Anadolu Üniversitesi Sosyal Bilimler Dergisi | AÜSBD | Anadolu University Journal of Social Sciences

Analysis of Globalization and Economic Growth for Turkey with ARDL Model

Türkiye için Küreselleşme ve Ekonomik Büyümenin ARDL Modeli ile Analizi

Prof. Dr. Cüneyt Koyuncu - Tufan Sarıtaş

Abstract

In this study, short and long term possible relationships between globalization and growth in Turkey were investigated for 1970-2013. In this context, three models for three different growth indicators were established. Firstly, it has been examined whether there is a long-lasting relationship between the series by using ARDL boundary test method. Then, both short and long term coefficients of the series were estimated by using error corrected form of the ARDL Model. Finally, Granger causality test was applied in the context of Toda-Yamamoto Approach. After the analyzes made for three different models; it was found that there was a long-term significant positive correlation between globalization and growth but there was no short term significant correlation between them for each of the three models. In addition, after conducting causality test for three models, no causality relationship between growth and globalization was identified.

Keywords: *Globalization, Economic Growth, Co-integration, Stationarity, ARDL Model*

Öz

Bu çalışmada 1970-2013 yılları için Türkiye'de küreselleşme ile büyüme arasındaki kısa ve uzun dönemli olası ilişkiler araştırılmıştır. Bu bağlamda üç farklı büyüme göstergesi için üç ayrı model kurulmuştur. Öncelikle ARDL sınır testi yöntemi ile seriler arasında uzun dönemli bir ilişki olup-olmadığı incelenmiştir. Daha sonra ARDL Modelinin Hata Düzeltmeli gösterimi yardımıyla serilere ilişkin kısa ve uzun dönem katsayıları tahmin edilmiştir. En son olarak Toda-Yamamoto Yaklaşımı çerçevesinde ise Granger nedensellik testi uygulanmıştır. Üç ayrı model için yapılan analizler sonrasında; üç modelin her biri için küreselleşme ile büyüme arasında uzun dönemde aynı yönlü anlamlı bir ilişkinin var olduğu fakat küreselleşme ile büyüme arasında kısa dönemde herhangi bir anlamlı ilişkinin bulunmadığı tespit edilmiştir. Ayrıca üç model için yapılan nedensellik testleri sonrasında büyüme ile küreselleşme arasında herhangi bir nedensellik ilişkisi bulunamamıştır.

Anahtar Kelimeler: *Küreselleşme, Ekonomik Büyüme, Eş-bütünleşme, Durağanlık, ARDL Modeli*

Introduction

Globalization is defined in different ways by scientists working in different branches of science. In these definitions, sometimes the economic dimension comes to the forefront but sometimes, political, social and technological dimensions come to the forefront. Owing to the fact that globalization affects all fields of the society (such as arts, economics, politics etc.) we may state that the scientist started to examine this concept. However, scientists in different branches of science who are working on globalization try to explain this concept from the perspective of their own disciplines. As a natural consequence of this situation, it is difficult to find a uniform definition of globalization in the literature.

Prof. Dr. Cüneyt Koyuncu, Bilecik Şeyh Edebali University, **cuneyt.koyuncu@bilecik.edu.tr**
Tufan Sarıtaş, Bilecik Şeyh Edebali University, **tufansaritas@gmail.com**

Due to the fact that globalization affects many areas in the society, the issue of its association with economic growth has been drawn attention of researchers. In this context, according to Lucas (1988), who emphasizes the relation of globalization-growth, the growth is positively affected and effective distribution of resources is provided in the countries that benefit from international factor mobilization through globalization (Yay, 2009, p.3). Dreher (2006, p.1092) believes that globalization affects economic growth positively. Dollar's (1992) study concludes that outward-oriented countries experience higher level export and also economic growth in those countries is positively affected as a result of favorable externalities stemming from export. Rivera-Batiz and Romer (1990) assume that the benefit from globalization is low in a neo-classical growth model but the effect of globalization is higher in endogenous growth model.

In this study, short and long term possible relationships between globalization and economic growth for Turkey have been investigated by utilizing time series data covering the period of 1970-2013. Although, as the estimation results indicate, there is no statistically significant short-term relationship between globalization and economic growth, a long-term positive significant correlation was found between the two series. This finding remains valid in all three distinct models.

In the following sections of the study, the literature will be discussed first, and empirical studies on the relationship between globalization and growth will be given in this section. In the third part, data and methodology will be explained and the data, model and methodology used in the analyses will be discussed. The estimation results will be reported and assessed in section four. The final section concludes.

Literature Review

There are many empirical studies in the literature that have examined the relationship between globalization and growth. However, since the KOF Index, which is one of the multidimensional globalization indexes, was used in this study, studies using the KOF Index as a measure of globalization in the literature were considered. The literature reviewed in this context is shown in Table 1.

As seen in the majority of studies in the literature, there is generally positive relationship between globalization and growth. However, the relationship between economic, social and political dimensions of globalization and growth has been observed as negative or meaningless.

Data and Methodology

In the study, the relationship between globalization and growth will be investigated in the period 1970-2013 in Turkey. In this context, used variables are GDP6 (GDP Growth, annual %), GDP11 (GDP per capita growth, annual %), LGDPCONGR (logarithmic growth rate of GDP constant 2010 US$), GFCF1 (Gross fixed capital formation, % of GDP), KOFAG (KOF overall globalization index), and HC (Human capital index). HC variable has been gathered from Penn World Table, KOFAG variable has collected from Zurich Technology Institute and the others are from the World Bank (WDI).

In the study, the ARDL Boundary Test Approach will be used as the analysis method. As known, probable long-term relationships between the series are tested by co-integration tests. However, as a constraint, the vast majority of co integration tests require that the series need to be integrated at the same level. On the other hand in the ARDL model, it is not necessary that the series are integrated at the same level. It is enough that the series are not integrated in order two or more. In addition to that, it has some advantages like allowing the series to have different lag-lengths and allowing to estimate simultaneously short-term and long-term parameters (Pesaran, 2001).

