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MODELING THE RELATION OF FINANCIAL INTEGRATION-ECONOMIC GROWTH WITH GMM AND QR METHODS[2]

Although international financial integration is an essential topic in economics and finance disciplines, researchers do not have a clear consensus on the relationship between financial integration and economic growth. The main reason for this situation is that financial integration can be heterogeneous and may differ according to the countries' income levels. On the other hand, most studies on the subject have accepted that financial integration has a homogeneous effect on growth by using a sample of countries with a heterogeneous structure. In this study, unlike traditional methods, the generalized method of moments and quantile regression analysis allows a comparison according to the countries' income levels, used together. Fifty-two countries were taken as a basis for the 2000-2019 period. The effect of financial integration and control variables on economic growth was tried to be measured. As a result of the study, direct foreign capital investments, portfolio investments, and current account balance have positive and significant effects on economic growth, and the effects of direct foreign capital and portfolio investments, current account balance, and inflation on economic growth differ between countries with high and low-income levels.
Keywords: Financial Integration; Economic Growth; GMM, Quantile Regression
JEL: F15; F36; F43

Introduction

The policies limiting international capital movements were widely accepted around the world for a certain period. However, the studies on this subject showed that the limitation of capital movements seriously harmed the country's economies. As a result, countries have been involved in financial integration by opening their financial markets to other countries in financial liberalization. The increase in financial liberalization has increased the trade volumes by reducing the borders between countries, and thus the economic synchronization process has accelerated. Free movement of capital, which constitutes one of the essential economic integration elements, is possible by opening financial markets to the outside. Today, countries are trying to establish competition policies to grow, create employment

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opportunities, provide positive macroeconomic indicators, and attract private capital movements to their countries.

The relationship between financial growth and financial integration, which is going through a faster process today, is the focus of many studies. Still not possible to make a general determination in terms of the finance-growth relationship's direction and strength, the determinations made have changed over time (Akkay, 2010, p. 56). However, market-based economies' change policies require developing and developed economies to improve their financial systems within the framework that resources are allocated to the most appropriate areas. The financial sector's primary purpose is to increase savings, investment opportunities, and risk diversity in economies. In such an environment, financial integration aims to provide more resources and benefits to economies and accelerate economic growth.

According to Levine (2005), financial integration refers to integrating local financial systems with international economies' financial systems. Integration begins when countries move the capital from local markets to international markets (Levine, 2005). Financial integration can be defined as a process in which the financial market in a country's economy is closely integrated with other countries' markets. With financial integration, there is an increase in capital flows and balancing for the prices and returns of financial assets traded in countries (De Brouwer, 2005). Baele et al. (2004) stated that financial market integration could only be mentioned if the following three are achieved; the unity of the rules to be applied to financial instruments and services is to ensure equal access to such tools and services and to treat parties equally in transactions in the market.

Saifuzzaman et al. (2016) state that while the positive effect of financial integration on growth is seen in developing countries, this effect is not seen in developed or underdeveloped countries. For developing countries, the capital flow is used as financing in sustainable investment projects. Otherwise, it contributes to the growth of the country. Numerous researchers have studied the relationship and causal links between economic growth and financial integration. Considering the studies' findings in the literature, it is concluded that financial integration supports economic growth and development, albeit at different levels. Levine (2001) emphasized that financial integration will contribute to growth by improving local financial systems' functioning through intensifying competition and importing financial services.

On the other hand, economic growth occurs with increased production factors and the increase in productivity using these factors (Gregorio, 1999). An efficient and efficient financial system in a country contributes significantly to economic growth. According to Goldschmidt (1969), financial integration contributes to economic growth in two ways. Thus, while the development of local financial markets increases capital accumulation efficiency, financial intermediation can increase the saving rate and, thus, the investment rate.

Studies on the subject are not entirely successful in explaining clearly the relationship between financial integration and economic growth, which expresses the financial openness level of a country to global markets. One of the main reasons for this is that the measurement of financial integration between countries exhibits a complex structure. Since financial integration is difficult to measure objectively, estimating its impact on the economy is equally tricky (Juraev, 2013, p. 3). In this study, with the desire to make a significant contribution to

the literature mentioned above, the relationship between financial integration processes and economic growth levels was investigated by the GMM method. The sample consists of 52 countries, whose data can be accessed in full. Under the following titles of the study, firstly, the literature on the subject will give. The analysis methods, the results obtained will mention, and the conclusion section will give at the last stage.

