Institutions, human capital and economic growth in developing countries

Md Akther Uddin
School of Business, University of Creative Technology, Chittagong, Bangladesh
Md Hakim Ali
Taylor's Business School, Taylor's University, Subang Jaya, Malaysia, and
Mansur Masih
UniKL Business School, Kuala Lumpur, Malaysia

Received 22 October 2019
Revised 20 January 2020
Accepted 7 February 2020

Abstract

Purpose – This paper aims to study institutions, human capital and economic growth in developing countries.

Design/methodology/approach – The study applies dynamic system Generalized Method of Moments (GMM) and simultaneous quantile regression on a panel of 120 developing countries for the period of 1996-2014.

Findings – The findings show that human development and institutions do have a significant positive effect on economic growth. Interestingly, institutions and human development have a significant negative interactive effect on the economic growth of developing countries. This paper argues that incremental investment in human development would impact economic growth negatively in the presence of weak and dysfunctional institutions because additional stock tends to be employed in rent-seeking and socially unproductive activities.

Research limitations/implications – The policy makers should bear in mind the critical role played by the institutions and the initial stage of growth of a country in making their education and health policies more effective.

Originality/value – The most important novelty is the study of various transmission channels: political, economic and financial institutions through which human development affect economic growth in developing countries. This paper also studies the Islamic economic development concept and empirically investigates whether Muslim countries are different from their counterparts. Moreover, this study extends the existing empirical growth literature by simultaneously applying dynamic system GMM and quantile regression techniques.

Keywords Political, Human development, Quantile regression, Economic growth, System GMM, Economic and financial institutions

Paper type Research paper

1. Introduction

This paper studies the role of institutions on human development–growth nexus in global context. We aim to address the following three research questions. (i) Do institutions (political, economic and financial) matter in the human development–growth nexus? (ii) If yes, does that role of institutions differ depending on the "initial" stage of growth of a country? (iii) Are Muslim countries different from non-Muslim countries in human development?

In contemporary growth theories, without a few exceptions, human and institutional development are identified important determinants of economic growth. Moreover, presence

Studies in Economics and Finance

1086-7376
DOI 10.1108/SEF-10-2019-0407

of functional institutions is important prerequisite for human capital to contribute to economic growth significantly, as human and social capital exert direct positive influence on productivity. However, the role of institutions on human development–growth nexus is not settled yet, as China has experienced exceptional growth without having fully functioning political and economic institutions which is known as "China Paradox".

The existing theoretical and empirical literature shows a clear paradox which deserves much attention. We apply two relatively advanced econometric techniques, dynamic system Generalized Method of Moments (GMM) and simultaneous quantile regression on an unbalanced panel of 120 developing countries of which 55 belong to the Organization of Islamic Countries (OIC).

The most important novelty is the study of various transmission channels: political, economic and financial institutions through which human development affect economic growth in developing countries. We also study the Islamic economic development concept and empirical investigate whether Muslim countries are different from their counterparts. Moreover, they study extends the existing empirical growth literature by simultaneously applying dynamic system GMM and quantile regression techniques.

The rest of the paper is organized as follows. Section 2 discusses the theoretical and empirical literature. Following that, the data and the econometric methodology are explained to address the research questions. The next section discusses the results and analysis. The last section deals with conclusions.

2. Literature review

The growth literature has been increasing exponentially since World War II which can be classified broadly under three categories: neoclassical growth, endogenous growth and new growth theories. Here, neoclassical growth model emphasizes factor accumulation of labor and capital as determinative of the steady-state of the economy whilst technology and productivity growth increase the rate of growth (Solow, 1999). The philosophy of "endogenous growth" theory claims the nation's human capital[1] leads to economic growth through the channel of technology as well as effective means of production. It is argued that technology is generated by the accumulation of education, skills, training, etc. and not left as the unexplained portion of growth as in the neoclassical models (Romer, 1994; Aghion *et al.*, 1998; Solow, 2000). In fact, the usage of human development has been sparked since the establishment of the human development index by Mahbubul Haq and Amartya Sen.

Benhabib and Spiegel (1994) in their seminal work studied the role of human capital in economic development and proposed a new model. Several empirical pieces of research support the strong linkage between human development and economic growth (Pischke, 1998; Sianesi and Van Reeenen; 2003; Narayan and Narayan, 2010; Gennaioli *et al.*, 2011; Lee and Hong, 2012). Cross-border studies conducted to this end are as follows: Teixeir aand Queirós (2016) for Organization for Economic Co-operation and Development countries; Ahsan and Haque (2017) for advanced and developing economies; Abubakar *et al.* (2015) for Economic Community of West African States; Mustafa *et al.* (2017) for Asian countries . On the flip side, negative, but not statistically significant relationship between human capital and growth is also reported by the studies of Pritchett (2001) and Holmes (2013). Therefore, the exact role of human capital on economic growth is still controversial.

In new growth theories, institutions are considered as the fundamental determinant of economic development (North and Thomas, 1973). The predominant view of institutions and growth theories is that market-supportive institutions and effective rule of law can drive strong economic growth (La Porta *et al.*, 1997, 1998; Acemoglu *et al.*, 2005). However, there is an argument that countries growing well could develop good institutions rather than vice-

versa (Lipset, 1959; Allen *et al.*, 2005; Narayan *et al.*, 2011). Cooray *et al.* (2017) recently investigate the role of political institutions, democracy, political rights and civil liberties on trade openness and labor force participation rate in Africa and find that improved political institutions enhance labor force participation rate which in turn boost a country's growth. Development of financial institutions is also found instrumental for economic growth (King and Levine, 1993; Bekaert *et al.*, 2005; Narayan and Narayan, 2013; Boadi *et al.*, 2019). Therefore, the role of informal institutions such as social capital also cannot be overlooked (Knack and Keefer, 1997; Putnam, 2000; Bengoa *et al.*, 2017).

In fact, the association of religion with growth is a new frontier of research in development economics. Since the 1970s Islamic economy has revived and offered an alternative financing method free from interest rate which is considered as *Riba* and strictly prohibited (Haqqi, 2009). The re-emergence of Islamic economics and finance has motivated some theoretical works to develop the growth model from an Islamic perspective (Anwar, 1987; Mannan, 1989; Chapra, 2008). Islam has placed great importance on human development and education which is recognized as one of the instrumental factors for sustainable development and promoting equitability. In this regard, the Prophet (PBUH) said: "Every Muslim, man, and woman must acquire knowledge"[2]. Moreover, Dissou *et al.* (2016) unearth that public spending on education has a positive effect on the long-run economic growth in Benin. Thus, the importance of political, economic and financial institutions for economic growth in Muslim countries is greatly emphasized (Bacha and Mirakhor, 2013; Çizakça, 2013) and empirically supported (Uddin *et al.*, 2017; Imam and Kpodar, 2016; Badeeb and Lean, 2017). For instance, better financial institutions not only perform the role of intermediary in channeling savings from surplus unit to deficit unit but also affect growth through the human development process as people have an additional fund to invest in the education of their children and self-development.

Thus, previous literature shows that the role of human development and institutions on economic growth is still unsettled. Moreover, the interactions between institutions and human development are not well studied. Human development is strictly correlated with institutions, and it is crucial to a development process (Tridico, 2007). Hall *et al.* (2010) found that increases in physical and human capital lead to output growth in countries with good institutions but in countries with bad institutions increases in human capital lead to negative growth rates as capital stock tends to be employed in rent-seeking and other socially unproductive activities. Saha and Zhang (2017) evaluates the interactive impact of democracy and economic growth on human development over 170 countries during 1980-2010 and confirms that the level of growth and democracy as an interaction plays an important role to human development in developing countries. By the way, Acemoglu *et al.* (2014) argue that the interaction between human capital and institutions is yet to be settled and existing empirical literature on this topic is skeptical about the channels and requires further study on which institutions influences the long-run development.

