The impact of adopting shareholder primacy corporate governance on the growth of the financial market in developing countries.

By

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Abstract

Since the late 1990s, developing countries have been encouraged by international financial organisations to adopt a shareholder primacy corporate governance model. It was anticipated that in an increasingly globalised financial market, countries which introduced corporate governance practices that favour investors would gain a comparative advantage and attract more capital leading to financial market growth.

The present research paper quantitatively investigates whether adopting shareholder primacy corporate governance norms has had any impact on the growth of the financial market, focusing on nineteen developing countries between 1995-2014. Time series indices are prepared for corporate governance regulations, financial market development along with three control indices. Then a lagged multilevel regression between these indices is used to investigate the strength of causality between the adoption of pro-shareholder corporate governance and the growth of the financial market.

The research paper finds that shifting towards a shareholder primacy model in corporate governance has a very small effect on growth of financial market in developing countries. Overall the financial, economic, and technological controls have much more impact on the growth of financial markets.

Keywords: *Quantitative corporate governance, graded response model, multi-level regression, Bayesian statistics, leximetrics*

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1. Introduction

Corporate governance has become a lightning rod for a wide variety of issues ranging from business standards to accounting standards, from corporate social responsibility to supply chain management, from a band aid to financial crisis, via a tool for ensuring macro/microeconomic stability to a way of improving political economy. Almost all strands of interdisciplinary studies in law, economics and finance have been invaded by the omnipresent spectre of corporate governance. Over the years, with repeated accounting frauds and related crises, there has been a growing clamour for a magic bullet to solve these problems, and so theoreticians and practitioners dusted off old ideas and 'reinvented' corporate governance in the early 1990s. Suddenly, the world seemed to be in the grip of a new mania. This coincided with the period following the grand success of the neo-liberal economic principles of 1980s, and the fall of the Soviet Union seemed to provide final proof of the superiority of free market principles. Thereafter followed a period of intense transplantation of legal ideas, the international financial organisations promised that '[T]he improvement of corporate governance practices is widely seen as one important element in strengthening the foundation for individual countries' long-term economic performance and in contributing to a strengthened international financial system.'[1] This economic rationale was also picked up by the United Nations Conference on Trade and Development which stated that improvements to corporate governance would 'facilitate investment flows and mobilize financial resources for economic development.'[2] This research paper explores whether the promise that countries adopting shareholder primacy corporate governance norms would benefit from higher financial market growth, which justified convergence and transplantation, specifically in the area of company law and corporate governance in developing countries, has been fulfilled.

The major corporate governance code available around this time period was the OECD Principles of Corporate Governance, which was based primarily on the shareholder value corporate governance model, although it also provided limited space for stakeholder models. So in effect what was being recommended to developing countries was a shareholder value model based on the Anglo-Saxon model. The claim was that if a country adopted a shareholder primacy corporate governance model, then foreign investors would invest in that country, stimulating the financial market, and local investors would also pitch in, leading to

[1] The 1999 Memorandum of Understanding between the World Bank and OECD, establishing the framework for the Latin American Roundtable among a series of Regional Corporate Governance Roundtables

[2] UNCTAD, 'Guidance on good practices in corporate governance disclosure' UNCTAD/ITE/TEB/2006/3

further growth of the financial market. Surplus capital can be used for economically useful – but less well-funded – activities, leading to economic growth and a sustainable future. The present research paper empirically investigates these claims and tries to find out whether changing the corporate governance of a country for the 'better', that is, by implementing a pro-shareholder approach, has any link with financial market growth in that country.

This author has also produced a separate paper which analyses whether the corporate governance regulations around the world are indeed converging towards a shareholder primacy model, based on the OECD Principles of Corporate Governance, and calculates the rate of such change over time.[3] The present research paper will investigate whether adopting shareholder primacy corporate governance has any overall impact on the growth of the financial market – this will allow investigation as to whether varying the corporate governance model towards a pro-shareholder approach has any effect in terms of increasing financial market development. This will allow the researcher to scrutinise the claims from international financial organisations that strong pro-shareholder corporate governance is fundamentally linked to improved long-term financial and economic performance.

The research was undertaken in a number of steps. First, we replicate the corporate governance index created in the companion paper.[4] Second, a Bayesian factor analysis was then used to build up a separate multi-country multiyear index of financial market growth consisting of five variables - foreign direct investment (FDI), market capitalisation of listed companies, S&P global equity index, volume of stocks traded and the number of listed domestic companies to represent the financial growth of countries, and three control indices of similar timescales comprised of a total of ten variables – annual percentage growth rate of GDP, purchasing power parity conversion factor, current account balance, real interest rate, external debt stocks, commercial bank branches per head of population, mobile cellular

[3] Navajyoti Samanta, 'Advantages of using Bayesian techniques to quantify and analyse comparative law: Evidences from a leximetric analysis of evolution of corporate governance regulations in 21 countries, 1995-2014' Conference Paper at American Society of Comparative Law Younger Comparativists Global Conference, Tulane University (2016). In this paper a database on the evolution of corporate governance in twenty-one countries for twenty years (1995-2014) was created. Local experts in corporate governance in those jurisdictions were asked to fill out a detailed questionnaire based on archival and allied qualitative research. The aim of this phase was to collect data on fifty-two separate company and corporate governance variables based on the OECD Principles of Corporate Governance and previous indices for twenty years (1995-2014). The variables were scaled polynomially, i.e., the value could be zero, or one, or two which meant the survey went beyond a simple yes/no response in order to take into account systems which use optional rules or 'soft law'. Thereafter, a graded response model was used with a Kalman filter to create a dynamic corporate governance index for twenty-one countries over a twenty year period. A dynamic index allowed the researcher to distribute the changes identified over a period of time rather than confining them to just one year. It is widely acknowledged that laws and regulations take some time to show their impact, hence considering development of corporate governance over a number of years yielded more realistic results.

[4] ibid

telephone subscriptions per head of population, electric power consumption per capita, high-technology (products with high R&D intensity) exports in current USD and the number of patent and trademark applications filed at USPTO.

Finally, a Bayesian multilevel lagged regression model was constructed, using the five indices. The financial market index was used as a dependent variable, the dynamic corporate governance index as predictor variable, and the three control indices as control variables. Four country level control variables were used for each country – human development index, GINI index, peace index and rule of law. This made it possible to check whether changes in corporate governance models and, especially, whether any shift towards a shareholder value model, has had any effect on financial market growth in developing countries.

The research finds that a shift towards a pro-shareholder value model in developing countries has little impact on the growth of financial markets, especially in comparison to the impact of economic and other control factors like increased investment in R&D and growth in high technology-led export-based industries. It is evident that the rule of law is twice as important as the quality of corporate governance in promoting market growth. This indicates that developing countries should perhaps put more emphasis on promoting the public perception that market regulators are independent from government, create efficient enforcement of rights in the courts or otherwise, and dispose quickly of commercial litigation rather than simply changing the corporate governance regulations to make it more shareholder friendly. It is far more effective to boost financial market growth by improving the economic growth factors and investing in R&D-led high technology-based export industries, as opposed to simply adopting more pro-shareholder regulations and norms.

This article is divided into four major parts, in Part II we review the literature on impact of corporate governance and discuss the different variables used, in Part III we discuss the methodology used in this research paper focussing on Bayesian factor analysis and multilevel regression modelling, in Part IV the results are analysed, concentrating on the debates surrounding impact of adopt of shareholder primacy corporate governance on growth of financial markets.

2. Literature review

As explained before, this article solely focuses on finding out if change in corporate governance model towards a more shareholder primacy approach had any positive impact on financial growth of the countries adopting such stance. As such the review would focus on literature which discusses on the dependent and control variables used in such impact studies.

2.1 Dependent/outcome variable

The dependent variables are those which are affected by the independent variables, under this definition the dependent variable in this case would be those economic and market parameters which are directly affected by changes in corporate governance regulations. It is necessary to briefly review the dependent variables used by other researchers; La Porta et al. (1997)[5] divided dependent variables into measures of three categories – equity finance, debt finance and microeconomic data (based on the WorldScope database). As a measure of equity finance they used the ratio of stock market capitalisation to GNP, number of listed firms in relation to its population, number of initial public offerings (IPOs) in relation to its population; as a measure of debt finance the total bank debt of the private sector and the total face value of corporate bonds were used; and four parameters were used as a measure of microeconomic performance (limited to public companies): the median ratio of market capitalisation to sales of companies, the median ratio of market capitalisation to cash flow, the median ratio of total debt to sales of all firms and the median ratio of total debt to cash flow. La Porta, Lopez and Shleifer (2006)[6] refreshed their stock market development parameters to adjust with the changes from public enforcement to private enforcement. They use seven proxies to quantify the development of the financial market – the first variable was 'ratio of stock market capitalization to gross domestic product (GDP) scaled by the fraction of the stock market held by outside investors'; the second variable was a log of the 'number of domestic publicly traded firms in each country relative to its population'; the third variable was 'the value of initial public offerings in each country relative to its GDP'; the fourth variable sought to reflect the access to equity for new and medium-sized firms from securities market, it was an index (scaled from 1-7) compiled by the Global Competitiveness Report 1999[7] from interviews and surveys with business executives in various countries; the fifth variable was block premium and acted as a proxy for private benefits for control, the researchers computed it by 'taking the difference between the price per share paid for the control block and the exchange price 2 days after the announcement of the control transaction, dividing by the exchange price and multiplying by the ratio of the proportion of cash flow rights represented in the controlling block'; the sixth variable looked at the 'average percentage of common shares owned by the top three shareholders in the 10 largest

[5] La Porta et al., 'Legal Determinants of External Finance' (1997) 52 (3) Journal of Finance 1131-1150
[6] La Porta et al., 'What Works in Securities Laws' (2006) Journal of Finance 1-32
[7] Klaus Schwab et al. (eds), *The Global Competitiveness Report 1999* (Oxford University Press, New York).

nonfinancial, privately owned domestic firms in a given country', it acted as a proxy for ownership concentration; the seventh variable measured 'the ratio of traded volume to GDP' and acted as a proxy for liquidity. Djankov et al.[8] used six of the dependent variables used by La Porta, Lopez and Shleifer (2006)[9] and dropped the access to equity index. Armour, Deakin et al. (2008)[10] similarly look at four time series financial development indicators – stock market capitalisation as a percentage of GDP, the value of stock trading as a percentage of GDP, the stock market turnover ratio and also the number of domestic firms listed in the stock market.