In the analysis, three different models were established using GDP6, GDP11 and LGDPCONGR series as dependent variables. In this context, three models for the application of the ARDL boundary test approach as follows:

Table 1. Literature Summary

Author	Period / Countries	Empirical Results
Dreher (2006)	1970-2002 123 Countries	A positive relationship between general, economic and social globalization and growth. Political globalization and growth relation are meaningless.
Potrafke (2010)	1951-2006 21 OECD Countries	The relationship between political, social and general globalization and growth is meaningless. Positive relationship between globalization and growth.
Chang vd. (2011)	1970-2006 G7 Countries	Positive relationship between globalization and growth.
Chang and Lee (2011)	1990-2006 OECD and Transition Countries	Positive relationship between general, economic, social, political globalization and growth.
Marginean and Orastrean (2011)	2005-2009 23 Countries	Globalization and growth relationship are meaningless.
Rao and Vadlamannati (2011)	1970-2005 21 African Countries	Positive relationship between globalization and growth.
Mutascu and Fleischer (2011)	1970-2007 Romania	Positive relationship between globalization and growth.
Villaverde and Maza (2011)	1970-2005 101 Countries	A positive relationship between economic and social globalization and growth.
Osterloh (2012)	1971-2004 OECD Countries	Negative relation between growth and general globalization; Positive relationship between economic globalization and growth.
Leitao (2012)	1995-2008 European Nation	A positive relationship between economic, social, political and general globalization and growth.
Chang vd. (2013)	1990-2009 Azerbaijan, Georgia, Russian, Turkey	Positive relationship between globalization and growth.
Gurgul and Lach (2014)	1990-2009 Transition Countries	Positive relationship between growth and economic and social globalization; The relationship between growth and political globalization is meaningless.
Samimi and Jenatabadi (2014)	1980-2008 33 Countries	Globalization and growth relations are positive in the high and middle income groups; but it is negative in low income group.
Sarıkaya (2015)	1971-2009 129 Countries	Positive relationship between social globalization and growth.
Hayaloğlu (2015)	1995-2011 91 Countries	A positive relationship between general, economic, social, political globalization and growth in high, middle and low income group. Negative relation between general, economic, social globalization and growth in low-income group.
Doğan and Can (2016)	1970-2012 South Korea	Positive relationship between economic, social, political globalization and growth.

$$\Delta GDP6_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta GDP6_{t-i} + \sum_{i=0}^{q} \alpha_i \Delta KOFAG_{t-i} + \sum_{i=0}^{r} \delta_i \Delta GFCF1_{t-i} + \sum_{i=0}^{m} \lambda_i \Delta HC_{t-i} + \theta_0 GDP6_{t-1} + \theta_1 KOFAG_{t-1} + \theta_2 GFCF1_{t-1} + \theta_3 HC_{t-1} + \varepsilon_t \quad (1)$$

$$\Delta GDP11_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta GDP11_{t-i} + \sum_{i=0}^{q} \alpha_i \Delta KOFAG_{t-i} + \sum_{i=0}^{r} \delta_i \Delta GFCF1_{t-i} + \sum_{i=0}^{m} \lambda_i \Delta HC_{t-i} + \theta_0 GDP11_{t-1} + \theta_1 KOFAG_{t-1} + \theta_2 GFCF1_{t-1} + \theta_3 HC_{t-1} + \varepsilon_t \quad (2)$$

$$\Delta \mathrm{LGDPCONGR}_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta \mathrm{LGDPCONGR}_{t-i} + \sum_{i=0}^{q} \alpha_i \Delta KOFAG_{t-i} + \sum_{i=0}^{r} \delta_i \Delta GFCF1_{t-i} + \sum_{i=0}^{m} \lambda_i \Delta HC_{t-i} + \theta_0 \mathrm{LGDPCONGR}_{t-1} + \theta_1 KOFAG_{t-1} + \theta_2 GFCF1_{t-1} + \theta_3 HC_{t-1} + \varepsilon_t \quad (3)$$

GDP6, GDP11, KOFAG, GFCF1, HC and LGDPCONGR terms in the equations correspond to the variables described above. While θ_0, θ_1, θ_2 and θ_3 terms show the coefficients of long-term relationship between the series; β_i, α_i, δ_i and λ_i terms show the coefficients of short-term relationship between the series. Δ is defined as first degree difference operator, β_0 is constant term of the model, and ε_t is white noise error model.

The short and long term relationships between the series are investigated by the ARDL model in several steps. First, the model prediction is made and the possible short and long-run relationships between the series are revealed as a result of the F-test of the H_0 hypothesis claiming that all of the coefficients of the lagged series are equal to zero. Against to H_0: $\theta_0 = \theta_1 = \theta_2 = \theta_3 = 0$ hypothesis claiming that there is no long-term relationship (co-integration) between the series; we test H_0: $\theta_0 \neq \theta_1 \neq \theta_2 \neq \theta_3 \neq 0$ alternative hypothesis claiming that that there is a long term relationship (co-integration) between the series. In this test, F-statistic value is compared with upper and lower boundary values stated by Peseran et al. (2001). If the F-statistic value exceeds the upper limit, H_1 is accepted; if it is smaller than lower limit then H_0 hypothesis is accepted. However, no decision can be made if the F-statistic value remains between the upper and lower limits.

When H_1 hypothesis is accepted (i.e., having co-integration), the appropriate lag-lengths for the series are determined using one of the different model selection criteria. In the models we build under the assumption that the appropriate lags is ARDL (p, q, r, m); "p" represents the lag length of GDP6, GDP11 and LGDPCONGR series, but "q", "r", and "m" represent lag lengths of series KOFAG, GFCF1 and HC respectively.