3. Model and methodology

3.1 System GMM

In this paper, we investigate the dynamic linkages between *human development* and economic growth by following (Mankiw *et al.*, 1992; Beck *et al.*, 2000; Demirgüç-Kunt and Levine, 2004) as baseline model and then incorporating institutions and Islamic economic development (Anwar, 1987; Mannan, 1989; Mirakhor, 1993) to build our empirical model. We estimated the following growth equation recently applied in empirical literature by Aisen and Veiga (2013) and Imam and Kpodar (2016) as it captures dynamic effect, solves the

problem of endogeneity, works with unbalanced panel data and is suitable for long panel and short time series (N > T):

$$Y_{it} = \alpha_i InitialGDPpercapita_{it} + \beta_i X_{it} + \gamma_{it} HD_{it} + \gamma_{it} ID_{it} + v_i + \mu_t + \varepsilon_{it} \quad (1)$$

where i indicates the country ($i = 1,\ldots N$) and t indicates the time period ($t = 1,\ldots T_i$).

Where Y_{it} stands for the economic growth of country i at the end of period t, X_{it} is a vector of other control variables hypothesized to affect output growth, and HD_{it} *represents proxy for human development*, ID_{it} *represents proxy for institutional development*, α, β and γ are the parameters and vectors of parameters to be estimated, v_i are country-specific effects, μ_t are time dummies and, ε_{it} is the error term. The main control variables comprise of the initial GDP per capita, capital investment to GDP, savings to GDP, CO_2 emission per capita (metric tons). Equation (1) forms the basis for our estimation.

The sample of our study has only six non-overlapping 3-years periods which might lead to the dynamic panel biasness; therefore, the ordinary least squares (OLS) estimation is not efficient. To this end, Aisen and Veiga (2013) spotted the shortcoming of estimating the dynamic model [Equation (1)] by applying the OLS. To overcome the limitation of fixed effect, Arellano and Bond (1991) recommends the first difference of the variable which is known as the standards or difference GMM. First difference of equaition (1) can be rewritten as follows:

$$\Delta Y_{it} = \alpha_i InitialGDPpercapita_{it} + \beta_i \Delta X_{it} + \gamma_{it} \Delta HD_{it} + \gamma_{it} \Delta ID_{it} + \Delta v_i + \Delta \mu_t + \Delta \varepsilon_{it} \quad (2)$$

Arellano and Bover(1995) and Blundell and Bond (1998) propose the use of System GMM estimator to overcome the issues associated with difference GMM estimator such as serial correlation and weak instrument issues. The augmenting of the first differenced moment conditions by level moment conditions in System GMM enhances more efficiency in estimation (Blundell and Bond, 1998). Moreover, System GMM removes the probability of the correlation of the level form of the variables as well as the time and the country dummy is applied to capture time and country-specific effect heterogeneity. Furthermore, the motivation of using system GMM in our study is further justified by the unbalanced panel data which resembles in our study data set. However, the issue of downward biases of standard error existing in system GMM, excessive use of instruments leading to biased coefficient (Roodman, 2009a, 2009b) and the presence of over-identification can be solved either the collapse option or using only certain lags; hence, the later one is applied by following the xtabond2 command by Roodman, (2009a) in Stata 13.

3.2 Quantile regression

The existence of a various level of human capital, institutions and economic growth along with the evidence of outliers and heavy-tailed distributions is quite obvious in our study, and we simply do not want to remove it because they are outlier rather, we want to intuitively explore the meaningfulness of that. The calculation of coefficient estimates at different quantile of the conditional distribution would be quite meaningful by the help of quantile regression which is not possible in OLS. Hence, the advantage of using quantile regression over conventional regression is the ability to capture the entire conditional distribution of the dependent variable (Coad and Rao, 2006) while conventional regression only focuses on the mean. Moreover, the quantile regression method avoids the restrictive assumptions of identical distribution of error terms at all points of the conditional distributions (Coad and Rao, 2006). Thus, relaxing that assumption helps to capture the

country heterogeneity as well as consider the opportunity that estimated slope parameters diverge at different quantiles of the conditional distribution of lower and higher per capita GDP. Therefore, by following the quantile regression framework of Tiwari (2013) we try to investigate whether different stages of economic growth are affected by human development variables.

The quantile regression model in the framework of Koenker and Bassett (1978) can be written as follows:

$$y_{it} = \acute{x}_{it}\beta_0 + \varepsilon\theta_{it} with Quant_\theta((y_{it}|x_{it}) = \acute{x}_{it}\beta_0, \tag{3}$$

Where i denotes country, t denotes time, y_{it} denotes economic growth, $\acute{x}_{it}$ is a vector of regressors, β is the vector of parameters to be estimated, ε is vector of residuals. $Quant_\theta((y_{it}|x_{it})$ denotes θ^{th} conditional quantile of y_{it} given x_{it}. θth regression quantile, $0 < \theta < 1$, solves the following problem:

$$\min_{\beta} \frac{1}{n}\left\{\sum_{i,t:y_{it}>\acute{x}_{it}\beta} \theta|y_{it} - \acute{x}_{it}\beta| + \sum_{i,t:y_{it}<\acute{x}_{it}\beta} (1-\theta)|y_{it} - \acute{x}_{it}\beta|\right\} = \min_{\beta} \frac{1}{n}\sum_{i=1}^{n} \rho_\theta \varepsilon_{\theta it} \tag{4}$$

where $\rho_\theta(\cdot)$ which is known as the "check function", is defined as:

$$\rho_\theta(\varepsilon_{\theta it}) = \begin{cases} \theta\varepsilon_{\theta it} & if\ \theta\varepsilon_{\theta it} \geq 0 \\ (\theta-1)\varepsilon_{\theta it} & if\ \theta\varepsilon_{\theta it} \leq 0 \end{cases} \tag{5}$$

Finally equation (2) is solved by linear programming methods. According to Buchinsky (1998), as one increases θ continuously from 0 to 1, one traces the entire conditional distribution of y_{it}, conditional on x_{it}.

Due to the advantages (as stated above) of quantile regression estimation technique over OLS, fixed and random effect models, in the study we examined at the 5th, 25th, 50th, 75th and 95th quantiles as shown here:

$$Q_{0.05}(EG) = \alpha_{0.05} + \beta_{0.05,1}X + \beta_{0.05,2}HD + \varepsilon_{0.05it} \tag{6}$$

$$Q_{0.25}(EG) = \alpha_{0.25} + \beta_{0.25,1}X + \beta_{0.05,2}HD + \varepsilon_{0.25it} \tag{7}$$

$$Q_{0.50}(EG) = \alpha_{0.50} + \beta_{0.50,1}X + \beta_{0.05,2}HD + \varepsilon_{0.50it} \tag{8}$$

$$Q_{0.75}(EG) = \alpha_{0.75} + \beta_{0.75,1}X + \beta_{0.05,2}HD + \varepsilon_{0.75it} \tag{9}$$

$$Q_{0.95}(EG) = \alpha_{0.95} + \beta_{0.95,1}X + \beta_{0.05,2}HD + \varepsilon_{0.95it} \tag{10}$$

Here, EG denotes Economic Growth, X is set of control variables (including institutional variables) and HD refers to Human Development indicators. We have used *sqreg* module of Stat 13 for running simultaneous quantile regression estimation by using yearly data span from 1996 to 2014 for a panel of 120 countries.

4. Data, empirical results and discussions

We estimate the [equation (1)] dynamic linkages between *human and institutional development* with economic growth by using two-step system GMM estimator of an unbalanced panel of 120 countries (see Appendix Table AII). The sample size is constrained by data availability, in particular with regard to the variables capturing *human and institutional development*. We also find it difficult to choose an appropriate proxy, which are available for a long period of time and large number of countries. To overcome this challenge, we have used a number of indicators along with the latest composite indicator, human capital per capita. We have taken the natural logarithm of several controls and focus variables (see Appendix Table AI for variable definitions, sources and their expected sign based on the existing literatures). Summary statistics and correlation matrix are presented in Appendix Tables AIII and AIV.

By following the recent empirical literature, at first, we apply the System GMM. The results from dynamic panel estimations are presented in Tables I–IV. The diagnostic tests on dynamic System-GMM reveal the followings. All the models passed the AR (2) tests, as indicated by *p*-value showing that the serial correlation in the error terms is not second order. The numbers of instruments are less than the number of groups (i.e. countries). The validity of the instruments used as a necessity for System-GMM is confirmed, as indicated by the *p*-values of the Hansen J test. Most importantly, most of our independent and control variables are statistically significant and show expected sign in the base model and other key equations. Considering all test statistics of these models we can conclude that the estimated models are adequately specified. In some estimation we intentionally didn't exclude the statistically insignificant variables, as theory and previous studies identify them as a key determinant of economic growth otherwise it would suffer from the model misspecification.

