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INVESTIGATING THE CROSS COUNTRY CAUSAL RELATIONSHIP BETWEEN INSTITUTIONS AND ECONOMIC PERFORMANCE: A PANEL COINTEGRATION ANALYSIS

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ABSTRACT

This paper analyzes the long-run dynamics between quality of institutions measured by recently developed Index of institutionalized social technologies, and Economic performance in the sample of 84 countries covering the period 2002-2006. Panel cointegration tests and FM OLS (Fully Modified OLS) estimators are used to test for cointegration. Institutional quality and growth are found to have long run positive cointegrating relationship.

KEYWORDS: Institutions, Growth, Panel Cointegration, FMOLS

JEL Classification: O1; O4; O5; C8

INTRODUCTION

Exploring the relationship between economic performance and the quality of institutions has been a major area of interest. The better quality of institutions has a positive and significant effect on growth and human development and this effect is more vehement for long term growth than short term (Acemoglu et al. 2001, 2002, 2005). As mentioned in the next section, many empirical studies have investigated the relationship between quality of institutions and economic growth and find positive effects of institutions on output growth. The role of regulatory institutional capacity also play important role for the cross-country variations in economic growth through positive impact on total factor productivity Olson et al. (1998).The causality between institutions and economic performance is also important issue and studies shows better institutions leads to a higher income rather than causation being in the opposite direction [Acemoglu et. al 2000; Olson et al. 1998; Rodrik et al. 2002; Kauffman et al. 2005]. Some studies find that the quality of governance and institutions is important in explaining the higher rates of investment through improving the climate for capital creation (Kirkpatrick, Parker, & Zhang 2006; World Bank, 2003).Other studies reiterated institutional roles in improving international capital flows in particular FDI and portfolio investment [Reisen and De Soto 2001; Gelos and Wei 2002].

However, all these studies did not consider the integration and cointegration properties of the data which can be determined by stationarity and cointegration analysis. Whether a particular institutional measure is stationary determines whether or not changes in that institutional structure are permanent. Whether institutions and growth are cointegrated determines whether they tend to move together. Thus, it is not clear what the estimated panel models represent: Do they represent a structural long run equilibrium relationship or a spurious one? This study considers this issue of the utmost importance, and we believe the present paper throws some light on this question.

More specifically, this paper contributes the following:

- This study used panel unit root tests to examine the stationarity properties of the data.
- The Panel cointegration framework of is applied to test for multivariate cointegrating relationships.

- Cointegrating vectors are estimated using the fully modified (FM) OLS estimation technique for heterogeneous cointegrated panels (Pedroni, 2000).

This study used Real GDP per capita in real term taken from Heston and Summers (2009), as a measure of economic growth (Table 1 provides detailed information about the variables and their data source.)

The existent literature used various indicators to measure the quality of institutions across countries. These includes [Political Risk Service (PRS) ;Business Environment Risk Intelligence (BERI); World Economic Forum (WEF) ; Global Integrity; Freedom House; Gwartney and Lawson 2008 ;Miller and Holmes 2009; and Bertelsmann, Marshall et al. (POLITY); and World Governance Indicators (WGI) [Kaufmann et al. 2008]] However, these indicators have major shortcomings[1]. Firstly, they are poorly identified, multi-faceted lack proper theoretical basis on which different indicators are aggregated into indices. Secondly, most of their sub indices have an extremely high degree of inter-correlation. Thirdly, they lack of dimensionality. As there is only a single dominant factor in the WGI indicators, which shows that the indices in fact measure the same basic concept. and. Finally, most of these indices failed to depict political institutions that are crucial to this analysis. Like ICRG and WGI both fail to include political constraints whereas POLITY indicators are narrowly political; in sum each of these indicators is an incomplete and imperfect proxy for institutions.

All of the above-mentioned shortcomings are recently addressed in Siddiqui and Ahmed (2013). They performed exploratory factor analysis on 31 diverse institutional indicators from different data sources. Three dimensions of institutions were identified, namely the factor of Institutional and Policy Rents (RiiF1), the factor of Political Rents (RpiF2) and the factor of Risk-reducing Technologies (SiiF3). These three factors are then aggregated into the Index of Institutionalized Social Technologies (IIST)which measures the overall quality of institutions.