On the basis of the available literature the researcher has selected five indicators which act as a measure for financial market development - market capitalisation, annual foreign direct investment, number of IPOs, S&P global equity index and stock turnover ratio. The theoretical (or established) connection between corporate governance and these dependent variables are explained in Appendix A.

2.2 Control variables

Ideally predictor and control variables should not be correlated (both within and between themselves) but both of them are expected to have some correlation with the dependent variables. Researchers should preferably be able to show from previous literature that control variables are correlated to dependent variables. It thus depends on the skill of the researcher to choose the proper underlying constituent variables which make up the dependent, predictor and control variables. Before the control variables used in this study are explained the control variables used in similar studies in the past will briefly be discussed.

In their 1997 paper[11], La Porta et al. while looking to isolate the impact of investor rights on external finances, first controlled for GDP growth as 'such a growth is likely to affect both valuations and market breadth';[12] the second control was a log of real GNP as the growth of 'capital markets might be an increasing returns to scale activity, and therefore larger economies might have larger capital markets';[13] they then control for the rule of law in the sense that it would allow to act as a proxy for likelihoods of implementation of law on books

[8] Simeon Djankov et al., 'The Law and Economics of Self-Dealing' (2005) <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=864645>

[9] La Porta et al. (n 6)

[10] John Armour, Simon Deakin et al., 'Shareholder Protection and Stock Market Development: An Empirical Test of the Legal Origins Hypothesis' (2008) ECGI Working Paper No.108/2008 available at <http://ssrn.com/abstract=1094355>

[11] La Porta et al. (n 5)

[12] ibid

[13] ibid

to law in action, and therefore a country with stronger rule of law is expected to have a better capital market as investors are supposed to feel more secure in investing in such jurisdictions. La Porta et al. did not control for GDP per capita as the correlation between GDP per capita and rule of law was around 0.87 and thus controlling for GDP per capita would not significantly add to the explanatory power of the predictor variable (which in the case of La Porta et al. was investor rights, a precursor of corporate governance).

In their 2006 paper[14] on examining the effect of securities laws on stock market development, La Porta et al. controlled for log GDP per capita on the basis that 'economic development is often associated with capital deepening.';[15] they then controlled for the efficiency of the judiciary on the basis that 'richer countries might have higher quality institutions in general, including better property rights and rule of law, which could be associated with better financial development regardless of the content of the laws.'[16] They also refer to their earlier studies in 1997 and 1998 as a rationale to control for anti-director rights and legal origin on the basis that investor protection derived from corporate law and legal origin are associated with stock market development. La Porta et al. also tried to evaluate the relative importance of components of investor protection in securities law and they then variedly controlled for (1) supervisor attributes; (2) rule-making powers; (3) investigative powers; (4) orders; and (5) criminal sanctions.

Djankov et al. in their 2008 published paper[17] investigated the impact of the 'legal protection of minority shareholders against expropriation by corporate insiders' (which they called the anti-self-dealing index) on stock market development (which was comprised of five variables – ratio of Stock market capitalization to GDP, control premium, log of firm to population ratio, average ratio of IPO to GDP and ownership concentration). To isolate this impact Djankov et al. controlled for log of per capita Gross Domestic Product on the basis that an increase in economic wellbeing would allow for surplus cash which could be invested in the financial market; to control for enforcement they looked at a log of the time taken to collect on a bounced check; following the La Porta et al. hypothesis of the financial market being influenced by legal origin they controlled for the type of legal origin (whether or not the country was under a common law system); disclosure and liability in publishing a prospectus is controlled 'to deal with the problem of the validity of the instrument'[18] and to take into

[14] La Porta et al. (n 6)
[15] ibid
[16] ibid
[17] Djankov et al. (n 8)
[18] ibid

account as financial market indicators 'heavily focus on disclosure'; tax evasion is controlled for as it is significant 'for stock market capitalization and log domestic firms per capita and it is a subjective variable highly correlated with perceptions of the quality of corporate governance as proxied by the perceived incidence of insider trading or the perceived quality of financial disclosure',[19] therefore to rule out the effect of the informal economy on financial market indicators, Djankov et al. use tax evasion as a control; they next control for newspaper circulation as it can be a proxy for 'public opinion pressure, [which] through the media could also curb private benefits', thus a control for newspaper circulation can effectively allay concerns that the benefits of disclosure come not from anti self-dealing measures but 'from the effects of the open media working as a watchdog'; finally Djankov et al. look at whether investor protection is a by-product of political determinants rather than legislative competence in drafting robust anti self-dealing regulations, so they control for legislative competitiveness and proportional representation in legislature on the basis of the model (Volpin and Pagano 2005) that one sided legislative assemblies with 'higher proportional electoral systems are conducive to weaker investor protection'. Djankov et al. also use the control variables to construct alternate theories and test their original hypothesis.

Armour, Deakin et al. in 2008[20] while analysing the possibility of a link between shareholder protection and stock market development controlled for legal origin, state of economic development proxied by level of per capita GDP and countries' positions on the World Bank 'rule of law' index.

The final 2008 paper[21] from La Porta et al. summarised the research development in correlating financial growth with legal origin hypothesis. In this paper they control for per capita income as a very crude proxy for quality of judiciary and hence enforcement; they also control for measure of human capital, proxied by average years of schooling in 1960, as growth in education leads to growth of the economy in general. In a telling conclusion highlighting the importance of correct control variables, La Porta et al. state that 'If politics were appropriately controlled for in the regressions legal origin would not matter.'[22]

Thus control variables should adhere to the following qualities:

- they must affect any one of the preceding financial market variables or directly related economic growth variables with supporting literature

[19] ibid
[20] Armour, Deakin et al. (n 10)
[21] La Porta et al., 'The Economic Consequences of Legal Origins' (2008) 46 (2) Journal of Economic Literature 285-332
[22] ibid 312

- they should not directly affect the corporate governance framework variables

The control index is subdivided into four broad categories: macroeconomic indicators, human development and financial inclusion indicators, proxies for enforcement and indicators for industrial value addition through an increase in R&D.

The literature on Graded Response Model and corporate governance convergence and coding is available in the companion article.[23]

3. Methodology

This research paper empirically investigates whether adopting a more shareholder primacy corporate governance, over a period of time, leads to an increase in the growth of financial markets in developing countries. This is done primarily by performing a regression analysis. A multiple linear regression model can be mathematically represented as:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \varepsilon \qquad (1)$$

In the equation above, Y is the dependent variable which is influenced by two independent variables X_1 and X_2. For the purposes of this research Y is the financial market indicator, X_1 is the corporate governance indicator and X_2 is the control variable. We already have the observed values of Y, X_1 and X_2; X_1 is a matrix of various corporate governance indices such as the shareholders rights index, anti-managerial rights index, minority rights index, stakeholder rights index etc. Y is a bundle of stock market performance indicators such as the total volume traded, number of IPOs, market capitalisation etc. However, in this research the primary interest is in isolating the effect that corporate governance has on the financial market (the effect is represented in the model as β_1) – this is the predictor variable, but it is evident from experience that the growth of financial markets is affected by many other factors (apart from corporate governance) such as interest rates, financial inclusion, rule of law etc.; so all these other factors are bundled as control variables (the effect of control variables are represented in the model as β_2). Control variables thus help to accurately measure the impact of the main observed variable being studied (in this case the impact of an inclination towards shareholder corporate governance on the financial market), above and beyond the effects of other variables. The autocorrelation among variables are usually taken care of by the error term represented in the model as ε.

[23] Samanta (n 3)

3.1 Construction of a dependent financial index and control index using Bayesian factor analysis

The present research uses five variables to measure and construct the financial growth index and fourteen variables to create the control index for financial growth. Out of the control variables four are country level indicators, which means the variable is time independent i.e. there is little variation in these variables over time, while the remaining ten vary for each country per year. Until now most researchers have used one variable as a proxy for financial growth or have performed multiple regression analysis with different dependent variables to analyse the link between change in corporate governance and financial growth. This type of analysis fails to take into account the latent nature of financial growth which can only be expressed or measured by a factor analysis of several variables thereby adequately 'explain[ing] the observed relationship among a set of observed variables in terms of a smaller number of unobserved variables'[24].

The five variables were chosen for this study are Foreign Direct Investment (FDI), Market capitalisation of listed companies, S&P global equity index, traded volume of stocks traded and number of listed domestic companies to represent the financial growth of countries. To construct this financial market index similar methodological issues of measurement are faced as were encountered while constructing the index for corporate governance development. IRT would not be the proper solution as the financial market growth variables are continuous in nature. Therefore a factor analysis model would 'provide a flexible framework for modelling multivariate [financial] data by a […] latent factor.'[25] The traditional method of performing factor analysis is using the Maximum likelihood factor analysis which 'relies on large sample theory, and it is consequently often recommended to use it only in large samples (e.g. N=200 or more). In smaller samples, Maximum likelihood factor analysis can run into problems like model non-convergence, negative residual variances etc. Bayesian statistics typically perform better in small samples, and may therefore be useful in studies that rely on smaller sample sizes.'[26] As data is available for 17-20 years per country, a Bayesian factor analysis will give a better fit index than using a Maximum likelihood estimator.

