Journal of Economic Integration jei

Vol.31 No.3, September 2016, 531~546
http://dx.doi.org/10.11130/jei.2016.31.3.531

Financial Integration – Growth Nexus : A Quantile Regression Analysis

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Abstract

Our study aims to examine the role of economic development in moderating the relationship between international financial integration and economic growth, and we find that international financial integration has a positive impact on economic growth by and large. However, the growth impact of international financial integration does not exist in countries where economic development is too low or in highly developed countries. This suggests that policy makers, especially in developing countries, should ensure the presences of capabilities in order to gain from the financial market integration. The method involves a quantile regression technique on cross-sectional data of 73 countries.

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 pISSN: 1225-651X eISSN: 1976-5525

JEL Classifications: E44, F36, F43, G15, O50
Keywords: International Financial Integration, Economic Growth, Economic Development, Quantile Regression Analysis

I. Introduction

The literature mentions numerous factors that could influence a nation's economic growth. For instance, Smith (1986) proposed capital accumulation and labor productivity; Solow (1956) proposed technological advancement; and Romer (1986) and Lucas (1988) proposed human capital. Many other growth factors have been suggested, including International Financial Integration (IFI).

IFI is a condition in which global financial markets are closely linked. During the past several decades, international financial markets have experienced major transformations. The global economy has become more financially integrated, driven by the potential benefits of financial globalization. The depth and breadth of IFI are extraordinary, as Chen and Quang (2014) showed concerning the rapid decline of capital controls in many countries. According to Baele *et al.* (2004), eliminating frictions and barriers to exchange alongside efficient capital allocation by IFI could enhance economic growth.

IFI stimulates growth straightforwardly via three channels. First, IFI improves global capital allocative efficiency, by which financial resources flow to their most productive uses, ultimately increasing potential economic growth. Second, IFI promotes risk diversification and risk sharing across countries. The escalation of financial instruments and cross-ownership of assets resulting from IFI should expand opportunities to diversify portfolios and share idiosyncratic risk across regions (Baele *et al.* 2004). Third, IFI could significantly influence economic growth through the development of financial systems.

Although many scholars expect IFI to have a positive impact on growth, studies offer no consensus about such a relation. Some researchers argue that IFI can spur growth and others claim that removing the distorting effects of capital controls could magnify negative effects of pre-existing distortions and cause welfare loss. In addition, empirical results concerning this relation are mixed. Quinn (1997), Bekaert *et al.* (2005), Honig (2008), Masten *et al.* (2008), and Shen, Lee and Lee (2010) recorded a positive relation between IFI and growth. Quinn (1997) found that capital account liberalization, which

indicates a nation's level of IFI, significantly and positively influences growth in real per capita Gross Domestic Product (GDP). Edison *et al.* (2002) confirmed a positive relation between IFI and growth but acknowledged that it is rather weak. On the other hand, Boyd and Smith (1992), Bailliu (2000), Soto (2000), and Gourinchas and Jeanne (2013) demonstrated that IFI undermines growth.

These mixed findings may suggest that other factors moderate the IFI–growth nexus. Borensztein *et al.* (1998), Chang *et al.* (2009), Gu and Dong (2011), and Samimi and Jenatabadi (2014) found that IFI's contribution to growth is conditional on the presence of third factors. More studies that are contemporary seek to illuminate whether the positive growth impact of IFI relies on such third factors as a sound institutional framework. However, results remain mixed, at best, as indicated by Edison *et al.* (2002) and Klein (2005). According to Edison *et al.* (2002), IFI could influence economic growth only in countries with sound institutions and policies. This claim is backed by Prasad *et al.* (2003), who mention that the ability of a developing country to benefit from financial globalization could be significantly influenced by the quality of its macroeconomic framework and institutions. Alfaro *et al.* (2004) proved that foreign capital causes growth only in countries with well-developed financial markets. Samimi and Jenatabadi (2014) showed that economic integration increases growth in countries with better-educated workers and well-developed financial systems. The level of human capital, which is influenced by the level of economic development, is vital in moderating the relation between foreign capital and economic growth. Either labor or domestic firms must have adequate capacity to absorb advanced technologies borne by foreign capital and implement it domestically to reap full benefits. The importance of economic development in the IFI–growth nexus is mentioned by Boyd and Smith (1992), Arestis and Demetriades (1997), Bhagwati (1998), Stiglitz (2000), Alfaro *et al.* (2008), and Kamau (2010).

