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# INSTITUTION AND DEVELOPMENT REVISITED: A NONPARAMETRIC APPROACH

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# ABSTRACT

The paper uses nonparametric methodology to examine the role of institutions in understanding differential levels of development across countries. By using the Li-Racine (2004) generalized kernel estimation methodology, our paper allows a deeper look into the impact of institutions on development. The analysis is carried out for a set of 102 countries over 1980 to 2004. Similar to parametric results established in the literature, the nonparametric analysis lends further support to the view that institutions matter in the development of countries in the context of economic policies and geographic factors. There is minimal evidence to suggest that institutions have a negative impact on development. Our results further indicate (a) parametric estimates suffer from misspecification bias and (b) the impact of institutional quality on development quality is heterogeneous across countries and time periods.

***Keywords:*** Development, Institutions, Geography, Openness, Principal component, Nonparametric analysis

***JEL Classification:*** C3, O10, O57, P51, R11

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# 1. Introduction

Do institutions cause differential levels of development across countries? Should the development agenda of an underdeveloped country be directed towards building institutions with standards similar to those of developed countries?[1] What effects do institutions have on indicators of development? Answers to these questions are relevant for policymakers and planners worldwide.

The relevant literature states that institutions, economic policy and geography are the three most important determinants of a country's economic performance. The *institutions hypothesis* advocates that quality of institutions trumps both geography and policy in determining a country's level of development (Acemoglu et al. (2001); Rodrik et al. (2004); Easterly and Levine (2003); and Basu (2008)). According to the *policy hypothesis*, efficient resource allocation by economic policy is responsible for faster economic growth (Sachs and Warner (1995); Edwards (1998); Frankel and Romar (1999); Dollar and Kraay (2001, 2003); and Wacziarg and Welch (2003)).[2] The *endowment hypothesis* states that geography/biogeographic or climatic conditions explain cross-country differences in economic performances (Diamond (1997); Gallup et al. (1998); Masters and McMillan (2001); and Hibbs and Olsson (2004, 2005)).[3] This body of literature suggests that Institutions Don't Rule (Sachs (2003)).

The purpose of our paper is to further investigate the *institutions hypothesis*. We use two innovative measures of development quality (*DQI*) and institutional quality (*IQI*) by applying the latent variable technique developed by Nagar and Basu (2002). Utilizing the Li-Racine nonparametric estimation technique for mixed data, developed by Li and Racine (2004) and Racine and Li (2004), our paper explores the relationship between development quality and institutional quality. The technique of choice allows us to examine the *DQI-IQI* the relationship in a data driven specification free manner.

The existing body of literature uses single indicators such as, GDP per capita as a proxy for development or the rule of law and property rights to measure institutional quality. For our analysis, we use two indices, the development quality index (*DQI*) and the institutional quality index (*IQI*), from the principle components methodology proposed in Nagar and Basu (2002).[4] These indices are capable of capturing a broader range of issues related to development and institutions. According to Acemoglu et. al. (2001), institutions

[1] There is no established convention for the designation of "developed" and "developing" countries or areas in the United Nations system. In common practice, Japan in Asia, Canada and the United States in North America, Australia and New Zealand in Oceania, and Europe are considered to be "developed" regions or areas. For details, refer to the United Nations Statistics Division. Table A1 gives a complete list and classification of the countries used in the paper.

[2] However, Stiglitz (1999), Rodriguez and Rodrik (2000) and Muqtada (2003) question the effectiveness of trade reform and macroeconomic policies on the economy in the absence of institutional support.

[3] Gallup et al. control for macroeconomic policies, while Hibbs and Olsson (2004; 2005) control for institutions and economic policies. They find that only geography matters for economic performance.

[4] The three basic components of *DQI* are Economic(*EDQI*), Health(*HDQI*) and Knowledge(*KDQI*). *IQI* also has three components: Economic(*EIQI*), Social(*SIQI*) and Political(*PIQI*). Section 3.1 discusses the various components of *EDQI*, *HDQI*, *KDQI*, *EIQI*, *SIQI* and *PIQI*. See also annex table A.2 for data sources of these components and their definitions.

positively influence GDP per capita, by securing property rights.[5] Their estimates obtained from parametric specifications suggest that, geography does not cause variations in GDP per capita. Rodrik et. al. (2004) argue that institutions dominate geography and trade policies in influencing income levels around the world. Easterly and Levine (2003) show that geography (not economic policy) effects country incomes indirectly via institutions.[6] Basu (2008) strongly supports the importance of institutions in the context of specific economic policy mixes and geography by using parametric estimation techniques. These highly quoted studies which argue that "Institutions Rule" over geography and economic policy, use parametric estimation techniques. Since the relationship between institutions and development is at the core of current academic and policy debate, our paper takes a look at issue in a nonparametric framework.

The contribution of our paper is in the application of the Li-Racine nonparametric methodology to investigate the relationship between various institutional and development indicators, in a panel with both time and country effects.[7] In the estimation of any model with development and institutional indicators, mainly two types of biases can be at work: (a) misspecification bias and (b) endogeneity/omitted variable bias. The parametric estimates potentially suffer from both. The nonparametric estimates in the paper effectively deal with (a). Bias due to (b) is left for future works.