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[24] Daniel B. Rowe, *Multivariate Bayesian Statistics: Models for Source Separation and Signal Unmixing* (CRC Press 2003)

[25] Joyee Ghosh and David Dunson, 'Default priors and efficient posterior computation in Bayesian Factor analysis' available at < http://people.ee.duke.edu/~lcarin/DunsonBayesianFA.pdf> accessed 12 June 2015

[26] Dirk Heerwegh, 'Small Sample Bayesian Factor Analysis' Working Paper SP03 (2014) available at <http://www.phusewiki.org/docs/Conference%202014%20SP%20Papers/SP03.pdf> accessed on 12 June 2015; see also Navajyoti Samanta, 'Utilising item response theory in computing corporate governance indices' (2015) 2 (4) Edinburgh Student Law Review (ESLR) 103-116

The classical factor model can be defined as below:

$$\Sigma = \Lambda\Phi\Lambda' + \Psi \quad (2)$$

Where Λ is a p x k matrix of factor loading i.e. the contribution of each variable to the final index, p is the number of observed indicators or variables, k is the number of latent trait factors being measured, and Ψ is the diagonal p x p matrix with uniqueness on the diagonal.[27] This can also be represented in terms of observed variable y as:

$$y_i = \Lambda\eta_i + \varepsilon_i,\ \varepsilon_i \sim N_p(0, \Sigma) \quad (3)$$

Where Λ is a p x k matrix of factor loading, p is the number of observed indicators or variables (j = 1,…,p), k is the number of latent trait factors being measured, i is the number of observation per indicator (i = 1,…,n), ε_i is the residual with a diagonal covariance matrix Σ and $\eta_i \sim N_k(0, I_k)$ which is a vector of standard normal latent factors.[28] In our research p=5 (number of variables), k=1 (number of latent trait, which in this research is the financial development index) and i=18 (number of observation which is the time period).

To convert equation (9) into a fully Bayesian approach it is necessary to 'compute the posterior density over all unknown parameters in the model conditional on the observable indicators and any prior information.'[29] To do this the equation (9) can be rewritten as:

$$y_{ij} \sim N(\gamma_{j0} + \gamma_{j1}\xi_i, \omega_j^2) \quad (4)$$

Where γ is the factor loading, ξ is the single latent factor and ω^2 is the measurement error variances. This can expressed as a likelihood function as:

$$\mathcal{L} \equiv p(Y|\theta) \propto \prod_{i=1}^{n}\prod_{j=1}^{p} \phi\left(\frac{y_{ij} - \gamma_{j0} - \gamma_{j1}\xi_i}{\omega_j}\right) \quad (5)$$

Where Y is the n x p matrix of observed indicators, $\theta = \{\Gamma, \psi, \xi\}$ is the matrix set of unknown parameters comprising of factor loading [$\Gamma = (\gamma_{10}, \ldots, \gamma_{p1})'$], measurement error [$\psi = (\omega_1^2, \ldots, \omega_p^2)'$] and latent factor variable [$\xi = (\xi_1, \ldots, \xi_n)'$], and ϕ is the standard normal density.

Extrapolating prior distribution over the components of θ from equation (5) can be represented as:

$$\begin{aligned} p(\theta) &= p(\xi_1, \ldots, \xi_n)p(\gamma_1|\omega_1^2)p(\omega_1^2) \ldots p\left(\gamma_p|\omega_p^2\right)p\left(\omega_p^2\right) \\ &= \prod_{i=1}^{n} p(\xi_1) \prod_{j=1}^{p} p\left(\gamma_j|\omega_j^2\right)p\left(\omega_j^2\right) \end{aligned} \quad (6)$$

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[27] Kanti V. Mardia, John T. Kent and John M. Bibby, *Multivariate Analysis* (San Diego Academic Press 1980)

[28] See generally Hedibert Freitas Lopes and Mike West, 'Bayesian model assessment in factor analysis' (2004) 14 Statistica Sinica 41 available at <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.10.8242&rep=rep1 &type=pdf> accessed 12 June 2015; David John Bartholomew, *Latent Variable Models and Factor Analysis* (2nd edn, Wiley 1999).

[29] Simon Jackmann, *Bayesian Analysis for the Social Sciences* (Wiley 2009) 438

Equation (12) fits the Bayes rule of posterior density being proportional to the prior times likelihood. This factorial equation can be operationalised as:

$$\xi_i \sim N(\mu_\xi, \sigma^2), \qquad i = 1, \dots, n \qquad (7)$$

$$\gamma_j|\omega_j^2 \sim N(g_{j0}, \omega_j^2 G_{j0}), \qquad j = 1, \dots, p \qquad (8)$$

$$\omega_j^2 \sim inverse - Gamma\left(\frac{\nu_{j0}}{2}, \frac{\nu_{j0}\omega_{j0}^2}{2}\right), j = 1, \dots, p \qquad (9)$$

Where g_{j0} and G_{j0} are user specified hyper-parameters of initial values for intercept and slope for the simulations. As stated earlier ω_{j0}^2 is the measurement error variances. The mean, standard deviation and the initial values for the common priors for the inverse Gamma densities are provided. As Simon Jackmann envisages, in the absence of prior information about factor loading large values are set for the elements of the prior sum of square matrices[30] and run the simulations for a longer period of time until the model converges. It is a resource-intensive method but is simpler to execute.

A one dimension latent variable model for financial growth is fitted, with p=5 set of underlying indicators, using a Byesian model and a Gibbs sampler. The initial value of g_{j0} and G_{j0} as 0.5 is taken as a halfway point between 0 and 1 and for latent variable ξ_i and the item parameters the lack of identification by imposing normalisation. Thus restrictions are imposed on the latent variable with fixed mean and variance and thereby inducing local identification; similarly for item parameters a restriction on sign will rule out invariance to rotation and provide global identification. Moreover, normalising latent variables to a fixed location eliminates translations and ensures that the latent variable and item parameters are jointly identified. This will also ensure the identification of measurement error variance parameters. Therefore, a Bayesian rule for the financial development index can be written as:

$$p(\theta|Y) \alpha p(\theta).p(Y|\theta) \qquad (10)$$

which obtains the prior value of the index from p(θ) – the probability of a set of unknown parameters comprised of factor loading, measurement error and latent factors, from equation (12) and likelihood of p(Y|θ), i.e. probability of the observed value given the probability of unknown parameters, from equation (11). As there are multiple unknown parameters it is not possible to solve them algebraically. To compute this it is necessary to rely on Gibbs sampler, 'building up a Monte Carlo based approximation to the posterior density by sequentially sampling from low dimensional conditional densities'.[31]

[30] ibid 439
[31] ibid 438, 442

From equation (16) a total of n+3p parameters are obtained, so to approximate the value of latent variable output it is necessary to simulate the values across n+3p dimensional distribution. A N(0,1) prior for latent variable output is specified, thereby imposing normalising restrictions, inverse Gamma priors of (0.01, 0.01) are also specified for the measurement error variance parameters. The JAGS code implementing these for preparing the control index is as below:

```
1 ######           Bayesian factor analysis for Control index       ######
2 #                        Adapted from Simon Jackmann                    #
3 # http://jackman.stanford.edu/mcmc/book/Examples/factanal/factorMCMC.R #
4
5 for(fcl in 1:X2n){            ## loop over each country
6
7 for(i in 1+(17*(fcl-1)):17*fcl){ ## loop over observations for each year
8
9 for(j in 1:10){                     ## loop over indicators
10
11 X2mu[i,j] <- X2gamma[j,1] + X2gamma[j,2]*X2xi[i]
12
13 X2[i,j] ~ dnorm(X2mu[i,j],X2tau[j])
14
15               }
16
17             }
18
19 ## prior for latent variable
20
21 for(i in 1+(17*(fcl-1)):17*fcl){  ## loop over observations for each yr
22
23       X2xistar[i] ~ dnorm(0,1)
24
25       X2xi[i] <- (X2xistar[i]-mean(X2xistar[]))/sd(X2xistar[])
26
27                                  }
28
29 ## priors for the measurement parameters
30 for(j in 1+(10*(fcl-1)):10*fcl){  # loop over 10 control indicators per
country
31 ## intercepts and slopes
32 X2gamma[j,1:2] ~ dmnorm(g0[1:2],G0[1:2,1:2])
33 ## measurement error variances
34 X2tau[j] ~ dgamma(.01,.01)T(.00000001,5)
35 X2omega[j] <- 1/sqrt(X2tau[j])
36                                 }
37
38    }
39
40  ######                    END OF BFA FOR CI                  ######
```

Code snippet 1

Please note that we follow similar codes for preparing the financial development index which is the factor analysis of five variables; however as the financial development index is on the left hand side of the final regression analysis, [please refer to equation (17)], there is a clash

between setting the prior for latent variables for the financial development index [refer to lines 19-27 in the codes above] in the Bayesian factor analysis model and the regression model. Hence the prior for computing the Bayesian factor analysis to produce the financial development index is provided by a nested prior from the regression model.

3.2 Structural models

3.2.1 Regression analysis

Once the panel data[32] for financial development index, control index and the corporate governance index is obtained, the next step would be to ascertain the relationship between the variables, especially whether there is a causal effect of change in corporate governance on financial development. Regression techniques have become quite common in law and economics literature and are a useful tool to estimate quantitatively the effect of causal variables on dependent variables.[33]

A simple regression model can be represented mathematically as:

$$Y_i = \beta 0 + \beta 1 X_i + \varepsilon_i \qquad \text{for } i = 1,\ldots,n, \qquad (11)$$

where Y_i is the dependent or outcome variable for individual/count i, similarly X_i is the independent or explanatory variable for individual i, $\beta 0$ is the constant or the intercept value, i.e. the estimated value of Y_i if X_i is 0, $\beta 1$ is the regression coefficient which would provide a quantitative estimation of effect of X_i on Y_i and ε_i is the error term.