Literature Research

The concepts of financial integration and financial globalization are frequently used interchangeably. However, these two concepts essentially contain different meanings from each other. Financial globalization is a general concept referring to the increasing global connectivity created through cross-border financial flows. Financial integration refers to the links of a single country with international capital markets. Although these concepts are closely related, they are fundamentally different (Kose et al., 2003, p. 2).

Financial integration is considered a vital factor in promoting a more efficient financial system (Obstfeld, 2009). Selvarajan & Ab-Rahim (2020) emphasize that financial openness and integration can be considered a double-edged sword. The economic growth increase with the connection between these two factors and through technology and capital accumulation. However, this also increases vulnerabilities that may lead to a financial crisis (Osada, Saito, 2010; Mahajan, Verma, 2015). Financial integration offers countries more opportunities and leads to higher economic growth in theory. The financial system that integrated let the free flow of capital and participating countries benefit from portfolio diversification returns (Mahajan, Verma, 2015). Although these gains do not entail significant risks, financial integration flaws due to country-specific characteristics can cause volatility in the economy (Ramey, Ramey, 1995; Hoxha, et al., 2013). This is particularly important in developing countries with weak policies, poor financial stability, or marginal creditworthiness. Therefore, variable capital flows carry liquidity risk due to the possibility of capital flowing in the opposite direction in the event of an economic shock or a recession (Aziakpono, 2013). According to Agenor (2003), the appreciation of the exchange rate because of inflationary pressures, monetary expansion, and large and rapid capital inflows can negatively affect the stability of a small and developing economy (Selvarajan, Ab-Rahim, 2020, p. 192).

Many studies in the literature have focused on research on the relationship between economic and financial development. Although the history of these studies dates very back (Schumpeter, 1912; Robinson, 1952; McKinnon, 1973; Shaw, 1973; Lucas, 1988), this relationship continues to be an essential subject of research and discussion today (Levine, 1997; Rajan, Zingales, 1998, 2004; Tsuru, 2000; Levine, 2003; Eschenbach, 2004; Demirgüç-Kunt, Levine, 2008; Bonfiglioli, 2008; Acaravci, Öztürk, Acaravci, 2009; Choong, Chan, 2011; Al-Malkawi, et al. 2012). It is argued that the development of financial markets supports economic growth through various channels in the study, which has many and robust empirical results. On the other hand, some studies suggest that underdeveloped financial systems prevent international capital and trade flow and significantly slow down countries' economic growth rates (Ahmed, 2016, p. 43). Efforts to restructure financial systems have increased in many developing countries to avoid the negative consequences of

the financial system's inadequacy. The financial system facilitates global financial integration by international standards and creates a favourable environment for foreign direct investment (FDI) and stock flows (Ahmed, 2016, p. 43).

The studies on the effects of financial integrations on growth use various methodologies and reveal different results. Mesten (2008) states that the integration of financial markets leads to more capital accumulation and economic growth and increases the supply of funds by providing financially less developed countries with access to distant financial markets. The main reason for this effect is that markets become more efficient and sophisticated with increasing competition (Masten et al., 2008).

Considering the theoretical studies on the subject, financial integration, directly and indirectly, affects economic growth. Obstfeld (1994) emphasized that financial integration can improve capital allocation. The direct financial integration channel can positively impact growth by facilitating the efficient international allocation of capital and international risk allocation (Fetai, 2015, p. 98). Indirect financial integration implies that the development of national financial markets contributes to economic growth. This happens in two ways: First, competition from foreign financial intermediation can increase through financial integration. As a result, there is a decrease in investment cost and efficiency (Levine, 2001). Second, financial integration provides access to foreign financial markets and supports financial development, as it enables direct loans through foreign financial intermediaries (Fetai, 2015, p. 98).

Financial integration also affects the domestic markets of countries. Institutional improvements through financial integration (regulations that increase overall stability and reduce asymmetric information problems) affect internal markets through corporate governance. On the other hand, foreign financial intermediaries' access to foreign financial markets occurs through direct lending and being listed on foreign stock exchanges. This is expressed as the second channel through which financial integration affects financial development (Masten et al., 2008).