Our nonparametric estimates find minimal support for any negative impact of *IQI* on *DQI*. For majority of the countries examined, the impact of institutions on the quality of development is quite favorable. Since the Li-Racine methodology provides weighted estimates (weights determined by all observations) of the regression function and its slope at every data point, we can also examine the nonparametric estimates for various sub-groups by country characteristics, language and legal systems. The impact of institutional quality on development quality is far from uniform across countries or time periods. However, the favorable relationship between IQI and DQI, or minimal support for a negative relation between the two variables, is robust to most sub groups.

We now plot a course for the rest of the paper. Section 2 presents the latent variable technique for calculating the DQI and IQI and the Li-Racine estimation technique for mixed data, utilized in the paper to estimation the IQI-DQI relationship. Section 3 discusses the data set and the empirical model. Main results of the paper are presented in section 4 and section 5 concludes the paper.

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[5] In Acemoglu et. al. (2001), property rights are measured as average protection against expropriation risk.

[6] Bardhan (2005) argues that institutions could play an important role in determining economic performance, but question still remains "Institutions matter, but which ones?"

[7] See Li and Racine (2007)

# 2. Empirical Methodology

## 2.1 Computing the DQI and IQI

The *DQI* and *IQI* are latent variables, which cannot be measured directly in a straightforward manner.[8] However, we assume that any latent variable ($Y$) is linearly determined by exogenous variables $X_1$, $X_2$, … $X_k$. Let $Y=\alpha+\beta_1 X_1+\ldots+\beta_k X_k+\varepsilon$, where $X_1$, $X_2$, … $X_k$ is set of indicators that are used to capture $Y$. If variance of error $\varepsilon$ is small relative to the total variance of the latent variable $Y$, we can reasonably assume that the total variation in $Y$ is largely explained by the variation in the indicators. So, which linear combination of $X_1$, $X_2$, … $X_k$ can account for the explained part of the total variation in $Y$ due to the indicators $X_2$, … $X_k$?

Nagar and Basu (2002), propose to replace the set of indicators by an equal number of their principal components (PC), so that 100% of variation in indicators is accounted for by their PCs.

First, the indicators are transformed, or $X_k$= [$X_k$ - minimum($X_k$)/(maximum($X_k$) – minimum($X_k$))].[9] Finally, both *DQI* and *IQI* are computed as a weighted sum of the transformed version of these selected indicators, where respective weights are obtained from the analysis of principal components.[10] Hence, the highest weight is assigned to the first PC, because it accounts for the largest share of total variation in all indicator variables. Similarly, the second PC accounts for the second largest share and therefore is assigned the second largest weight, and so on.

Therefore, to calculate *DQI*, we separately compute from the analysis of principle components, three components of *DQI*: Economic *DQI*, Health *DQI* and Knowledge *DQI*. The analysis of PCs is re-utilized to construct the *DQI* for each country in a particular time period, from these three components. Similarly, we construct three separate components of *IQI*: Economic *IQI*, Social *IQI* and Political *IQI*, and then combine them to obtain *IQI*.[11] Higher values of *DQI* and *IQI* indicate a higher level of development and institutional quality respectively.

## 2.2 A Generalized Kernel Estimation

The paper uses the Li-Racine Generalized Kernel Estimation Methodology (by Li and Racine (2004) and Racine and Li (2004)) to examine the relationship between institutional quality and development quality. Equation (1) represents the basic regression model.

[8] See Anderson (1984) for detailed discussion on multivariate statistical analysis.

[9] N is the total number of countries in the sample and $k$ = 1, 2, …N.

[10] See Nagar and Basu (2002) for details, and also see Basu, Klein and Nagar (2005).

[11] See Annex Table A2 for a list of all indicator variables used to construct *IQI* and *DQI* and their components.

$$y_i = m(x_i) + \varepsilon_i \tag{1}$$

In equation (1), $y_i$ represents the $i^{\text{th}}$ observation on the dependent variable and $i$ indexes country-time observations of $N$ countries and $T$ time intervals. Also, $m(.)$ is an unknown smooth regression function with argument $x_i$=[$x_i^c, x_i^u, x_i^o$], where $x_i^c$ is a $NT\times k$ vector of continuous variables, $x_i^u$ is a $NT\times 1$ vector of unordered discrete variables (country effects), $x_i^o$ is a $NT\times 1$ vector of ordered discrete variables (time effects) and $\varepsilon_i$ is a $NT\times 1$ vector of errors. Following the Li-Racine methodology, we take a first order Taylor expansion of (1) around $x_j$ to obtain equation (2).

$$y_i \approx m(x_j) + (x_i^c - x_j^c)\beta(x_j) + \varepsilon_i \tag{2}$$

Here, $\beta(x_j)$ is the partial derivative of $m(x_j)$ with respect to $x^c$. The estimate of $\delta(x_j) \equiv [m(x_j)\ \beta(x_j)]'$ is represented by equation (3).