In a regression model, like in equation (17), where there is a single explanatory variable, the model is referred to as a simple regression model. In social sciences literature it is difficult to find simple regression models as we know from qualitative experience that outcomes are often determined by more than one factor. So it is necessary to introduce more variables on the right hand side of the equation (11) to isolate the effect that the explanatory variable has on the outcome variable:

$$Y_i = \beta 0 + \beta 1 X1_i + \beta 2 X2_i + \varepsilon_i \qquad \text{for } i = 1,\ldots,n \qquad (12)$$

In this equation there are two sets of independent variables on the right hand side, $X1_i$ can be designated as the explanatory variable or the variable whose effect on Y_i is being investigated and $X2_i$ is the control variable, i.e. any other independent variable which also affects Y_i.

[32] Sometime also referred to as time series cross sectional data. In the present study the panel data matrix for regression analysis will be approximately 21(countries)x20(time period)x3(indices). Please note that the control index will be divided into group/country level indicators and individual/time level indicators as the model progresses.

[33] See generally Alan O. Sykes, 'An Introduction to Regression Analysis' Chicago Working Paper in Law & Economics <http://www.law.uchicago.edu/files/files/20.Sykes_.Regression.pdf> acceded 10 June 2015

Equation (18) is an example of multiple regression as there are more than one variable whose effects are being estimate on the outcome variable. Equation (12) can also be written as:

$$Y_i \sim (\beta 0 + \beta X_{i,} \sigma^2), \qquad \text{for } i = 1, \ldots, n, \qquad (12.1)$$

where X is an n by 2 matrix (as there are two independent variables) with i^{th} row X_i or using multivariate notation,

$$Y_i \sim (\beta 0 + \beta X, \sigma^2 I),$$

where Y is a vector of length n, X is a n by 2 matrix of predictors, β is a column vector of length 2 and I is the n by n identity matrix.[34]

3.2.1.1 Pooled regression

In the present research paper the individual countries can be denoted as j, there are 21 countries, so j = 1 to 21, Y the outcome variable is the financial development index prepared by the Bayesian factor analysis of five factors, X1 the explanatory variable is the corporate governance index prepared by utilising the graded response model on fifty two variables, X2 the control variable is the control index created from fourteen variables. However in addition to individual countries j it is necessary to also add a factor for time, as the study is longitudinal in nature, so equation (12) can be rewritten as:

$$Y_{jt} = \beta 0 + \beta 1 X1_{jt} + \beta 2 X2_{jt} + \varepsilon_{jt} \qquad (13)$$

For this research t = 1 to 20, to account for twenty year period, and as stated earlier, j = 1 to 19 for nineteen countries. Equation (13) can also be represented as a distribution in terms of:

$$Y_{jt} \sim N(\beta 0 + \beta 1 X1_{jt} + \beta 2 X2_{jt} + \varepsilon_i, \sigma^2)$$
$$\sigma^2 \sim N(0, \omega^2) \qquad (13.1)$$

The model as described in equation (13) and (13.1) can also be designated as a complete pooling model as group indicators are not included in the model,[35] in other words the coefficients β0, β1 and β2 do not vary across countries and time period. This is computed using the following JAGS code:

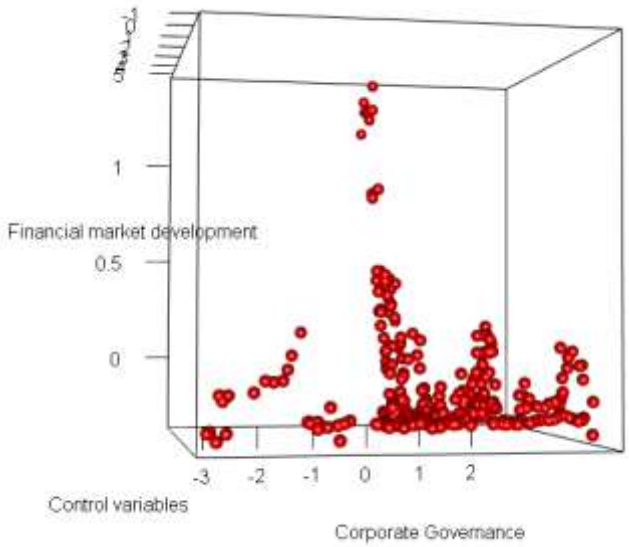
```
for(i in 1:X1n*20) {  ## loop over all countries across all time period
  Yxi[i] ~ dnorm(Rmu[i], Rtau) ## likelihood
  Rmu[i] <- b0 + b1*z.theta[i] + b2*X2xi[i]
                                    }
Rtau ~ dgamma(.01,.01)    ## prior for tau
b0 ~ dnorm(0,1.0E-12)    ## prior for beta - intercept
b1 ~ dnorm(0,1.0E-12)   ## prior for beta – corporate governance
b2 ~ dnorm(0,1.0E-12)  ## prior for beta – control index
```

Code snippet 2

[34] Andrew Gelman and Jennifer Hill, *Data analysis using regression and multilevel/hierarchical modelling* (Cambridge University Press 2007) 38

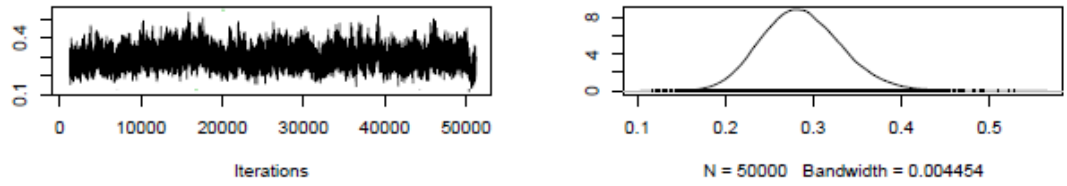
[35] ibid 251

The code in line 2 and 3 executes the simple OLS equation (13.1). The prior distribution is set between line 5 to 8. The output in a 3d format is as below:

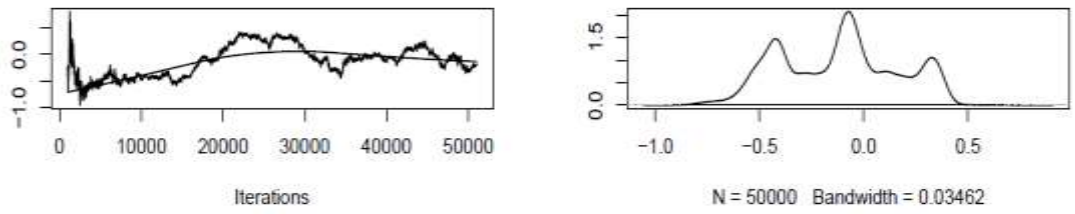


The graph shows that there is a low correlation between corporate governance and financial growth, however, there is also high dispersion, it suggests that the model can be refined further.

A visual check for convergence in a Bayesian model is to inspect the trace plot, if a model has converged then the trace plot moves along a central line and the density plot is usually uniform. Trace and density plot of a single chain of converged variable usually looks as below:

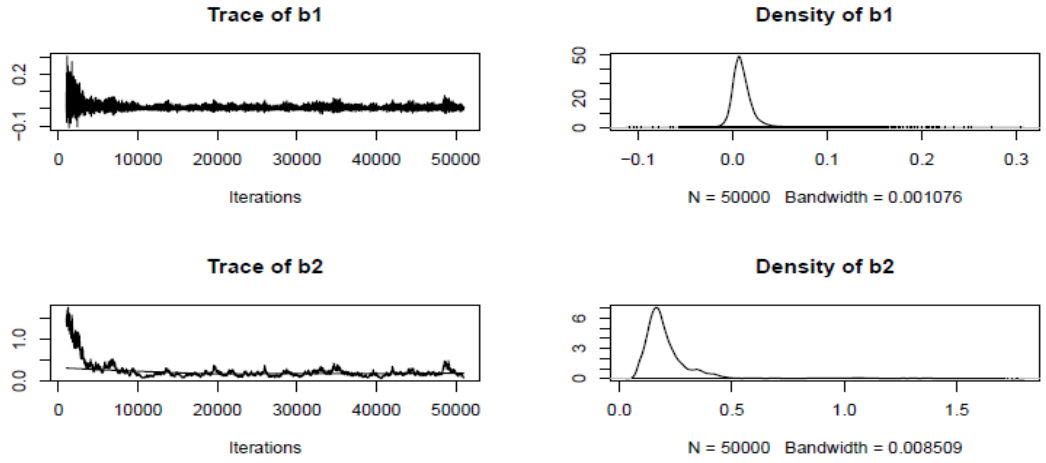


Therefore the trace plot below of the intercept suggests that the model had not stabilised even after 50,000 iterations and is likely to be biased, inefficient and/or inconsistent:



The density plot on the above right shows that there are at least three distinct intercept categories. This indicates that despite relative convergence (as shown below) in the

coefficients the groups are not homogenous and the model needs to be explored further to fully explain the links between corporate governance and financial growth. Thus although OLS pooled regression 'captures not only the variation of what emerges through time or space, but [also] the variation of these two dimensions simultaneously'[36], our analysis shows that errors may not be independent and homoscedastic over time, and hence pooled OLS regression leads to erroneous results.[37]



3.2.1.2 Unpooled regression

Therefore the next step of model building would be to let the intercept vary with the country. The new derived equation will be:

$$Y_{jt} = \beta 0_j + \beta 1X1_{jt} + \beta 2X2_{jt} + \varepsilon_{jt} \quad (14)$$

$$Y_{jt} \sim N(\beta 0_j + \beta 1X1_{jt} + \beta 2X2_{jt} + \varepsilon_i, \sigma^2) \quad (14.1)$$

[36] Federico Podestà, 'Recent developments in quantitative comparative methodology: The case of pooled time series analysis' DSS PAPERS SOC 3-02 <http://localgov.fsu.edu/readings_papers/Research%20Methods/Podesta_Pooled_Time_Series_Cross_Section.pdf> accessed 10 June 2015

