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An Empirical Investigation of the Impact of Institutions on Economic Growth

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Abstract

This paper explores the impact of institutions on economic growth, measured in terms of Gross Domestic Product (GDP) per capita. A wide range of economic, non-economic, social, environmental and political factors contribute to economic growth and prosperity. Institutions are discussed as a range of array of regulatory and accountability mechanisms, beyond the boundaries of market functioning. This paper takes composite values of democracy index, vested interests, accountability, human rights and freedom of association and uses it as a proxy for institutions. A range of theoretical and empirical evidence, in addition to panel data analysis indicates positive role of institutions in economic growth.

Keywords: *Institutions, Democracy, Economic Growth, Investment, Fertility, Education, Inequality, Education, Government, Political Stability, Rule of Law, Life Expectancy, Panel Data.*

Introduction

Over the last few decades, the varying degree of economic growth across the globe raises concerns and questions about validity of contributing and influencing factors. Several attempts have been made to explore the root causes of economic prosperity and growth. Countries with similar GDP growth rates are not necessarily exhibit the same levels of socio-economic dynamics, human development indicators and wellbeing measures. Traditional economic factors including trade openness, capital share per capita, investment ratios, government consumption, black market premium and infrastructure are usually considered conducive for economic growth. Geography, distance with equator, race or ethnic background, colonial history, governance structures and even choice between socialism and capitalism are some of the much-discussed non-economic factors for economic growth. On the basis of these broad categories, several researchers and economists, especially North (1998), Rodrick (2000) and Barro (1996) have come up with the notion of role of institutions in economic growth. Institutions are formal and informal rules to govern interactions among individuals. North defines institutions as "a set of rules, compliance procedures, moral and ethical behavioural norms designed to constrain the behaviour of individuals in the interests of maximising the wealth or utility of principals" (North 1998, pp 201-202). Furthermore, North (1990, p.4) elaborates "Institutions are the rules of the game in a society, … the humanly devised constraints that shape human interaction … They structure incentives in human exchange, whether political, social or economic". Role of institution on economic growth is analysed on the basis of cross-country empirical evidence and extensive relevant literature (Acemoglu, Johnson and Robinson, 2001). This paper explains the importance of institutions for economic growth through looking at cross-linkages of human, social, physical and political capital. Institutions support processes and mechanisms for contract enforcement, protection of property rights, education and health systems, democratic structures, rule of law, and market functioning.

Panel data of 32 countries is used to investigate the question, on the basis of theoretical and econometrical analysis. The next section is theoretical overview based on literature review, followed by empirical analysis with explanation of variables and model specification. Fourth section carries model estimation and statistical inference of the model which leads to concluding section.

Literature Review

There is a great deal of literature[1] available on the factors which contribute to economic growth and subsequently institutions have emerged as one of the main forces. Focus on institutions gained momentum in 1960s mainly with the works of Ronald Coase, Douglass North and Harold Demsetz. Historically, institutions used to be taken as orthodox structures supposedly to be uniformed across the world but this has transformed over the years to search for uniqueness and customisation of institutions. Around 1990s the role of institutions emerged as a positive player in economic development, however, there are still ambiguities that which institutions are significant to steer the process of economic growth.

Institutions are both formal and informal, where formal institutions comprise of legal and political structures and written rights including laws, constitution, policies etc. On the other hand, informal institutions include culture, norms and conventions backed by social customs (Sobel, R. and Coyne, C. 2011). Both formal and informal institutions cannot work in isolation. Formal institutions are heavily dependent on informal institutions for their functioning. (de Soto 1989; Boettke, Coyne, and Leeson 2008; Williamson 2009).

Institutions don't just exist; they evolve and transform. The quality and efficiency of institutions vary across regions and even within countries. Institutions don't function in silos. They are inter-connected with other institutions in a country operating in the presence of several endogenous and exogenous factors. Williamson (2000, pp 596-600) illustrates hierarchy of social analysis to map the impact of institutions on economic growth with level of social analysis. Hierarchy of social change is inversely proportional to the time required to change.

Table 1 Co-integrating institutions – Williamson's Hierarchy of Social Analysis

Level	Description	Time to change
1	Embeddedness: informal institutions, customs, traditions, norms, and religion	100 – 1000 years
2	Institutional environment: formal rules of the game, especially property (polity, judiciary, and bureaucracy)	10 – 100 years
3	Governance: play of the game, especially contract (aligning governance structure with transactions)	1 – 10 years
4	Resource allocation and employment (prices and quantities, incentive alignment)	Continuous

Source: Williamson (2000, pp 596-600)

World Bank's 2002 report on *Building Institutions for Markets*, merely looks at the economic side of institutions, from neoliberal perspective. Previously the 'one size fits all' prescriptions of the international financial institutions almost failed because most of the programmes ignored the differences in institutions across the world (Chang 2007). Adding on, the financial crises in different countries[2] around end of the century, motivated the need for institutions which are able to prevent and cope with such crises. It paved the way for IMF and World Bank to come up with 'governance related conditionalities' to their financial

[1] Barro 1996; Aron 2000; Acemoglu, Johnson, and Robinson 2001, 2002; Glaeser et al. 2004; Rodrik, Subramanian, and Trebbi 2004; Acemoglu and Johnson 2005; Gwartney, Lawson, and Holcombe 1999; Ovaska and Sobel 2005; Sobel, Clark, and Lee 2007.