4.1 Human development and economic growth

In our all dynamic model estimations (Tables I–IV), we found the strong evidence of convergence in developing countries supported by the existing literature (Barro, 1991). In contemporary empirical literature, it is usually assumed that the initial GDP per capita is pre-determined, which rules out contemporaneous correlation with the error term but not feedbacks from past shocks. Table I (equation – 01-6) indicates that a one-standard-deviation increase in capital investment is associated with an increase in per capita GDP growth of 2.46 per cent to 3.69 per cent assuming *ceteris paribus*. If savings to GDP increases by 1 per cent, per capita income in developing countries will increase by 2.53 per cent to 4.95 per cent assuming all other variables remain constant. One per cent increase in CO_2 emission would lead to increase economic growth by 0.04 per cent to 0.06 per cent. One-standard-deviation increase in domestic credit provided by financial sector could increase in per capita GDP growth of 0.36 per cent to 0.56 per cent. Instrumental effect of institutional development on economic growth is also identified. One percentage point increase in economic freedom index could increase per capita GDP by 1.5 per cent to 3.25 per cent. Interestingly, one per cent increase in different proxies of human development can lead to increase in real economic growth by 0.029 per cent to 0.85 per cent.

Capital investment, a proxy for factor productivity, affects economic growth positively as investment plays a significant role in not only developed countries but also in developing countries. As we are considering sustainable development where sustainable development goals put high importance on environmental protection, therefore, we include CO_2 emission per capita as a measure of environmental externality as well a proxy of industrial development; countries with higher CO_2 emissions tend to grow faster (Kais and Sami, 2016;

Table I.
Human capital and economic growth in developing countries

	Dependent variable: economic growth					
	1	2	3	4	5	6
Log of initial GDP	−1.342*** [0.36]	−1.130** [0.47]	−2.732*** [0.71]	−2.720*** [0.56]	−1.542** [0.62]	−2.836*** [0.55]
Log capital investment (% of GDP)	7.401*** [1.24]	10.217*** [2.07]	11.377*** [2.47]	10.278*** [2.09]	10.925*** [2.45]	11.084*** [2.19]
CO_2 emission per capita	0.139*** [0.04]	0.181*** [0.05]	0.166*** [0.06]	0.171*** [0.05]	0.147** [0.07]	0.162*** [0.06]
Log of savings (% of GDP) (−1)	7.613* [4.15]	2.514 [5.10]	5.161 [5.08]	13.338** [6.12]	17.803*** [5.62]	14.585** [6.78]
Domestic credit provided by financial sector (% of GDP) (−1)	0.011** [0.01]	0.015*** [0.00]	0.018*** [0.00]	0.017*** [0.00]	0.017*** [0.00]	0.017*** [0.00]
Log of economic freedom index	4.667** [1.84]	9.785*** [2.94]	6.975* [3.80]	5.070* [2.99]	4.857 [3.43]	0.206 [2.87]
Primary school enrollment		0.087*** [0.03]				
Secondary school enrollment			0.101*** [0.03]			
Average year of schooling (−1)				0.680*** [0.22]		
Healthcare spending (% of GDP) (−1)					0.886*** [0.23]	
Human capital per person (−1)						2.357** [0.93]
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	522	489	444	444	520	440
Instruments	95	76	76	76	76	76
Number of groups	107	107	104	99	107	91
Arellano-Bond: AR(1)	0.001	0.011	0.036	0.002	0.003	0.002
Arellano-Bond: AR(2)	0.056	0.056	0.062	0.064	0.248	0.218
Sargan test (p-val)	0	0	0	0	0	0
Hansen test (p-val)	0.127	0.318	0.155	0.374	0.131	0.192

Notes: System-GMM estimations for dynamic panel-data models. Sample period: 1996–2014. Syntax *xtabond2 twostep small robust* – All explanatory variables were treated as endogenous. Their two period lagged values were used as instruments in the first-difference equations and their once lagged first-differences were used in the levels equation; two-step results by using robust standard errors are corrected for finite samples [by using Windmeijer's (2005) correction] and Hansen J tests never reject the validity of the over-identifying restrictions. Second-order autocorrelation of residuals is always rejected. Standard errors are in parentheses. Significance levels at which the null hypothesis is rejected: *** 1; ** 5; * 10%

Panayotou, 2016). Most of the developing countries extensively use fossil fuels, one of the main sources of CO_2, which is mainly used in agricultural sectors, cars, generating electricity, and other light industries. Brazil, Russia, India, China and South Africa nations contribute more than 50.0 per cent of global emissions in 2014. Country reduced carbon dioxide emissions as its income has increased, also, emissions have fallen over the long run (Narayan and Narayan, 2010). Financial development, measured by domestic credit provided by financial sectors, plays a significant positive role in economic growth of developing countries (Boadi *et al.*, 2019).

Economic freedom, a proxy for economic institutional quality, affects economic growth positively which is also supported by (Aisen and Veiga, 2013; Kacprzyk, 2016). It is argued that access to sound money, trade freedom and property rights have positive impact on economic growth. Human capital broadly human development is found to be positively significant for different human capital proxy variables in all five models. This supports the notion that countries with higher stock of human capital tends to grow faster than others. In another words, countries with more primary school enrolment, higher secondary school enrolment, substantial average year of schooling and larger amount of healthcare spending, grow faster in comparison with other countries where those are absent or lower. Thus, our result is consistent with Bodman and Le (2013) wherein they explain that human capital improves the workforce' skill and expertise which have positive impact on productivity. Moreover, health spending is found to have significant positive effect on economic growth which is supported by the finding of Gyimah-Brempon and Wilson (2004) and Ahsan and Haque (2017).

4.2 The role of political stability on human development and growth nexus

Previously, it is shown in Table I that all human and institutional development variables across various models are statistically significant. However, we are interested to explore the role of political institutions on human capital and economic growth nexus. Table II [equations (1) to (4)] shows that political stability plays a pivotal role in economic growth of developing countries. Recent empirical studies support our findings (Uddin *et al.*, 2017; Aisen and Veiga, 2013). When we make interaction of political stability and political risk variables with various human development indicators, we find significant interactive effects on economic growth. Interestingly, the results [equations (1) to (3)] show that the interactive effect of two predictive variables is less than the sum of the individual effects. In other words, human capital and political stability contribute positively to the growth separately but their combined effect is negative and tends to decrease. Hall *et al.* (2010) argue that in countries with weak institutions increase in physical and human capital lead to negative growth rates because addition to capital stock tend to be employed in rent-seeking and other socially unproductive activities. Moreover, we observe brain drain from many developing countries because of intense political instability.

Governments in developing countries fail to provide sufficient incentive structure for skilled and productive workforce to stay in a country during the political turmoil (Docquier *et al.*, 2007). So the hypothesis reflects that the coefficient of human capital is influenced by the political institution. However, the interaction between political risk and human development variables shows mixed results on real economic growth. As expected we find that the role of human development on economic growth would decrease during high political risk. The justification could be that the higher level of political risk tends to divert fund from healthcare and education sector to non-development sector. Our findings are consistent with Benhabib and Spiegel (1994) whereby they argue that certain institutions must be present for human capital to contribute positively to economic growth. So, the