$$\hat{\delta}(x_j) = \begin{pmatrix} \hat{m}(x_j) \\ \hat{\beta}(x_j) \end{pmatrix}$$

$$= \left[ \sum_i K_{\hat{h}} \begin{pmatrix} 1 & (x_i^c - x_j^c) \\ (x_i^c - x_j^c) & (x_i^c - x_j^c)(x_i^c - x_j^c)' \end{pmatrix} \right]^{-1} \sum_i K_{\hat{h}} \begin{pmatrix} 1 \\ (x_i^c - x_j^c) \end{pmatrix} y_i \tag{3}$$

In equation (3), $K_{\hat{h}} = \prod_{s=1}^{q} \hat{h}_s^{-1} w\left(\frac{x_{si}^c - x_{sj}^c}{\hat{h}_s}\right) \prod_{s=1}^{r} l^u\left(x_{si}^u, x_{sj}^u, \hat{\lambda}_s^u\right) \prod_{s=1}^{p} l^o\left(x_{si}^o, x_{sj}^o, \hat{\lambda}_s^o\right)$ is the generalized kernel function. The commonly used product kernel $K_h$ is from Pagan and Ullah (1999), where $w$ is the standard normal product kernel function with window width $h_s = h_s(\text{NT})$ associated with the $s^{th}$ component of $x^c$. The kernel function $l^u$ is a variation of Aitchison and Aitken (1976) kernel function which equals one if $x_{si}^u = x_{sj}^u$ and $\lambda_s^u$ otherwise. Also, $l^o$ is the Wang and Van Ryzin (1981) kernel function which equals one if $x_{si}^o = x_{sj}^o$ and $\left(\lambda_s^o\right)^{|x_{si}^o - x_{sj}^o|}$ otherwise. Details about this estimation methodology are available in Li and Racine (2004) and Racine and Li (2004).

It is well known in the nonparametric literature that estimation of the bandwidths ($h$, $\lambda^u$, $\lambda^o$) is crucial. N © implements a number of 'data-driven' numerical algorithms to determine the appropriate bandwidth or smoothing parameters for a given sample. The paper uses the Least squares cross validation method as discussed in Racine and Li (2004). Least squares cross validation selects $h_1$, $h_2$, … $h_q$, $\lambda_1^u$, $\lambda_2^u$, … $\lambda_r^u$, $\lambda_1^o$, $\lambda_2^o$, … $\lambda_p^o$ to minimize the following cross validation function:

$$CV = \sum_{i=1}^{n} \left(y_i - \hat{m}_{-i}(x_i)\right)^2 M(x_i) \tag{4}$$

Here, $\hat{m}_{-i}(x_i) = \Sigma_{l \neq i}^{n} y_l K_\gamma(.)/\Sigma_{l \neq i}^{n} K_\gamma(.)$ is the leave-one-out kernel estimate of $m(x_i)$ and $0 \leq M(.) \leq 1$ is a weight function. The purpose of *M(.)* is to avoid difficulties caused by dividing by zero or by the slow convergence rate induced by boundary effects.

# 3. Data and Empirical Model

## 3.1 Data

Our paper is based on 102 countries, of which 76 are developing countries, 22 are OECD countries, and 29 are least developed and small-medium size countries, as defined by United Nations and WTO respectively.[12] We look at data of indicators from several international sources, research institutions and think-tanks[13]. For our analysis, we compute two indices, the development quality index (*DQI*) and the institutional quality index (*IQI*), for 102 countries and five time intervals: 1980-1984, 1985-1989, 1990-1994, 1995-1999, and 2000-2004. We construct a panel of 510 observations with all country-time combinations.

The *DQI* is calculated from three aspects of development: economic (*EDQI*), health (*HDQI*) and knowledge (*KDQI*). Economic development indicators are: GDP/capita, telephone lines/1000 people, television sets/1000 people, radios/1000 people, power consumption/capita, and energy use/capita; health development indicators are: life expectancy at birth, infant mortality rate, physicians/1000 capita, immunization rate, and $CO_2$ emissions/capita; and knowledge development indicators are: adult literacy rate, primary school enrollment rate, secondary school enrollment rate and total years in schools. The *DQI* is a composite index, which covers 15 indicators of development.

Likewise, the *IQI* is constructed to evaluate the quality of institutions. It is also calculated from three aspects of institutional quality: economic(*EIQI*), social(*SIQI*) and political(*PIQI*). Economic institutional quality is a combination of: legal and property rights, bureaucratic quality, corruption, democratic accountability, government stability, law and order, independent judiciary, and regulation; social institutional quality is based on: press freedom, civil liberties, physical integrity index, empowerment right index, freedom of association, women's political rights, women's economic right, and women's social right; and political institutional quality depends on: executive constraint, index of democracy, political rights, polity score, lower legislative, upper legislative and independent sub-federal units. The *IQI* is based on 23 indicators of quality of institutions.[14]

[12] See Annex Table A1 for a complete list of countries.