[37] Podestà lists five major complications for using OLS procedure on pooled data: 1) errors tend to be dependent from a period to the next, 2) the errors tend to be correlated across countries (or groups), 3) errors tend to be heteroskedastic, such that they may have differing variances across ranges or sub sets of nations. In other words, countries with higher values on variables tend to have less restricted and, hence, higher variances on them, 4) errors may contain both temporal and cross-sectional components reflecting cross-sectional effects and temporal effects. Errors tend to conceal unit and period effects. In other words, even if we start with data that were homoscedastic and not auto-correlated, we risk producing a regression with observed heteroskedastic and auto-correlated errors. This is because heteroscedasticity and auto-correlation we observe is a function also of model misspecification. The misspecification, that is peculiar of pooled data, is the assumption of homogeneity of level of dependent variable across units and time periods. In particular, if we assume that units and time periods are homogeneous in the level (as OLS estimation requires) and they are not, then least squares estimators will be a compromise, unlikely to be a good predictor of the time periods and the cross-sectional units, and the apparent level of heteroscedasticity and auto-correlation will be substantially inflated, 5) errors might be non-random across spatial and/or temporal units because parameters are heterogeneous across subsets of units. In other words, since processes linking dependent and independent variables tend to vary across subsets of nations or/and period , errors tend to reflect some causal heterogeneity across space, time, or both.

where j is the country and t is the time period. This model can also be referred to as no pooling as separate models are fit within it for each country.[38] In computation terms this model is referred to as a Bayesian Inference for Panel Data Regression Model with a Non-Hierarchical model for Unobserved Unit Level Heterogeneity. This is better than letting the slopes (the regression coefficients) vary as well, because then cross validation cannot be performed at country level.[39] The following JAGS code is used:

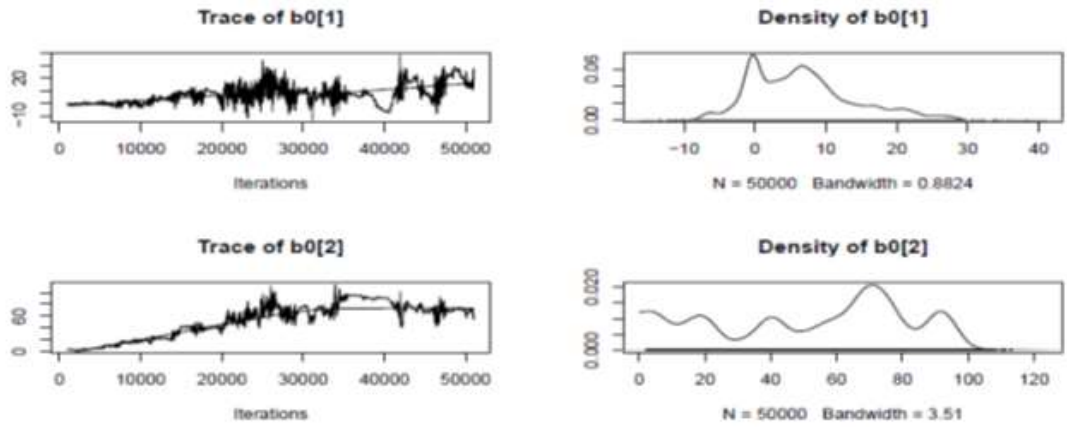
```
1  for(Ri in 1:Yn) {                    ## loop over countries
2
3    for(Rloop in 1+(20*(Ri-1)):(20*Ri)) {      ## loop over time periods
4
5        Rmu[Rloop] <- b0[Ri] + b1*z.theta[Rloop] + b2*X2xi[Rloop]
6
7        Yxi[Rloop] ~ dnorm(Rmu[Rloop], Rtau)        ## likelihood
8                                              }
9                        }
10 for(Rti in 1:Yn) {
11
12   b0[Rti] ~ dnorm(0, 0.001)   ## priors for country specific intercept
13
14                       }
15
16 b1 ~ dnorm(0, 0.001)              ## prior for beta
17 b2 ~ dnorm(0, 0.001)                ## prior for beta
18 Rtau ~ dgamma(.01,.01)                ## prior for tau (precision)
```

Code snippet 3

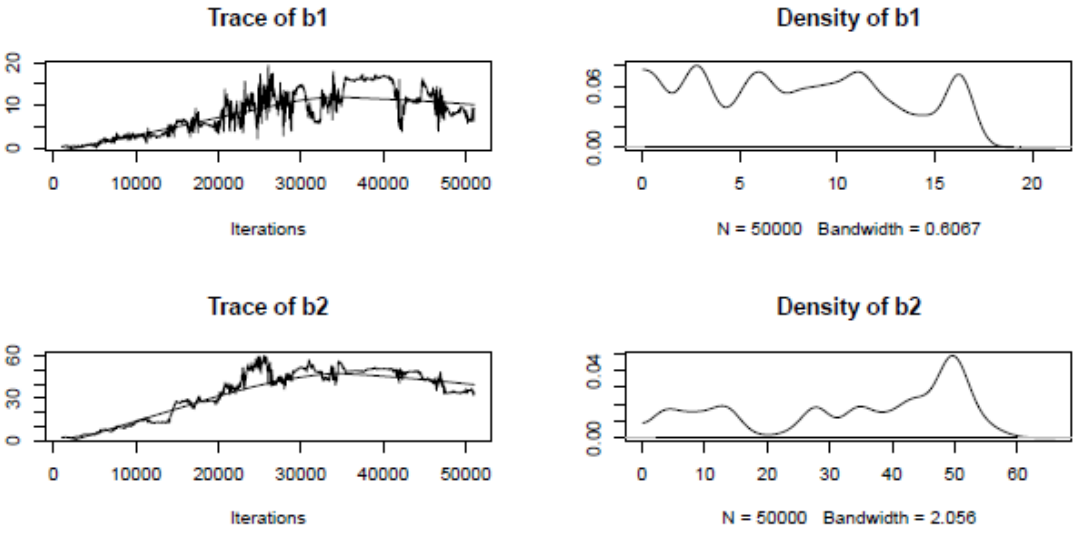
Line 1 to 9 sets out the main argument, Yxi is the financial development index for each country, it is in a 420 by 1 matrix, each cell represents one country and one year. Similarly there is a 420 by 1 matrix for Z.theta which is the corporate governance index and X2xi which is the control index. Line 7 provides the distribution of financial development which is normal over mean Rmu and standard deviation Rtau. Rmu is bounded by the regression equation as stated in equation (14). So Rmu is a function of an intercept β0 which is allowed to float across countries and a constant coefficient β1 across all countries for corporate governance and β2 for control index. So we get 21 intercepts, the convergence and density plots for couple of $\beta 0_1$,…., $\beta 0_{21}$ is as below:

[38] Gelman and Hill (n 34) 251

[39] Andrew Gelman, 'Multilevel (hierarchical) modelling: what it can and can't do' (2005) <http://www.stat.columbia. edu/~gelman/research/unpublished/multi.pdf > accessed 10 June 2015



Almost all of them show instability and from the density plot and bandwidth[40] we find that coefficient for corporate governance index and control index have also become less stable.[41]



3.2.2 Random unpooled

The relative instability of β0 shows that the model is a random effects model, so the next step will be to introduce unit specific heterogeneity and reduce standard deviation of the priors. As we see from the previous JAGS code lines 10-14, there is a fixed normal prior, we would let this prior to vary.[42]

[40] John DiNardo and Justin L. Tobias, 'Nonparametric Density and Regression Estimation' (2001) 15 (4) Journal of Economic Perspectives 11, 16 <http://www.uibk.ac.at/econometrics/dl/jep01fall/02_nonparametric.pdf> accessed 10 June 2015

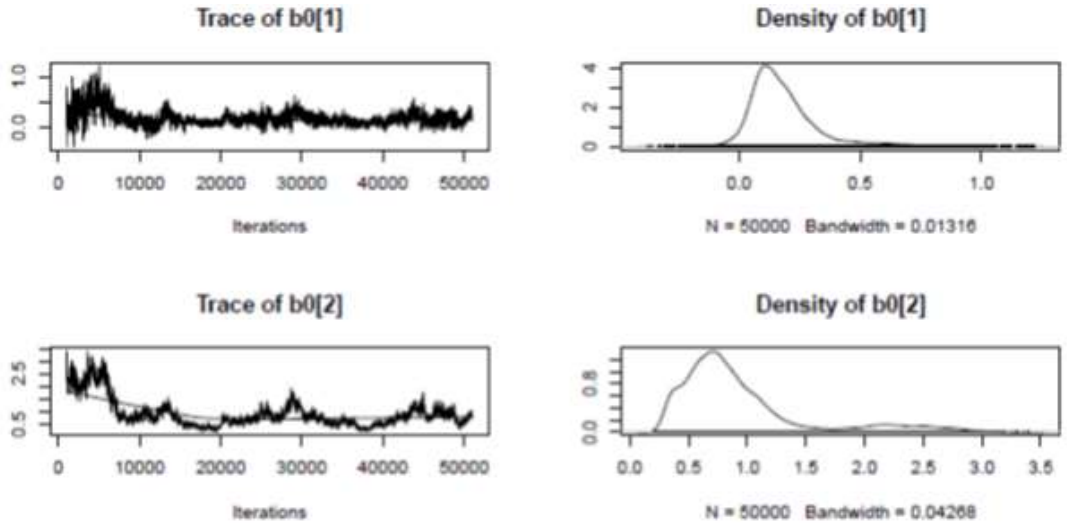
[41] Please note that the entire convergence plots along with the replication images for the intermediate models are available on request.