[2] Mexico 1995, Asia 1997, Russia 1998, Brazil 1999, Argentina 2002.

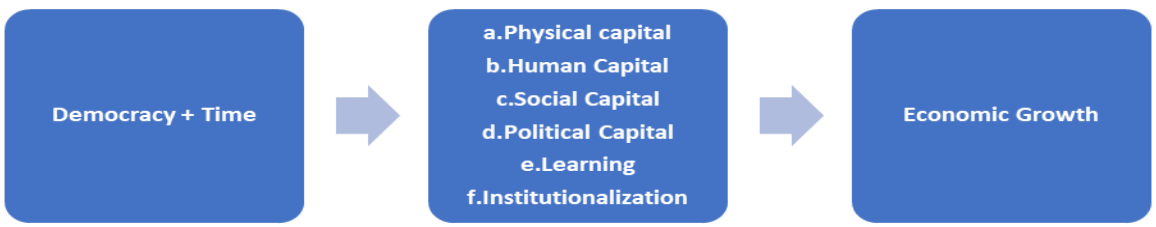
assistance programmes which led to global standardization of institutions. The institutions directly controlling economic factors contribute significantly to economic growth. Property rights, technological change, resource allocations and specialised production are key institutional arrangements for economic growth. Transaction costs of trade is a key element of economic performance (North 1989). Rodrik, Subramanian, and Trebbi (2004) prioritises institutions over geography in terms of impact on economic growth.

Private-Property institutions are the main factors of economic prosperity according to Acemoglu, Johnson, and Robinson (2001, 2002). A subsequent work by Acemoglu and Johnson (2005) also talks about property institutions by emphasising the role of property rights institutions in comparison with contracting institutions for economic growth. Drury, A., Krieckhaus, J. and Lusztig, M. (2006) uses time series cross section data from 100 countries of 16 years to establish that in general, corruption has a negative impact on economy. Mauro (1995) also supports the argument that corruption reduces investment which hampers economic growth. On the contrary, some researchers see positive relationship of corruption with economy through more competition, broader tax net and increased public spending (Leff 1968, Nye 1967).

Rodrick (2000) regards democracy as 'meta institution' for economic growth. The role of democracy on economic growth is convoluted. A number of researchers have vouched for positive impact on economic growth whereas some have argued that democracy has neither negative or no impact on economic growth. Barro (1996a) defines the nonlinear relationship between democracy and economic growth that economy grows during the initial phases of political freedom but slows down when moderate level of political freedom is achieved. North (1990) argues that authoritarian elites can quarry society unless restricted by democratic institutions. Similarly, Bueno de Mesquita et al (2001) suggests that authoritarian leaders engage in cronyism and corruption because they have fewer checks. Impact of democracy on economic growth is summarised by Sirowy and Inkeles (1990: pp133) "…political pluralism acts to release energies and foster conditions conducive to change, entrepreneurial risk, and economic development".

On the contrary, neoclassical political-economy literature criticises democracy for its role for economic growth. Examples from East Asia supports the argument that authoritarian regimes elude rent seeking and politically motivated policies and mistakes (Haggard 1990). Politicians tend to reap particularistic privileges and influences policies which puts more burden on state resources, leading to decreased government efficiency (Olson, 1982; Amsden, 1989; Evans 1995; Wade, 1990). Categorical conclusion comes from Helliwell (1994) and Przeworski (2000) that there is no *statistically* significant relationship. However, democracy do have several *indirect* effects such as political stability, increased public expenditures on education and health which has positive impact on economic growth. Chang argues for a reverse causality between institutions and economic growth. On the other hand, Hayek (1944) and Friedman (1962) intertwine political and economic institutions, in addition that political freedoms lead to economic freedoms and vice versa. Gerring (2005) with the acknowledgement of complexity of the notion of democracy's indirect effects on economic growth has illustrated a simple diagram to show the pathway.

Figure 1 Journey from Democracy to Economic Growth



Source: Adopted from Gerrings (2005).

Another important factor is international trade which plays key role in market formation and transformation for economic growth. Trade is regarded as a main decisive factor whether the country would grow or not (Sachs and Warner, 1995; Dollar and Kraay, 2004). The next section talks about the empirical analysis of the impact of institutions on economic growth.

Theoretical Framework

Neoclassical growth model is the basis for the framework of empirical analysis with several other factors including fertility rate, investment, openness, rule of law and size of government, in this paper. The assumption of neoclassical growth model implies, for example, diminishing returns to capital which means as economy prospers, the rate of growth slows down. If investment rate is high and population growth rate is low then economy grows fast. Distortions in rule of law, civil unrest and political instability hampers growth rate. This paper is based on the hypothesis that institutions play positive role in economic growth for the developing countries. GDP is the dependent variable and institutions are taken as the explanatory variable. There are 8 other control variables in the model, which are explained in the following section.

This paper is an attempt to build on the works by Rodrick, Barro and Acemoglu backed by a number of relevant theoretical and empirical studies. 'Democracy and Growth' by Robert J Barro (1996a) shows a panel data of 100 countries to assess the linkages of democracy and economic growth. Barro (1996a) explores the positive effects of rule of law, free markets, small government consumption, and high human capital on economic growth. When these variables and initial level of GDP is held constant, the role of democracy on economic growth is weakly negative. So, the relationship between democracy and economic growth involves the effect of political freedom on growth and standard of living on democracy. Another pioneering work of Barro (1996b) supports the notion of conditional convergence for economic growth. High initial schooling and life expectancy, lower inflation and openness to trade facilitates economic growth.