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However, another issue emphasized in the literature in the context of financial integration is foreign direct investments. Many economists and theorists have emphasized a relationship between economic growth and foreign direct investment (FDI) inflows. Iacovoiu and Panait (2014) show that as economies develop and grow, the infrastructure in those countries, employees' qualifications, etc. They also stated that the opportunities would improve. This will encourage the direct investments of international companies that want to convert their ownership advantages into capital at a more affordable cost. Iacovoiu (2018) showed a weak positive correlation between economic development and foreign direct investment flows.

In the context of financial integration, the subject of researching the relationship between foreign direct investments and economic growth attracts significant attention, especially by the administrations of developing countries, as well as in the academic field. In developing countries, since economic growth is one of the main focal points, policies regarding FDI attractiveness are prioritized in the economic growth and development process (Vo et al., 2019) and stated that FDI reduces the savings-investment imbalance supports the technology used in the production of goods and services. FDI increases human capital as well as tax revenue (Buckley et al., 2002). It can be said that FDI is one of the essential factors for the financial integration process as it increases long-term benefits and connections between different countries (Dinh, Vo, Nguyen, 2019).

Theoretically and by policymakers, the importance of foreign direct investment is emphasized at every opportunity. On the other hand, we frequently come across studies conducted in practical terms. Significant parts of these studies examine the impact of FDI on emerging economies. Lucas (1990) and Gourinchas and Jeanne (2013) emphasized that FDIs are mainly attracted by developed countries, although they are based in developing countries. Studies conducted based on developed countries include studies by Mencinger (2003), Carkovic and Levine (2005), Johnson (2006), Türkcan, Duman and Yetkiner (2008), and Herzer (2012). The results of these studies generally suggest that FDI has a negative effect on growth. On the other hand, in studies based on both developed and developing countries like Olofsdotter (1998), Reisen and Soto (2001), Alfaro et al. (2004), Li and Liu (2005), Batten and Vo (2009), the positive effect is pointed out (Bermejo Carbonell, Werner, 2018).

Borensztein et al. (1998) analyzed the impact of FDI on economic growth between 1970 and 1979, 1980 and 1989. The authors concluded that FDI positively influenced economic growth and that FDI and domestic investment complement each other. Based on their study results using panel data from 18 countries in Latin America, Bengoa and Sanchez-Robles (2003) concluded that FDI positively affects economic growth when countries have sufficient human capital, liberalized markets, and economic stability. Soltani and Ochi (2012) found a causal relationship between economic growth and FDI in their study using data from 1975-2009 in Tunisia and concluded that FDI causes significant economic growth (Ameer, Xu, 2017).

Ameer and Xu (2017) emphasize that the effects of foreign direct investments in developed and developing countries may differ. The first reason for this difference is that financial markets are not well developed in many developing countries. Many companies do not have access to foreign capital markets in developing countries. Companies in these countries also face more and more financial constraints. Second, foreign direct investment outflows are likely to reduce domestic capital. Therefore, when outgoing investors have scarce domestic resources, they can reduce domestic production. Third, the ability to receive information from abroad depends on the absorption capacity of the investing firm. Firms with low technological capacity will not be able to access information effectively through FDI outlets. In their study, Ameer and Xu (2017) determined that foreign direct investment outflows and inflows positively and significantly affect economic growth in developing economies in the long run.

Data Set and Econometric Method

The relationship between financial integration and economic growth was discussed in this study. The Generalized Method of Moments (GMM) and Quantile Regression Analysis (QRM) were performed, using annual data for the 2000-2019 period based on 52 countries whose data can access fully regardless of their development level. Since the data set has T<N characteristics, the time or period is less than the number of countries (cross-section), and we decided to use the GMM method first. The data set was obtained from the World Bank database. The variables used in the study are portfolio equity net inflows (current US $), current account balance (% of GDP), inflation consumer prices (annual %), foreign direct investment net inflows (% of GDP), foreign direct investment net outflows (% of GDP) and GDP per capita (current USD).