The extent of all those features—sound institutions, prudent policies, strong macroeconomic framework, effective financial market, and human capital—is indicated by a country's degree economic development. Edison *et al.* (2002) investigated the moderating role of economic development in the relation between IFI and economic growth using interacting variables. Nonetheless, they disregarded the IFI–growth relation at various levels of economic development, which could be crucial in establishing which groups of countries benefit from IFI.

This study addresses this gap in the literature by examining the relation between IFI and economic growth among countries occupying different levels of economic

development. We adopt a quantile regression technique that is frequently used for this type of analysis. Although previous studies tested the IFI–growth relation, no studies have examined it for varying degrees of economic development. Our results could guide governments and policymakers toward better and more accurate decisions regarding their involvement in IFI.

This study is organized as follows. Section II discusses the method and sources of data. Section III presents the empirical evidence and discusses the analysis. Section IV concludes the study.

II. Methodology and Data

A. Quantile regression technique

Consider a real valued random variable Y that is characterized by the distribution function $F(y) = \Pr(Y \leq y)$, where the θ-quantile of Y is defined as $Q_Y(\theta) = \inf\{y : F(y) \geq \theta$. The quantile regression essentially transforms the conditional distribution function $F_{Y|X}(y)$ into the conditional quantile function $Q_{Y|X}(\theta) = \inf\{y : F_{Y|X}(y) \geq \theta$ by segmenting it. With the use of previously defined quantiles, these segments describe the cumulative distribution of the conditional dependent variable Y given the various realizations of explanatory variable X.

The quantile regression model can be written in the simplest setting with one exogenous regressor as

$$Y_i = \eta_\theta X_i + \varepsilon_{\theta i} \tag{1}$$

To estimate η_θ, Koenker and Bassett (1978) solve the following optimization problem:

$$\min_{\eta_\theta} \sum_i \rho_\theta(\varepsilon_{\theta i}) \varepsilon_{\theta i} \tag{2}$$

where

$$\rho_\theta(\varepsilon_{\theta i}) = \begin{cases} \theta\varepsilon_{\theta i} & \text{if} \quad \varepsilon_{\theta i} \geq 0 \\ (\theta - 1)\varepsilon_{\theta i} & \text{if} \quad \varepsilon_{\theta i} < 0 \end{cases} \tag{3}$$

is known as the check function. The solution provides an estimate of the parameter of interest, that is,

$$\hat{\eta}_\theta = \arg\min \sum_i \rho_\theta(\varepsilon_{\theta i})\varepsilon_{\theta i} \tag{4}$$

and therefore allows estimation of the conditional quantile function of Model 1, given by

$$Q_\theta(Y_i | X_i) = \hat{\eta}_\theta X_i \tag{5}$$

Quantile regression offers advantages over other techniques. First, it provides a wider view of the conditional distribution as the entire family of quantile functions is estimated. This describes the central and tail characteristics of the conditional distribution. In short, quantile regression considers both the shifting location and the changing shape of the conditional distribution of growth (Andini and Andini 2014). Second, quantile regression estimates are more robust regarding outliers in response measurements, whereas mean-based estimates are sensitive to outliers. Third, the quantile regression estimator can be more efficient than a mean-based estimator when residual heteroscedasticity is present. The estimator provides an interesting approach to the analysis of parameter heterogeneity and to the assessment of how policy variables affect countries according to their positions along the conditional growth distribution (Mello and Perrelli 2003).

With the purpose of obtaining robust empirical evidence, this study combines the advantages of quantile regression with those of cross-sectional analysis. In detail, the distribution of the dependent variable is conditioned on a set of observable and universally time-invariant characteristics of sampled countries. Thus, we estimate using the model proposed by Edison *et al.* (2002):

$$GDP_i = \gamma_i + \eta_{1\theta} IFI_{j,i} + \eta_{2\theta} CONTROLSET_i + \varepsilon_{\theta i} \tag{6}$$

GDP_i is real per capita GDP of country i, IFI_i is international financial integration, and $CONTROLSET_i$ is a set of control variables.