[13] See Annex Table A2 for data sources of the indicators used in the paper.

[14] See Annex Table A2 for definition and sources of DQI and IQI indicators.

## 3.2 The Empirical Model

The main objective of our work is to examine the impact of institutional quality (*IQI*) on development quality (*DQI*). Other covariates in the model are the geography indicator (DISTEQ) and the openness / world integration indicator (*OPEN*). *DISTEQ* is the absolute distance of a country from the equator and *OPEN* is a trade/GDP ratio. To capture the relationship between institutional quality and development quality, we replace a typical parametric model of the form, $DQI_{it}=\beta_0+\beta_1 IQI_{it}+\beta_2 DISTEQ_{it}+\beta_3 OPEN_{it}+\varepsilon_{it}$ with the corresponding nonparametric model in equation (5). Here, *m(.)* is an unknown smooth function of the covariates, $\alpha_i$ are unobserved country characteristics that are constant over time and $\gamma_t$ are time specific effects that are uniform for all countries. This flexible estimation strategy helps us avoid any functional form misspecification bias and enables us to explore the shape of the underlying relationship without superimposing any *a priori* functional form restriction.

$$DQI_{it}=m(\alpha_{it}, \gamma_{it}, IQI_{it}, DISTEQ_{it}, OPEN_{it}) \qquad (5)$$

# 4. Results

Table 1 displays the nonparametric estimates of the responsiveness of *DQI* to changes in *IQI*.[15] The nonparametric estimation technique gives us an estimate of the regression function and its slope at every country-time period combination. The table reports the slope estimates at the 25th, 50th and 75th percentiles (labeled quartiles 1, 2 and 3 or Q1, Q2 and Q3). For comparison we also state the results from a similar parametric model. The table also indicates which estimates are significant at the 90% or 95% confidence level.

Initially we examine the results for all countries. At the first quartile, the nonparametric estimate of the impact of *DQI* on *IQI* is -0.198 (0.81), which is statistically insignificant at conventional levels. At the median, the impact is positive, 0.383 (1.464), but also not significant. Finally, at the 75th percentile, the nonparametric estimate is positive significant at the 95% confidence level (1.213 (0.163)). For the overall sample, we can make two important conclusions. First, there is minimal evidence of a statistically significant, negative impact of institutions on development. Second, the effect of higher *IQI* is not uniform across country-time period combinations. Since the nonparametric estimates are calculated at every data point, we also examine 25th, 50th and 75th percentiles for five country groups: (i) OECD, (ii) Latin America, (iii)Sub-Sahara Africa, (iv)Asia and the Pacific and (v)the Middle East and North Africa.[16] The nonparametric estimate of the regression function or the slope at any observation is a weighted average, where the weights are determined by the closeness of other data points to that observation. Hence we are able to examine the nonparametric slope estimates for various subgroups. The results for three country groups, (i)OECD, (ii)Latin America and (v)Middle East and North Africa are very similar. At the first quartile, the nonparametric estimate of the impact of *IQI* on

[15] All nonparametric estimates are calculated using N©.

[16] Refer to annex table A1 for a list of countries in various country groups.

*DQI* is negative but insignificant [-.20(.81) for (i), -.12(.44) for (ii) and –.84(.65) for (v)]. At the median, the impact is positive but significant [.43(.00) for (i), .21(.00) for (ii) and .05(.00) for (v)]. At the 75$^{th}$ percentile, the impact is again positive significant [1.38(.00) for (i), 1.01(.00) for (ii) and .90(.27) for (v)]. For these three country groups, the nonparametric estimates mostly suggest a positive impact of *IQI* on *DQI*. For all countries in (iii)Sub Saharan Africa, the nonparametric point estimates are significant positive at the 25$^{th}$, 50$^{th}$, and 75$^{th}$ percentile (.13(.04), .50(.01) and 1.16(.00)). Here, the *DQI-IQI* relationship is overwhelmingly significant positive. Institutions seem to play a vital role in the development of these countries. For (iv) Asia and the Pacific, the nonparametric estimate of $\partial DQI/\partial IQI$ is negative insignificant (-.45(1.47)) at the first quartile, positive insignificant (.008(.17)) at the second quartile and significant positive (1.35(.50)) at the third quartile. Once again, for these countries, there is minimal evidence of a statistically significant negative relationship between *DQI* and *IQI*.

We now compare and contrast the parametric and nonparametric estimates.[17] There is a substantial impact of relaxing the usual parametric assumptions. First we look at the full set of all countries and then at the following country groups: (i)OECD, (ii)Latin America, (iii)Sub-Sahara Africa, (iv)Asia and the Pacific and (v)the Middle East and North Africa. As indicated by table 1, the parametric estimate of the impact of *IQI* on *DQI* is negative significant for the entire dataset and the country groups (excluding (ii)) mentioned earlier. Only for countries in (ii)Latin America, the parametric estimate of $\partial DQI/\partial IQI$ is positive but insignificant. For the entire dataset, about 67% of all nonparametric estimates are positive and 69% of all estimates are significant. The nonparametric estimates are far from uniform. In addition, if we look at the estimates for the entire dataset, the parametric estimate of the impact of *IQI* on *DQI* lies between the second and third quartile of the nonparametric estimates and is roughly two times as large as the median of the nonparametric estimates. It is clear that parametric estimates are global estimates whereas nonparametric estimates are locally weighted, vary across the observations and give a broader picture of the *DQI-IQI* relationship.