Rodrick (2000, 2004) provides empirical evidence for the role of institutions for economic growth. He regards democracy as a meta institution which paves the way to build economic and political institutions. Markets in order to function are backed by non-market institutions to guarantee regulations, property rights and macroeconomic stabilisation. Another key reference article is "Institutions as a fundamental cause of long run growth" by Acemoglu et al. (2005). It talks about differences in economic institutions as the cause of variation in economic development. It argues that economic institutions determine what incentives of and the constraints on economic actions and sharp economic outcomes. The paper takes the approach of Barro (1996a) and Rodrick (2000, 2004) to estimate the impact of institutions on economic growth.

Methodology

Data and variable description

GDP is the dependent variable with institutions as the explanatory variable. There are 8 other control variables in the model, which are explained in the following lines.

The Dependent Variable

1. **Real Per Capital Gross Domestic Product (GDP):** The dependent variable is real per capital Gross Domestic Product (GDP) taken as log value. The paper takes GDP as synonymous with economic growth and development. GDP is defined by World Bank as Annual percentage growth rate of GDP per capita based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. GDP per capita is gross domestic product divided by midyear population. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for

depreciation of fabricated assets or for depletion and degradation of natural resources. The source for GDP data is World Development Indicators of the World Bank. It is computed on continuous values of 20 years. It is denoted by $logGDP_{it}$ in the model.

Explanatory Variables: In this model, 'institutions' is used as independent variable.

2. **Institutions:** Institutions are rules, enforcement mechanism, and organizations (World Bank 2002). Since institution is a complex and multi-layered phenomenon, a proxy is used for this model. A cumulative value for Democracy index, vested interests, accountability, human rights and freedom of association is used for institution. This is the main explanatory variable of the model with positive sign which means institutions have positive impact on economic growth. Data is taken from Economist Intelligence Unit[3]. It is computed on continuous values of 20 years. It is denoted by Ins_{it}.

Control Variables: In this paper, 8 control variables are used, which can have influence on economic growth.

3. **Fertility Rate:** Fertility rate is a control variable in the model. In neoclassical growth model, a high rate of population growth has a negative effect on steady state level of output per effective worker. High population growth rate countries tend to remain in low-productivity cycle. Although fertility decisions are endogenous but an exogenous drop in birth rates can raise growth rate of per capita output (Barro 1996a). Population growth when high, tends to reduce the total capital per worker which leads to lower level of economic productivity. It is defined by World Bank as *"Total fertility rate represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with age-specific fertility rates of the specified year*. The model predicts fertility to be a negative sign. The source for fertility rate data is World Development Indicators of the World Bank. It is computed on the basis of values of twenty years in logarithm form. It is denoted by $logFer_{it}$.

4. **Government Consumption Ratio:** Government consumption is another control variable. It covers all public-sector expenditures excluding education and military expenses. Small government sizes are hypothesized to hamper growth rates. Government consumption is said to shift resources from private sector to public sector which supposedly reduces the efficiency of resources. High government consumption requires higher inflows from taxation which reduces motivation to work or produce among the private sector which may retard growth. It is defined as *"General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defence and security but excludes government military expenditures that are part of government capital formation. Data are in constant 2010 U.S. dollars."*. It is estimated to carry a negative impact on economic growth. It is computed on the basis of values of twenty years. It is denoted by GCR_{it}.

5. **Investment Ratio:** Saving rate is exogenous and equal to ratio of investment to output, in neoclassical growth model. A high saving rate improves the steady state level of output per effective worker which has positive impact on growth rate. Investment ratio/saving rate is defined as *"Gross savings are calculated as gross national income less total consumption, plus net transfers."* Investment is estimated to be positively related to economic growth. Source of date is World Development Indicators, World Bank. It is computed on the basis of values of twenty years. It is denoted by Inv_{it}.

[3] https://www.eiu.com/home.aspx

6. **Inequality:** The paper takes inequality as a control variable and uses Gini as a measure of inequality. A higher Gini coefficient signifies more inequality. *Gini is a statistical measure of the degree of variation represented in a set of values, used especially in analysing income inequality.* The model predicts negative sign for inequality. Inequality data is taken from World Governance Indicators, World Bank. It is computed on the basis of values of twenty years. It is denoted by $Gini_{it}$.

7. **Political Stability:** 'Political stability and absence of violence' is used as a control variable. World Governance Indicators define it as "*Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism."* The model predicts positive sign for political stability. The source for Political Stability data is World Governance Indicators of the World Bank. It is computed on continuous values of 20 years. It is denoted by $STBL_{it}$ in the model.

8. **Life Expectancy:** Log of life expectancy is taken as an indicator of good health, based on the general assumption that healthy workers are more efficient and productive. World Bank defines it as "Life expectancy at birth indicates the number of years a new-born infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life." The model predicts life expectancy to be a positive sign. The source for data is World Development Indicators of the World Bank. It is computed on the basis of values of twenty years in logarithm form. It is denoted by $logLif_{it}$.