Finally, the error correction model is estimated by using the determined optimum lag lengths. Three error correction models that we have established in this context as follows:

$$GDP6_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta GDP6_{t-i} + \sum_{i=0}^{q} \alpha_i \Delta KOFAG_{t-i} + \sum_{i=0}^{r} \delta_i \Delta GFCF1_{t-i} + \sum_{i=0}^{m} \lambda_i \Delta HC_{t-i} + \varphi ECM_{t-1} + \varepsilon_t \quad (4)$$

$$GDP11_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta GDP11_{t-i} + \sum_{i=0}^{q} \alpha_i \Delta KOFAG_{t-i} + \sum_{i=0}^{r} \delta_i \Delta GFCF1_{t-i} + \sum_{i=0}^{m} \lambda_i \Delta HC_{t-i} + \varphi ECM_{t-1} + \varepsilon_t \quad (5)$$

$$LGDPCONGR_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta LGDPCONGR_{t-i} + \sum_{i=0}^{q} \alpha_i \Delta KOFAG_{t-i} + \sum_{i=0}^{r} \delta_i \Delta GFCF1_{t-i} + \sum_{i=0}^{m} \lambda_i \Delta HC_{t-i} + \varphi ECM_{t-1} + \varepsilon_t \quad (6)$$

In equations above; β_i, α_i, δ_i and λ_i terms refer to the dynamic coefficients that bring the model to the balance; ECM term refers to error correction term; φ term refers to the speed of adjustment at which the model reverts to long-term after a shock occurred in short-term. The φ coefficient in all models should be negative and statistically significant.

Besides the ARDL boundary test approach, the Granger Causality Test was applied within the context of Toda-Yamamoto approach in order to determine the existence and direction of the possible causality relationship between the series. As it is known, the Toda-Yamamoto approach requires first determining the maximum integration level (i.e., dmax) of series included in the model. Following this, the appropriate lag length is determined in the context of the model selection criteria by setting the unrestricted VAR model at level values of the series. VAR (P+dmax) model is estimated under the assumption that the most suitable model is VAR (P). Then, this predicted model is tested with the VAR Granger Causality/Block Exogeneity Wald Test. The existence and direction of possible causal relations between the series are identified as a result of the causality test.

Empirical Results

The Kwiatkowski-Phillips-Schmidt-Shin (KPSS) stationarity test was used to determine whether the series are stationary or not. While the null hypothesis of the KPSS test indicates that the series are stationary, the alternative hypothesis says that the series are not stationary. The results of the KPSS Unit Root Test for the level and first difference values of the series are reported in Table 2.

Table 2. KPSS Stationarity Test Results

Variable	Model	Test Statistic	Critical Value		
			%1	%5	%10
GDP6	Constant	*0.0542*	*0.7390*	*0.4630*	*0.3470*
	Constant, Linear Tr.	*0.0428*	*0.2160*	*0.1460*	*0.1190*
GDP11	Constant	*0.0471*	*0.7390*	*0.4630*	*0.3470*
	Constant, Linear Tr.	*0.0426*	*0.2160*	*0.1460*	*0.1190*
LGDPCONGR	Constant	*0.0651*	*0.7390*	*0.4630*	*0.3470*
	Constant, Linear Tr.	*0.0466*	*0.2160*	*0.1460*	*0.1190*
KOFAG	Constant	*0.8120*	*0.7390*	*0.4630*	*0.3470*
	Constant, Linear Tr.	*0.1090*	*0.2160*	*0.1460*	*0.1190*
ΔKOFAG	Constant	*0.1404*	*0.7390*	*0.4630*	*0.3470*
	Constant, Linear Tr.	*0.1404*	*0.2160*	*0.1460*	*0.1190*
GFCF1	Constant	*0.3588*	*0.7390*	*0.4630*	*0.3470*
	Constant, Linear Tr.	*0.1561*	*0.2160*	*0.1460*	*0.1190*
ΔGFCF1	Constant	*0.1206*	*0.7390*	*0.4630*	*0.3470*
	Constant, Linear Tr.	*0.0597*	*0.2160*	*0.1460*	*0.1190*
HC	Constant	*0.8513*	*0.7390*	*0.4630*	*0.3470*
	Constant, Linear Tr.	*0.0900*	*0.2160*	*0.1460*	*0.1190*
ΔHC	Constant	*0.0934*	*0.7390*	*0.4630*	*0.3470*
	Constant, Linear Tr.	*0.0791*	*0.2160*	*0.1460*	*0.1190*

According to the KPSS test results, GDP6, GDP11 and LGDPCONGR are I (0); KOFAG, GFCF1 and HC are I (1). Since none of our series are integrated at two or more levels, we can test for the existence of co-integration by applying the ARDL boundary test approach to these series.

Three different models were used in the study. According to this, GDP6 is dependent variable in the first model; GDP11 is in the second one and LGDPCONGR is in the third one.

In the first model; It is observed that the most suitable model is ARDL (4,1,2,5) by using Schwarz criterion among 2058 different ARDL models, each one of which has estimated with a maximum of 6 lags for the series. Among the estimated 2058 models, the first 20 models with the lowest Schwarz value are shown in Figure 1 in the Appendix.

The results of the ARDL bound test questioning the co-integration between GDP6 series and KOFAG, GFCF1 and HC series are shown in Table 3. As seen in Table 3., the hypothesis of "*H0: Long-term relationships (co integration) does not exist"* is rejected because F-stat.= 17.70853 value is greater than upper limit critical values (i.e., I(1) Bound) at all significance levels. In other words, this result implies that there is a long-term relationship between growth and globalization [at the same time between growth and the other remaining series GFCF1 (i.e., physical capital) and HC (i.e., human capital)].