Table 2 reports the median nonparametric estimate of the responsiveness of *DQI* to changes in *IQI*, for each country along with its rank for each measure (where the lowest estimate is assigned a ranking of one). The United Kingdom has the highest negative median estimate of $\partial DQI/\partial IQI$, while Denmark has the highest positive median estimate. Among 102 countries, 29 countries have negative median estimates and 73 have positive median estimates. Table 3 presents the median elasticities by time periods to access any changes in the *DQI-IQI* relationship over time. For every time period, the median nonparametric estimate of the slope of the *DQI-IQI* function, is positive, although in absolute values, the median elasticities decline over time.

To briefly evaluate the effects of the remaining covariates, table 4 presents a summary of the parametric and nonparametric estimates (where the nonparametric results correspond to the median estimates across country-time observations) for the entire

[17] The parametric estimates are calculated separately for the entire dataset and also each country group. The nonparametric estimates are calculated only once with the entire dataset of 510 observations (102 countries and 5 time periods). The nonparametric method gives us an estimate of the slope of the regression function at every country-time combination.

dataset.[18] The parametric estimate of $\partial DQI/\partial OPEN$ is significant negative and that of $\partial DQI/\partial DISTEQ$ is significant positive. The median nonparametric estimate of responsiveness of *DQI* to *OPEN* and *DISTEQ* is positive and negative respectively, and both are insignificant. The nonparametric estimates suggest that institutions matter more than geography or economic policy in influencing the path of development of a country.

Any discrepancy between the signs of the parametric and nonparametric estimates may arise due to two types of biases: a misspecification bias and an endogeneity/omitted variable bias. The parametric model potentially suffers from both, the nonparametric model potentially suffers only from the second type of bias. Thus, it is the misspecification bias and its interaction with the endogeneity bias that drives the differences across the two estimation techniques. Nonparametric instrumental variable techniques are not fully developed and will be explored in future research.

## 4.1 Institutions Matter, but which ones?

What can the nonparametric estimates say about Bardhan's (2005) question, "Institutions matter, but which ones?" We run three different nonparametric regressions, with the Li-Racine methodology, to evaluate the impact of economic, political and social institutional quality (*EIQI*, *PIQI* and *SIQI* respectively) on development quality (*DQI*). For the first model, $DQI_{it}=m(\alpha_i, \gamma_t, PIQI_{it}, OPEN_{it}, DISTEQ_{it})+\varepsilon_{it}$, 82% of all nonparametric estimates of $\partial DQI/\partial PIQI$ estimates are insignificant. The evidence to support any statistically significant relationship between development quality and political institutional quality is minimal. In the second model, $DQI_{it}=m(\alpha_i, \gamma_t, SIQI_{it}, OPEN_{it}, DISTEQ_{it})+\varepsilon_{it}$, again only 18% of nonparametric estimates of $\partial DQI/\partial SIQI$ are significant. There is limited evidence to support the notion that the impact of social institutions on development is statistically significant. Finally, in the third model examined, $DQI_{it}=m(\alpha_i, \gamma_t, EIQI_{it}, OPEN_{it}, DISTEQ_{it})+\varepsilon_{it}$, 62% of all nonparametric estimates of $\partial DQI/\partial EIQI$ are positive and all estimates are significant at the 95% confidence level. For a majority of the country-time period observations, the relationship between development quality and economic institutional quality is significant positive. "Economic Institutions" matter more than political or social institutions in determining a country's development path. More details are available in Table 5 in the form of the 25th, 50th and 75th percentiles of the nonparametric estimates of $\partial DQI/\partial PIQI$, $\partial DQI/\partial SIQI$ and $\partial DQI/\partial EIQI$.

How can legal institutions influence a country's development quality? Table 6 examines the impact of *IQI* on *DQI* for countries with three different types of legal systems, (i) British (ii) French and (ii) Scandinavian. It displays the 25th, 50th and 75th percentiles of all nonparametric estimates. More than 50% of the nonparametric estimates of the impact of *IQI* on *DQI* are significant positive, for countries following the British legal system. For countries who follow the French legal system, the *IQI-DQI* relationship is significant positive only for 38% of all nonparametric estimates. The same proportion is 36% for countries with a Scandinavian legal system. It appears that the British legal

[18] We report only the median nonparametric estimates for brevity. More detailed nonparametric results for the remaining covariates are available if requested from the authors.

system is more effective than either the French or the Scandinavian legal system in favorably influencing the development paths of countries.