9. **Rule of Law:** Rule of law is taken as an important control variable which seem to have positive correlation with economic growth. Maintenance of rule of law is favourable to growth, as advocated by Barro (1996a). It is defined as *"Reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence."* The model predicts positive sign for rule of law. Data is taken from World Governance Indicators, World Bank. It is computed on the basis of values of twenty years. It is denoted by Law_{it}.

10. **Secondary School Enrolment:** Secondary school enrolment is taken as a control variable in the model. It is defined by WDI as *"Gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Secondary education completes the provision of basic education that began at the primary level and aims at laying the foundations for lifelong learning and human development, by offering more subject- or skill-oriented instruction using more specialized teachers".* The model predicts education to be a positive sign. The source for data is World Development Indicators of the World Bank. It is computed on the basis of values of twenty years. It is denoted by SEM_{it}.

Model Specification

The model is 'strongly balanced' with 213 observations of 32 countries, covering a period of 20 years.

Choice of Countries: The countries are chosen from three distinct regions: East Asia, Latin America and South Asia. The rationale for choosing the countries from these three regions is embedded in the following reasons: All three regions have different models for development, there is a lot of diversity among the three prescribed regions. East Asia is mainly authoritarian regions with very strong role of the state; South Asia is mainly democratic whereas, Latin America is a combination with repeated changes in governance types. The East Asian region has comparatively stronger institutions in terms of law and regulation enforcement as compared to Latin America and South Asia. Further selection of countries is based on availability of data for 10 variables.

Timeframe: Timeframe is from 1996-2016 because data for the main explanatory variable *Institutions* is available from 1996 only.

Reliability of Data: The attempt has been made to use most appropriate data source in the research. However, quality of data varies across countries. In most developing countries, a large share of business transactions are cash based which are not accounted for in the national figures. Two out of three regions i.e. South Asia and Latin America may have poor quality data for some variables which may have impacted the results differently. The probability of some variables having low quality of data is mitigated through theoretical and empirical evidences from existing literature. Two variables, private property institutions and corruption which were part of the initial model, were dropped on the basis of non-availability of reliable and consistent data. The data quality for Gini for several countries is inconsistent which may cause misrepresentation of results.

Panel Data: Panel data is used for the model to control individual heterogeneity across variables. Panel data yields more information, more variability and also less collinearity among the variables, more degrees of freedom and more efficiency (Baltagi 2005). On the other hand, panel data has some drawbacks. There can be measurement errors, selectivity and/or issue of attrition. Macro panels on countries or regions with long time series that do not account for cross-country dependence may lead to misleading inference.

Hypothesis: The hypothesis of the model is Institutions play positive role in economic growth.

The model is defined as:

$$\mathbf{LogGDP_{it} = \beta_1 Ins_{it} - \beta_2 LogFer_{it} - \beta_3 GCR_{it} + \beta_4 Inv_{it} - \beta_5 Gini_{it} + \beta_6 Stbl_{it} + \beta_7 LogLif_{it} + \beta_8 Law_{it} + \beta_9 SEM_{it} + \alpha_i + \epsilon_{it}}$$

'i' subscript is cross section countries dimension
't' subscript is time series dimension
α_i is an unobserved heterogeneity
ϵ_{it} is the idiosyncratic error

$\mathbf{LogGDP_{it}}$ as log of GDP per capita growth

Ins_{it} as Institutions
$logFer_{it}$ as Log of Fertility Rate
GCR_{it} as Govt Consumption Ratio
Inv_{it} as Investment Ratio
$Gini_{it}$ as Inequality Index
$STBL_{it}$ as Political Stability and Non-Violence
$logLif_{it}$ as Log Life Expectancy
Law_{it} as Rule of Law
SEM_{it} as Education Enrollment

Discussion

The model is 'strongly balanced' with 213 observations over 32 countries, covering a period of 20 years with 10 variables. A number of diagnostic tests are carried out to validate the model of impact of institutions on economic growth. Data summary is provided in Appendix 1.
Multicollinearity: Multicollinearity refers to the case where there is exact linear relationship between two or more independent variables within a multiple regression, which is violation of one of Guass-Morkov

assumptions. In presence of multicollinearity coefficient estimates are not biased but variances are biased and usual OLS procedure becomes invalid. (Wooldridge, 2009). The model is checked to prevent multicollinearity issues to bias analysis, correlation among explanatory variables is checked.

Table 2: Correlation

GDP	*INS*	*logfer*	*GCR*	*INV*	*GINI*	*STBL*	*loglif*	*LAW*	*SEM*
INS	1.0000								
logfer	-0.3070	1.0000							
GCR	0.0366	0.0709	1.0000						
INV	-0.2870	-0.2168	0.2369	1.0000					
GINI	-0.1450	0.4430	-0.2405	-0.3445	1.0000				
STBL	0.0081	0.1838	0.2253	-0.2512	-0.1732	1.0000			
loglife	0.4568	-0.7125	0.0500	-0.0676	-0.2735	-0.0564	1.0000		
LAW	0.4695	-0.6270	0.0435	0.0241	-0.3827	-0.1041	0.4733	1.0000	
SEM	0.5078	-0.5243	-0.1154	-0.0353	-0.0941	-0.1331	0.4433	0.3473	1.0000

In the correlation matrix all values are less than 0.90 which means there is no multicollinearity in the model. Results show that institutions are positively corelated with economic growth. Original STATA result is appended as Appendix 2.