Table II.
Human capital and economic growth: the role of political institutions

	Dependent variable: economic growth			
	1	2	3	4
Log of initial GDP	−2.302*** [0.57]	−2.093*** [0.69]	−1.523** [0.71]	−1.735*** [0.36]
Log of capital investment (% of GDP)	10.366*** [2.19]	10.597*** [2.45]	8.204*** [1.91]	10.971*** [2.27]
CO_2 emission per capita	0.148*** [0.05]	0.145** [0.06]	0.142** [0.06]	0.170*** [0.06]
Log savings (% of GDP) (−1)	12.465** [5.81]	4.549 [4.59]	6.739 [5.37]	11.871** [5.58]
Domestic credit provided by financial sector (% of GDP) (−1)	0.020*** [0.00]	0.021*** [0.00]	−0.028 [0.02]	−0.008 [0.01]
Log of economic freedom index	6.603** [3.04]	7.045* [3.94]	8.199** [3.32]	7.422** [3.05]
Average year of schooling (−1)	2.004** [0.80]			
Political stability	2.897* [1.68]	3.635** [1.56]		
Average year of schooling x Political stability	−0.326* [0.18]			
Secondary school enrollment		0.251** [0.11]	−0.344** [0.16]	
Secondary school enrollment x Political stability		−0.039* [0.02]		
Political risk			−7.820*** [2.56]	−0.028 [0.83]
Secondary school enrollment x Political risk			0.083** [0.03]	
Healthcare spending (% of GDP) (−1)				0.999*** [0.22]
Healthcare spending x Political risk				−0.138** [0.05]
Time dummies	Yes	Yes	Yes	Yes
Observations	444	444	426	498
Instruments	94	94	94	94
Number of groups	99	104	99	102
Arellano-Bond: AR(1)	0.002	0.042	0.02	0.002
Arellano-Bond: AR(2)	0.069	0.06	0.081	0.065
Sargan test (p-val)	0	0	0	0
Hansen test (p-val)	0.491	0.251	0.229	0.259

Notes: System-GMM estimations for dynamic panel-data models. Sample period: 1996–2014. Syntax *xtabond2 twostep small robust*. All explanatory variables were treated as endogenous. Their two-period lagged values were used as instruments in the first-difference equations and their once lagged first-differences were used in the level's equation; two-step results by using robust standard errors are corrected for finite samples [by using Windmeijer's (2005) correction] and Hansen J tests never reject the validity of the over-identifying restrictions. Second-order autocorrelation of residuals is always rejected. Standard errors are in parentheses. Significance levels at which the null hypothesis is rejected: *** 1; ** 5; * 10%

marginal positive effect of human capital on economic growth requires higher political stability and lower political risk as many developing countries in Asia, Africa and Middle East are facing intense political instability in different forms (unstable government, insurgency, rise of extremism and regional war) for the last two decades or so.

4.3 The role of economic institutions on human development and growth nexus

It is well documented in literature that financial development and economic growth are positively correlated. However, as stated earlier, the role of financial development on human development and growth nexus is not settled yet. Logically, we expect more combined effect than individual effect of the two variables as access to finance would encourage people to invest on education and healthcare. At the same time, human capital speeds up individual's knowledge and risk-taking ability which spurs the investment and thus create the additional demand for credit. We estimate the growth equation to see the extent of the interactive variable of human capital and financial institution on economic growth. Table III [equations (1) to (4)] shows that the interactions of human capital and financial development have significant negative effect on real economic growth. For example, health care spending is more exogenous as it largely depends on government policy. We know that developing countries are suffering from low quality economic institutions which actually hamper the proper challenging of fund for health care development. Therefore, we have seen the combined effect of these variables decreases significantly.

This finding is in consistent with Kendall (2012) and Amin and Mattoo (2008) where they argue that human capital development may enable less finance-intensive activities. High transaction costs in developing countries lead to unfavorable economic performance. The most common method is through establishing clear property rights to facilitate the smooth functioning of markets. High transaction cost can also be linked to the size of the unproductive informal sector. Unsecured assets and a lack of formal documents also diminish incentives to expand, and bank credit is difficult to obtain under such circumstances (Aziz, 2019). In this regard, Barro (2000) explained that secure property rights improve growth performance by encouraging investment as well as enhancing the productivity of investments. In short, human development cannot effect positively on economic growth in the presence of inefficient financial systems and less economic freedom.

4.4 Are OIC countries different from non-OIC countries?

After analyzing how economic and financial institutions contribute in human development–growth nexus, we move to see how Muslim countries are different from their counterparts. It would be useful to look deeper into the relationship between human capital and growth as level of skill effect the usage of technology towards economic growth. However, given the different technological development across the OIC countries, there may be different level of demand for primary, secondary and average year of schooling across the OIC countries. Table IV [equations (1) to (4)] provides the differential effect of human capital classifying different OIC countries, namely, lower, upper, Asian and African OIC countries using interaction terms. The results show that school attainment and healthcare spending are significantly lower in low income OIC countries compared to the rest of the developing countries.

The composite index of human development, human capital per capita, is also found significantly lower in poor OIC countries. Therefore, increase in educational attainment is pivotal for low income OIC countries as suggested by Bergheim (2005) and Howitt (2005). They argue that higher level of human capital indicates more skilled workers and thus a higher level of productivity. Interestingly, Asian OIC countries outperform other developing countries in educational attainment. Contrarily, African OIC countries are still lagging behind in overall

Table III.
Human capital and economic growth: the role of economic and financial institutions

Dependent variable: economic growth				
	1	2	3	4
Log of initial GDP	−1.647*** [0.40]	−2.513*** [0.63]	−1.153** [0.51]	−1.882*** [0.52]
Log of capital investment (% of GDP)	9.068*** [1.79]	10.288*** [1.85]	10.932*** [2.25]	11.446*** [2.06]
CO_2 emission per capita	0.150*** [0.05]	0.169*** [0.06]	0.125** [0.05]	0.112** [0.05]
Log of savings (% of GDP) (−1)	10.397** [4.74]	4.144 [3.95]	13.055*** [4.30]	12.119** [5.03]
Domestic credit provided by financial sector (% of GDP) (−1)	−0.009 [0.01]	0.021*** [0.00]	0.029*** [0.00]	0.027*** [0.00]
Log of economic freedom index	1.477 [2.31]	3.812 [3.19]	3.635 [3.03]	0.142 [2.40]
Healthcare spending (% of GDP)	0.931*** [0.20]		0.957*** [0.20]	
Healthcare spending x Economic freedom index	−0.011*** [0.00]			
Secondary school enrollment		0.089*** [0.02]		
Secondary school enrollment x Domestic credit provided by financial sector		−0.000*** [0.00]		
Healthcare spending x Domestic credit provided by financial sector			−0.006*** [0.00]	
Human capital per capita (−1)				2.244*** [0.82]
Human capital per capita x Domestic credit provided by financial sector				−0.014** [0.01]
Time dummies	Yes	Yes	Yes	Yes
Observations	489	442	518	437
Instruments	85	85	85	85
Number of groups	105	104	107	90
Arellano-Bond: AR(1)	0.001	0.031	0.003	0.002
Arellano-Bond: AR(2)	0.017	0.073	0.085	0.244
Sargan test (p-val)	0	0	0	0
Hansen test (p-val)	0.302	0.30	0.135	0.221

Notes: System-GMM estimations for dynamic panel-data models. Sample period: 1996–2014. Syntax *xtabond2 twostep small robust*. All explanatory variables were treated as endogenous. Their two-period lagged values were used as instruments in the first-difference equations and their once lagged first-differences were used in the level's equation; two-step results by using robust standard errors are corrected for finite samples [by using Windmeijer's (2005) correction] and Hansen J tests never reject the validity of the over-identifying restrictions. Second-order autocorrelation of residuals is always rejected. Standard errors are in parentheses. Significance levels at which the null hypothesis is rejected: ***, 1; **, 5; *, 10%