Does a history of colonial rule matter? We may be able to indirectly answer this question by looking at the proportion of people speaking English or any other European language in the countries. Table 7 examines the *IQI-DQI* relationship for (i) countries where the fraction of English language speaking people is more than ½ and (ii) countries where more than 50% of the population speak other European languages. It gives us the $25^{th}$, $50^{th}$ and $75^{th}$ percentiles of all nonparametric estimates. In both language-groups, there is minimal evidence to support a negative impact on institutions on development. The nonparametric estimates of $\partial DQI/\partial IQI$ are significant positive for most countries.

## 5. Conclusions

The impact of institutional quality on development quality has enormous policy implications for international institutions such as the United Nations to achieve the Millennium Development Goals (MDGs). In this paper, we reassess the relationship between institutional quality and development quality by utilizing the Li-Racine methodology. Their nonparametric methodology allows us to deal with misspecification bias, although the endogeneity bias is left for future studies.

We examine a dataset of 102 countries over 5 time periods. There is minimal evidence of a statistically significant, negative impact of institutions on development. However, the nonparametric estimates are far from uniform over all country-time period combinations. The paper also offers a closer look of the impact on institutional quality on development quality for various country-groups, legal-groups and language-groups. Economic institutions have a more significant impact on development than social or political institutions. We see a better *DQI-IQI* relationship for countries under the British than the French or the Scandinavian legal system. For countries where majority of the people speak English or other European languages, *IQI* has a favorable impact on *DQI*.

The results of the nonparametric model of our paper support the notion that in general “Institutions Rule”. It is possible that countries with better institutional quality are in a better position to reap benefits from trade integration and geography. On the other hand, countries with weak institutional quality find it difficult to enhance their overall development level. Overall, our preliminary results indicate that in addition to the significance of institutions, the role of economic policies and geography are also key in determining the level of development. Hence, the level of institutions, economic policies and geography are the three key determinants of the differential levels of development across countries. Their relative significance in explaining development quality depends on the exact stage of development of the country. Our nonparametric model results strongly support the findings of Basu (2008) in the context of parametric framework. Future research will investigate the development–institution relationship further, by estimating a fixed/random effects nonparametric model. The model can be enhanced by adding more covariates, which can capture the channels that countries follow in order to climb up the ladder of development.

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## Table 1: Impact of IQI on DQI for various country groups

| | All Countries | OECD | Latin America | Middle East and N Africa | Sub-Sahara Africa | Asia and Pacific |
|---|---|---|---|---|---|---|
| Q1 | -0.198 (0.81) | -0.198 (0.81) | -0.121 (.441) | -0.843 (0.646) | 0.128** (0.04) | -0.446 (1.473) |
| Q2 | 0.383 (1.464) | 0.433** (.000) | 0.205** (.000) | 0.047** (.000) | 0.497** (.009) | 0.008 (.169) |
| Q3 | 1.213** (.163) | 1.379** (.000) | 1.006 ** (.000) | 0.899** (0.269) | 1.161** (.000) | 1.346** (.495) |
| Parametric | -0.675** (.000) | -2.313** (.000) | 0.028 (0.093) | -0.209** (0.101) | -0.062** (0.029) | -0.224* (0.124) |

Standard errors are in parentheses
* implies the estimate is significant at the 90% level
** implies the estimate is significant at the 95% level.