Selection of Model: In order to choose the most appropriate model, there are three options: Constant Coefficient/Pooled OLS model with the assumption that constant/s does not vary across countries or years. It also assumes that there are no significant individual effects. Fixed Effect Model is to enable the model to control for omitted variables that vary between countries while being constant over time. Random Effect Model is about having no significant variable between countries while there are significant time-based effects.

The Constant Coefficients/Pooled OLS Model: The constant coefficient model (OLS) assumes that there is neither statistically significant country nor statistically significant temporal effects. The results of the regression are given below with coefficients and their corresponding significance.

Table 3 Constant Coefficient Model

Variables	Pooled OLS
INS	0.259**
	(0.121)
logfer	0.792***
	(0.168)
GCR	0.00488***
	(0.00140)
INV	0.00383
	(0.00238)
GINI	0.00414*
	(0.00223)
STBL	-0.0453*
	(0.0249)
loglif	7.564***
	(0.701)
LAW	0.250***
	(0.0411)

SEM	0.00762***
	(0.000910)
Constant	-25.53***
	(3.072)
Observations	213
Number of CNTRY	25

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results from the constant coefficient/pooled OLS model denotes that there is a positive correlation between institutions and economic growth at a 5% significance level. Detailed STATA result is appended as Appendix 3.

Fixed effects model: If the variables differ for countries but static for time, a fixed effect regression is used to control for omitted variables. The FE model is used so that the estimated coefficients cannot be biased on the basis of omitted time invariant characteristics, for example, ethnicity, race, gender etc. The following table indicates the results for the fixed effects model.

Table 4 Fixed Effects Model

Variables	Fixed Effects
INS	0.353***
	(0.114)
logfer	0.835***
	(0.163)
GCR	0.00461***
	(0.00136)
INV	0.00657***
	(0.00231)
GINI	0.00293
	(0.00210)
STBL	-0.0557**
	(0.0238)
loglif	6.662***
	(0.693)
LAW	0.225***
	(0.0409)
SEM	0.00763***
	(0.000860)
Constant	-21.67***
	(3.045)
Observations	213
Number of CNTRY	25
R-squared	0.756

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results of the Fixed Effect model show institutions as highly significant at 1% confidence level. It indicates 76% R square. Detailed STATA result is appended as Appendix 4.

Random effects model: The random effects model is useful if there might be omitted variables which are constant over time, while there are variations between them. In this model, time invariant variables are included in the regression as regressors.

Table 5 Random Effects Model

Variables	Random Effect
INS	0.259**
	(0.121)
Logfer	0.792***
	(0.168)
GCR	0.00488***
	(0.00140)
INV	0.00383
	(0.00238)
GINI	0.00414*
	(0.00223)
STBL	-0.0453*
	(0.0249)
Loglif	7.564***
	(0.701)
LAW	0.250***
	(0.0411)
SEM	0.00762***
	(0.000910)
Constant	-25.53***
	(3.072)
Observations	213
Number of CNTRY	25

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results from the random effect model perform slightly worse than fixed effects model. Significance of institutions drop from 1% to 5% in random effect model. BPLM and Hausman tests are done to select the most efficient model. Detailed STATA result is appended as Appendix 5.

Breusch and Pagan Lagrange Multiplier test:

In order to identify any omitted country or time specific effects, Breusch and Pagan Lagrange Multiplier test is used to determine whether the intercept has the same value across countries and years. The Breusch and Pagan Lagrange Multiplier test give the following results:

Table 6 Breusch and Pagan Lagrange Multiplier test results

Test: H_0 :	**Var (u) = 0**
Chibar 2 (01) =	306.66
Prob > chibar2 =	0.0000
(V_b-V_B is not positive definite)	

As the P value of chi2 distribution is significant so null hypothesis is rejected. Random Effect model is more efficient than pooled OLS. Detailed STATA result is appended as Appendix 6.

Hausman test: Hausman test is used to identify whether to use the random or fixed model. It can help to check if there is a significant correlation between the unobserved random effect and the regressors and if there is no correlation then the model should follow random effect. On the other hand, if there is correlation then the random effects model would show inconsistency in estimates and appropriate model would be fixed effects. If the difference is not significant, it is safe to use the random model whereas if the P value is significant, the fixed effects model should be used. Hausman test produces the following results:

Table 7 Hausman Test Results

Test: H_0 :	**difference in coefficients not systematic**
chi2(9) = (b-B)' [(V_b-V_B)^(-1)](b-B) =	125.88
Prob>chi2 =	0.0000
(V_b-V_B is not positive definite)	

The results of Hausman test indicate that the difference between the models is significant. The random effect estimates are inconsistent. So, the fixed effect model is more robust for this model. Detailed STATA result is appended as Appendix 7.

Heteroscedasticity: Heteroscedasticity is present when the variance of the residuals is not-constant making it violation of one of the Gauss-Markov assumptions under which our statistical inference can be justified. Presence of heteroscedasticity means coefficient estimates are unbiased and consistent but are not efficient and the estimated variances are biased while confidence intervals and significance tests are not valid (Wooldridge, 2009). In this paper we use the Modified Wald test for group-wise heteroskedasticity.

Table 8 Modified Wald test for group-wise heteroskedasticity

H0: sigma(i)^2 = 0	**sigma^2 = 0 for all i**
chi2 (25) =	**5627.96**
Prob>chi2 =	**0.0000**

The null is homoskedasticity (or constant variance). The significant p value (p-value>chi2 is<a), shows that we can reject the null hypothesis and conclude that there is heteroskedasticity. Detailed STATA result is appended as Appendix 8.