We sampled 73 countries from 1980 to 2013. For IFI, the variable is represented by the quantities of Flow of Capital (FOC) and Inflow of Capital (IFOC). *FOC* is defined as the ratio of capital inflows and outflows (foreign direct investment and portfolio) to GDP, and *IFOC* is the ratio of capital inflows to GDP. The selection of control variables closely follows Edison *et al.* (2002): initial GDP per capita (*initial*), average years of secondary schooling in the population over age 15 (*school*), consumer price index (*inf*), and fiscal balance as a share of GDP (*gov*). Data concerning initial schooling are from Barro and Lee (2013). All other data are from the International Monetary Fund's (IMF) International Financial Statistics, World Development Indicators (WDI), or the United Nations Conference on Trade and Development (UNCTAD).

III. Results

Table 1 shows descriptive statistics and correlation coefficients among variables in this analysis. In general, all variables, except inflation and government, correlate positively with economic growth. Signs of all coefficients, except the initial income and government balance, are in line with our hypotheses. Between the two main variables—flow of capital and inflow of capital—the former has higher correlation coefficients, suggesting that changes in this variable could have a much greater impact than changes in capital inflows on economic growth.

Table 1. Descriptive statistics

Variable	*Growth*	*IFOC*	*FOC*	*Initial*	*School*	*Inf*	*Gov*
Mean	8.998	1.977	1.730	8.414	1.778	2.319	16.058
Maximum	11.093	4.121	4.686	10.627	2.487	6.021	32.290
Minimum	6.012	1.250	−0.581	5.566	0.525	0.006	8.319
Standard Deviation	1.298	0.418	0.891	1.331	0.485	1.380	4.292
Correlations							
Growth	1.000						
IFOC	0.405***	1.000					
FOC	0.674***	0.903***	1.000				
initial	0.956***	0.334***	0.612***	1.000			
school	0.781***	0.4475***	0.6330***	0.7519***	1.000		
inf	−0.383***	−0.082	−0.235**	−0.366***	−0.033	1.000	
gov	−0.306***	−0.165	−0.229	−0.259**	−0.314***	−0.172	1.000

(Notes) (i) **(***) indicates statistical significance at the 5% (1%).

(ii) Growth = logarithm of latest real per capita GDP in 2013; IFOC = logarithm of FDI and portfolio inflows divided by GDP; FOC = logarithm of FDI plus portfolio inflows and outflows divided by GDP; initial = logarithm of initial real per capita GDP in 1980; school = logarithm of average years of secondary schooling in the population older than age 15 in 1980; inf = logarithmic difference of the consumer price index; gov = fiscal balance as a share of GDP.

The analysis continues with the estimation of coefficients using Ordinary Least Squares (OLS) regression, and the results appear in Table 2. We estimate three models. Model 1 features no IFI variables. Model 2 and Model 3 include *IFOC* and *FOC*, respectively, as a variable.

Table 2. Effect of international financial integration on economic growth

	FOC	*IFOC*	*Initial income*	*Initial schooling*	*Inflation*	*Government balance*	*R-squared*
Model 1	-	-	0.737*** (0.000)	0.501*** (0.002)	−0.105*** (0.005)	−0.021 (0.051)	0.932
Model 2	0.138** (0.048)	-	0.721*** (0.000)	0.380** (0.033)	−0.091** (0.018)	−0.020 (0.054)	0.937
Model 3	-	0.191 (0.124)	0.743*** (0.000)	0.419** (0.020)	−0.099*** (0.010)	−0.020 (0.051)	0.935

(Note) **(***) indicates statistical significance at the 5% (1%). *P*-values in parentheses.

All three models generally present similar results in terms of the sign and significance of all control variables. Initial income and initial schooling positively influence economic growth. Initial income, in this context, represents a country's economic development, whereas initial schooling indicates its degree of human capital. Theoretically, both variables should demonstrate positive relations with national economic growth, a conjecture supported by Glaeser and Saiz (2004). On the other hand, results show a negative relation between inflation and real per capita *GDP*, a finding consistent with Ayyoub *et al.* (2011) and Kasidi and Mwakanemela (2013). In contrast, government balance demonstrates no impact on economic growth, a finding that coincides with Vuyyuri and Seshaiah (2004) and Velnampy and Achchuthan (2013).