Table 3. ARDL Bound Test Estimation Results for Model-1

F-statistic 17.70853	*Critical Values*	
Significance	$I(0)$ *Bound*	$I(1)$ *Bound*
10%	*2.97*	*3.74*
5%	*3.38*	*4.23*
2.5%	*3.8*	*4.68*
1%	*4.3*	*5.23*

As shown in Table 4 below, the long-term coefficient of the KOFAG variable, 0.417831, is statistically significant and this confirms the conclusion of the bound test we have obtained above, "There is a long-term relationship (co-integration)". In other words, there is a long-term positive relationship between growth (GDP6) and globalization (KOFAG). The fact that the short term coefficient of -0.350257 for the KOFAG series is not statistically significant indicates that there is no relation between growth and globalization in the short-term.

The fact that the long-term coefficient of the GFCF1 series is -0.692693 and statistically significant shows that there is a long-term inverse relationship between GDP6 and GFCF1. Moreover, the fact that the long-term coefficient value of 116.851980 of HC series is statistically significant hints that there is a positive relationship between HC and GDP6 series.

Also, the ECM coefficient in Table 5 takes the expected negative value and is statistically significant at 1%.

Table 4. Long Term Coefficients of ARDL (4,1,2,5) Model for Model-1

Dependent Variable: *GDP6*			
Variable	*Coefficient*	*t-Statistic*	*Prob.*
KOFAG	*0.417831*	*3.045715*	*0.0059*
GFCF1	*-0.692693*	*-3.232994*	*0.0038*
HC	*116.851980*	*4.026086*	*0.0006*
@TREND	*-3.154179*	*-4.156584*	*0.0004*

Table 5. Error Correction Estimation (ECM) Results of ARDL (4,1,2,5) Model for Model-1

	Dependent Variable: *GDP6*		
	Coefficient	*t-Statistic*	*Prob.*
$\Delta GDP6_{t-1}$	*-0.110560*	*-1.037383*	*0.3108*
$\Delta GDP6_{t-2}$	*0.016897*	*0.159796*	*0.8745*
$\Delta GDP6_{t-3}$	*0.175418*	*2.546894*	*0.0184*
$\Delta KOFAG$	*-0.350257*	*-1.631837*	*0.1169*
$\Delta GFCF1$	*1.385796*	*8.991593*	*0.0000*
$\Delta GFCF_{t-1}$	*1.216759*	*3.912911*	*0.0007*
ΔHC	*239.874964*	*5.034817*	*0.0000*
ΔHC_{t-1}	*24.189802*	*0.368806*	*0.7158*
ΔHC_{t-2}	*-202.282336*	*-3.184090*	*0.0043*
ΔHC_{t-3}	*-109.403654*	*-1.647565*	*0.1137*
ΔHC_{t-4}	*-283.354827*	*-4.808832*	*0.0001*
C	*-196.175990*	*-10.288586*	*0.0000*
ECM_{t-1}	*-1.400933*	*-10.229434*	*0.0000*

$$ECM = GDP6 - \left(\begin{array}{l} 0.4178 KOFAG - 0.6927 GFCF1 + \\ 116.8520 HC - 3.1542 @TREND \end{array} \right)$$

Diagnostic Tests Results

Diagnostic Tests	Test Value (Prob.)
Breusch-Godfrey Serial Correlation LM Test	*4.6608 (0,0973)**
Heteroskedasticity Test: Breusch-Pagan-Godfrey	*5.5157 (0,9925)**
Ramsey RESET Test	*1.4367 (0.2612)**
Jarque-Bera Test	*4.1763 (0.1239)**

Notes: * The diagnostic test results at %1 significance level indicate that there is no problem in the model in terms of autocorrelation, heteroscedasticity, normality, and model specification error.

After that, Granger causality test was applied with Toda Yamamoto approach to determine the causality relation between the series. It is seen that the maximum integration level (dmax) for the series is 1 because GDP6 is I(0) and KOFAG, GFCF1 and HC series are I(1). Since Schwarz criterion=7.681247 for 1 lag and Schwarz criterion=7.715575 for 2 lags were gathered for unrestricted VAR models, the most suitable lag is 1 according to the Schwarz criterion (i.e., P=1). Then, VAR Granger Causality/Block Exogeneity Wald Test test results are obtained and reported below by estimating the VAR (p=1+dmax=1) model, VAR (2). According to the test results a causality association is identified;

a) at the level of 10% significance from GFCF1 to GDP6,

b) at the level of 10% from GDP6 to GFCF1, at the level of 1% from KOFAG to GFCF1 and at the level of 5% from HC to GFCF1.

Table 6. VAR Granger Causality/Block Exogeneity Wald Tests for Model-1

Dependent Variable: *GDP6*			
Excluded	*Chi-sq*	*df*	*Prob.*
KOFAG	*2.298410*	*2*	*0.3169*
GFCF1	*5.242928*	*2*	*0.0727*
HC	*1.575115*	*2*	*0.4550*
All	*6.918142*	*6*	*0.3285*

Dependent Variable: *KOFAG*			
Excluded	*Chi-sq.*	*df*	*Prob.*
GDP6	*0.071920*	*2*	*0.9647*
GFCF1	*4.443621*	*2*	*0.1084*
HC	*4.269796*	*2*	*0.1183*
All	*16.38732*	*6*	*0.0118*

Dependent Variable: *GFCF1*			
Excluded	*Chi-sq.*	*df*	*Prob.*
GDP6	*4.916918*	*2*	*0.0856*
KOFAG	*10.09671*	*2*	*0.0064*
HC	*9.136768*	*2*	*0.0104*
All	*16.61751*	*6*	*0.0108*

Dependent Variable: *HC*			
Excluded	*Chi-sq.*	*df*	*Prob.*
GDP6	*3.133421*	*2*	*0.2087*
KOFAG	*2.610793*	*2*	*0.2711*
GFCF1	*0.618644*	*2*	*0.7339*
All	*5.578686*	*6*	*0.4720*

In the second model; It is observed that the most suitable model is ARDL (4,1,2,5) by using Schwarz criterion among 2058 different ARDL models estimated with a maximum of 6 lags for each series. Among the estimated 2058 models, the first 20 models with the lowest Schwarz value are displayed in Figure 2 in Appendix.