Wooldridge test for serial autocorrelation: In a classical regression model, there is an assumption of independence of disturbances from observation to observation. If this assumption is violated then problem of autocorrelation emerges. In order to test autocorrelation in panel data, Wooldridge (2002) has designed a simple test which was further authenticated by Drukker (2003).

Table 9 Wooldridge test for autocorrelation in panel data Results

H_0	**no first-order autocorrelation**
F(1, 14)	**44.286**
Prob > F	**0.0000**

The above-mentioned results show that the model suffers from autocorrelation. There is a possibility that autocorrelation exists because of model miss-specification or an omitted lagged dependent variable. However, autocorrelation is tested for macro panels with long time series (over 20-30 years). Autocorrelation is not a problem in micro panels. The paper here, has 20 countries so it is at the borderline. The model shall proceed with correction of autocorrelation. Detailed STATA result is appended as Appendix 9.

Dynamic Panel Model: The result from autocorrelation test suggests that the model seems to suffer from auto-correlation which can be corrected by estimating a dynamic panel model based on the Generalised

Method of Moment (GMM) estimation (Arellano & Bond 2002). Lagged variable when included, shows persistence over regressor ($logGDP_{it}$) and error term (ε_{it}). For Dynamic panel data model estimation, Arellano-Bond technique is used to include one lagged variable. With inclusion of one lagged variable the new Dynamic Panel Model is as follows:

$$\mathbf{LogGDP_{it} = \beta_1 Ins_{it} - \beta_2 LogFer_{it} - \beta_3 GCR_{it} + \beta_4 Inv_{it} - \beta_5 Gini_{it} + \beta_6 Stbl_{it} + \beta_7 LogLif_{it} + \beta_8 Law_{it} + \beta_9 SEM_{it} + \beta_{10} LogGDP_{it-1} + \alpha_i + \epsilon_{it}}$$

Where, $LogGDP_{it-1}$ is lagged variable for the dependent variable. With lagged variables introduced, the results are as follows:

Table 10 Dynamic Effects Model

Variable	Dynamic
INS	0.366***
	(0.116)
Logfer	0.853***
	(0.166)
GCR	0.00470***
	(0.00138)
INV	0.00646***
	(0.00232)
GINI	0.00283
	(0.00216)
STBL	-0.0576**
	(0.0240)
loglif	6.597***
	(0.704)
LAW	0.215***
	(0.0425)
SEM	0.00770***
	(0.000866)
laggdp	-0.00154
	(0.00243)
Constant	-21.40***
	(3.092)
Observations	212
Number of CNTRY	25
R-squared	0.756

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

With lagged variables introduced, the model produces the most efficient results. Institutions are highly significant with 1% change in institution will bring 0.36% change in economic growth. The results speak in favour of institutions' positive impact on economic growth. Detailed STATA result is appended as Appendix 10.

Conclusion

The paper demonstrates the impact of institutions on economic growth through theoretical and empirical evidences. The paper establishes a model on the basis of 32 countries from Latin America, South Asia and East Asia over a period of twenty countries. The model is inspired by Barro (1996) and Rodrick (2000) which shows positive correlation of institutions on economic growth along with control variables such as fertility, investment ratio, government size, inequality, political stability and rule of law. The model required a lagged dependent variable to ratify the autocorrelation among variables. With inclusion of lagged variable, the model has come up as a dynamic panel data model with highly significant positive relation of institutions with economic growth.

The model predicted negative signs for fertility rate, government consumption ratio and inequality and positive signs for the rest. However, the results have indicated that they all have positive relation with economic growth. Signs of control variables are linked with the socio-economic conditions of the selected countries. High fertility rate may have negative impact on economic growth per capita but it may not be the case for subsistence or low-capital economies which is the case with majority among the set of 32 countries. Inequality is being used as a control variable, which somehow validates Kuzent's curve theory that inequality increases in initial levels of economic growth. This is valid for the countries which are analysed for this model. Latin America, South Asia and East Asia are regions with emerging economics. Political stability has turned out to have an insignificant negative impact on economic growth. East Asian countries have high economic growth rate as compared to Latin America and South Asia but they are generally authoritarian regimes as compared to the other two regions. Appendix 11 shows institutional development over the years for 32 countries.

Although the model produces highly significant result, the research faces some limitations in terms of a smaller number of countries and limited time frame. The paper suggests further research on the model with widened scope and expanded number of countries covering a longer period of time. The results are generally consistent with Barro (1996) and Rodrick (2000) in which they have established positive correlation with democracy and institutions. The model shows highly significant positive correlation of institutions and economic growth with relevant contributing factors and enabling environment.