Table IV.
Human capital and economic growth in OIC countries

	Dependent variable: economic growth				
	1	2	3	4	5
Log of initial GDP	−2.452*** [0.65]	−2.426*** [0.62]	−1.451*** [0.52]	−1.925*** [0.59]	−2.132*** [0.55]
Log of capital investment (% of GDP)	10.355*** [2.52]	10.911*** [2.28]	10.268*** [2.24]	10.089*** [2.17]	9.840*** [2.19]
CO_2 emission per capita	0.138** [0.06]	0.151*** [0.06]	0.163** [0.06]	0.075 [0.06]	0.140** [0.06]
Log of savings (% of GDP) (−1)	6.091 [4.94]	15.150** [7.00]	16.007*** [5.58]	14.247** [6.09]	14.892** [5.70]
Domestic credit provided by financial sector	0.018*** [0.00]	0.018*** [0.00]	0.017*** [0.01]	0.017*** [0.00]	0.019*** [0.01]
Log of economic freedom index	6.327 [3.82]	3.723 [3.12]	5.488* [2.93]	6.421** [2.76]	3.47 [2.93]
Secondary school enrollment	0.108*** [0.03]				
Low-income OIC dummy	5.842** [2.90]	21.863* [12.28]			
Low-income OIC x Secondary school enrollment	−0.142* [0.07]				
Human capital index (−1)		3.135** [1.34]			2.692* [1.38]
Low-income OIC x Human capital per capita		−13.634* [8.19]			
Lower middle income OIC dummy			7.591* [3.95]		
Healthcare spending (% of GDP) (−1)			0.812*** [0.24]		
Lower middle income OIC x Healthcare spending			−1.341** [0.60]		
Average year of schooling (−1)				0.268 [0.26]	
Asian OIC dummy				−7.677 [4.82]	
Asian OIC x Average year of schooling				1.158* [0.61]	
African OIC dummy					13.562** [6.65]
African OIC x Human capital per capita					−7.215** [3.31]
Time dummies	Yes	Yes	Yes	Yes	Yes
Observations	444	439	520	444	439
Instruments	89	89	89	89	89
Number of groups	104	90	107	99	90
Arellano-Bond: AR(1)	0.04	0.002	0.002	0.002	0.002
Arellano-Bond: AR(2)	0.051	0.224	0.183	0.06	0.205
Sargan test (p-val)	0	0	0	0	0
Hansen test (p-val)	0.322	0.398	0.24	0.283	0.304

Notes: System-GMM estimations for dynamic panel-data models. Sample period: 1996–2014. Syntax *xtabond2 twostep small robust*. All explanatory variables were treated as endogenous. Their two-period lagged values were used as instruments in the first-difference equations and their once-lagged first differences were used in the level's equation; two-step results by using robust standard errors are corrected for finite samples [by using Windmeijer's (2005) correction] and Hansen J tests never reject the validity of the over-identifying restrictions. Second-order autocorrelation of residuals is always rejected. Standard errors are in parentheses. Significance levels at which the null hypothesis is rejected: *** 1; ** 5; * 10%

human development compare to the rest of the developing countries. This necessitates the incremental investment in education and healthcare sectors in low income OIC countries in general and African OIC countries in particular. All in all, OIC countries as a group have consistently underperformed other country groups except Gulf Cooperation Council countries. The lack of stable political, economic and financial institutions is considered as the key obstacles for economic growth in Muslim countries (Askari and Rehman, 2013).

4.5 Simultaneous quantile regression results

To check the consistency and robustness of our results obtained in GMM estimations, we have run simultaneous quantile regression to capture the non-linearity. In earlier section, we find that there is no significant difference between OIC and non-OIC countries in institutional development. However, in terms of human development, we have identified some disparity between these two groups. Consequently, at this stage, to see the impact of educational attainment, healthcare development and overall human development on economic growth, we run simultaneous quantile regression by segregating all sample countries into developing countries, OIC countries and non-OIC countries. The above figure (Figure 1) shows the marginal effect of all focused variables on economic growth within zero to one.

The bold dotted line represents the OLS coefficient and difference between the OLS and the marginal effects of human development for all percentage points of the quantiles in the economic growth distribution tell us that one cannot just consider the relationship between economic growth and human development variables in the conditional mean model. Figure 1 shows that the effect of educational attainment is positive in the lower quantile which mirrors the same findings in the previously used GMM model. Figure 1 also gives us the similar result of GMM model for OIC countries where secondary school enrolment positive in the lower quantile and negative in the upper quantile in addition to that average year of schooling is negative in almost all quantile. Human capital per capital index is positive at the lower quantile and highly negative at the upper quantile for OIC countries. For non-OIC countries average year of schooling and human capital index is positive at the upper quantile (the curve is opposite to the curve of OIC countries) which means that low income OIC countries suffer from the low level human development.

5. Conclusions

The paper studies the moderating effect of institutions and human development on the economic growth of 120 developing countries. The importance of institutions and human development on growth is widely accepted by economists with only a few exceptions. However, in spite of having natural and human resources, many developing countries cannot catch up with the developed world because of poor institutional quality. At the same time, the "China Paradox" has forced us to rethink the role of these two vital determinants of growth. Therefore, we made a humble attempt to address the following research questions:

RQ1. Do institutions (political, economic and financial) matter in human development–growth nexus for developing countries?

RQ2. If yes, does that role of institutions differ depending on the "initial" stage of growth of a country?

RQ3. Are OIC countries different from non-OIC countries in human development?

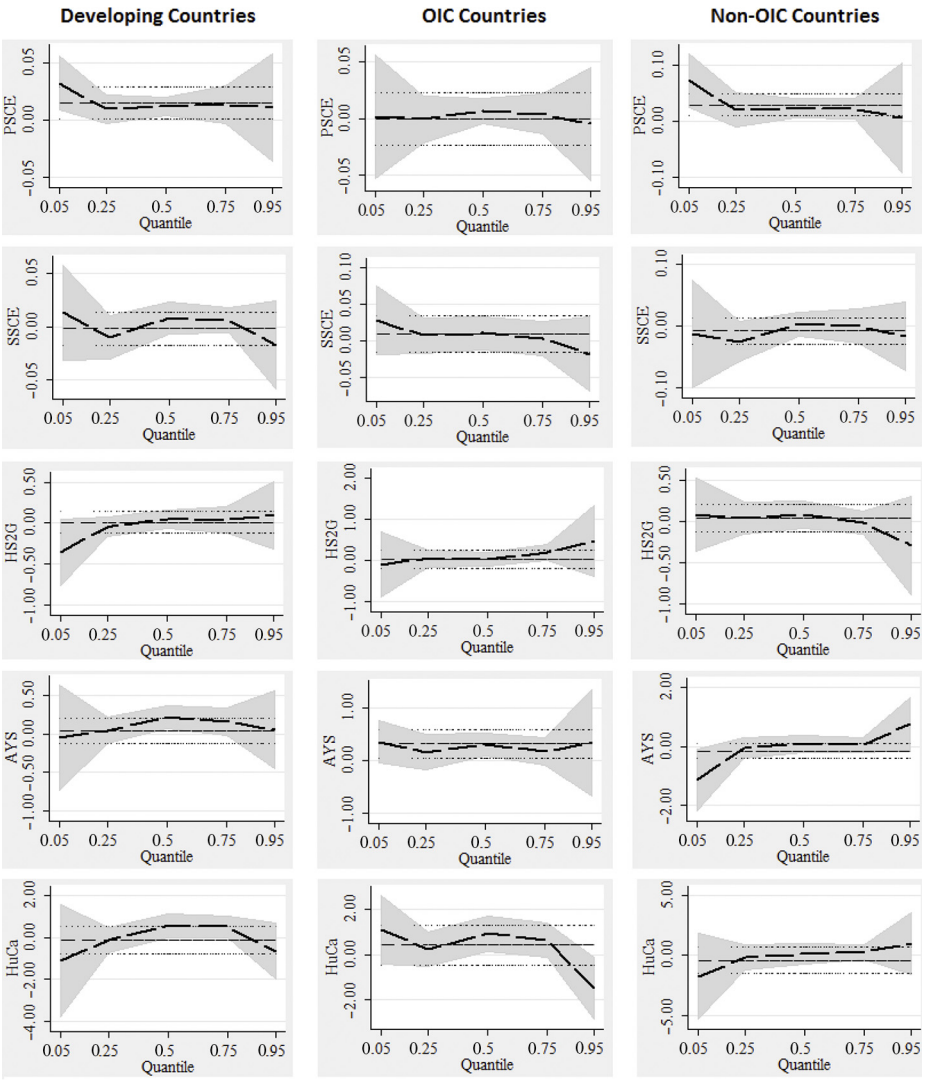

Figure 1.
Variation in the human capital variables coefficient over the conditional quantiles

Notes: Confidence intervals extend to 95% confidence intervals in both directions. 100 replications is used to bootstrap standard errors. horizontal bold dotted lines represent OLS estimates with 95% confidence intervals. we have plotted the graphs using the Stata command "grqreg" developed by Azevedo (2011)

Human development in different forms is found to be a significant determinant of economic growth of developing countries. The importance of political, economic and financial institutions on growth is reconfirmed. Most importantly, we found significant negative effect of most of the interactive variables (institutions and human development) on economic

growth which implies that their combined effect tends to be less than the sum of their individual effects. It is argued that incremental investment in human development would impact economic growth negatively in the presence of weak and dysfunctional institutions because additional stock tends to be employed in rent-seeking and socially unproductive activities. The effect of institutions, however, differs significantly depending on the "initial" stage of growth of a country as evidenced in the lower, middle and upper-income OIC and non-OIC countries. No significant difference is observed between OIC and non-OIC countries in institutional development. Although Asian OIC countries outperform their African counterparts but overall human development is still lower in the OIC countries than the non-OIC countries.

