by GDP.[9] Overall, the estimated models in Table 3 are relatively well specified. Hence, all three diagnostic statistics were found to be satisfactory. The Hansen test did not reject the over-identification restrictions. As expected, the null hypothesis of the absence of the first order serial correlation (AR1) was rejected, but the null hypothesis of the absence of the second order serial correlation (AR2) was not.

Table 4 reports the estimated results of Eq. (2), which examines the nonlinear relationship between financial development and institutions. In the specification, an additional quadratic term for the measures of institutions factor was included in the estimation to allow for the formation of the U-shaped pattern. The empirical results indicate that the institutions and governance indicator and the squared term are insignificant determinants of private sector credit in Models 3a and 3b. Nevertheless, both are statistically significant determinants of stock market development in Models 4a and 4b, regardless of whether the measure is proxied by WGI and ICRG. The coefficients on institutional quality and its squared term are negative and positive, respectively. This implies that institutions have a nonlinear relationship with stock market development. Again, all three diagnostic statistics were found to be satisfactory.

To shed additional light on the quantitative importance of institutions for stock market development under the U-shaped relationship, we determined the threshold level institutional quality for the sample countries. The threshold values for both WGI and ICRG were computed as 19.80 and 16.96, respectively.[10] In a scenario where the institutions in the country are lower than or equal to the threshold, institutional quality will exert a negative effect on stock market development. This implies that financial development will be lessened when institutional quality improves. On the other hand, if the institutional quality exceeds the threshold, the institutions quality effect on financial development will turn positive. In other words, further institutional reforms will lead to stock market development. Based on the dataset, we observed that most of the low-income countries in this study fell below the threshold level, whereas the high-income countries were above the threshold level.

The marginal effect in all models in Table 4 is evaluated at the mean, maximum, and minimum values of institutions, based on the calculated standard errors (Brambor et al. 2005). For example, in Model 4a, the mean, maximum, and minimum values of the WGI in logarithms are 3.963, 4.600, and 1.725, respectively, yielding the marginal effect of 0.684, 1.130, and −0.882. As shown in this table, the marginal effect

Footnote 8 continued
of high-income countries. On average, the market capitalization in these countries is quite low. This may explain why the results were somewhat poorer when stock market measures were employed in the analysis. In addition, this indicator fluctuates with stock market prices.

9 For further discussion on measuring trade openness, see Squalli and Wilson (2011).

10 $\exp(2.9857) = 19.80$ and $\exp(2.8309) = 16.96$.

Table 4 Results of dynamic panel GMM estimations. Dependent variable: financial development (FD) non-linear model

	FD: private sector credit		FD: stock market capitalization	
	Model 3a (Institutions: WGI)	Model 3b (Institutions: ICRG)	Model 4a (Institutions: WGI)	Model 4b (Institutions: ICRG)
Constant	0.86	1.90	5.16	23.95
	(0.99)	(0.39)	(2.65)	(4.66)
FD_{it-1}	0.75	0.73	0.56	0.61
	(10.76)***	(12.49)***	(6.19)***	(7.61)***
RGDPC	0.10	0.09	0.11	0.15
	(1.98)**	(1.75)	(1.85)	(1.67)
Trade openness	0.04	0.09	0.03	0.05
	(0.27)	(0.84)	(0.16)	(0.24)
Financial openness	−0.27	−0.17	−0.30	−0.44
	(−3.20)***	(−2.26)**	(−1.84)	(−1.94)
Institutions	−0.13	−1.58	−2.09	−4.02
	(−0.47)	(−0.51)	(−2.81)***	(−3.52)***
$Institutions^2$	0.06	0.38	0.35	0.71
	(1.34)	(0.74)	(2.58)***	(3.15)***
Hansen test of over identifying restrictions	54.97	52.74	46.32	47.18
	(0.991)	(0.995)	(0.999)	(0.998)
Arellano-bond test for AR(1)	−3.05	−2.98	−2.34	−2.98
	(0.002)***	(0.003)***	(0.019)***	(0.003)
Arellano-bond test for AR(2)	−0.34	−0.66	−0.88	−0.79
	(0.736)	(0.507)	(0.381)	(0.420)
Sample period	1996−2004	1984−2004	1996−2004	1984−2004
Number of countries (N)	63	63	51	51
Number of time periods (T)	5	5	5	5
Marginal effect:				
Mean	0.342	0.458	0.684**	1.661**
	(0.215)	(0.517)	(0.341)	(0.775)
Maximum	0.630	1.366	1.130***	3.681***
	(0.402)	(0.845)	(0.411)	(1.378)
Minimum	−0.212	−0.581	−0.882***	−1.955***
	(0.110)	(0.528)	(0.295)	(0.628)

All models are estimated using the Arellano and Bond dynamic panel system GMM estimations (Stata xtabond2 command). Figures in parentheses are t-statistics, except for Hansen test (p values), Arellano-Bond test for serial correlation (p values) and marginal effect (SE). ** and *** indicate the respective 5 and 1 % significance levels

is an insignificant determinant of banking sector development in Models 3a and 3b; regardless, the institutions variable is measured by WGI or ICRG. Nevertheless, the marginal effect is a statistically significant determinant of stock market capitalization at conventional levels in Models 4a and 4b, where the institutions variable is measured by WGI and ICRG, respectively.