The results of the bound test questioning co-integration between GDP11 series and KOFAG, GFCF1 and HC series are shown in Table 7. As seen in Table 7, the hypothesis of "*H0: Long-term relationships (co-integration) does not exist*" is rejected because F-stat.= 15.87554 value is greater than upper limit critical values at all significance levels. In other words, this result implies that there is a long-term relationship between growth and globalization (at the same time between growth and the other remaining series GFCF1 (i.e., physical capital) and HC (i.e., human capital)).

Table 7. ARDL Bound Test Estimation Results for Model-2

F-statistic	*Critical Values*	
15.87554		
Significance	$I(0)$ *Bound*	$I(1)$ *Bound*
10%	*2.97*	*3.74*
5%	*3.38*	*4.23*
2.5%	*3.8*	*4.68*
1%	*4.3*	*5.23*

As shown in Table 8 below, the long-term coefficient of the KOFAG variable, 0.464115, is statistically significant and this confirms the conclusion of the bound test we have obtained above, "There is a long-term relationship (co-integration)". In other words, there is a long-term positive relationship between GDP11 and KOFAG. The fact that the short term coefficient of -0.289133 for the KOFAG is not statistically significant indicates that there is no relation between GDP11 and KOFAG in the short-term.

The fact that the long-term coefficient of the GFCF1 series is -0.694211 and statistically significant reveals that there is a long-run reverse relationship between

Table 8. Long Term Coefficients of ARDL (4,1,2,5) Model for Model-2

Dependent Variable: *GDP11*			
Variable	*Coefficient*	*t-Statistic*	*Prob.*
KOFAG	*0.464115*	*3.188909*	*0.0042*
GFCF1	*-0.694211*	*-3.073348*	*0.0056*
HC	*117.908770*	*3.842364*	*0.0009*
@TREND	*-3.203208*	*-3.972958*	*0.0006*

Table 9. Error Correction Estimation (ECM) Results of ARDL (4,1,2,5) Model for Model-2

	Dependent Variable: *GDP11*		
	Coefficient	*t-Statistic*	*Prob.*
$\Delta GDP11_{t-1}$	*-0.115794*	*-1.035871*	*0.3115*
$\Delta GDP11_{t-2}$	*0.013241*	*0.119127*	*0.9063*
$\Delta GDP11_{t-3}$	*0.170790*	*2.365469*	*0.0272*
$\Delta KOFAG$	*-0.289133*	*-1.319822*	*0.2005*
$\Delta GFCF1$	*1.344471*	*8.499741*	*0.0000*
$\Delta GFCF1_{t-1}$	*1.140900*	*3.598525*	*0.0016*
ΔHC	*232.896016*	*4.776259*	*0.0001*
ΔHC_{t-1}	*16.115427*	*0.240636*	*0.8121*
ΔHC_{t-2}	*-197.127397*	*-3.032440*	*0.0061*
ΔHC_{t-3}	*-106.114364*	*-1.562608*	*0.1324*
ΔHC_{t-4}	*-272.593096*	*-4.522350*	*0.0002*
C	*-199.361138*	*-9.739938*	*0.0000*
ECM_{t-1}	*-1.374109*	*-9.685558*	*0.0000*

$$ECM = GDP11 - \begin{pmatrix} 0.4641 KOFAG - 0.6942 GFCF1 + \\ 117.9088 HC - 3.2032 @TREND \end{pmatrix}$$

Diagnostic Tests Results	
Diagnostic Tests	Test Value (Prob.)
Breusch-Godfrey Serial Correlation LM Test	*3.0808 (0,2143)**
Heteroskedasticity Test: Breusch-Pagan-Godfrey	*5.7335 (0,9907)**
Ramsey RESET Test	*1.5111 (0.2448)**
Jarque-Bera Test	*3.9711 (0.1373)**

Notes: * The diagnostic test results at %1 significance level indicate that there is no problem in the model in terms of autocorrelation, heteroscedasticity, normality, and model specification error.

GDP11 and GFCF1. Meanwhile, the fact that the long term coefficient value of 117.908770 of HC series is statistically significant implies that there is a positive association between HC and GDP11.

Moreover, the ECM coefficient in Table 9 takes the expected negative value and is statistically significant at 1%.

After that, Granger causality test was applied with Toda Yamamoto approach to determine the causality relation between the series. It is seen that the maximum integration level for the series is 1 due to the fact that GDP11 is I(0) and KOFAG, GFCF1 and HC series are I(1). Since Schwarz criterion=7.643750 for 1 lag and Schwarz criterion=7.687825 for 2 lags were obtained for unrestricted VAR models, the most suitable lag is 1 according to the Schwarz criterion. Then, VAR Granger Causality/Block Exogeneity Wald test results are gathered and reported below by estimating the VAR (p=1+dmax=1) model, VAR (2). According to the test results;

a) There exists a causality relationship at the significance level of 10% from GFCF1 to GDP11,

b) A causality relationship was found at the significance level of 5% from HC to GFCF1, at the significance level of 1% from KOFAG to GFCF1 and at the significance level of 10 % from GDP11 to GFCF1.