## Table 2: Impact of IQI on DQI by country

| Ccode | Median | Rank | Ccode | Median | Rank | Ccode | Median | Rank | Ccode | Median | Rank |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AGO | 1.025 | 75 | ESP | 9.859 | 101 | KOR | -0.953 | 5 | PRY | 0.227 | 43 |
| ALB | 0.179 | 39 | ETH | 0.344 | 49 | KWT | -0.990 | 4 | ROM | -0.287 | 14 |
| ARE | -0.263 | 15 | FIN | 0.653 | 63 | LBR | 0.497 | 53 | SAU | -0.231 | 18 |
| ARG | 0.484 | 52 | FRA | 0.938 | 71 | LKA | -0.314 | 12 | SDN | 1.422 | 85 |
| AUS | 9.606 | 100 | GAB | 0.336 | 48 | LUX | -0.197 | 21 | SEN | 0.131 | 36 |
| AUT | 0.566 | 56 | GBR | -5.831 | 1 | MAR | 0.298 | 45 | SGP | -0.528 | 10 |
| BEL | 0.896 | 70 | GHA | 0.162 | 38 | MDG | -0.023 | 28 | SLV | -0.246 | 17 |
| BGD | 0.505 | 54 | GIN | 2.968 | 94 | MEX | 0.631 | 62 | SWE | 0.575 | 57 |
| BGR | -0.932 | 6 | GNB | 2.877 | 93 | MLI | 0.128 | 35 | SYR | 0.877 | 69 |
| BHR | -0.257 | 16 | GRC | 5.671 | 97 | MOZ | 0.045 | 33 | TGO | 1.270 | 83 |
| BOL | 0.749 | 67 | GTM | 0.580 | 58 | MWI | 0.400 | 50 | THA | 2.153 | 91 |
| BRA | 0.224 | 42 | GUY | 0.596 | 60 | MYS | -2.747 | 2 | TTO | 2.142 | 90 |
| BWA | 0.617 | 61 | HND | 0.313 | 46 | NER | 1.161 | 81 | TUN | 1.446 | 87 |
| CAN | 5.263 | 96 | HTI | 0.038 | 31 | NGA | -0.353 | 11 | TUR | -1.374 | 3 |
| CHE | 9.485 | 99 | HUN | 1.268 | 82 | NIC | 0.670 | 64 | TZA | 1.438 | 86 |
| CHL | 0.035 | 30 | IDN | 1.681 | 89 | NLD | 9.344 | 98 | UGA | -0.227 | 19 |
| CHN | 1.346 | 84 | IND | -0.182 | 22 | NOR | 1.086 | 78 | URY | 3.321 | 95 |
| CIV | 0.845 | 68 | IRL | 1.006 | 74 | NZL | 0.232 | 44 | USA | 0.589 | 59 |
| CMR | -0.876 | 7 | IRN | -0.843 | 9 | OMN | 1.098 | 79 | VEN | -0.198 | 20 |
| COL | 0.730 | 66 | ISL | -0.864 | 8 | PAK | -0.007 | 29 | VNM | 1.521 | 88 |
| CRI | 0.192 | 40 | ISR | 0.047 | 34 | PAN | 0.148 | 37 | ZAF | -0.105 | 25 |
| DNK | 10.415 | 102 | ITA | 0.964 | 73 | PER | 0.205 | 41 | ZAR | 1.100 | 80 |
| DOM | -0.121 | 23 | JAM | 2.825 | 92 | PHL | -0.071 | 27 | ZMB | 0.315 | 47 |
| DZA | -0.099 | 26 | JOR | 0.549 | 55 | PNG | 0.478 | 51 | ZWE | 1.046 | 76 |
| ECU | -0.299 | 13 | JPN | 0.039 | 32 | POL | -0.106 | 24 | | | |
| EGY | 0.691 | 65 | KEN | 0.947 | 72 | PRT | 1.049 | 77 | | | |

## Table 3: Impact of IQI on DQI by time periods

| | Median | Rank |
|---|---|---|
| 1980-84 | 0.657 | 5 |
| 1985-89 | 0.536 | 4 |
| 1990-94 | 0.495 | 3 |
| 1995-99 | 0.371 | 2 |
| 2000-04 | 0.208 | 1 |

## Table 4: Summary of Covariate Effects

| | *OPEN* | *DISTEQ* |
|---|---|---|
| *DQI* | | |
| *Parametric* | -0.430**<br>(0.074) | 0.221**<br>(.075) |
| *Nonparametric* | 0.033<br>(0.079) | -0.229<br>(0.811) |

Standard errors are in parentheses
* implies the estimate is significant at the 90% level
** implies the estimate is significant at the 95% level.

## Table 5: Nonparametric Estimates of the Impact of Economic, Political and Social Institutions on Development

| | $\partial DQI/\partial EIQI$ | $\partial DQI/\partial SIQI$ | $\partial DQI/\partial PIQI$ |
|---|---|---|---|
| Q1 | -0.072**<br>(.000) | 0.293<br>(12.444) | -1.292<br>(3.614) |
| Q2 | 0.051**<br>(.000) | 0.987**<br>(.000) | 0.250<br>(6.958) |
| Q3 | 0.192**<br>(.000) | 2.096<br>(19.569) | 2.155<br>(26.574) |

Standard errors are in parentheses
* implies the estimate is significant at the 90% level
** implies the estimate is significant at the 95% level.

## Table 6: Impact of IQI on DQI for various legal groups

| | **Legal British** | **Legal French** | **Legal Scandinavian** |
|---|---|---|---|
| Q1 | -0.168**<br>(.000) | -0.278**<br>(.000) | -0.39**<br>(.000) |
| Q2 | 0.333**<br>(.000) | 0.203**<br>(.000) | 0.772**<br>(.000) |
| Q3 | 1.196**<br>(.067) | 0.977<br>(1.305) | 1.172<br>(1.094) |

Standard errors are in parentheses
* implies the estimate is significant at the 90% level
** implies the estimate is significant at the 95% level.

## Table 7: Impact of IQI on DQI for various language fractions

| | **Fraction English** | **Fraction Others** |
|---|---|---|
| Q1 | -0.009<br>(1.252) | -0.030<br>(1.169) |
| Q2 | 3.756**<br>(1.280) | 3.138**<br>(1.324) |
| Q3 | 0.593**<br>(0.000) | 10.575**<br>(0.262) |

Standard errors are in parentheses
* implies the estimate is significant at the 90% level
** implies the estimate is significant at the 95% level.