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Appendices

Appendix 1 Data Summary

```
. sum

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
        c_id |        672        16.5     9.23997         1         32
 CountryName |          0
        year |        672        2006    6.059811      1996       2016
         COR |        672   -.0239728    .9399443 -1.672876    2.32558
         INS |        644    .4903408    .1726022     .0885      .9375
-------------+---------------------------------------------------------
         FER |        654    2.478251    .8579471      .901      5.198
         GDP |        670    4.32e+10    4.64e+11  258.5951   9.50e+12
         GCR |        646   -2.532549    16.22642 -109.3215   56.47645
         INV |        619    25.75668    9.891412  5.530645   53.46358
        GINI |        325    46.19932     8.34035      27.6       64.3
-------------+---------------------------------------------------------
        STBL |        634   .0715597    .9788369 -2.810035    1.755193
         LIF |        653    72.49466     5.79506    58.423    84.27805
         LAW |        672   -.0606477    .8888194 -2.178493    1.923105
         SEF |        465    80.28016     23.3956    15.34452    154.695
         SEM |        466    78.30636    20.49695    21.76999    168.9041
-------------+---------------------------------------------------------
        OPEN |        546    1.24e+09    1.02e+10 -4.00e+10    1.25e+11
   laggedGDP |        639    9797.312    12659.04  258.5951    54800.37
       CNTRY |        672        16.5     9.23997         1         32
      loggdp |        670    9.302928    3.887083  5.555264    29.88276
      loglif |        653    4.280273     .080903  4.067709    4.434122
-------------+---------------------------------------------------------
      logfer |        654    .8466571    .3551663    -.10425    1.648274
      laggdp |        670    9.302928    3.887083  5.555264    29.88276

.
end of do-file
```

Appendix 2 Multicollinearity Test Results

```
. corr INS logfer GCR INV GINI STBL loglif LAW SEM
(obs=213)

             |      INS   logfer      GCR      INV     GINI     STBL   loglif      LAW      SEM
-------------+---------------------------------------------------------------------------------
         INS |   1.0000
      logfer |  -0.3070   1.0000
         GCR |   0.0366   0.0709   1.0000
         INV |  -0.2870  -0.2168   0.2369   1.0000
        GINI |  -0.1450   0.4430  -0.2405  -0.3445   1.0000
        STBL |   0.0081   0.1838   0.2253  -0.2512  -0.1732   1.0000
      loglif |   0.4568  -0.7125   0.0500  -0.0676  -0.2735  -0.0564   1.0000
         LAW |   0.4695  -0.6270   0.0435   0.0241  -0.3827  -0.1041   0.4733   1.0000
         SEM |   0.5078  -0.5243  -0.1154  -0.0353  -0.0941  -0.1331   0.4433   0.3473   1.0000


.
end of do-file
```

Appendix 3 The Constant Coefficients/Pooled OLS Model Detailed Results

```
. xtreg loggdp INS logfer GCR INV GINI STBL loglif LAW SEM

Random-effects GLS regression                   Number of obs      =       213
Group variable: CNTRY                           Number of groups   =        25

R-sq:  within  = 0.7510                         Obs per group: min =         1
       between = 0.7629                                        avg =       8.5
       overall = 0.6522                                        max =        19

                                                Wald chi2(9)       =    555.16
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
      loggdp |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         INS |   .2590656   .1205329     2.15   0.032     .0228255    .4953057
      logfer |   .7916617   .1678186     4.72   0.000     .4627433     1.12058
         GCR |   .0048834    .001396     3.50   0.000     .0021474    .0076195
         INV |   .0038266   .0023817     1.61   0.108    -.0008414    .0084946
        GINI |   .0041381     .00223     1.86   0.064    -.0002327    .0085088
        STBL |  -.0452794   .0249034    -1.82   0.069    -.0940892    .0035303
      loglif |   7.564293   .7010672    10.79   0.000     6.190227     8.93836
         LAW |   .2495484   .0410961     6.07   0.000     .1690015    .3300953
         SEM |   .0076165   .0009104     8.37   0.000     .0058321    .0094008
       _cons |  -25.53354   3.072151    -8.31   0.000    -31.55485   -19.51224
-------------+----------------------------------------------------------------
     sigma_u |   .44588209
     sigma_e |   .09318596
         rho |    .9581501   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Appendix 4 The Fixed Effect Model Detailed Results

```
. xtreg loggdp INS logfer GCR INV GINI STBL loglif LAW SEM,fe

Fixed-effects (within) regression               Number of obs      =       213
Group variable: CNTRY                           Number of groups   =        25

R-sq:                                           Obs per group:
     within  = 0.7557                                         min =         1
     between = 0.7242                                         avg =       8.5
     overall = 0.6025                                         max =        19

                                                F(9,179)           =     61.53
corr(u_i, Xb)  = 0.3424                         Prob > F           =    0.0000

------------------------------------------------------------------------------
      loggdp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         INS |   .3528912    .114119     3.09   0.002     .1276994    .5780829
      logfer |   .8347413   .1634568     5.11   0.000      .512191    1.157291
         GCR |   .0046126   .0013572     3.40   0.001     .0019345    .0072908
         INV |   .0065664   .0023067     2.85   0.005     .0020144    .0111183
        GINI |   .0029315   .0020986     1.40   0.164    -.0012097    .0070728
        STBL |  -.0556963   .0238417    -2.34   0.021    -.1027433   -.0086494
      loglif |   6.662117   .6931461     9.61   0.000     5.294328    8.029906
         LAW |   .2253358   .0408949     5.51   0.000     .1446376    .3060339
         SEM |   .0076329   .0008601     8.87   0.000     .0059358    .0093301
       _cons |  -21.66649    3.04483    -7.12   0.000    -27.67486   -15.65811
-------------+----------------------------------------------------------------
     sigma_u |   .73916186
     sigma_e |   .09318596
         rho |   .98435507   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(24, 179) = 110.98                     Prob > F = 0.0000