Developing countries in general and Muslim countries in particular need to develop their institutions gradually to get the incremental benefits of human capital accumulation. China, which managed to grow consistently without fully functioning institutions, cannot be a perfect example for other developing countries. The roots of the impressive long-term performance of China lie in the exceptional continuity of the Chinese civilization which managed to preserve its uniqueness and traditions without major interruptions (Popov, 2014). Moreover, China has developed unique market-oriented reform in the last four decades but still preserving its century old collective Asian values (Yao and Yueh, 2009; Yue, 2018). Our results have been consistent for various proxies of institutional and human development indicators. Although different estimators have given consistent results for various sample groups but our study is not without limitations. Firstly, the sample period is constrained by the data available for key political and economic institutions. Secondly, it is difficult to capture human development from all dimensions. Thirdly, limitation of econometric estimations is widely accepted. Taking everything into consideration, the issue offers a great potential of future research directions, such as study of regional differences, study of causality by taking longer time-series data, and develop robust human and institutional indicators for developing and developed countries.

Notes

1. The term "human development" is inclusive of "human capital" and is used interchangeably.
2. Sahih Bukhari and Sahih Muslim
3. Government effectiveness reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation and the credibility of the government's commitment to such policies.
4. Average year of schooling data are available from 1980 but with an interval of 5 years till 2005 after that yearly data are available. When calculating 3 year average, for the period of 1996 and 2002, we take the average of 1990 and 2000, 2000 and 2005, respectively.

References

Abubakar, A., Kassim, S.H. and Yusoff, M.B. (2015), "Financial development, human capital accumulation and economic growth: empirical evidence from the Economic Community of West African States (ECOWAS)", *Procedia-Social and Behavioral Sciences*, Vol. 172, pp. 96-103.

Acemoglu, D., Gallego, F.A. and Robinson, J.A. (2014), "Institutions, human capital, and development", *Annual Review of Economics*, Vol. 6 No. 1, pp. 875-912.

Acemoglu, D., Johnson, S. and Robinson, J.A. (2005), "Institutions as a fundamental cause of long-run growth", *Handbook of Economic Growth*, Vol. 1, pp. 385-472.

Aghion, P., Howitt, P. and García-Peñalosa, C. (1998), *Endogenous Growth Theory*, MIT press.

Ahsan, H. and Haque, M.E. (2017), "Threshold effects of human capital: schooling and economic growth", *Economics Letters*, Vol. 156, pp. 48-52, doi: 10.1016/j.econlet.2017.04.014.

Aisen, A. and Veiga, F.J. (2013), "How does political instability affect economic growth?", *European Journal of Political Economy*, Vol. 29, pp. 151-167.

Allen, F., Qian, J. and Qian, M. (2005), "Law, finance, and economic growth in China", *Journal of Financial Economics*, Vol. 77 No. 1, pp. 57-116.

Amin, M. and Mattoo, A. (2008), "Human capital and the changing structure of the Indian economy", World Bank Working Paper Series.

Anwar, M. (1987), "Modelling interest-free economy: a study in macroeconomics and development (no. 4)", International Institute of Islamic Thought.

Arellano, M. and Bond, S.R. (1991), "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations", *The Review of Economic Studies*, Vol. 58 No. 2, pp. 277-297.

Arellano, M. and Bover, O. (1995), "Another look at the instrumental variables estimation of error component models", *Journal of Econometrics*, Vol. 68 No. 1, pp. 29-51.

Askari, H. and Rehman, S. (2013), "A survey of the economic development of OIC countries", *Economic Development and Islamic Finance*, The World Bank, Washington, DC, p. 299.

Azevedo, J.P. (2011), "GRQREG: stata module to graph the coefficients of a quantile regression", Statistical Software Components.

Aziz, I.J. (2019), "Economics and culture", *Buletin Ekonomi Moneter Dan Perbankan*, Vol. 22 No. 1, pp. 282-302.

Bacha, O.I. and Mirakhor, A. (2013), "Islamic Capital markets and development", *Economic Development and Islamic Finance*, Vol. 253.

Badeeb, R.A. and Lean, H.H. (2017), "Financial development, oil dependence and economic growth: evidence from the Republic of Yemen", *Studies in Economics and Finance*, Vol. 34 No. 2, pp. 281-298.

Barro, R.J. (1991), "Economic growth in a cross section of countries", *The Quarterly Journal of Economics*, Vol. 106 No. 2, pp. 407-443.

Barro, R.J. (2000), "Rule of law, democracy, and economic performance", in O'Driscoll, G.P., Holmes, K.R. and Kirkpatrick, M. (Eds), *In 2000 Index of Economic Freedom*, Dow Jones, New York, pp. 31-51.

Barro, R.J. and Lee, J.W. (2013), "A new data set of educational attainment in the world, 1950–2010", *Journal of Development Economics*, Vol. 104, pp. 184-198, available at: www.barrolee.com/main.htm

Beck, T., Levine, R. and Loayza, N. (2000), "Finance and the sources of growth", *Journal of Financial Economics*, Vol. 58 Nos 1/2, pp. 261-300.

Bekaert, G., Harvey, C.R. and Lundblad, C. (2005), "Does financial liberalization spur growth?", *Journal of Financial Economics*, Vol. 77 No. 1, pp. 3-55.

Bengoa, M., Martínez-San Román, V. and Pérez, P. (2017), "Do R&D activities matter for productivity? A regional spatial approach assessing the role of human and social capital", *Economic Modelling*, Vol. 60, pp. 448-461.

Benhabib, J. and Spiegel, M.M. (1994), "The role of human capital in economic development evidence from aggregate cross-country data", *Journal of Monetary Economics*, Vol. 34 No. 2, pp. 143-173.

Bergheim, S. (2005), "Human capital is the key to growth-success stories and policies for 2020", Deutsche Bank Research.

Blundell, R. and Bond, S.R. (1998), "Initial conditions and moment restrictions in dynamic panel data models", *Journal of Econometrics*, Vol. 87 No. 1, pp. 115-143.

Boadi, I., Osarfo, D. and Boadi, P. (2019), "Bank-based and market-based development and economic growth: an international investigation", *Studies in Economics and Finance*, Vol. 36 No. 3.

Bodman, P. and Le, T. (2013), "Assessing the roles that absorptive capacity and economic distance play in the foreign direct investment-productivity growth nexus", *Applied Economics*, Vol. 45 No. 8, pp. 1027-1039.

Buchinsky, M. (1998), "Recent advances in quantile regression models: a practical guide for empirical research", *The Journal of Human Resources*, Vol. 33 No. 1, pp. 88-126.

Chapra, M.U. (2008), "Ibn Khaldun's theory of development: does it help explain the low performance of the present-day Muslim world? ", *The Journal of Socio-Economics*, Vol. 37 No. 2, pp. 836-863.

Çizakça, M. (2013), "Finance and development in Islam: a historical perspective and a brief look forward", in Iqbal, Z. and Mirakhor, A. (Eds) *Economic Development and Islamic Finance*, The World Bank, Washington, DC, p. 133.

Coad, A. and Rao, R. (2006), "Innovation and market value: a quantile regression analysis", *Economic Bulletin*, Vol. 15, pp. 1-10.

Cooray, A., Dutta, N. and Mallick, S. (2017), "Trade openness and labor force participation in Africa: the role of political institutions", *Industrial Relations: A Journal of Economy and Society*, Vol. 56 No. 2, pp. 319-350.

Demirgüç-Kunt, A. and Levine, R. (Eds) (2004), *Financial Structure and Economic Growth: A Cross-Country Comparison of Banks, Markets, and Development*, MIT press.