In addition to using the panel data analysis, this study also estimated Equations (1) and (2) using a cross-country analysis. Given that institutions and governance are deep factors and usually evolve slowly, actual variations in these variables may be reflected on perceptions with a lag, and the lag may differ from one country to the next. Therefore, a cross-section regression was employed to cope with the persistence of institutional quality. In addition, it can verify the nonlinear relationship between stock market capitalization and institutions. Given the volatility of stock markets, the relationship likely cannot be assessed using variations over a short sample period because there is too much short-term noise.

The results of cross-country regressions in Table 5 are broadly similar to those reported in Tables 3 and 4, where the institutional quality variable is a significant determinant of the private sector credit in linear Models 1a and 2a. This results in a nonlinear U-shaped relationship between stock market capitalization and institutions, as illustrated in Models 3b and 4b. The notable differences are that financial openness appears to be insignificant in cross-country regressions in influencing private sector credit, and the real GDP per capita variable loses significance at conventional levels in Models 3 and 4, where the financial development indicator is proxied by stock market capitalization.

4.1 Robustness checks

A large number of robustness checks were carried out to examine the sensitivity of the results to alternative estimation strategies and methods. The first set of robustness checks involves the application of an alternative estimation method, namely, the fixed effects (within) estimator. To this end, we report the results of estimating the private sector credit linear equation and stock market capitalization nonlinear equation[11] in Table 6. The results of the fixed effects estimator (regardless of whether the financial development indicator is private sector credit or stock market capitalization) are quantitatively quite similar to those reported using the system GMM estimator, as seen in Tables 3 and 4. More specifically, the coefficient of the lagged dependent variable is remarkably close to that obtained with the GMM estimator. All coefficients have the same sign as those obtained with the system GMM estimator; the real GDP per capita and institutions are statistically significant determinants of private sector credit and stock market capitalization. The results of the fixed effects estimator also highlight the nonlinear relationship between stock market capitalization and institutions, as is the case with the GMM estimator. Therefore, the empirical results are robust

[11] The institutions variable is an insignificant determinant of private sector credit in the nonlinear model and stock market capitalization in the linear model. The empirical results, however, are not reported. The time dummies were included in the robustness checks, but not reported to conserve space.

Table 5 Results of cross-country estimations. Dependent variable: financial development (FD)

	Private sector credit				Stock market capitalization			
	Institutions = WGI		Institutions = ICRG		Institutions = WGI		Institutions = ICRG	
	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b	Model 4a	Model 4b
Constant	−1.74	−1.73	−6.73	−23.89	−1.72	6.85	−5.34	10.67
	(−2.66)	(−1.21)	(−3.04)	(−1.03)	(−1.59)	(1.21)	(−2.01)	(0.32)
RGDPC	0.18	0.18	0.23	0.26	0.19	0.17	0.17	0.15
	(1.99)**	(2.01)**	(2.42)**	(2.74)***	(1.16)	(1.43)	(1.32)	(1.13)
Trade openness	0.22	0.22	0.36	0.34	0.18	0.15	0.22	0.22
	(1.03)	(1.02)	(1.55)	(1.46)	(0.53)	(0.45)	(0.70)	(0.68)
Financial openness	−0.19	−0.19	−0.39	−0.31	0.04	0.08	0.04	0.07
	(−1.95)	(−1.81)	(−1.74)	(−1.83)	(0.15)	(0.32)	(0.18)	(0.29)
Institutions	1.03	1.03	2.91	14.06	0.71	−3.49	2.15	−8.18
	(7.01)***	(1.71)	(3.02)***	(0.95)	(1.39)	(−2.05)**	(1.88)	(−2.49)**
Institutions^2	–	0.09	–	-1.86	–	0.61	–	1.69
		(1.01)		(−0.78)		(2.26)**		(2.14)**
R-square	0.7057	0.7059	0.6284	0.6367	0.3983	0.4182	0.4189	0.4243
Number of countries (N)	63	63	63	63	51	51	51	51
Marginal effect (Mean)	–	0.3621	–	0.4850	–	0.8233**	–	2.1259**
		(0.2547)		(0.3212)		(0.4025)		(0.8698)

All models are estimated using the robust standard errors estimations (Stata reg Y X, robust command). Figures in parentheses are t-statistics except for marginal effect, which are standard errors. ** and *** indicate the respective 5 and 1 % significance levels

Table 6 Robustness checks. Dependent variable: financial development (FD)