Table 10. VAR Granger Causality/Block Exogeneity Wald Tests for Model-2

Dependent Variable: *GDP11*			
Excluded	*Chi-sq*	*df*	*Prob.*
KOFAG	*2.368009*	*2*	*0.3061*
GFCF1	*4.827445*	*2*	*0.0895*
HC	*1.670406*	*2*	*0.4338*
All	*6.885407*	*6*	*0.3316*

Dependent Variable: *KOFAG*			
Excluded	*Chi-sq.*	*df*	*Prob.*
GDP11	*0.023505*	*2*	*0.9883*
GFCF1	*4.058331*	*2*	*0.1314*
HC	*4.337333*	*2*	*0.1143*
All	*16.31502*	*6*	*0.0122*

Dependent Variable: *GFCF1*			
Excluded	*Chi-sq.*	*df*	*Prob.*
GDP11	*4.895282*	*2*	*0.0865*
KOFAG	*10.11177*	*2*	*0.0064*
HC	*9.067611*	*2*	*0.0107*
All	*16.58919*	*6*	*0.0109*

Dependent Variable: *HC*			
Excluded	*Chi-sq.*	*df*	*Prob.*
GDP11	*3.380548*	*2*	*0.1845*
KOFAG	*2.806921*	*2*	*0.2457*
GFCF1	*0.727458*	*2*	*0.6951*
All	*5.842537*	*6*	*0.4411*

In the third model; It is observed that the most suitable model is ARDL (4,1,2,5) by utilizing Schwarz criterion among 2058 different ARDL models estimated with a maximum of 6 lags for each series. Among the estimated 2058 models, the first 20 models with the lowest Schwarz value are shown in Figure 3 in Appendix.

The results of the bound test questioning of co-integration between LGDPCONGR series and KOFAG, GFCF1 and HC series are shown in Table 11. As seen in Table 11, the hypothesis of "*H0: Long-term relationships (co-integration) does not exist*" is rejected because F-stat.= 16.89994 value is greater than upper limit critical values at all significance levels. In other

words, this result suggests that there is a long-term relationship between growth and globalization (at the same time between growth and the other remaining series GFCF1 (i.e., physical capital) and HC (i.e., human capital)).

As shown in Table 12 below, the long-term coefficient of the KOFAG variable, 0.003914, is statistically significant and this supports the conclusion of the bound test we have obtained above, "There is a long-term relationship (co-integration)". In other words, there is a long-run positive relationship between LGDPCONGR and KOFAG. The fact that the short term coefficient of -0.003650 for the KOFAG series is not statistically significant denotes that there is no relation between LGDPCONGR and KOFAG in the short-term.

Table 11. ARDL Bound Test Estimation Results for Model-3

F-statistic 16.89994	*Critical Values*	
Significance	$I(0)$ *Bound*	$I(1)$ *Bound*
10%	*2.97*	*3.74*
5%	*3.38*	*4.23*
2.5%	*3.8*	*4.68*
1%	*4.3*	*5.23*

The fact that the long-term coefficient of the GFCF1 series is -0.006562 and statistically significant shows that there is a long-term adverse relationship between LGDPCONGR and GFCF1. Meantime, the fact that the long term coefficient of 1.119436 values of HC series is statistically significant implies that there is a positive relationship between HC and LGDPCONGR in the long-term.

Furthermore, the ECM coefficient in Table 13 takes the expected negative value and is statistically significant at 1%.

Table 12. Long Term Coefficients of ARDL (4,1,2,5) Model for Model-3

Dependent Variable: *LGDPCONGR*			
Variable	*Coefficient*	*t-Statistic*	*Prob.*
KOFAG	*0.003914*	*2.881832*	*0.0087*
GFCF1	*-0.006562*	*-3.104875*	*0.0052*
HC	*1.119436*	*3.903057*	*0.0008*
@TREND	*-0.030145*	*-4.026282*	*0.0006*

Table 13. Error Correction Estimation (ECM) Results of ARDL (4,1,2,5) Model for Model-3

	Dependent Variable: *LGDPCONGR*		
	Coefficient	*t-Statistic*	*Prob.*
$\Delta LGDPCONGR_{t-1}$	*-0.099572*	*-0.911076*	*0.3721*
$\Delta LGDPCONGR_{t-2}$	*0.034512*	*0.319664*	*0.7522*
$\Delta LGDPCONGR_{t-3}$	*0.188471*	*2.683043*	*0.0136*
$\Delta KOFAG$	*-0.003650*	*-1.710086*	*0.1013*
$\Delta GFCF1$	*0.013498*	*8.826823*	*0.0000*
$\Delta GFCF1_{t-1}$	*0.011445*	*3.761062*	*0.0011*
ΔHC	*2.311599*	*4.882336*	*0.0001*
ΔHC_{t-1}	*0.256526*	*0.393336*	*0.6979*
ΔHC_{t-2}	*-1.997406*	*-3.160619*	*0.0045*
ΔHC_{t-3}	*-1.020377*	*-1.544458*	*0.1367*
ΔHC_{t-4}	*-2.692069*	*-4.623447*	*0.0001*
C	*-1.870330*	*-10.052551*	*0.0000*
ECM_{t-1}	*-1.395803*	*-9.993163*	*0.0000*

$$ECM = LGDPCONGR - \begin{pmatrix} 0.0039 KOFAG - 0.0066 GFCF1 + \\ 1.1194 HC - 0.0301 @TREND \end{pmatrix}$$

Diagnostic Tests Results

Diagnostic Tests	Test Value (Prob.)
Breusch-Godfrey Serial Correlation LM Test	*5.2260 (0.0733)**
Heteroskedasticity Test: Breusch-Pagan-Godfrey	*5.4841 (0.9928)**
Ramsey RESET Test	*1.6902 (0.2098)**
Jarque-Bera Test	*4.3755 (0.1121)**

Notes: * The diagnostic test results at %1 significance level indicate that there is no problem in the model in terms of autocorrelation, heteroscedasticity, normality, and model specification error.