This study used IIST and its three sub indices namely RiiF1, RpiF2 and SiiF3 as proxy of institutions. The RiiF1 assesses institutions' ability to limit rent-seeking opportunities that divert innovation and resources from productive avenues, whereas RpiF2 focuses on political competition and participation. The SiiF3 measures the quality of institutions that reduce transactional risk through proper enforcement of property rights. Weak risk-reducing institutions increase transaction cost as people divert their resources from productive activities to private arrangements. RiiF1 and RpiF2 represent two dimensions of institutions that are related to anti-rent-seeking technologies, whereas SiiF3 is related to risk-reducing technologies. These are theoretically motivated by North (1981) two theories of the state—a "contract theory" and a "predatory theory."

These indices are in 0 to 1 ranges where higher values indicating better institutional quality. By the nature of this construction, these variables are bounded above and below by random numbers, which makes it impossible for the series to be non-stationary. Thus, this study transformed the index using inverse logit function to allow it to vary without limit. Risk reducing technology removes information asymmetry, creates mutual trust and hence decreases the risk of creating long term business relationships. It re-price contravention activities through increasing risk of getting caught. This Index is aggregate form of following risk reducing Technologies. This index focuses on technologies which helps eliminate three kinds of rent. Accordingly it is subdivided into three indices namely index of Institutional rents, index of Policy rents and index of Political

Anti-Rent seeking technologies plugs in predatory opportunities that arise due to gaps or loopholes in ineffective or week institutions, creating rents for controlling agents betting them higher return than though innovation hence is making society moves from innovative to rent seeking activities. This index specially focuses on technologies which helps

[1] See Siddiqui and Ahmed (2013) for a detailed discussion.

curb the rent seeking opportunity arising from institutions, policies and political system. Specifically, this index focuses on technologies which helps eliminate three kinds of rent. Accordingly it is subdivided into three indices namely index of Institutional rents, index of Policy rents and index of Political Rents. The plan of the paper is as follows: In Section 2, we present a brief literature review. The econometric techniques are presented in Section 3. The results are discussed in Section 4. The paper concludes with a summary of methodology and results.

REVIEW OF LITERATURE

North (1990) defines institutions as the rules of the game in a society or, more formally, "the humanly devised constraints that shape human interaction". These rules of game can be in form of formal institutions like laws and regulations or informal ones which assimilated to culture Tabellini (2005) or social capital Putnam & at al. (1993). Some institutions lowers transaction cost thereby result in innovation and productivity whereas other institutional features impedes information flow, raising information costs and eroding the gains from information, and limit entrepreneurial activity. Examples of institutions that stunt economic growth include government, police and/or court corruption, excessive taxation and/or regulation, unstable and/or inconsistent monetary and fiscal policy. [Frye and Shleifer 1997; Johnson, Kaufmann, Zoido-Lobaton 1998; Shleifer and Vishney 1993, 1994; Soto 1989, 2000; Rodrik at al. 2002; Easterly and Levine 2002; Kaufmann and Kraay 2002; Kaufmann, Kraay and Mastruzzi 2005; Knack and Keefer 1995; Mauro 1995; Meon and Sekkat 2004; Barro 1997,2000; Sachs and Warner 1995]. On distinguishing between kinds of institutions, North (1981) proposes two theories, a "contract theory" of the state and a "predatory theory" of the state. According to the first theory, the state and associated institutions provide the legal framework that enables private contracts to facilitate economic transactions hence reducing transaction costs. According to the second, the state is an instrument for transferring resources from one group to another.

Institutions contributes to growth and development by reducing risk of doing business thus preventing diversion of resources and by preventing predatory rent seeking activities thereby diverting resource towards innovation. A society free of diversion, productive units are rewarded by the full amount of their production and individual units do not need to invest resources in avoiding diversion.

In particular (Acemoglu et al. 2001, 2002, 2005) show that quality of institutions have a more important effect on long term growth than on short term one. Jalilian et al. (2007) emphasises the role of regulatory institutional capacity in accounting for cross-country variations in economic growth Méon and Weill (2006) , Olson et al. (1998) find evidence suggesting that institutional factors are strongly related to total factor productivity. As productivity growth is higher in countries with better institutions and quality of governance.

With regards to causal effect between institutions and economic performance , studies like [Acemoglu, Johnson, and Robinson 2000; Olson et al. 1998; Rodrik et al. 2004; Kauffman et al. 2005, p. 38], indicates indicate that a better institutions leads to a higher income rather than causation being in the opposite direction. In particular Kauffman suggests that a one standard deviation improvement in governance institutions leads to a two to threefold difference in income levels in the long run.