Generalized Method of Moments (GMM) Approach

In recent years, panel data analysis has been used more frequently in the finance discipline. The use of panel data analysis methods brings some advantages. For example, since the panel data set provides the opportunity to analyze with more than one section, it is possible to work with a large data set. In this way, the short time series expands with the added sections and works with data with short time dimensions created (Baltagi, 2005). However, despite these advantages, there are some weaknesses in panel data analysis. For example, panel estimation results become biased in models with dynamic relationships (Baltagi, 2005).

Also, panel fixed effects and panel random-effects models do not give meaningful results in panels where the following situations are in question (Roodman, 2006; as cited in İskenderoğlu, Karadeniz, Atioğlu, 2012):

- Time dimension involved in undersampling;
- There are many data;
- The linear relationship is emphasized;
- The lagged value of the dependent variable is included in the sampling as an independent variable;
- The independent variables are not entirely exogenous;
- Although there is no variance and autocorrelation between the data, there are different variances and autocorrelations in the data;
- The time dimension is small, but the data is large.

Lars Peter Hansen formalized the GMM estimator in 1982 as a generalization of the moments method, which came to the fore as a result of a study by Karl Pearson in 1894. Generalized Method of Moments (GMM) is a suitable method to obtain consistent and asymptotically distributed estimators of statistical models' parameters. The method has been applied in many economics areas, but most frequently in finance (Hall, 2009, p. 1). Unlike the maximum

likelihood estimate (MLE), GMM does not require full knowledge of data distribution. For the GMM estimation, only certain moments are derived from the basic model needed. While in some cases where the distribution of data is known, MLE can be very computationally burdensome; GMM can be easily applied. For models with more torque conditions than model parameters, GMM estimation provides a more straightforward method to test the proposed model's properties. The Arellano-Bover/Blundell-Bond Generalized Moments Method was first proposed by Arellano-Bond (1991) and later developed in Arellano-Bover (1995) and Blundell-Bond (1998). Because the data considers the time series feature and does not include biased results, GMM is carried out in this study. The validity of the results of the Arellano-Bover/Blundell-Bond System GMM can be realized with two different post-prediction tests. The first is the Sargan or Hansen J test, which shows whether the tool variables used in GMM estimation are used precisely and correctly. The other is the first and second-order autocorrelation tests (İskenderoğlu, 2008, p. 155). Since the GMM methods' predictions were tested with instrument variables, these variables were expected to reflect the main variables fully. It is necessary to perform the Sargan or Hansen test to measure this situation (Gujarati, 2004, p. 713). Hansen test results reveal whether the tool variables used for prediction are sufficient. The dynamic panel data prediction model results under GMM conditions should be tested with the first and second-order autocorrelation tests proposed by Arellano and Bond (1991). According to the results obtained, the second-order autocorrelation is expected to be statistically insignificant (Arellano, 2003, p. 121). In GMM studies, whether the model estimation is performed correctly or not can be examined with the Wald test, unlike the classical F test (Roodman, 2006, p. 35; as cited in İskenderoğlu, et al., 2012).

The first difference Generalized Method of Moments (GMM) (Arellano, Bond, 1991) used to capture the effect of lagged values. GMM's basic assumption is that the initial differences of instrumental variables are unrelated to fixed effects and allow the model to offer more tools and increase efficiency. Roodman (2006) stated that it is appropriate to use both difference and system GMM estimators when small T, large N panels, independent variables are not strictly exogenous and heteroskedasticity autocorrelation is present in the sample.

The research hypothesis of this study is established on the impact of financial integration on economic development. Gehringer (2013) stated that putting such a relationship in a static regression framework would significantly disadvantage, mainly referring to inherent problems. Individual country effects are necessarily associated with lagged dependent variables, resulting in inconsistencies in OLS and other static panel techniques (Baltagi, 2001).

The first difference generalized method of the moments model proposed by Arellano and Bond (1991) was applied to eliminate the problems mentioned above. This estimator has been used to deal with serious internality problems (Gehringer, 2013). The methodology involves taking the first differences of the equation at the level. This allows us to eliminate country-specific and time-invariant influences associated with current and past validations of explanatory variables. This model can express as follows (Gehringer, 2013, p. 298).