After that, Granger causality test was applied with Toda Yamamoto approach to determine the causality relation between the series for Model-3. It is seen that the maximum integration level for the series is 1 owing to the fact that LGDPCONGR is I(0) and KOFAG, GFCF1 and HC series are I(1). Since Schwarz criterion=-1.530422 for 1 lag and Schwarz criterion=-1.393301 for 2 lags were obtained for unrestricted VAR models, the most suitable lag is 1 according to the Schwarz criterion. Then, VAR Granger Causality/Block Exogeneity Wald test results are obtained and reported below by estimating the VAR (p=1 + dmax=1) model, VAR (2). According to the test results; a causality relationship was found at the significance level of 5% from HC to GFCF1 and at the significance level of 1% from KOFAG to GFCF1.

Table 14. VAR Granger Causality/Block Exogeneity Wald Tests for Model-3

Dependent Variable: *LDGPCONGR*			
Excluded	*Chi-sq*	*df*	*Prob.*
KOFAG	*2.119818*	*2*	*0.3465*
GFCF1	*4.397737*	*2*	*0.1109*
HC	*1.338970*	*2*	*0.5120*
All	*5.956306*	*6*	*0.4281*

Dependent Variable: *KOFAG*			
Excluded	*Chi-sq.*	*df*	*Prob.*
LGDPCONGR	*0.089651*	*2*	*0.9562*
GFCF1	*4.396134*	*2*	*0.1110*
HC	*4.261749*	*2*	*0.1187*
All	*15.74344*	*6*	*0.0152*

Dependent Variable: *GFCF1*			
Excluded	*Chi-sq.*	*df*	*Prob.*
LGDPCONGR	*4.181493*	*2*	*0.1236*
KOFAG	*9.681470*	*2*	*0.0079*
HC	*8.427767*	*2*	*0.0148*
All	*15.28414*	*6*	*0.0182*

Dependent Variable: *HC*			
Excluded	*Chi-sq.*	*df*	*Prob.*
LGDPCONGR	*2.806051*	*2*	*0.2459*
KOFAG	*2.648567*	*2*	*0.2660*
GFCF1	*0.457940*	*2*	*0.7954*
All	*5.628211*	*6*	*0.4661*

Conclusion

In this study, short and long-term possible relationships between globalization and economic growth in Turkey for 1970-2013 were investigated. In this context, three models for three different growth indicators were established.

In the first model, GDP6 (GDP growth, annual %) was selected as a dependent variable and the relationship between GFCF1 (% of GDP), KOFAG (KOF overall globalization index) and HC (human capital index) independent variables was tested. The empirical findings for Model-1, in which GDP6 is used as a dependent variable, suggest that KOFAG and HC increase GDP6 and GFCF1 decreases GDP6 in the long term. In the short term, no significant relationship between KOFAG and GDP6 has been found. According to the results of the causality test applied for Model-1, causality relations were found; at 10% significance level from GFCF1 to GDP6, at 10% significance level from GDP6 to GFCF1, at 5% significance level from HC to GFCF1, and at 1% significance level from KOFAG to GFCF1.

The empirical findings for Model-2, in which GDP11 is utilized as a dependent variable and GFCF1, KOFAG and HC are independent variables, suggest that KOFAG and HC increase GDP11 and GFCF1 decreases GDP11 in the long term. In the short term, no significant relationship between KOFAG and GDP11 has been found. According to the results of the causality test applied for Model-2, we identified a causality association; at 10% significance level from GFCF1 to GDP11, at 10% significance level from GDP11 to GFCF1, at 1% significance level from KOFAG to GFCF1, and at 5% significance level from HC to GFCF1.

The empirical findings for Model-3, in which LGDPCONGR is used as a dependent variable and GFCF1, KOFAG and HC are independent variables, reveal that KOFAG and HC increase LGDPCONGR and GFCF1 decreases LGDPCONGR in the long term. In the short term, no significant relationship between KOFAG and LGDPCONGR has been found. According to the results of the causality test applied for Model-3, there is a causality relation; at 1% significance level from KOFAG to GFCF1, and at 5% significance level from HC to GFCF1.

As a result, after the analyzes made for three different models using three different growth indicators; we identified that there is a long-term significant association between globalization and growth in each of the three models, but it was found that there was no significant relationship between the two variables in the short term. Also, there was no causality relationship between growth and globalization in regard to the causality tests results obtained for the three models.

References

Chang, C.P., Lee, C. C., Hsieh, M.C. (2011). Globalization, Real Output and Multiple Structural Breaks, *Global Economic Review*, 40(4), 421-444.

Chang, C.P., Berdiev, A.N., Lee, C.C. (2013). Energy Exports, Globalization and Economic Growth: The Case of South Caucasus, *Economic Modelling*, 33, 333-346.

Doğan, B., Can, M. (2016). Küreselleşmenin Büyümeye Etkisi: Güney Kore Örnekleminde Eş-bütünleşme Analizi, *Çankırı Karatekin Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 6(1), 1-24.

Dollar, D. (1992). Outward – Oriented Developing Economies Really Do Grow More Rapidly Evidence from 95LCDs: 1976-1985, *Economic Development and Culturel Change*, 40(3), 523-544.

Dreher, A. (2006). Does Globalization Affect Growth? Evidence From A New Index of Globalization, *Applied Econımics*, 38(10), 1091-1110.

Gurgul, H., Lach, L. (2014). Globalization and Economic Growth: Evidence From Two Decedes of Transition in CEE, *Economing Modelling*, 36, 99-107.

Hayaloğlu, P., Kalaycı, C., Artan, S. (2015). Küreselleşme Farklı Gelir Grubundaki Ülkelerde Ekonomik Büyümeyi Nasıl Etkilemektedir?, *Osmangazi Üniversitesi İİBF Dergisi*, 10(1), 119-152.