The results for IFI, the study's main variable, are mixed. Using FOC as a proxy for IFI, the estimation shows that IFI exerts a significant positive impact on economic growth. However, an estimation using IFOC shows that IFI has no influence on growth. One possible reason for the mixed results is that IFOC may not clearly reflect IFI and, thus, may be a poor relative measure of IFI. According to Edison *et al.* (2002), it is important to measure inflows and outflows when creating an IFI proxy. In addition, Vo and Daly (2007) contended that the de facto measures of international IFI, also known as volume-based capital account openness measures, should cover the abilities of foreign investors investing domestically (inflow of capital) and domestic investors in the host country to invest abroad (outflow of capital). The between-variables correlation analysis in Table 1 shows that relations between FOC and other variables are consistent with our expectation, but this is not the case for IFOC. Thus, our analysis focuses on the results using FOC, as we expect it to be a better measure of IFI than IFOC.

Our results are supported by Edison *et al.* (2002), based on their panel estimates that show only one IFI indicator, FOC, significantly associated with growth. As mentioned earlier, IFI could assist nations in enhancing growth through numerous direct and indirect channels such as risk sharing and technological spillover. Previous studies endorse IFI's positive and significant effect, including those by Obstfeld (1994), Acemoglu and Zilibotti (1997), Levine (2001), and Bekaert *et al.* (2005).

The OLS cross-sectional estimation shows results only for the overall sample of countries. It does not specify the growth impact of IFI in countries with different levels of economic development. We therefore estimated using the quantile regression technique. This estimation is performed using 100 bootstrap replications, the number commonly accepted in the literature, as indicated by Andrews and Buchinsky (2000). Results of the quantile regression estimates appear in Table 3 and Table 4, wherein IFI is represented by FOC and IFOC, respectively.

Table 3. Quantile regression results using FOC

(FOC represents IFI)

	FOC	*Initial income*	*Initial schooling*	*Inflation*	*Government balance*	*Pseudo R-squared*
Quantile 10	0.020 (0.814)	0.843*** (0.000)	0.537** (0.016)	−0.039 (0.565)	−0.028 (0.159)	0.790
Quantile 20	0.045 (0.660)	0.829*** (0.000)	0.403** (0.076)	−0.029 (0.639)	−0.024 (0.183)	0.785
Quantile 30	0.174 (0.107)	0.792*** (0.000)	0.287 (0.183)	−0.076 (0.171)	−0.012 (0.448)	0.781
Quantile 40	0.194** (0.036)	0.773*** (0.000)	0.315 (0.092)	−0.071 (0.137)	−0.011 (0.521)	0.783
Quantile 50	0.180** (0.028)	0.781*** (0.000)	0.153 (0.414)	−0.066 (0.158)	−0.007 (0.639)	0.785
Quantile 60	0.146** (0.048)	0.738*** (0.000)	0.187 (0.269)	−0.078** (0.022)	−0.006 (0.671)	0.789
Quantile 70	0.160** (0.032)	0.676*** (0.000)	0.282 (0.080)	−0.085*** (0.004)	−0.004 (0.737)	0.793
Quantile 80	0.126 (0.109)	0.688*** (0.000)	0.309 (0.060)	−0.071** (0.027)	−0.005 (0.698)	0.778
Quantile 90	0.173 (0.171)	0.732*** (0.000)	0.111 (0.686)	−0.048 (0.369)	0.000 (0.991)	0.714

(Note) **(***) indicates statistical significance at the 5% (1%). *P*-values in parentheses.

Table 4. Quantile regression results using IFOC

(IFOC represents IFI)

	IFOC	*Initial income*	*Initial schooling*	*Inflation*	*Government balance*	*Pseudo R-squared*
Quantile 10	0.038 (0.823)	0.846*** (0.000)	0.537** (0.011)	−0.038 (0.589)	−0.028 (0.227)	0.789
Quantile 20	0.051 (0.794)	0.817*** (0.000)	0.417** (0.019)	−0.071 (0.327)	−0.026 (0.169)	0.784
Quantile 30	0.033 (0.878)	0.805*** (0.000)	0.524** (0.010)	−0.063 (0.294)	−0.014 (0.414)	0.776
Quantile 40	0.301 (0.159)	0.848*** (0.000)	0.249 (0.177)	−0.056 (0.273)	−0.015 (0.363)	0.779
Quantile 50	0.266 (0.165)	0.813*** (0.000)	0.195 (0.299)	−0.069 (0.147)	−0.010 (0.526)	0.778
Quantile 60	0.207 (0.259)	0.749*** (0.000)	0.277 (0.177)	−0.099*** (0.018)	−0.010 (0.504)	0.781
Quantile 70	0.182 (0.277)	0.683*** (0.000)	0.375 (0.091)	−0.092*** (0.031)	−0.004 (0.782)	0.783
Quantile80	0.183 (0.307)	0.704*** (0.000)	0.330 (0.139)	−0.077 (0.082)	−0.004 (0.763)	0.768
Quantile 90	0.096 (0.719)	0.712*** (0.000)	0.225 (0.548)	−0.098 (0.205)	0.025 (0.291)	0.709

(Note) **(***) indicates statistical significance at the 5% (1%). *P*-values in parentheses.