In the analysis phase of the study with GMM, the instrumental variables were determined as the explanatory variables' 1-term lagged values. Difference dynamics models are used to

eliminate individual (singular) effects. The empirical GMM model established to test the effect of financial integration and other macroeconomic variables on economic growth is as follows:

$$\Delta GDP_{it} = \beta_1 + (y\text{-}1)GDP_{i,\,t-1} + \beta'_2\Delta IN_{i,\,t-1} + \beta'_3\Delta OUT_{i,\,t-1} + \beta'_4\Delta PRT_{i,\,t-1} + \beta'_5\Delta INF_{i,\,t-1} + \beta'_6\Delta CAB_{i,\,t-1} + \Delta\eta + \Delta\varepsilon_{it} \quad (1)$$

Here, when Δ expresses the first differences of variables, GDP_{it} gives the dependent variable (GDP per capita), and GDP_{it-1} gives the value of GDP_{it} with a period lag. $IN_{i,\,t-1}$, $OUT_{i,\,t-1}$ and $PRT_{i,\,t-1}$ give the financial integration variables, while $INF_{i,\,t-1}$ and $CAB_{i,\,t-1}$ give the one-period lagged values of the control variables. η is unobservable time-specific effects and ε_{it} is the country-specific error term. However, considering that the equation includes variables whose first differences in level are taken, country-specific effects are eliminated. (Gehringer, 2013, p. 298).

In the estimation procedure, explanatory variables were instrumented with their own lagged levels. The essential assumption involved in the model's creation and operation is that the country-specific term will not be associated in a serial sense in the original equation in the level values. Hansen J test and second-order serial correlation test of residues were performed to check the model's general validity (Gehringer, 2013, p. 298).

In this study, the relationship between GDP (economic growth) and financial integration investigated, the results of the estimation made with the two-stage GMM are shown in Table 1. It is formed in line with the expectations of the results. It is seen that direct foreign capital inflows to countries affect economic growth positively and significantly. However, direct net capital outflow affects economic growth negatively and significantly. It is seen that securities investments (portfolios) have a positive and significant effect on economic growth as indirect foreign capital investments. The inflation coefficient was included in the model as the control variable expected to be negative and statistically significant. This expectation has been met in the results. Moreover, the ratio of the current account balance to GDP, which expresses the sum of net exports of goods and services, net primary income, and net secondary income included in the model as another control variable, positively and significantly affects the economic growth. All these relationships are significant at the 1% significance level.

Lagging differences in explanatory variables are used as tools (instruments) variables in GMM estimation. Since the explanatory variable can be related to the error term, this problem can be solved using the explanatory variable as a tool. The efficiency of the GMM estimator depends on the validity of its tools. For this purpose, Hansen J-test results were used to question the validity of the tools. AR (1) and AR (2) tests are used to test the hypothesis of whether the error terms are serially related (i.e., whether there is autocorrelation between residues). The Wald test statistics show that all of the independent variables used in the model are significant in explaining the dependent variable.

As seen in the table, the GMM estimator is well modelled. The lagged coefficients of GDP per capita are statistically significant in the table and the Hansen J-test, which tests the instrument variables' validity, shows that the model's instrument variables are healthy. We used the Hansen test instead of the Sargan test to test the externality of instrumental variables because the Sargan test is not robust enough to detect heteroskedasticity and autocorrelation

(Roodman, 2006; Jang, Park, 2011). J-statistics, developed by Hansen (1982), expresses the GMM objective function's value using an efficient GMM estimator. The *J* statistic serves as a multipurpose test statistic to identify the faulty model. A large *J* statistic indicates an incorrectly defined model. However, the *J – statistic* on its own does not provide any information about how the model was misidentified. When the Hansen J test statistics are examined, the probability value is more significant than *0.05,* and the null hypothesis cannot reject. Therefore, the GMM estimator's results confirm the hypothesis that instrumental variables are not related to the set of residuals. Also, *AR (1)* autocorrelation test statistics are negative and significant, while *AR (2)* test statistics are insignificant. These results show that there is the first-order autocorrelation in the model, but not the second order.