Dissou, Y., Didic, S. and Yakautsava, T. (2016), "Government spending on education, human capital accumulation, and growth", *Economic Modelling*, Vol. 58, pp. 9-21.

Docquier, F., Lohest, O. and Marfouk, A. (2007), "Brain drains in developing countries", *The World Bank Economic Review*, Vol. 21 No. 2, pp. 193-218.

Gennaioli, N., Porta, R.L., Lopez-de-Silanes, F. and Shleifer, A. (2011), Human capital and regional development (No. w17158). National Bureau of Economic Research.

Hall, J.C., Sobel, R.S. and Crowley, G.R. (2010), "Institutions, capital, and growth", *Southern Economic Journal*, Vol. 77 No. 2, pp. 385-405.

Haqqi, A.R.A. (2009). *The Philosophy of Islamic Law of Transactions*, CERT Publications.

Holmes, C. (2013), "Has the expansion of higher education led to greater economic growth?", *National Institute Economic Review*, Vol. 224 No. 1, pp. R29-R47.

Howitt, P. (2005), "Health, human capital and economic growth: a Schumpeterian perspective", *Health and Economic Growth: Findings and Policy Implications*, MIT Press, Cambridge, MA, pp. 19-40.

Imam, P. and Kpodar, K. (2016), "Islamic banking: good for growth? ", *Economic Modelling*, Vol. 59, pp. 387-401, available at: http://dx.doi.org/10.1016/j.econmod.2016.08.004

Kacprzyk, A. (2016), "Economic freedom–growth nexus in European Union countries", *Applied Economics Letters*, Vol. 23 No. 7, pp. 494-497.

Kais, S. and Sami, H. (2016), "An econometric study of the impact of economic growth and energy use on carbon emissions: panel data evidence from fifty eight countries", *Renewable and Sustainable Energy Reviews*, Vol. 59, pp. 1101-1110.

Kendall, J. (2012), "Local financial development and growth", *Journal of Banking and Finance*, Vol. 36 No. 5, pp. 1548-1562.

King, R.G. and Levine, R. (1993), "Finance and growth: schumpeter might be right", *The Quarterly Journal of Economics*, Vol. 108 No. 3, pp. 717-737.

Knack, S. and Keefer, P. (1997), "Does social capital have an economic payoff? A cross-country investigation", *The Quarterly Journal of Economics*, Vol. 112 No. 4, pp. 1251-1288.

Koenker, R. and Bassett, G. (1978), "Regression quantiles", *Econometrica*, Vol. 46 No. 1, pp. 33-50.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A. and Vishny, R.W. (1998), "Law and finance", *Journal of Political Economy*, Vol. 106 No. 6, pp. 1113-1155.

La Porta, R., Lopez, -de, -Silanes, F., Shleifer, A. and Vishny, R.W. (1997), "Legal determinants of external finance", *The Journal of Finance*, Vol. 52 No. 3, pp. 1131-1150.

Lee, J.W. and Hong, K. (2012), "Economic growth in Asia: determinants and prospects", *Japan and the World Economy*, Vol. 24 No. 2, pp. 101-113.

Lipset, S.M. (1959), "Some social requisites of democracy: economic development and political legitimacy", *American Political Science Review*, Vol. 53 No. 1, pp. 69-105.

Mankiw, G., Romer, D. and Weil, D. (1992), "A contribution to the empirics of economic growth", available at: http://eml.berkeley.edu/~dromer/papers/MRW_QJE1992.pdf

Mannan, M.A. (1989), "Economic development and social peace in Islam: an analytical study of the process of economic development in the Muslim community of today (with an account of real-life experiments in Bangladesh", Ta-Ha publishers LTD & Bangladesh Social Peace Foundation, pp. 55-56.

Mirakhor, A. (1993), "Equilibrium in a non-interest open economy", *Journal of King Abdulaziz University-Islamic Economics*, Vol. 5 No. 1, pp. 3-23.

Mustafa, G., Rizov, M. and Kernohan, D. (2017), "Growth, human development, and trade: the Asian experience", *Economic Modelling*, Vol. 61, pp. 93-101.

Narayan, P.K. and Narayan, S. (2010), "Carbon dioxide emissions and economic growth: panel data evidence from developing countries", *Energy Policy*, Vol. 38 No. 1, pp. 661-666.

Narayan, P.K. and Narayan, S. (2013), "The short-run relationship between the financial system and economic growth: new evidence from regional panels", *International Review of Financial Analysis*, Vol. 29, pp. 70-78.

Narayan, P.K., Narayan, S. and Smyth, R. (2011), "Does democracy facilitate economic growth or does economic growth facilitate democracy? An empirical study of Sub-Saharan Africa", *Economic Modelling*, Vol. 28 No. 3, pp. 900-910.

North, D.C. and Thomas, R.P. (1973), *The Rise of the Western World: A New Economic History*, Cambridge University Press.

Panayotou, T. (2016), *Economic Growth and the Environment*, CID Working Paper 56, Harvard.

Pischke, J.D. (1998), "Poverty, human development and financial services", Occasional Paper no. 25.

Popov, V. (2014), *Mixed Fortunes: An Economic History of China, Russia, and the West*, Oxford University Press.

Pritchett, L. (2001), "Where has all the education gone?", *The World Bank Economic Review*, Vol. 15 No. 3, pp. 367-391.

Putnam, R.D. (2000), "Bowling alone: America's declining social capital", *Culture and Politics*, Palgrave Macmillan, New York, NY, pp. 223-234.

Romer, P.M. (1994), "The origins of endogenous growth", *Journal of Economic Perspectives*, Vol. 8 No. 1, pp. 3-22.

Roodman, D. (2009a), "How to do xtabond an introduction to difference and system GMM in Stata", *The Stata Journal: Promoting Communications on Statistics and Stata*, Vol. 9 No. 1, pp. 86-136.

Roodman, D. (2009b), "A note on the theme of too many instruments", *Oxford Bulletin of Economics and Statistics*, Vol. 71 No. 1, pp. 135-158.

Saha, S. and Zhang, Z. (2017), "Democracy-growth nexus and its interaction effect on human development: a cross-national analysis", *Economic Modelling*, Vol. 63, pp. 304-310.

Solow, R.M. (1999), "Neoclassical growth theory", *Handbook of Macroeconomics*, Vol. 1, pp. 637-667.

Solow, R.M. (2000), "Growth theory: an exposition", OUP Catalogue.

Teixeira, A.A. and Queirós, A.S. (2016), "Economic growth, human capital and structural change: a dynamic panel data analysis", *Research Policy*, Vol. 45 No. 8, pp. 1636-1648.

Tiwari, A.K. (2013), "Taxation, economic growth and political stability", *Transition Studies Review*, Vol. 20 No. 1, pp. 49-61.

Tridico, P. (2007), "Institutions, human development and economic growth in transition economies", *The European Journal of Development Research*, Vol. 19 No. 4, pp. 569-593.

Uddin, M.A., Ali, M.H. and Masih, M. (2017), "Political stability and growth: an application of dynamic GMM and quantile regression", *Economic Modelling* , Vol. 64, pp. 610-625.

Windmeijer, F. (2005), "A finite sample correction for the variance of linear efficient two-step GMM estimators", *Journal of Econometrics*, Vol. 126 No. 1, pp. 25-51.

Yao, Y. and Yueh, L. (2009), "Law, finance, and economic growth in China: an introduction", *World Development*, Vol. 37 No. 4, pp. 753-762.

Yue, J. (2018), *China's Rise in the Age of Globalization*, Palgrave.

Further reading

Gyimah-Brempong, K. and Wilson, M. (2004), "Health human capital and economic growth in sub-Saharan African and OECD countries", *The Quarterly Review of Economics and Finance*, Vol. 44 No. 2, pp. 296-320.

Islam, R., Ang, J.B. and Madsen, J.B. (2014), "Quality-adjusted human capital and productivity growth", *Economic Inquiry*, Vol. 52 No. 2, pp. 757-777.

Mirakhor, A. and Askari, H. (2010), *Islam and the Path to Human and Economic Development*, *Palgrave Macmillan*.

North, D.C. (1991), "Institutions", *Journal of Economic Perspectives*, Vol. 5 No. 1, pp. 97-112.