Leitao, N. C. (2012). Economic Growth, Globalization and Trade, *Management Research and Practise*, 4(3), 18-24.

Lucas, R. E. Jr. (1988). On the Mechanics of Economic Development, *Journal of Monetary Economics*, 22(1), 3-42.

Marginean, S., Orastean, R. (2011). Globalization and Economic Crises in European Countries, *International Journal of Economics and Finance Studies,* 3(1), 209-218.

Mutascu, M., Fleischer, A. (2011). Economic Growth and Globalization in Romania, *World Applied Sciences Journal*, 12(10), 1691-1697.

Osterloh, S. (2012). Words Speak Louder Than Actions: The Impact of Politics on Economic Performans, *Journal of Comparative Economics*, 40(3), 318-336.

Peseran, M. H., Shin, Y., Smith, R. J. (2001). Bounds Testing Approaches to the Analysis of Level Relationship. *Journal of Applied Econometrics*, *16(3)*, 289-326.

Potrafke, N. (2010). Political Cycles And Economic Performance İn OECD Countries: Empirical Evidence From 1951-2006, *Public Choise*, 150(1-2), 155-179.

Rao, B. B., Vadlamannati, K. C. (2011). Globalization and Growth in the Low Income African Countries with Extreme Bounds Analysis, *Economic Modelling*, 28(3), 795-805.

Rivera Batiz, L. A., Romer, P. M. (1990). Economic Integration and Endogenous Growth (Working Paper No: 3528), *The National Bureau of Economic Research*, http://www.nber.org/papers/w3528.pdf

Samimi, P., Jenatabadi, H.S. (2014). Globalization and Economic Growth: Empirical Evidence on the Role of Complementarities, *Globalization and Economic Growth*, 9(4), 1-7.

Sarıkaya, M. (2014). *Sosyal Küreselleşme ve Büyüme Üzerine Etkisi*, Yayınlanmamış Yüksek Lisans Tezi, Mustafa Kemal Üniversitesi Sosyal Bilimler Enstitüsü, Hatay.

Villaverde, J., Maza, A. (2011). Globalization, Growth and Convergence, *World Economy*, 34(6), 952-971.

Yay, T. (2009). Küreselleşme Karşısında Piyasa ve Devlet, *Ekonomi Bilimleri Dergisi*, 1(1), 1-11.

Appendix

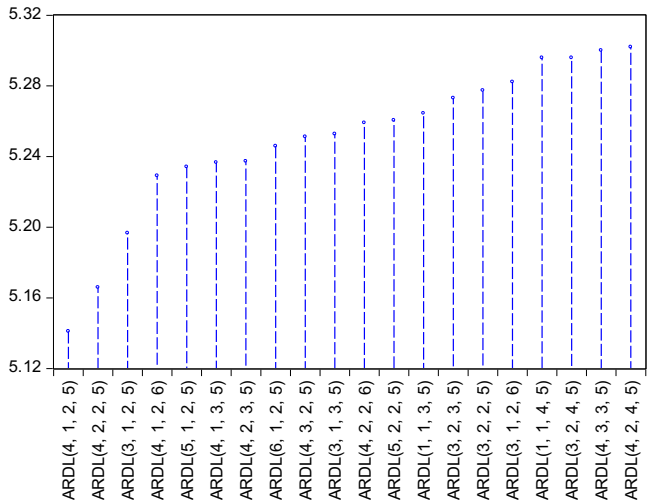

Figure 1. Schwarz Criteria (top 20 models) for Model-1

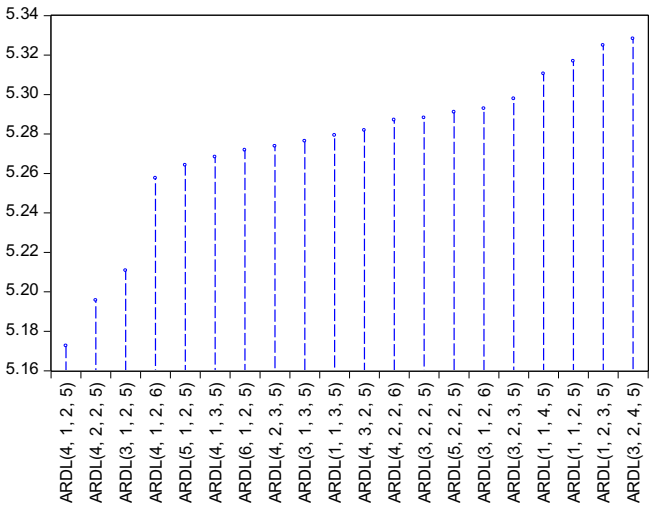

Figure 2. Schwarz Criteria (top 20 models) for Model-2

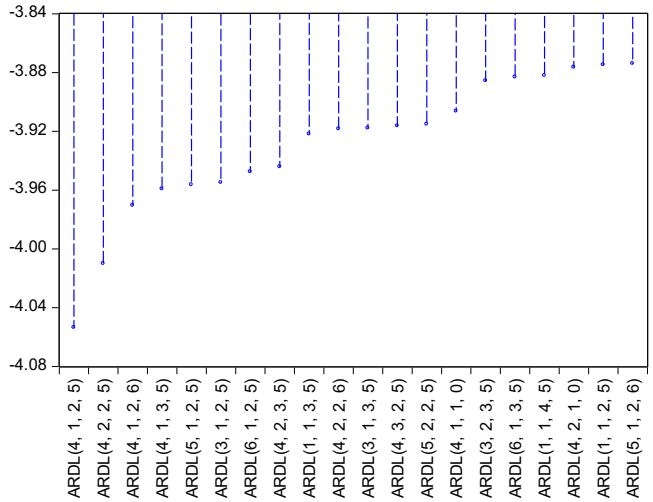

Figure 3. Schwarz Criteria (top 20 models) for Model-3