Table 1

GMM Output

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	0.865741	0.001609	538.1309	0.0000*
IN(-1)	0.000410	4.16E-05	9.846333	0.0000*
OUT(-1)	-0.000308	6.63E-05	-4.643045	0.0000*
PRT(-1)	0.000641	5.12E-05	12.52092	0.0000*
INF(-1)	-0.001288	6.09E-05	-21.14638	0.0000*
CAB(-1)	0.000545	0.000134	4.072514	0.0001*
	Effects Specification			
Cross-section fixed (first differences)				
Mean dependent var	0.025257	S.D. dependent var		0.047609
SE of regression	0.051352	Sum squared resid		2.452461
J-statistic	54.97947	Instrument rank		53
Prob(J-statistic)	0.198085			
Test order	**m-Statistic**	**rho**	**SE(rho)**	**Prob.**
AR(1)	-5.411022	-0.716442	0.132404	0.0000*
AR(2)	-1.490655	-0.807938	0.542002	0.1361
Wald Test Statistics	**Value**	**df**		**Prob.**
F-statistic	1639.996	(5, 930)		0.0000*
Chi-square	8199.981	5		0.0000*

Note: GDP per capita is the dependent variable. Results are a two-step GMM estimator – one lag used as instrumental variables in the GMM method.

** Indicates significance at % 1. The Hansen J test shows the p-value for the null hypothesis of the validity of the instruments. AR (1) and AR (2) are the autocorrelated p-values of the error term for the first and second orders. These values indicate that there is no autocorrelation between residual values.*

Quantile Regression Model (QRM) Approach

The quantile regression model was first put forward by Koenker and Bassett (1978) and attracted considerable attention both theoretically and empirically. In quantile regression models, the relationship between the quantiles of the dependent variable's distribution and the independent variables are presented in detail, with this structure, quantile regression is based on the minimization of asymmetric weighted absolute residual squares. Quantile regression offers an essential alternative to the conditional mean-based OLD regression, as it provides complete information on the distribution of the dependent variable. Laplace (1818) proved that the absolute deviation error estimator in the bivariate model has a smaller asymptotic variance than the EKK estimator under certain conditions, thus paving the way

for theoretical work for large sample estimators based on sample quantiles. Koenker and Bassett (1978) developed Laplace's (1818) invention. Here, they proposed a conditional quantile function model that allows estimation of the entire distribution of the dependent variable in their model, which they define as quantile regression (Saçıldı, Koşan, 2018, p. 189).

The median may become a more appropriate measure of central tendency when it comes to a skewed distribution. For this reason, conditional median regression was used instead of conditional average regression for modelling position shifts. Conditional-median regression was first proposed by Boscovich in the middle of the 18th century and then reconsidered by Laplace and Edgeworth. The median-regression model is for the problematic conditional mean estimates of the linear regression model (LRM). Median regression predicts a covariable effect on the conditional median, representing the central position even if the distribution is skewed (Hao, Naiman, 2007, p. 29).

Koenker and Bassett (1978) proposed the quantile regression model (QRM), a more general form than the median regression model, to model both position shifts and shapeshifts. QRM estimates the potential differential effect of a covariant on various quantities in the conditional distribution; for example, a sequence of 19 equidistant quantiles from .05th quant to .95th quantiles. With median and non-median quantities, these 19 fitted regression lines capture the displacement (median line), and scale and more complex shapeshift (lines for non-median quantities). In this way, QRM predicts the different effects of a covariate on the full distribution and accommodates different variances. Following Koenker and Bassett (1978), the QRM corresponding to LRM in equation two can express in equation three as follows (Hao, Naiman, 2007, p. 29):

$$y_i = \beta_0 + \beta_1 x_i + \varepsilon_i \quad (2)$$

$$y_i = \beta_0^{(p)} + \beta_1^{(p)} x_i + \varepsilon_i^{(p)} \quad (3)$$

In this equation, $0<p<1$ represents the population's proportion with scores below the quantile in p. Given x_i, denotes that the conditional quantile *pth* is $Q^{(p)}(y_i|x_i) = \beta_0^{(p)} + \beta_1^{(p)} x_i$. Therefore, the conditional quantile *pth* is determined by the quantile specific parameters, $\beta_0^{(p)}$, $\beta_1^{(p)}$and a given value of the covariate x_i. ε_i shows the error terms. Since the $\beta_0^{(p)} + \beta_1^{(p)} x_i$ term is a constant, $Q^{(p)}(y_i|x_i) = \beta_0^{(p)} + \beta_1^{(p)} x_i + Q^{(p)}(\varepsilon_i)$. Thus, an equivalent QRM formulation requires that the *error term's pth quantile* be zero (Hao, Naiman, 2007, p. 29).