Sianesi, B. and Van Reenen, J. (2003), "The returns to education: macroeconomics", *Journal of Economic Surveys*, Vol. 17 No. 2, pp. 157-200.

Slesman, L., Baharumshah, A.Z. and Ra'ees, W. (2015), "Institutional infrastructure and economic growth in member countries of the organization of Islamic cooperation (OIC)", *Economic Modelling*, Vol. 51, pp. 214-226.

Vieira, F.V., Holland, M., da Silva, C.G. and Bottecchia, L.C. (2013), "Growth and exchange rate volatility: a panel data analysis", *Applied Economics*, Vol. 45 No. 26, pp. 3733-3741.

Corresponding author

Md Akther Uddin can be contacted at: aktherpu@gmail.com

Appendix

Table AI. Variable definition, source and expected coefficient sign

	Definition and source	Expected sign
Dependent variable		
Economic growth	Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2010 US dollars. **Source:** The World Bank	(+)
Independent control variable		
Log GDP per capita	GDP per capita is gross domestic product divided by midyear population. Data are in constant 2010 US dollars. **Source:** The World Bank	(+/−)
Log capital investment (% of GDP)	Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. **Source:** The World Bank	(+)
CO_2 emission per capita	Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring. **Source:** The World Bank	(+/−)
Log savings (% of GDP)	Gross savings are calculated as gross national income less total consumption, plus net transfers. **Source:** The World Bank	(+)
Domestic credit provided by financial sector (% of GDP)	Domestic credit provided by the financial sector includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net. The financial sector includes monetary authorities and deposit money banks, as well as other financial corporations where data are available (including corporations that do not accept transferable deposits but do incur such liabilities as time and savings deposits). Examples of other financial corporations are finance and leasing companies, money lenders, insurance corporations, pension funds and foreign exchange companies. **Source:** The World Bank	(+)
Economic freedom index	The overall index of economic freedom has ten components grouped into four broad categories: Rule of Law; Limited Government; Regulatory Efficiency and Open Markets. The overall economic freedom is scored on a scale of 0 to 100, where 100 represents the maximum freedom. **Source:** The Heritage Foundation	(+)
Political stability	*Political stability* and absence of violence/terrorism measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism. **Source:** The Worldwide Governance Indicators, The World Bank	(+)
Political risk	This indicator, sourced from Worldwide Governance Indicators: Government Effectiveness[3], shows the government's commitment to policies which is vital for economic growth. It is calculated according to the formula: Government Effectiveness/ 2.5*3 + 4. **Source:** Datastream, Oxford Economics	(−)
Human development indicators		
Average year of schooling[4]	Average number of years of education received by people ages 25 and older, converted from education attainment levels using official durations of each level. **Source:** Barro and Lee (2013).	(+)

(*continued*)

	Definition and source	Expected sign
Primary school enrollment	Gross enrolment ratio (GER). Primary. Total is the total enrollment in primary education, regardless of age, expressed as a percentage of the population of official primary education age. GER can exceed 100% due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition. **Source**: UNESCO	(+)
Secondary school enrollment	Gross enrolment ratio. Secondary. All programmes. Total is the total enrollment in secondary education, regardless of age, expressed as a percentage of the population of official secondary education age. GER can exceed 100% due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition. **Source**: UNESCO	(+)
Health spending (% of GDP)	Total health expenditure is the sum of public and private health expenditure. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities and emergency aid designated for health but does not include provision of water and sanitation. **Source**: The World Bank	(+)
Human capital per person	The index of human capital per person is based on years of schooling and returns to education. **Source:** Penn World Table 9.0	(+)

Table AI.

Non-OIC (65)		OIC (55)	
Andorra	Lesotho	Afghanistan	Libya
Angola	Liberia	Albania	Malaysia
Argentina	Macedonia	Algeria	Maldives
Armenia	Malawi	Azerbaijan	Mali
Bahamas	Malta	Bahrain	Mauritania
Barbados	Mexico	Bangladesh	Morocco
Belarus	Moldova	Benin	Mozambique
Belize	Mongolia	Brunei	Niger
Bhutan	Montenegro	Burkina Faso	Nigeria
Bolivia	Namibia	Cameroon	Oman
Bosnia and Herzegovina	Nepal	Chad	Pakistan
Botswana	Nicaragua	Comoros	Qatar
Brazil	Panama	Djibouti	Saudi Arabia
Burma (Myanmar)	Papua New Guinea	Egypt	Senegal
Cambodia	Paraguay	Gabon	Sierra Leone
Chile	Peru	Gambia	Somalia
China	Philippines	Guinea	Sudan
Colombia	Puerto Rico	Guyana	Suriname
Croatia	Romania	Indonesia	Syria
Dominican Republic	Russia	Iran	Tajikistan
Ecuador	Rwanda	Iraq	Togo
El Salvador	Samoa	Ivory Coast	Tunisia
Eritrea	Serbia	Jordan	Turkey
Fiji	South Africa	Kazakhstan	Turkmenistan
Ghana	Sri Lanka	Kuwait	Uganda
Honduras	Tanzania	Kyrgyzstan	United Arab Emirates
Hungary	Thailand	Lebanon	Uzbekistan
India	Ukraine		Yemen
Jamaica	Uruguay		
Kenya	Venezuela		
Kiribati	Vietnam		
Laos	Zambia		
	Zimbabwe		

Table AII.
Sample countries

Variables	Observations	Mean	SD	Minimum	Maximum
Economic growth	2,196	4.67	6.14	−62.08	106.28
GDP per capita	2,197	6,157.71	10,051.63	122.49	74632.24
Capital investment (% of GDP)	2,059	23.24	8.46	−2.42	74.82
CO_2 emission per capita	1,872	3.69	6.88	0.01	68.70
Log savings to GDP	1,785	20.12	12.50	−37.34	73.91
Economic freedom index	2,005	56.43	9.31	16	79
Domestic credit provided by financial sector (% of GDP)	2,090	45.30	59.20	−114.70	2066.19
Political stability	1,909	4.61	0.91	1.68	6.54
Political risk	2,116	4.42	0.79	2.09	6.79
Primary school enrollment	1,821	100.92	18.15	22.2	165.65
Secondary school enrollment	1,519	66.42	27.47	5.13	111.15
Average year of schooling	1,252	6.68	2.72	0.7	11.7
Health spending (% of GDP)	2,223	5.65	2.08	1.56	14.39
Human capital per person	1,787	2.20	0.58	1.05	3.41

Table AIII.
Summary statistics

Table AIV.
Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Economic growth (1)	1													
GDP per capita (2)	−0.13**	1												
Capital investment (% of GDP) (3)	0.23***	−0.14***	1											
CO_2 emission per capita (4)	−0.09*	0.88***	−0.06	1										
Log savings to GDP (5)	0.11*	0.42***	0.41***	0.49***	1									
Economic freedom index (6)	−0.11*	0.33***	−0.08	0.20***	0.03	1								
Domestic credit provided by financial sector (% of GDP) (7)	−0.11*	0.22***	0.11*	0.26***	0.19***	0.35***	1							
Political stability (8)	−0.04	0.30***	0.04	0.22***	−0.10*	0.34***	0.11**	1						
Political risk (9)	0.06	−0.44***	−0.03	−0.32***	−0.22***	−0.61***	−0.52***	−0.45***	1					
Primary school enrollment (10)	0.03	0.01	0.01	−0.07	0.05	0.08	0.05	−0.06	−0.02	1				
Secondary school enrollment (11)	−0.20***	0.51***	0.07	0.46***	0.24***	0.37***	0.36***	0.22***	−0.46***	0.14***	1			
Average year of schooling (12)	−0.15***	0.31***	0.02	0.32***	0.13**	0.28***	0.26***	0.19***	−0.34***	0.05	0.81***	1		
Health spending (% of GDP) (13)	−0.11*	−0.14**	−0.06	−0.19***	−0.37***	0.15***	−0.02	0.21***	−0.07	0.11*	0.08	0.09*	1	
Human capital per person (14)	−0.15***	0.28***	0.05	0.28***	0.09*	0.28***	0.21***	0.19***	−0.33***	0.04	0.81***	0.96***	0.10*	1

Note: Significance level of the Pearson's correlation coefficient ***, 1%; **, 5%; *, 10%