[42] For background in this technique refer to Jackman (n 202); Simon Jackman, 'Estimation and Inference Are Missing Data Problems: Unifying Social Science Statistics via Bayesian Simulation.' (2000) 8 Political Analysis 307—332; Simon Jackman, 'Estimation and Inference via Bayesian Simulation: An Introduction to Markov Chain Monte Carlo.' (2000) 44 American Journal of Political Science 375-404.

```
for(Ri in 1:Yn) {                    ## loop over countries

  for(Rloop in 1+(20*(Ri-1)):(20*Ri)) {      ## loop over time periods

      Rmu[Rloop] <- b0[Ri] + b1*z.theta[Rloop] + b2*X2xi[Rloop]

      Yxi[Rloop] ~ dnorm(Rmu[Rloop], Rtau)        ## likelihood
                                            }
                  }
 for(Rti in 1:Yn) {

b0[Rti] ~ dnorm(0, Rtau.alpha) ## priors for country specific intercept

                   }

 b1 ~ dnorm(0,1.0E-12)          ## prior for beta
 b2 ~ dnorm(0,1.0E-12)           ## prior for beta
Rtau.alpha ~ dgamma(.01,.01)     ## prior for tau.alpha (precision)
Rtau ~ dgamma(.01,.01)            ## prior for tau (precision)
Rsigma <- 1/sqrt(Rtau)             ## std dev of idiosyncratic errors
Rsigma.alpha <- 1/sqrt(Rtau.alpha)  ## std dev of unit-specific terms
```

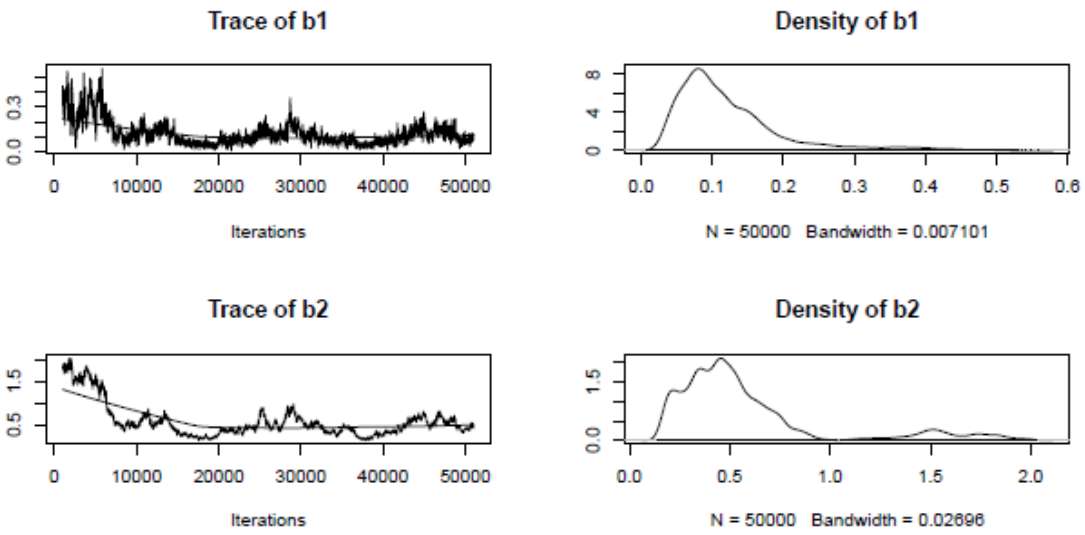
Code snippet 4

The new model lets the standard deviation float to account for unobserved unit level heterogeneity. We find that there is comparatively more convergence for $\beta 0_1$,…., $\beta 0_{21}$, as depicted below:



and the coefficient for corporate governance and control index becomes relatively stable with some strong variations in the tail.[43]

[43] Please note that the entire convergence plots along with the replication images for the intermediate models are available on request.



3.2.3 Multilevel hierarchical

This proves that the next step to further converge the model would be to pick up variables from the control data set which do not vary much over the entire dataset and is not uniformly available. Also 'the multilevel model gives more accurate predictions than the no-pooling and complete-pooling regressions, especially when predicting group averages.'[44] We take out GINI coefficient, HDI indicator, rule of law and peace coefficient from the Bayesian factor analysis to act as a country level indicator with its own prior distribution.

So algebraically we can represent the new relationship drawing from equation (15.1) as:

$$Y_{jt} \sim N(\beta 0_j + \beta 1 X1_{jt} + \beta 2 X2_{jt} + \varepsilon_i, \sigma^2_j) \qquad (15)$$

this gives us the first level model, then we have a second level regression fit for each country,

$$\beta 0_j \sim N(\gamma_0 + \gamma_g X3j, \sigma^2_\beta) \qquad (15.1)$$

where j represents the country and t represents the year, X3 is the country level indicators, g represents the number of country level indicator, in our research it is 4, and γ represents the country level indicator coefficient $\gamma_0,\ldots, \gamma_4$. We assume that the errors in the second level regression is distributed normally over mean 0 and standard deviation σ_β.

The JAGS code for implementing equations (15) and (15.1) is as below:

[44] Gelman and Hill (n 34) 5

```
for(Ri in 1:Yn) {                    ## loop over countries

 for(Rloop in 1+(20*(Ri-1)):(20*Ri)) {  ## loop over time periods

   Yxi[Rloop] ~ dnorm(Rmu[Rloop], Rtau)    ## likelihood for find-dev

   Rmu[Rloop] <- b0[Ri] + b1*z.theta[Rloop] + b2*X2xi[Rloop]

                                     }

               }

for(Rti in 1:Yn) {

b0[Rti] ~ dnorm(Rhat[Rti],Rtau.alpha) ## priors for unit-specific terms

 Rhat[Rti]  <-  R0  +  R1*X3[Rti,1]  +  R2*X3[Rti,2]  +  R3*X3[Rti,3]  +
R4*X3[Rti,4]

             }

 R0 ~ dnorm(0,1.0E-12)
 R1 ~ dnorm(0,1.0E-12)
 R2 ~ dnorm(0,1.0E-12)
 R3 ~ dnorm(0,1.0E-12)
 R4 ~ dnorm(0,1.0E-12)

 b1 ~ dnorm(0,1.0E-12)                ## prior for beta1 - corp gov
 b2 ~ dnorm(0,1.0E-12)                ## prior for beta2 - control
```

Code snippet 5

We can try two different priors strategy – one favoured by Gelman and Hill giving a uniform distribution[45]

```
 Rtau.alpha <- pow(Rsigma.alpha, -2) ## prior for tau.alpha (precision)
 Rtau <- pow(Rsigma, -2)             ## prior for tau (precision)

 Rsigma ~ dunif(0,100)               ## std dev of idiosyncratic errors
 Rsigma.alpha ~ dunif(0,100)         ## std dev of unit-specific terms
```

Code snippet 6

and the other by Simon Jackmann favouring a Gamma distribution computed via the Poisson density[46]

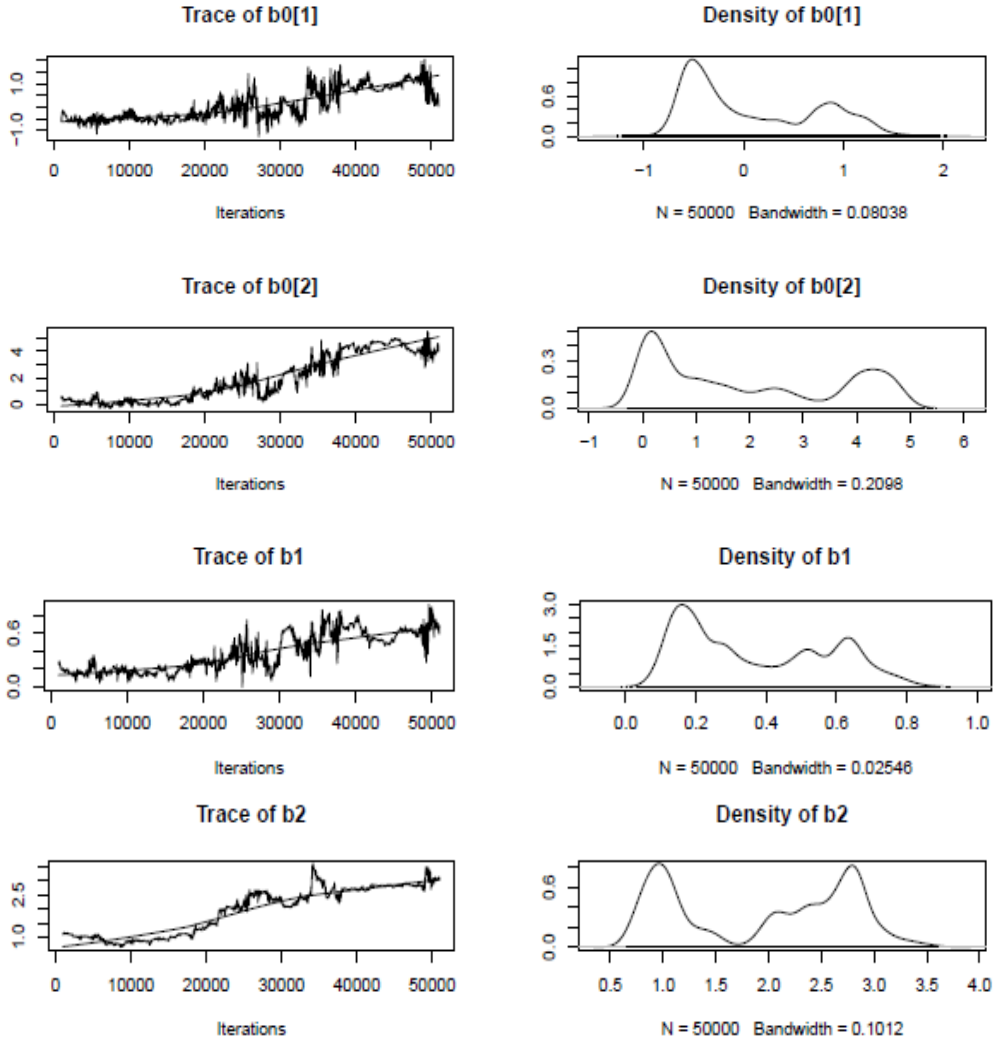
```
Rtau.alpha ~ dgamma(.01,.01)        ## prior for tau.alpha (precision)
Rtau ~ dgamma(.01,.01)               ## prior for tau (precision)

Rsigma <- 1/sqrt(Rtau)                ## std dev of idiosyncratic errors
Rsigma.alpha <- 1/sqrt(Rtau.alpha)     ## std dev of unit-specific terms
```

Code snippet 7

[45] The Uniform Distribution < https://stat.ethz.ch/R-manual/R-devel/library/stats/html/Uniform.html>
[46] The Gamma Distribution < https://stat.ethz.ch/R-manual/R-devel/library/stats/html/GammaDist.html>

Both give very similar results, however Gamma distribution is found to take a bit longer to converge.