Some studies find that the quality of governance and institutions is important in explaining the rates of investment, as they suggested they effect economic performance through improving the climate for capital creation [Kirkpatrick, Parker, & Zhang 2006; World Bank, 2003]. Other studies reiterated institutional roles in improving international capital flows in particular FDI [Reisen and De Soto 2001; Smarzynska and Wei 2000]. And portfolio investment [Gelos and Wei (2002)]

MODEL SPECIFICATION AND ECONOMETRIC TECHNIQUE

Following equation explore the causality between Institutions and Growth,

$$y_{it} = c + \beta_i X_{it-1} + \epsilon_{it}$$

where y_{it} is either the log of inward Growth (RGDPPC) or institutional quality (IIST) of

country i in year t and ϵ_t is an error term. These equations are to be considered as long run, or equilibrium relations. Provided all variables involved are integrated of order one, or I(1), valid economic inferences can be drawn only if these relations (or perhaps more, having investment share or inflation as dependent variable) are cointegrating relations, otherwise spurious inferences would result.

Unit Root Tests

Unit root test is used to test the stationarity property of the variable. Consider an individual time series variable, Y_t, that evolves through time according to the following equation:

$$Y_t = \alpha + \beta \cdot Y_{t-1} + \varepsilon_t$$

The variable, Yt, is said to be 'stationary' if, when shocked, it tends to revert back to a prior, time-invariant, mean level. This will be true if the coefficient on the lagged value of the variable, β, is less than one. If, instead, the coefficient β is equal to, or greater than, one, the series is non-stationary (i.e., it has a 'unit root'). A non-stationary series does not have a permanent mean level, rather any changes are permanently incorporated into the level of the series. Applying this concept to measures of institutions and Growth allows estimating whether, for each measure, changes to the series remain permanent. For example, Any country specific institutional reforms might change institutional qualities permanently or rather will decay back to their original level. This study used three different unit roots tests. Levin, Lin and Chu (2002) test all assume that there is a common unit root process, with null hypothesis of a unit root. Whereas, Fisher (1932), ADF and PP tests all allow for individual unit root processes. The tests are all characterized by the combining of individual unit root tests to derive a panel-specific result. An alternative approach to panel unit root tests uses Fisher's (1932) results to derive tests that combine the *p*-values from individual unit root tests. This idea has been proposed by Maddala and Wu (1999), and by Choi (2001).

Cointegration Testing

While stationarity is a property of an individual time series, cointegration refers to a relationship *among* two or more different non-stationary time series. In a broad sense, if two series are cointegrated it means that, when shocked apart, they tend to move back together. The benefit of using panel cointegration techniques is that it allows for variables to be related over long-time horizons, even though they may be shocked off this long-run relationship for short-run periods of time. Cointegration relationship can be explained more technically, if X_t and Y_t denote two non-stationary time series variables, define a new variable Z_t that is the following linear combination of X_t and Y_t:

$$Z_t = \alpha + \beta 1 \cdot Y_t - \beta 2 \cdot X_t + \varepsilon t$$

The new series Z_t essentially represents the difference between the series. If the two are cointegrated, and tend to be convergent together through time, then the variable Z_t will be stationary. If the two tend to drift apart or are not convergent, then Z_t will be non-stationary.

Applying this concept to our measures of institutions and growth, If these two are cointegrated, a change in one will only be permanent if both change. In other words, any policy reform to stimulate growth without reforming

institutions will only be meaningless in the long run as it will be pulled back to the long-run path determined institution. And if they are not cointegrated, each can be individually changed independent of changes to the other. In that case, policy reforms stimulating growth might be successful even without institutional reforms.

Until recently, that kind of estimation might not be possible, since these test require long time series. Traditional techniques like Johansen (1988) procedure might best suit traditional data as they are of a nature of long time series and small cross sections normally involving few countries. But unfortunately, most indices of institutional quality are fairly recent, and many span only a limited historical time period and sometimes reported in intervals. There advantage however is that they are available for large cross session of countries. Because of this lack of length in the data, these time series tests, for a given country, would be impossible to perform, Recently, however, methods have been developed that allow the use of combined cross-section and time-series data that allow this type of testing to be conducted for panel data with low *t* and large *n*. One of these a panel cointegration test, developed by Pedroni (1999) is conducted in this paper. He derives seven different statistics. For a small sample size, the test based on the group ADF statistic is the most powerful, followed by the test based on the panel v-statistic. Thus, we will adopt group ADF-statistic as criteria of accepting or rejecting the null.