.
end of do-file
```

Appendix 5 The Random Effect Model Detailed Results

```
. xtreg  loggdp INS logfer GCR INV GINI STBL loglif LAW SEM,re

Random-effects GLS regression                   Number of obs     =       213
Group variable: CNTRY                           Number of groups  =        25

R-sq:                                           Obs per group:
     within  = 0.7510                                         min =         1
     between = 0.7629                                         avg =       8.5
     overall = 0.6522                                         max =        19

                                                Wald chi2(9)      =    555.16
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =    0.0000
```

loggdp	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
INS	.2590656	.1205329	2.15	0.032	.0228255	.4953057
logfer	.7916617	.1678186	4.72	0.000	.4627433	1.12058
GCR	.0048834	.001396	3.50	0.000	.0021474	.0076195
INV	.0038266	.0023817	1.61	0.108	-.0008414	.0084946
GINI	.0041381	.00223	1.86	0.064	-.0002327	.0085088
STBL	-.0452794	.0249034	-1.82	0.069	-.0940892	.0035303
loglif	7.564293	.7010672	10.79	0.000	6.190227	8.93836
LAW	.2495484	.0410961	6.07	0.000	.1690015	.3300953
SEM	.0076165	.0009104	8.37	0.000	.0058321	.0094008
_cons	-25.53354	3.072151	-8.31	0.000	-31.55485	-19.51224
sigma_u	.44588209					
sigma_e	.09318596					
rho	.9581501	(fraction of variance due to u_i)				

```
. estimate store random

.
end of do-file
```

Appendix 6 Breusch and Pagan Lagrange Multiplier Test Results

```
. xttest0

Breusch and Pagan Lagrangian multiplier test for random effects

        loggdp[CNTRY,t] = Xb + u[CNTRY] + e[CNTRY,t]

        Estimated results:
                         |       Var      sd = sqrt(Var)
                 --------+------------------------------
                  loggdp |    .7734901        .8794828
                       e |    .0086836         .093186
                       u |    .1988108        .4458821

        Test:   Var(u) = 0
                                 chibar2(01) =   306.66
                              Prob > chibar2 =   0.0000

.
end of do-file
```

Appendix 7 Hausman Test Detailed Results

```
. hausman fixed random

                 ---- Coefficients ----
                 |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
                 |     fixed       random       Difference          S.E.
-----------------+------------------------------------------------------------
         INS     |    .3528912     .2590656       .0938255           .
      logfer     |    .8347413     .7916617       .0430795           .
         GCR     |    .0046126     .0048834      -.0002708           .
         INV     |    .0065664     .0038266       .0027398           .
        GINI     |    .0029315     .0041381      -.0012065           .
        STBL     |   -.0556963    -.0452794      -.0104169           .
      loglif     |    6.662117     7.564293      -.9021758           .
         LAW     |    .2253358     .2495484      -.0242126           .
         SEM     |    .0076329     .0076165       .0000164           .
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(9) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =      125.88
                Prob>chi2 =      0.0000
                (V_b-V_B is not positive definite)

.
end of do-file
```

Appendix 8 Modified Wald test for group-wise heteroskedasticity Result

```
. xttest3

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (25)  =    5627.96
Prob>chi2 =      0.0000


.
end of do-file
```

Appendix 9 Wooldridge test for autocorrelation in panel data Result

```
. xtserial loggdp INS logfer GCR INV GINI STBL loglif LAW SEM

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      14) =     44.286
           Prob > F =      0.0000

.
end of do-file
```

Appendix 10 Dynamic Panel Data Result

```
. xtreg loggdp INS logfer GCR INV GINI STBL loglif LAW SEM laggdp,fe

Fixed-effects (within) regression               Number of obs      =       212
Group variable: CNTRY                           Number of groups   =        25

R-sq:                                           Obs per group:
     within  = 0.7563                                         min =         1
     between = 0.7200                                         avg =       8.5
     overall = 0.5915                                         max =        19

                                                F(10,177)          =     54.93
corr(u_i, Xb)  = 0.3414                         Prob > F           =    0.0000

------------------------------------------------------------------------------
      loggdp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         INS |   .3657922   .1155208     3.17   0.002     .1378169    .5937674
      logfer |   .8527539    .165852     5.14   0.000     .5254521    1.180056
         GCR |   .0047033   .0013776     3.41   0.001     .0019846     .007422
         INV |   .0064602   .0023199     2.78   0.006      .001882    .0110383
        GINI |   .0028294   .0021627     1.31   0.192    -.0014386    .0070975
        STBL |  -.0576196   .0240266    -2.40   0.018     -.105035   -.0102041
      loglif |   6.597483   .7037815     9.37   0.000     5.208601    7.986366
         LAW |   .2154611   .0425366     5.07   0.000     .1315169    .2994053
         SEM |   .0076961   .0008658     8.89   0.000     .0059876    .0094047
      laggdp |  -.0015358   .0024345    -0.63   0.529    -.0063401    .0032685
       _cons |  -21.39757   3.092347    -6.92   0.000    -27.50019   -15.29496
-------------+----------------------------------------------------------------
     sigma_u |  .74835543
     sigma_e |   .0934965
         rho |   .9846309   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(24, 177) = 108.14                     Prob > F = 0.0000

.
end of do-file
```

Appendix 11 Institutional Development in 32 countries