Estimates for IFOC are not significant across all quantiles, a finding consistent with the results via OLS estimation. As mentioned in the introduction, IFOC may be insignificant because it is a poor proxy for IFI. Therefore, our discussion focuses only on the estimation results of the quantile regression using FOC to represent IFI.

Results in the quantile estimation using FOC show a significant positive impact of IFI on economic growth in quantiles 40, 50, 60, and 70 between the lower and upper tails of the conditional distribution. This finding indicates that IFI influences economic growth in countries that do not have excessively low or high levels of GDP per capita or economic development. Low-income countries are usually less-developed economies. They cannot reap the benefits of IFI because of constraints such as weak economic development. For instance, unsound domestic institutions, particularly those with weak

property rights, could reduce the profit opportunities of both domestic and foreign firms and eventually affect patterns of international capital flows (Ju and Wei 2010). Chen and Quang (2014) found that IFI could facilitate economic growth in countries satisfying specified threshold conditions of institutional quality and private credit.

IFI may be insignificant for economic growth in countries with relatively high economic development because they do not overly rely on foreign capital inflows for economic growth. Perhaps these countries generate domestic funds that are sufficient to finance economic activity, making factors such as research and development, Information and Communication Technology (ICT), and technological efficiency more important for their expansion. For example, growth trends among the Organization for Economic Co-operation and Development (OECD) countries over the past decade likely result from a mix of factors traditionally linked to efficient labor market mechanisms and the size of the ICT-producing industries, together with the pace of adoption of this technology by other industries, as indicated by data from OECD (2003).

We subsequently carried out inter-quantile tests to examine whether observed differences along estimated coefficients are statistically significant across quantiles, in line with Canarella and Pollard (2004). In the context of this study, inter-quantile tests examine whether differences in degree of economic development influence the relatio between IFI and economic growth. In carrying out these tests, we adopted the technique and practice of Andini and Andini (2014) under the hypothesis that the coefficient at the 80^{th} quantile differs from that at the 20^{th}. Results of the parameter heterogeneity tests, which use FOC and IFOC as proxies for IFI, are in Table 5. They indicate that the hypothesis of no homogeneity could not be rejected, which means that the coefficients of IFI are statistically different across quantiles.

Table 5. Inter-quantile tests

Flows of capital					
	FOC	*Initial income*	*Initial schooling*	*Inflation*	*Government balance*
Quantile 20^{th}- 80^{th}	0.081 (0.559)	−0.142 (0.205)	−0.094 (0.740)	−0.042 (0.519)	0.018 (0.447)
Inflows of capital					
	IFOC	*Initial income*	*Initial schooling*	*Inflation*	*Government balance*
Quantile 20^{th}- 80^{th}	0.131 (0.587)	−0.114 (0.293)	−0.087 (0.770)	−0.006 (0.934)	0.022 (0.369)

(Note) *P*-values in parentheses.

IV. Conclusion

The integration of global financial markets is said to be beneficial to countries in many aspects, including enhancing economic growth. Nonetheless, the literature provides no consensus on this relationship, suggesting that the impact of IFI on economic growth may be due to other factors. This study examines the impact of IFI on economic growth in groups of countries at different levels of economic development using the quantile estimation technique. The study finds that the growth impact of IFI does not appear in countries that have too high or too low levels of economic development. Lack of facilities in countries that have low levels of economic development may not help IFI to enhance economic growth. Meanwhile, in countries that have high levels of economic development, IFI is not a major source of funds to finance economic activities. The findings suggest that policy makers, especially the developing countries, should ensure that availability and the readiness of the relevant facilities in order to gain economic benefit from the international integration of their financial markets.

Received 29 April 2016, Revised 27 June 2016, Accepted 19 July 2016

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