Estimating the Long-Run Relationship: Fully Modified OLS

Following the cointegration tests, this study apply the fully modified OLS (FMOLS) method to estimate the long-run relationship. It is well known that despite its super-consistency, OLS estimation yields asymptotically biased results, because the non-stationary regressors are endogenously determined in the I(1) case (Christopoulos and Tsionas, 2004). On the other hand, FMOLS produces asymptotically unbiased estimators, as the statistic is constructed to make corrections for endogeneity and serial correlations to the OLS estimator.

Table 1: Estimation Variables' Data Sources and Description

	Variable Name	Description	Concept Measured	Source
1	RGDPPC	Real GDP per capita at 2005 Constant Prices (Chain series) in USD (rgdpch)	Economic Performance	Summers and Heston (2009)
2	IIST	Index Institutionalized Social Technologies	Institutions	Siddiqui and Ahmed (2013)
3	Rii	Index of Institutional and Policy Rents	Institutions	Siddiqui and Ahmed (2013)
4	Rpi	Index of Political Rents	Institutions	Siddiqui and Ahmed (2013)
4	Sii	Index of Risk reducing Technologies	Institutions	Siddiqui and Ahmed (2013)

Table 2: Descriptive Statistics

Variables	Minimum	Maximum	Mean	Std. Deviation	Observations
RGDPPC	0.263071	0.779946	13706.64	11525.3	420
IIST	745.44	45694.47	0.554097	0.121416	420
Rii	0	1	0.370813	0.205606	420
Rpi	0	1	0.716173	0.215897	420
Sii	0	1	0.647074	0.195891	420

Table 3: Unit Root Estimation at Level (No Trend)

	IIST		RGDPPC		Rii		Rpi		Sii	
Method	**Statistic**	**Prob.****	**Statistic**	**Prob.****	**Statistic**	**Prob.****	**Statistic**	**Prob.****	**Statistic**	**Prob.****
Levin, Lin & Chu t*	-6.61615	0	2.97314	0.9985	-13.8115	0	-4.52837	0	30.847	0
** Probabilities are computed assuming asympotic normality.										

Table 3: Contd.,

ADF - Fisher Chi-Sq.	172.263	0.3948	59.3469	1	210.52	0.0145	289.37	0	309.033	0
ADF - Choi Z-stat	-0.04376	0.4825	12.9376	1	2.94384	0.0016	-5.57906	0	-7.07138	0
** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.										
PP - Fisher Chi-square	192.217	0.081	75.0479	1	265.493	0	361.051	0	391.164	0
PP - Choi Z-stat	0.00812	0.5032	15.5982	1	4.10965	0	6.59052	0	-9.36357	0
** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.										

Table 4: Unit Root Estimation at First Difference (No Trend)

	IIST		**RGDPPC**		**Rii**		**Rpi**		**Sii**	
Method	**Statistic**	**Prob.****	**Statistic**	**Prob.****	**Statistic**	**Prob.****	**Statistic**	**Prob.****	**Statistic**	**Prob.****
Levin, Lin & Chu t*	-48.3946	0	-17.6005	0	-51.8667	0	-16.0059	0	-11.8977	0
** Probabilities are computed assuming asympotic normality										
ADF - Fisher Chi-Sq.	316.928	0	240.228	0.0002	412.566	0	332.967	0	390.061	0
ADF - Choi Z-stat	-5.794`9	0	-2.33123	0.0099	8.59329	0	-7.04749	0	-8.09998	0
** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.										
PP - Fisher Chi-square	363.424	0	294.49	0	445.952	0	382.374	0	445.063	0
PP - Choi Z-stat	-6.2327	0	-3.20909	0	-9.23209	0	-8.50413	0	-9.02872	0
** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.										