	Fixed effect				Difference GMM			
	Private sector credit (linear model)		Stock market capitalization (non-linear model)		Private sector credit (linear model)		Stock market capitalization (non-linear model)	
	Model 1a INS = WGI	Model 1b INS = ICRG	Model 2a INS = WGI	Model 2b INS = ICRG	Model 3a INS = WGI	Model 3b INS = ICRG	Model 4a INS = WGI	Model 4b INS = ICRG
Constant	−1.71	−3.28	−2.89	7.08	–	–	–	–
	(−0.94)	(−1.76)	(−0.97)	(1.11)				
FD_{it-1}	0.75	0.77	0.69	0.61	0.58	0.69	0.52	0.53
	(7.48)***	(7.72)***	(3.27)***	(3.45)***	(3.01)***	(5.31)***	(3.30)***	(2.96)***
RGDPC	0.20	0.19	1.03	0.85	0.22	0.18	0.10	0.13
	(2.14)**	(2.77)***	(2.86)***	(2.26)**	(2.05)**	(2.34)**	(2.49)**	(2.40)**
Trade openness	0.06	0.05	0.28	0.17	0.07	0.02	0.09	0.05
	(1.54)	(0.41)	(1.41)	(0.86)	(0.23)	(0.15)	(0.26)	(0.15)
Financial openness	−0.26	−0.21	0.02	0.03	−0.19	−0.27	−0.08	−0.12
	(−2.08)**	(−2.14)**	(0.10)	(0.16)	(−1.89)	(−1.97)	(−1.28)	(−1.36)
Institutions (INS)	0.18	0.37	−2.02	−3.81	0.17	0.63	−1.27	−1.54
	(2.21)**	(2.14)**	(−2.05)**	(−2.16)**	(2.29)**	(2.40)**	(−2.42)**	(−2.29)**
$Institutions^2$	–	–	0.24	1.24	–	–	0.36	0.58
			(2.14)**	(2.36)**			(1.91)	(2.43)**

Table 6 continued

	Fixed effect				Difference GMM			
	Private sector credit (linear model)		Stock market capitalization (non-linear model)		Private sector credit (linear model)		Stock market capitalization (non-linear model)	
	Model 1a INS = WGI	Model 1b INS = ICRG	Model 2a INS = WGI	Model 2b INS = ICRG	Model 3a INS = WGI	Model 3b INS = ICRG	Model 4a INS = WGI	Model 4b INS = ICRG
Hansen test of over identifying restrictions	–	–	–	–	51.63	51.93	39.39	43.62
					(0.231)	(0.222)	(0.67)	(0.49)
Arellano-bond test for AR(1)	–	–	–	–	−2.44	-2.88	−2.05	−2.33
					(0.015)**	(0.004)***	(0.040)**	(0.020)**
Arellano-bond test for AR(2)	–	–	–	–	-0.77	−0.75	−0.20	−0.35
					(0.439)	(0.451)	(0.839)	(0.725)
Number of countries (N)	63	63	51	51	63	63	51	51
Number of time periods (T)	5	5	5	5	5	5	5	5
Marginal effect (Mean)	–	–	0.7652**	1.8954**	–	–	0.7241**	1.7633**
			(0.3304)	(0.9250)			(0.3528)	(0.8547)

Figures in parentheses are t-statistics, except for Hansen test and Arellano-Bond test for serial correlation, which are *p* values, and marginal effect is standard errors. ** and *** indicate the respective 5 and 1 % significance levels

to the alternative estimation method. However, we did not pursue the fixed effects estimators any further because they are biased when a lagged dependent variable is present.

The second set of robustness checks involves using the two-step difference GMM estimator; these results are also reported in Models 3 and 4, Table 6. The empirical results are similar to those obtained using the dynamic GMM estimator shown in Table 4. More specifically, the lagged dependent variable remains positive and significant with a coefficient of about 0.5–0.7. Real GDP per capita and institutions are statistically significant determinants of both financial development indicators. Again, the results of the difference GMM also demonstrate a nonlinear relationship between stock market capitalization and institutions, as seen in Model 4b, where the institutions variable is measured by ICRG. In Models 4a and 4b, trade openness and financial openness have somewhat larger coefficients than those obtained with the dynamic GMM seen in Table 4; they are also insignificant. Based on this finding, we conclude that the qualitative nature of the results remains unaltered.

5 Conclusions

This study examined the role of institutions and governance in influencing financial development across developed and developing countries. Although institutional quality has been gaining popularity in recent years, especially to promote economic growth, no available econometric evidence has traced the link between institutional quality and financial development. As financial development and institutional quality become reality as sources of economic growth, it is important to understand how institutional quality affects financial development.

Based on dynamic panel system GMM estimations and two institutional quality datasets, the empirical results suggested that institutions and governance significantly enhance banking sector development. The stock market development indicator, on the other hand, illustrated a nonlinear relationship with influence from institutional quality, where the institutional quality indicator depicts the U-shaped relationship with stock market capitalization. The findings indicated that the banking sector and stock market respond differently to institutions and governance. The empirical results were robust to alternative estimation techniques and two institutional quality measures, namely, the World Governance Indicators and the International Country Risk Guide.

The marginal effect also demonstrated a significant result, which revealed that institutional quality does contribute to stock market development, but only when a threshold level of institutional development has been attained, a condition that is more prevalent in low-income economies. Most of the low-income countries are located at the low side of institutional quality, which suggests that further improvement of institutions and governance above the threshold will lead to an upturn in their stock market development.

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