Comparison of coefficient for corporate governance and control index is as below



It shows that the model has not yet converged.[47]

3.2.4 Multilevel hierarchical with lag

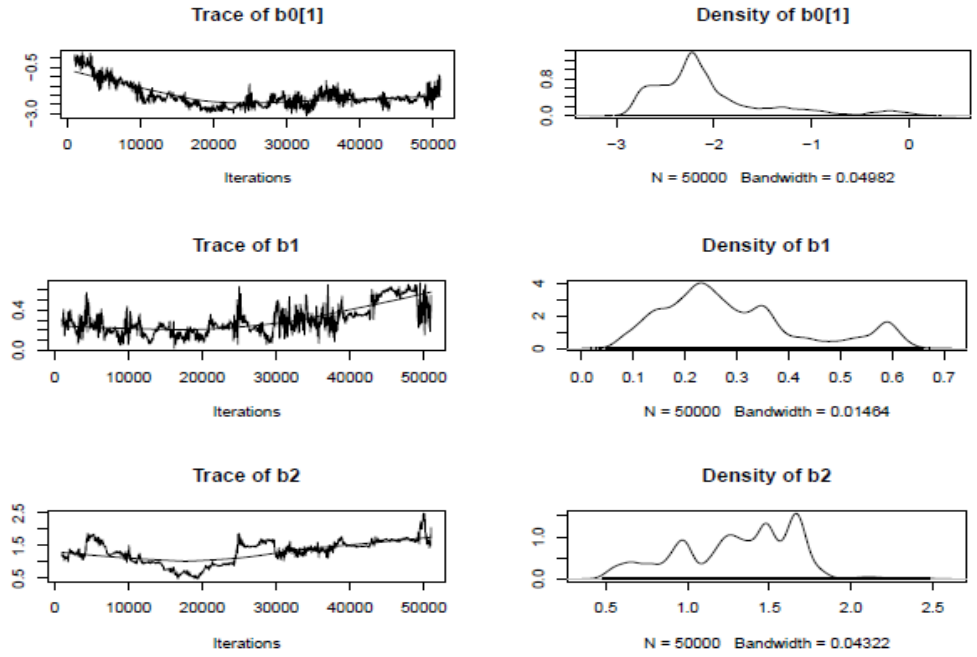
As evidenced by experience, the effect of the change in corporate governance on financial development is gradual, this is called lag effect.[48] We compensate for this lag effect by regressing the outcome at a later time period. So varying the time component we have:

$$Y_{jt+1} \sim N(\beta 0_j + \beta 1 X1_{jt} + \beta 2 X2_{jt+1} + \varepsilon_i, \sigma^2_j) \qquad (16)$$

[47] Please note that the entire convergence plots along with the replication images for the intermediate models are available on request.

[48] For instances of usage of lag effect in calculating impact of corporate governance see generally Barry D Baysinger and Henry N. Butler, 'Corporate governance and the board of directors: Performance effects of changes in board composition.' (1985) Journal of Law, Economics, & Organization 101-124; Jarrad Harford, Sattar A. Mansi and William F. Maxwell, 'Corporate governance and firm cash holdings in the US.' (2008) 87 Journal of Financial Economics 535-555.

The corporate governance index ranges from 1995-2014, however the financial index and control index data for 2013-14 is incomplete. So for corporate governance the time period 1995-2011 (17 years) is used with the corresponding financial and control index for time period 1996-2012. Thus the financial and control index lags one year behind the corporate governance index. The coefficient for corporate governance and control index is as below:[49]

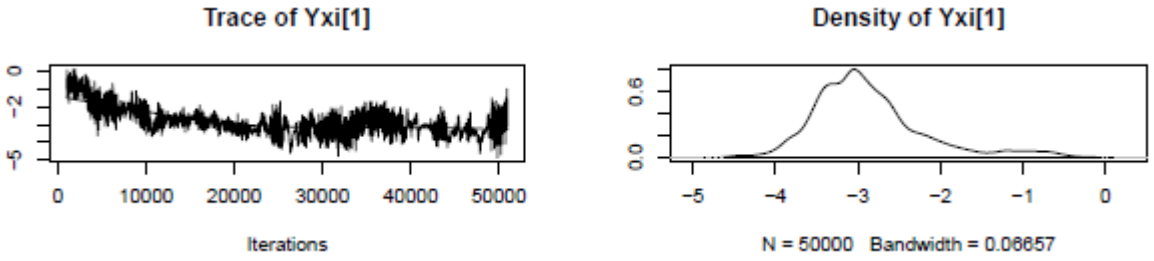


3.2.5 Convergence analytics

Even with lagging for corporate governance change, the model does not converge, so a few radical solutions were implemented.

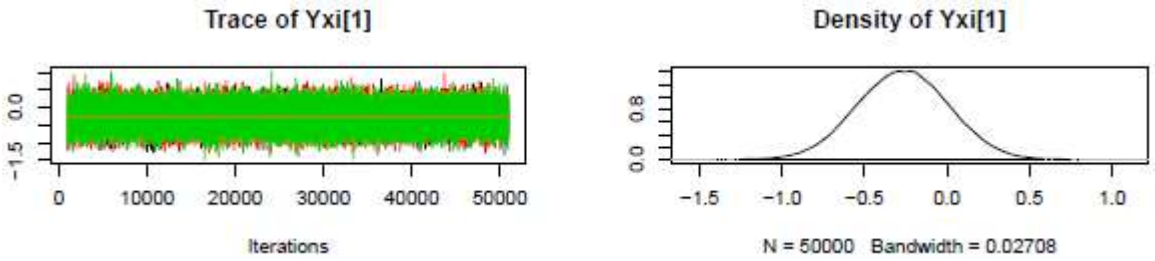
First, it was found that Yxi (the dependent variable) was not converging properly when its prior was obtained from the regression analysis [line 5 in code snippet 7]. So, a separate Bayesian factor analysis is run for Yxi and the value is fed into the main regression model.

The traceplot and density graphs change from



[49] Please note that the entire convergence plots along with the replication images for the intermediate models are available on request.

to



Second, the control variable index was split into three indices to reflect the underlying nature of the variables being factored in – so the new indices represented economic growth, financial inclusion and increase in investment in R&D and technology led export.

Third, priors for precision terms for country level indicators, which were fixed at dgamma(0.01,0.01) [line 1 code snippet 7] was changed to dgamma(2,0.6) for quicker convergence.

4. Analysis

As has already been explained in the methodology a Bayesian panel data multilevel regression model was run with the following variables. The dependent variable is a Bayesian factor analysis of five individual variables - Foreign Direct Investment (FDI), market capitalisation of listed companies, number of listed domestic companies, S&P global equity index and volume of stocks traded, which produces a financial market development index. The independent or the explanatory variable is a corporate governance index which is calculated utilising fifty two polynomial variables using a dynamic graded response model. There are three control indices – the first is a financial control index which is a Bayesian factor analysis of five variables: GDP, balance of payment, interest rates and external debt; the second control is a technological and financial inclusion index which is a Bayesian factor analysis of three variables: banks per capita, access to cellphones and access to internet; the third control is on industrial value addition through R&D which is calculated as a Bayesian factor analysis of two variables: annual value of high technology exports and the number of patent and trademark applications at USPTO. The country level controls are Human Development Index, GINI coefficient, peace index and rule of law index.

All the variables have been scaled during analysis, this has been done so that data across different scales can be brought to equal footing and be comparable. Standardised scores retain the order of values and do not alter the spread of the distribution. In order to interpret the regression coefficients adequately, it is important to get reacquainted with the dimensions of

the variables being studied. The outcome variable (financial market growth) mean varies between -0.484442342 to 5.590986766; corporate governance mean ranges from -3.534233674 to 2.379850602; control 1 mean varies from -0.812063767 to 6.603306772; control 2 mean varies from -0.963732058 to 2.522277709; control 3 mean varies from -0.544303762 to 7.081288848; HDI ranged between 1.708205376 to 1.658184144; GINI values ranged between -1.93865098 and 1.38711035; peace index ranged between -1.86111526 and 1.52476794; rule of law ranges from -1.6202276 to 1.9709245.