Table 5: Results of Pair-Wise Panel Pedroni and Kao Cointegration Tests

	Dependent Variable: RGDPPC	**With Regressor IIST**		**With Regressor Rii**		**With Regressor Rpi**		**With Regressor Sii**	
		Statistic1	**Prob.**	**Statistic1**	**Prob.**	**Statistic1**	**Prob.**	**Statistic1**	**Prob.**
1	**Pedroni Residual Cointegration Test 4**								
	Panel v-Statistic[2]	-2.00098	0.0227	0.424722	0.33552	0.86467	0.19361	0.44391	0.328554
	Panel rho-Statistic[2]	1.732489	0.9584	1.844211	0.967424	1.936207	0.973579	2.678898	0.996307
	Panel PP-Statistic[2]	1.21871	0.8885	-0.1754	0.430381	1.494637	0.932495	2.485563	0.993533
	Panel ADF-Statistic[2]	1.24301	0.8931	-0.22246	0.411977	1.829383	0.966329	2.884646	0.998041
	Group rho-Statistic[3]	3.376866	0.9996	3.801567	0.999928	4.273586	0.99999	4.819859	0.999999
	GroupPP-Statistic[3]	-1.68564	0.0459	-0.54641	0.292393	1.01763	0.845573	3.521729	0.999786

Table 5: Contd.,

	Group ADF-Statistic[3]	**-1.63033**	**0.0515**	**-0.38249**	**0.35105**	**2.054036**	**0.980014**	**4.389658**	**0.999994**
2	**Kao Residual Cointegration Test 4**								
	ADF	2.397256	0.0083	2.336326	0.009737	2.383568	0.008573	2.361477	0.009101

[1]Weighted Statistic
[2]Alternative hypothesis: common AR coefs. (within-dimension)
[3]Alternative hypothesis: individual AR coefs. (between-dimension)
[4]Lag selection: 1 lag for Kao and 0 lag for Pedroni based on SIC
Null Hypothesis: No cointegration
No deterministic trend

Table 6: Dynamic OLS Estimation Results

Dependent Variables	**RGDPPC**	**IIST**
Constant	-144093.47	0.595078
	(-17.35415)***	(212.4977)***
	[8303.11098]	[0.00280]
IIST	248991.81	2.85E-06
	(19.12295)***	(18.8711)***
	[13020.5722]	[1.51E-07]

t-values in ( ) and standard errors in [ ].
***: statistically significant at 1%
3 Lags included in Regression

RESULTS

The first part of the analysis is to assess the stationarity property of variables. At first unit root test on each of the variable on both level as well as first difference forms is performed. Table 3 reports this test on level form whereas table 4 reports result of first difference form. Overall results indicates that these variables are stationary in their first difference.

The lag order selection in ADF test as well as other tests is based on Schwarz Information Criterion. As it shows, institution variable is stationary at level, but when trend is included it becomes stationary at first difference. Rest of the variable also become stationary at first difference. The overall result suggests unit root at level but integrated in I (1)

After assessing the stationarity property, this study explore the presence of cointegration among variables. Table 5 reports the results of Panel Pedroni and Kao cointegration tests. Pedroni test report seven test statistics. As discussed earlier, group ADF statistics is adopted to acceptance and rejection of null hypothesis. In addition Kao test is also performed..The result of cointegration test is influenced by the length of lags. In literature there exist several suggested methods for choosing the lag orders. Here an SIC has been used**.**

The test showed mixed results. There was an evidence of co integration among IIST and per capita Real GDP. However little co integration evidence was found in case of the three sub indices with Real GDP per capital. The finding of cointegration has suggests that there clearly is a long run relationship among IIST and economic performance. To find the nature of the relationship, this study also performed FMOLS estimation. Table 6 further confirmed that this relationship is of positive one, meaning better quality institutions improve the long run economic performance of the country. The coefficients are large and highly significant.

CONCLUSIONS

This paper have examined the question of whether there is a long run relationship between Quality of institutions and economic performance, and if it exists, then what is its nature. Specifically, it investigate long run link between the index of institutionalized social technologies and its sub indices, and economic performance for 84 countries around the world, using annual data for the period of 2002 to 2006. The results indicate a clear long run cointegration relationship

between institutions and economic performance. The nature of the relationship indicates a positive and significant relationship between institutions to growth; The policy implications suggests that in order to achieve sustainable economic growth, policies focusing on long terms goals should be designed and implemented like for example the creation of sound political and social institutions that minimize rent seeking opportunities and reduce risk of doing businesses. These measures might produce adverse impact in short run in form of curbing opportunities of rent seekers; but its positive impact could be felt in long run. Hence, sustainable growth could only occur in the ambit of sound social and political institutions. As in their absence, even best policies for development and attracting investment might fail as no incentive can balance the huge business risk that could arise if property rights are not secured and contract enforcement is week. Also menses of corruption and nepotism divert any policy incentives given to entrepreneurs towards rent seekers making economy stuck in structural rigidities making any policy ineffective.

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