We can use quantile regression as a statistical method to estimate the conditional quantity function. The purpose of traditional regression analysis is to minimize the sum of squared errors (SSE). This method can express with the equation shown below (Yeh, 2014, p. 4):

$$SSE = \sum_{i=1}^{n} \left(Y_i - \hat{Y}_i\right)^2$$

However, in the quantile regression analysis, the aim is to minimize the "sum of weighted absolute errors" (SWAE):

$$SWAE = \theta \cdot \sum_{Y_i \geq \hat{Y}_i} \left| Y_i - \hat{Y}_i \right| + (1-\theta) \cdot \sum_{Y_i < \hat{Y}_i} \left| Y_i - \hat{Y}_i \right|$$

Here, *Θ illustrates the* quantile, which is *0<Θ<1*. *Y* is the actual value of the dependent variable. $\hat{Y} = \hat{\beta} X$ is the predictive value of the dependent variable. *X* = vector of independent variables, β = expresses the estimated values of the coefficient vector.

If a value of *Θ* chosen, the coefficient vector can estimate by minimizing the above SWAE error function. For example, when = 0.5, the error's weight where the real value is greater than the predicted value will be 0.5, and the weight of the error where the real value is less than the predicted value will be 0.5. Therefore, the error function is neutral for two types of error. In other words, the probability that the real value is greater or less than the predicted value is all 0.5, and the predicted value is an estimate of the median (Yeh, 2014, p. 4).

In the next phase of the study, the quantile regression model (QRM) is used, which allows the financial integration growth relationship to evaluate according to economic growth levels. QRM is a statistical technique aimed at making inferences and measuring conditional quantile functions. This analysis is instrumental when conditional distribution does not have a standard shape, such as asymmetric, coarse-tailed, or dashed distribution.

Table 2 includes forecast results for the entire period, including the 25th with low and 75th quantile with high growth rates. In the table, when looking at the economic growth-foreign direct capital investment inflow (FDII) relationship, the impact of foreign direct capital inflow on GDP per capita is quite different between countries with low and high growth rates. Although positive and significant in both quantiles at the coefficients, we see that the FDII variable's coefficient in the 25th quantile is significantly higher than the coefficient in the 75th quantile. In other words, in countries with high economic growth rates, FDII's have significantly higher effects of economic growth than countries with low economic growth rates. This is because FDII's are generally turning to more reliable countries. On the other hand, one unit increase in FDIIs in the 75th quantile increases GDP approximately nine times.

From the perspective of foreign direct capital investment outs (FDIO), the variable in question on economic growth is similar in coefficients for countries with high and low growth rates but has a negative and meaningful effect. When looking at net portfolio indents, the coefficient in the 25th quantile (countries with low growth levels) is higher than the 75th quantile. Its impact on economic growth is positive and significant in both quantiles. The conclusion is that foreign portfolio investments are more important for countries with low growth levels than countries with high growth rates in economic growth.

The results also provide essential information in terms of control variables. The inflation control variable has no statistically significant economic growth effect for countries with high and moderate growth rates. In contrast, in countries with low growth rates, it significantly negatively affects growth. When we look at the balance of current transactions, there is a significant impact on economic growth compared to countries with high and low growth rates. Especially in countries with low growth rates and significantly driven by economic policies, the balance of current transactions supports growth.