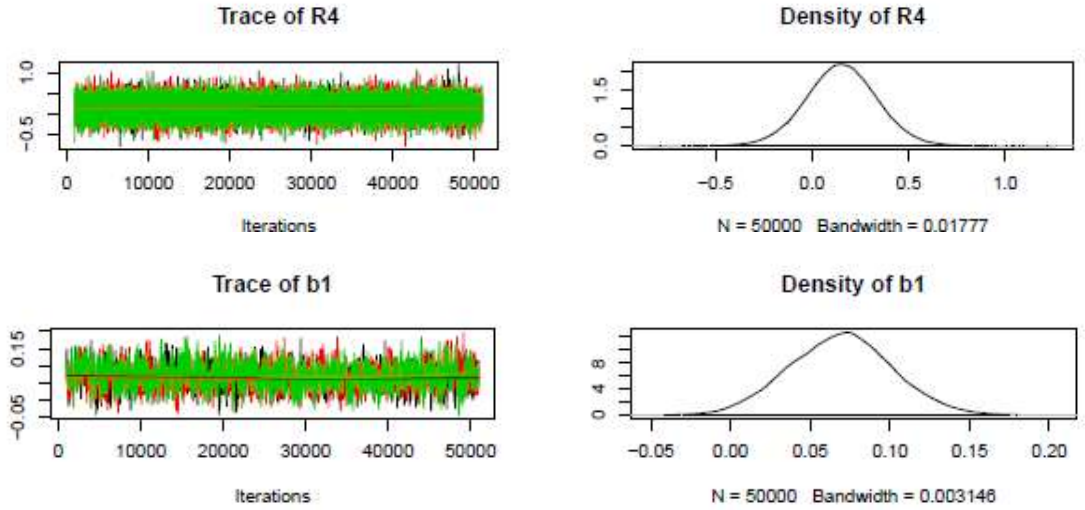
The results of the regression analysis with the mean estimate and 95% credible interval are summarised below:

Coefficients	Mean estimate	2.5% quantile	97.5% quantile
Corporate governance (b1)	0.065933098	0.003271972	0.128982723
Control 1 (economic) (b2)	0.416891465	0.330837219	0.496054383
Control 2 (technological inclusion) (b3)	0.084809059	0.013562828	0.15347945
Control 3 (industrial value addition) (b4)	0.370575484	0.28245685	0.451040566
Country level common intercept (R0)	-0.139287	-0.2875252	0.01033384
HDI (R1)	-0.07932591	-0.3499764	0.1961929
GINI (R2)	-0.008270965	-0.1712987	0.1565898
Peace index (R3)	-0.02080429	0.2493879	0.2069733
Rule of law (R4)	0.1610097	-0.2072071	0.5279218

The country level varying intercepts (b0) are as following:

	Mean	2.5% quantile	97.5% quantile
Brazil	-0.12244	-0.27047	0.02468
China	0.013511	-0.23057	0.263796
Chile	-0.16961	-0.30289	-0.03452
Colombia	-0.15642	-0.2914	-0.02088
India	-0.0192	-0.21219	0.175485
Indonesia	-0.16174	-0.29934	-0.02264
Peru	-0.20591	-0.33799	-0.07059
Pakistan	-0.27066	-0.4467	-0.09117
Poland	-0.317	-0.46093	-0.16702
Russia	-0.2549	-0.42917	-0.07813
Argentina	-0.26076	-0.39827	-0.12043
South Africa	-0.12753	-0.27251	0.015126
Iran	-0.28772	-0.43223	-0.14406
Kenya	-0.19227	-0.3366	-0.05165
Nigeria	-0.20744	-0.3563	-0.06275
Hong Kong	0.270039	0.094032	0.450204
Philippines	-0.24643	-0.38522	-0.10797
El Salvador	-0.17016	-0.30293	-0.03418
Vietnam	-0.0575	-0.2212	0.105893

The trace plots below on the left show that the MCMC chains have converged and the density plots on the right show the spread of the output. Uniform density plots and converging trace plots signify that the Bayesian model being run in this research has converged and is statistically valid. A couple of graphs are shown here the entirety of trace plots and density plots is available on request.



A further proof that the model is stable is provided by the Gelman and Rubin's convergence diagnostic, if the value is 1± 0.05 the variable is said to have converged. Below are Gelman and Rubin's convergence diagnostic for the regression coefficients:

Variable	Mean estimate of convergence diagnsotic
b1	1.010659
b2	1.0047
b3	1.011442
b4	1.001846
R0	1.000046
R1	1.000867
R2	1.000028
R3	1.001067
R4	1.001472

A comparison of corporate governance coefficient (b1) mean estimates of 0.0659 with the mean estimates of control variables like economic growth coefficient (b2) 0.4169 and industrial value addition coefficient (b4) 0.3706, shows that economic growth coupled with technology-led industrial growth has twelve times more impact on financial market development than a change in corporate governance model towards more shareholder value.

Another way of presenting the data would be to state that the model predicts that keeping other factors constant increasing the economy and high technology output by 1.25 times

double the financial development, while to reach the same level of financial development growth only by improving corporate governance would require a fifteen fold shift in the corporate governance regime towards a shareholder value model. As seen in the previous subchapter, the corporate governance regimes in all the countries have reached peak shareholder value orientation, it is possible therefore to posit that there is no scope for the level of change required in corporate governance models to make any significant contribution to financial market growth. Armour, Deakin et al. also found that 'increases in shareholder protection have not led to greater stock market development, as might have been expected.'[50] However they also posited that given the data was for 1995 to 2005 'the strengthening of shareholder rights which took place in the 1990s and 2000s has not been having its principal intended effect.' This research paper confirms that even under a longer time period, data change in the corporate governance model does not have any noticeable impact on financial market growth.

However the estimate of impact of change in corporate governance (b1) 0.0659 has more bearing on financial market development in comparison to the country level variables like GINI coefficient (R2) -0.0082, peace index (R3) -0.0208, HDI (R1) -0.0793, except for rule of law estimated at (R4) 0.161 which has double the impact on financial market development. The model predicts that GINI coefficient (-0.0082) has almost no impact on financial market development. What is interesting is that HDI affects the financial market development negatively, this can be correlated to the fact that lower HDI would mean lower wages which would lead to more FDI and hence greater financial development. However, this also paradoxically reduces the amount of technology-led exports and R&D expenditure which has a high impact on financial market growth.

The model also predicts that rule of law is twice as important as adopting shareholder primacy models on the growth of financial markets. This is in line with the common understanding that investors move to countries with a stable legal and judicial system.

So we can summarise that for the developing countries, studied under this research there is a weak impact of change in the corporate governance model on financial market growth, especially in comparison to the overall impact of financial, technological and economic growth.

[50] Armour, Deakin et al. (n 10) 42

5. Conclusion

The central premise on which convergence on shareholder primacy corporate governance was effected, namely that the adoption of shareholder primacy corporate governance stimulates financial market growth, has been proven false in this research paper. It was found that over the long term, changes in corporate governance regulations have little effect on the growth of financial markets in developing countries. Economic factors and investment in R&D and technology-led export industries have approximately seven and six times, respectively, more impact on the growth of the financial market than changes in corporate governance regulations.

It was also found that rule of law is almost two and a half times more important for the growth of the financial market than corporate governance regulations. It can therefore be concluded that the quality of law enforcement is far more important than the quality of law on the books in terms of fostering the sustainable growth of the financial market. This perhaps illustrates one of the major areas of improvement for developing countries – it is imperative that securities market regulators and commercial law courts are perceived to be independent, consistent, objective, efficient, transparent and that their orders are enforceable in a timely fashion. While developing countries have rapidly adopted regulations providing for ever-increasing shareholder control and influence, they have rarely invested adequately in ensuring the integrity and efficiency of regulators and enforcement mechanisms. It can thus be suggested that instead of applying window-dressing by rearranging corporate governance norms or plucking the low hanging fruits by adopting shareholder value regulations, countries should concentrate on increasing the efficiency of adjudication processes and enforcement authorities in order to put financial market growth on a more sustainable footing. Countries should invest more in upgrading judicial infrastructures and providing market regulators with sufficient financial resources and legislative powers. Regulators should be encouraged to take a proactive stance in enforcing legal rules in order to ensure that laws are not simply rules ‘on the books’ and are actually implemented in practice. It is possible to predict that improvements in the rule of law based around an efficient market regulator, and an independent judiciary, operating according to efficient and reliable processes, will contribute significantly to sustainable financial market growth, regardless of the precise content of corporate governance regulation.

While it is difficult to exercise a radical influence on economic growth in a short space of time, it is much easier to have a significant impact on R&D investment and encourage technology based industries. The author thus proposes that in order to achieve sustainable

growth in financial markets, developing countries should adopt policies encouraging R&D and focussing on high technology-led export industries. These policies could take the form of: favourable tax regulations for R&D investments; incentives for high technology industries through conducive regulatory mechanisms such as easier access to credit, simpler rules for doing business, fewer opportunities for regulatory arbitrage, single window clearance whereby businesses are allowed to submit regulatory documents to a single entity, tax credits etc.; and discouraging financial transactions which legitimise unproductive rent-seeking behaviour, for example by imposing higher tax rates on buy backs of shares, and rationalising capital gains tax rules, especially when they are being used as the primary avenue to seek returns on investment etc.[51] It is time to think beyond the existing shareholder primacy corporate governance regulations, and to rebuild a new corporate law structure based on sustainable economic growth, eschewing short term profit making.[52] It is necessary to question the rationale for society's decision to use law to provide the twin privileges of separate legal personality and limited liability to companies. Is it for the benefit of the few or is it for a wider societal good? Companies should not be treated like disposable financial and tax efficient vehicles, but rather as repositories of long term investment, where investors look not for quick speculative profits. Investors need to view themselves as force multipliers for long term sustainable economic growth. It is vital to move beyond the paradigm that the responsibility of companies is solely to be profit generating machines for their shareholders and that greed is good to viewing companies as trustees for its stakeholders – employees, customers, creditors, shareholders etc., As Jack Welch commented 'shareholder value is a result not a strategy.'[53]

This research paper thus proves that changes in corporate governance regulations to make it pro-shareholder have had little effect on the growth of financial markets in developing countries. At best the shareholder value model is a waste of time; at worst developing countries are being shoehorned into a one size fits all model which benefits foreign investors and domestic elites, but in the long term may irreparably harm the country's innovative capacity by allowing excessive rent-seeking on the part of the investors.

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[51] See generally William Lazonick, 'Stock Buybacks: From retain and reinvest to downsize and distribute' (2015) Working paper Centre for Effective public management at Brookings

[52] See generally Blanche Segrestin and Armand Hatchuel, 'Beyond Agency Theory, a Post-crisis View of Corporate Law' (2011) 22 British Journal of Management 484–499.

[53] See Francesco Guerrera, 'Welch condemns share price focus' *Financial* Times (New York, 12 March 2009); see also John Kay, *Obliquity: Why our goals are best achieved indirectly* (Profile Books 2010)