# ANNEX TABLES

## *Table A1.* List of countries in sample

| Country code | OECD (22) | Country code | Latin America (22) |
|---|---|---|---|
| AUS | Australia | BOL | Bolivia (Plurinational State of) |
| JPN | Japan | COL | Colombia |
| NZL | New Zealand | CRI | Costa Rica |
| GRC | Greece | DOM | Dominican Republic |
| PRT | Portugal | ECU | Ecuador |
| CAN | Canada | GTM | Guatemala |
| USA | United States | GUY | Guyana |
| AUT | Austria | JAM | Jamaica |
| BEL | Belgium | PER | Peru |
| CHE | Switzerland | PRY | Paraguay |
| DNK | Denmark | SLV | El Salvador |
| ESP | Spain | HND | Honduras |
| FIN | Finland | HTI | Haiti |
| FRA | France | NIC | Nicaragua |
| GBR | United Kingdom | ARG | Argentina |
| IRL | Ireland | BRA | Brazil |
| ISL | Iceland | CHL | Chile |
| ITA | Italy | MEX | Mexico |
| LUX | Luxembourg | PAN | Panama |
| NLD | Netherlands | TTO | Trinidad and Tobago |
| NOR | Norway | URY | Uruguay |
| SWE | Sweden | VEN | Venezuela (Bolivarian Republic of) |
| **Country code** | **Sub-Saharan Africa (26)** | **Country code** | **Asia and Pacific (13)** |
| AGO | Angola | BGD | Bangladesh |
| BWA | Botswana | CHN | China |
| CIV | Côte d'Ivoire | IDN | Indonesia |
| CMR | Cameroon | IND | India |
| ETH | Ethiopia | KOR | Republic of Korea |
| GAB | Gabon | LKA | Sri Lanka |
| GHA | Ghana | MYS | Malaysia |
| GIN | Guinea | PAK | Pakistan |
| GNB | Guinea-Bissau | SGP | Philippines |
| KEN | Kenya | SGP | Singapore |
| LBR | Liberia | THA | Thailand |
| MDG | Madagascar | VNM | Viet Nam |
| MLI | Mali | PNG | Papua New Guinea |
| MOZ | Mozambique | | |
| MWI | Malawi | **Country code** | **Middle East and North Africa (13)** |
| NER | Niger | ARE | United Arab Emirates |
| NGA | Nigeria | ISR | Israel |
| SDN | Sudan | KWT | Kuwait |
| SEN | Senegal | IRN | Iran (Islamic Republic of) |
| TGO | Togo | JOR | Jordan |
| TZA | United Republic of Tanzania | SYR | Syrian Arab Republic |
| UGA | Uganda | BHR | Bahrain |
| ZAF | South Africa | OMN | Oman |
| ZAR | Democratic Republic of the Congo | SAU | Saudi Arabia |
| ZMB | Zambia | DZA | Algeria |
| ZWE | Zimbabwe | EGY | Egypt |
| | | MAR | Morocco |
| **Country code** | **EU and other Europe (6)** | TUN | Tunisia |
| ALB | Albania | | |
| BGR | Bulgaria | | |
| ROM | Romania | | |
| HUN | Hungary | | |
| POL | Poland | | |
| TUR | Turkey | | |

*Source:* United Nations and World Bank.

***Table A2.*** **Development Quality Index (DQI) and Institutional Quality Index (IQI): Definitions and sources of indicators**

| **Economic DQI** | **Economic IQI** |
|---|---|
| GDP per capita (PPP, international 2000 $) | Legal and property rights[3] |
| Telephone mainlines (per 1,000 people) | Law and order[1a] |
| Television sets (per 1,000 people) | Bureaucratic quality[1a] |
| Radios (per 1,000 people) | Corruption[1a] |
| Electric power consumption (kwh per capita) | Democratic accountability[1a] |
| Energy use (kg of oil equivalent per capita) | Government stability[1a] |
| | Independent judiciary[2] |
| | Regulation[3] |
| **Health DQI** | **Social IQI** |
| Life expectancy at birth, total (years) | Press freedom[3] |
| Mortality rate, infant (per 1,000 live births) | Civil liberties[3] |
| Physicians (per 1,000 people) | Physical integrity index[4] |
| Immunization, DPT (percentage of children aged 12–23 months) | Empowerment rights index[4] |
| $CO_2$ emissions (metric tons per capita) | Freedom of association[4] |
| | Women's political rights[4] |
| | Women's economic rights[4] |
| | Women's social rights[4] |
| **Knowledge DQI** | **Political IQI** |
| Literacy rate, adult total (percentage of people aged 15 and above) | Executive constraint[6] |
| School enrolment, primary (% gross) | Political rights[3] |
| School enrolment, secondary (% gross) | Index of democracy[5] |
| Total number of years in school[1] | Polity score[6] |
| | Lower legislative[2] |
| | Upper legislative[2] |
| | Independent sub-federal units[2] |
| | |

*Note:* For DQI, data were obtained from the World Development Indicators CD-ROM 2006, World Bank. Data were also obtained from: [(1)]Barro and Lee (2000) dataset; [(1a)]PRS Group (2005) ICRG database; [(2)]POLCON Henisz Dataset; [(3)]Economic Freedom Index dataset, Freedom House; [(4)]CIRI Human Rights Data Project; [(5)]PRIO Dataset; [(6)]Polity IV Project.

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