Table 2

QRM Output

Variables	Quantile	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	0.250	0.974582	0.002942	331.2862	0.0000
	0.500	0.979501	0.002918	335.7202	0.0000
	0.750	0.973599	0.006827	142.6032	0.0000
IN(-1)	0.250	0.000181	3.76E-05	4.817523	0.0000
	0.500	0.000121	5.75E-05	2.098620	0.0361
	0.750	8.97E-05	3.95E-05	2.273780	0.0232
OUT(-1)	0.250	-0.000193	4.99E-05	-3.859718	0.0001
	0.500	-0.000107	0.000106	-1.014615	0.3105
	0.750	-0.000102	3.85E-05	-2.660475	0.0079
PRT(-1)	0.250	0.000958	0.000199	4.821828	0.0000
	0.500	0.000775	0.000186	4.160772	0.0000
	0.750	0.000535	0.000211	2.535211	0.0114
INF(-1)	0.250	-0.000213	7.89E-05	-2.694653	0.0072
	0.500	0.000534	0.000327	1.631048	0.1032
	0.750	0.000652	0.001185	0.550372	0.5822
CAB(-1)	0.250	0.001545	0.000345	4.484430	0.0000
	0.500	0.000631	0.000313	2.017575	0.0439
	0.750	-0.000741	0.000296	-2.499866	0.0126
C	0.250	0.103757	0.011825	8.774500	0.0000
	0.500	0.103583	0.012598	8.222088	0.0000
	0.750	0.154722	0.031889	4.851922	0.0000
Pseudo R^2	: 0.919732				

Conclusion

Considering the theoretical findings and suggested approaches, there are conflicting predictions about international financial integration and the effects of this process on growth. Considering the previous studies in the literature that can be regarded as fundamental studies on the subject, it is suggested that financial integration increases and facilitates the sharing of risk, along with some theories, thus improving specialization in production, capital distribution, and economic growth (Obstfeld, 1994; Acemoğlu, Zilibotti, 1997). In the standard neoclassical growth model, international financial integration facilitates capital-scarce countries' capital flow with positive output effects. On the other hand, financial integration can contribute positively to the intensification of competition with its growth effects and local financial systems' functioning through importing financial services (Klein, Olivei, 2000; Levine, 2001). However, there have been approaches that suggest that financial integration can retard growth. Boyd and Smith (1992) suggested that IFI in countries with weak institutions and policies (e.g., weak financial and legal systems) might cause capital outflow from countries with capital shortages to better institutions and capital-abundant countries. Therefore, some theories predict that international financial integration will only support growth in countries with strong institutions and good policies (Edison et al., 2002, p. 3).

This study aims to take a different approach by using two different panel data analysis methods to compare financial integration and economic growth. Although there have been discussions and many theoretical and empirical studies on this subject for many years, this is

still one of the controversial economic and financial issues. For this purpose, 52 countries were analyzed using GMM and QRM based on financial and economic data. Considering the results of this study, in line with the GMM analysis, direct foreign capital inflows positively affect economic growth, and direct net capital outflow negatively affects economic growth. On the other hand, portfolio investments have a positive effect on economic growth. While the inflation variable affects economic growth negatively, the current account balance affects economic growth positively.

According to the QRM analysis results, foreign direct investment (FDII) on GDP per capita differs in countries with low and high growth rates. In countries with high economic growth rates, the effect of FDIIs on economic growth is significantly higher than in countries with low economic growth rates. The reason for this may be that FDIIs generally head towards more reliable countries. On the other hand, foreign direct investment outflows have a negative impact on economic growth, regardless of the countries with high and low growth rates. The coefficient of net portfolio inflows is higher in countries with low growth levels than countries with high growth levels. Its effect on economic growth is positive in both quantiles. We concluded that foreign portfolio investments are more important for countries with low growth levels than countries with high growth rates in terms of economic growth.

On the other hand, the inflation control variable has no effect on economic growth in countries with high and medium growth rates. It negatively affects growth in countries with low growth rates. It has been observed that the current account balance has a significant impact on economic growth for countries with high and low growth rates. Especially in countries with low growth rates and economic policies that significantly drive economic growth, the current account balance has been found to support growth.

In summary, the phenomenon of financial integration has a significant impact on economic growth. This effect indicates a positive effect in general. In this context, this study's results are consistent with previous studies' findings in the literature. Findings from this study are in accordance with the findings of the studies conducted by Olofsdotter (1998), Borensztein et al. (1998), Reisen and Soto (2001), Bengoa and Sanchez-Robles (2003), Alfaro et al. (2004), Li and Liu (2005), Batten and Vo (2009), Soltani and Ochi (2012), Ameer and Xu (2017), and Bermejo Carbonell and Werner (2018).

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