Is there a long-run association between globalization and productivity: The case of Turkey

By Yüksel OKŞAK [†]

Abstract. This study examines short and long-run association between globalization and productivity by using a time series sample of Turkey covering the years from 1970 to 2014. Firstly, I check the stationarity status of the series and following that I conduct a cointegration analysis among series in the framework of ARDL boundary test technique. After that, both short-run and long-run coefficients are gathered by using error corrected form of ARDL Model. In addition to that, I provide the results for diagnostic check of the model. Eventually, a causality test is applied to see if there is a causal relationship between the series. According to the findings, globalization and productivity series are cointegrated and it is found that there is a long-run significant positive impact of globalization on productivity while this figure is negative for short-run. Moreover the test results for causality test imply that there exists just one unidirectional causality running from globalization to productivity.

Keywords. Globalization, Productivity, Co-integration, Stationarity, ARDL Model.

JEL. C32, F61, O47.

1. Introduction

Globalization, as captured by openness to goods and services international flows, has been a salient characteristic of the world economy since the 1980s. While the recent 2008 great depression has certainly slowed down this integration process, it has not led to questioning liberalization as a valid tool to trigger prosperity and progress. Yet it is now widely admitted that globalization may not be always beneficial for any country at any moment (Boucekkine, 2016).

While some of the findings of globalization-academic studies in academic writing speak of the positive effects of globalization on the economy, while others show some adverse effects. However, in general, the view that globalization has left a negative impact on the country's economies is gaining importance.

While defining the globalization, it has been observed that in some studies the social or political evaluation is the foreground in some studies, and in some studies it is evaluated from the economic perspective. (Adda, 2013) defines globalization as the abolition of obstacles in front of the capital, Steger (2003) defines world societies as the integration of each other in the process with increased exchange.

When the definitions with different tendencies are examined, it is seen that the common points are the cultural and economic integration of different societies in the world. Economic globalization, the growing role of international institutions, and the production and production by multinational corporations, is a deeper integration and interaction with the economy of trade. The globalization of the economy is due to market economy, supply and demand, and therefore production and consumption gain a cross border dimension. It is expected that the workforce will also interact due to the increasing economic globalization (Okşak & Koyuncu,

[a†] Bilecik Şeyh Edebali University, Pazaryeri Vocational School, Bilecik, Turkey.

☎ . +90 (228) 214 1740

✉ . yuksel.oksak@bilecik.edu.tr

2017). Mastromarco & Simar, (2018) examine on their papers whether the countries that pursue outward orientation policies and that are increasingly economically integrated with the rest of the world have an increase in economic performance. They also emphasize that increasing globalization and interconnection among countries will result in spatial and temporal dependence that each country will influence the production process.

On the other hand (Koyuncu & Ünver, 2017) emphasizes that the level of globalization of an individual country may be the determinant of the degree of corruption in the country. On the other hand (Koyuncu & Ünver, 2017) emphasizes that the level of globalization of an individual country may be the determinant of the degree of corruption in the country.

In the modern era of globalization, information and communication technology (ICT) are considered key sectors that profoundly contribute to economic growth. Most of the economic activities, trade, and foreign direct investment are mainly dependent on modern sources of ICT (Latif *et al.,* 2018).

Globalization in production; the increase of transportation and communication facilities due to the developing technology and the production factors in the different geographies of the world through the transnational working enterprises (mostly multinational companies), the transfer of the production factor to the region where the production factor is located or the production factors in the different geographies of the world the establishment of the production mechanism in these regions to operate. Consequently, businesses that operate on a global scale with the aim of achieving such a benefit, in which costs are lowered and productivity is increased, also accelerate the globalization process.

According to Lee & Narjoko (2015) effects of globalization on firms' productivity can also be indirect via technological spillovers. These are indirect technological transfers from one firm (exporter and/or foreign-owned) to other firms in the domestic market. They also emphasize that the overall evidence is slightly tilted toward a positive correlation between exporting/FDI with firm-level productivity levels.

In the following sections of the study, the literature will be discussed briefly in terms of globalization and productivity first, and empirical studies on the short and long-run association between globalization and productivity will be given in this section. Then, data and methodology will be explained and the data, model and methodology used in the analysis will be explained. Then the results of the estimation will be reported and discussed. The final part will be included in the result section. According to the study's empirical results, globalization reduces productivity in the short term and increase productivity in the long term in Turkey.

2. Literature review

The recent macroeconomic literature has become interested in studying the impact that the steady process of globalization of the world economies over the past three decades may have had on macroeconomic dynamics in single countries. Various studies have argued that globalization may have made domestic variables, such as real output and inflation, potentially more responsive to global indicators than to local developments (Milani & Park, 2015).

Recent empirical studies which utilize plant- or establishment-level data to examine globalization's impact on productivity have discovered many causal mechanisms involved in globalization's impact on firms' productivity. Because these pathways have been broad, there have been few attempts to summarize the several and detailed mechanisms of self-selection and learning at the same time (Kimura, 2010).

Finally when we examine the literature in general; it can be said that empirical studies concentrate on the impact of globalization on macroeconomic variables such as economic growth, financial development and inflation.

2.1. Brief literature review on globalization

Table 1. *Brief Literature Summary on Globalization*

Author	Period / Countries	Empirical Results
Kim *et al.,* (2018)	1980-2011 53 developed and developing countries	Globalization reduces government size and debt, government size is found to increase with trade openness but decreases with financial, social and political globalization, government debt increases with financial and trade openness but decreases with social and political globalization.
Koyuncu & Sarıtaş (2017)	1970-2013	Conducting causality test for three models, no causality relationship between growth and globalization was identified
Shahbaz *et al.,* (2018)	1970 – 2014 25 developed economies	The empirical results reveal that, for most countries, globalization increases energy consumption.
Lee, & Narjoko, (2015)	ASEAN countries	Globalization via trade and foreign direct investment should continue to be important development strategies. A more nuanced approach focusing on exporters and potential exporters, especially SMEs, are likely to be needed.
Okşak & Koyuncu, (2017)	1990-2014 101 countries	Estimation results imply that there is a positive statistically significant relationship between economic globalization, social globalization, overall globalization and female labor force participation
Chang *et al.,* (2011)	1970-2006 G7 Countries	Positive relationship between globalization and growth.
Latif *et al.,* (2018)	2000-2010 BRICS Economies	The long-run elasticities between ICT and economic growth, which suggests that ICT positively contributes to economic growth. Findings from long-run output elasticities show that both FDI and globalization have a long-run effect on economic growth.
Berdiev & Saunoris (2017)	119 countries	The results suggest that globalisation is a useful tool in combating shadow activities.
Cooray *et al.,* (2012)	80 developing countries	Foreign direct investment and trade have a negative impact on female labor force participation. While the impact is of negligible economic size, it is stronger for younger cohorts, potentially reflecting a higher incentive to stay out of the labor force and invest in education in view of an increased skill premium due to globalization.
Koyuncu, & Ünver (2017)	2002-2012 African countries	Results imply that over all globalization, economic globalization, and social globalization reduce corrupt activities in an economy
Chang & Lee (2011)	1990-2006 OECD and Transition Countries	Positive relationship between general, economic, social, political globalization and growth.
Osterloh (2012)	1971-2004 OECD Countries	Negative relation between growth and general globalization.

2.2. Brief Literature Review on Productivity

Table 2. *Brief Literature Summary on Productivity*

Author	Period / Countries	Empirical Results
Koyuncu & İşcan (2016)	2000-2013 51 countries	The main finding of the study reveals a strong and statistically significant negative association between unionization rate and labor productivity and this finding remains valid in all models
Mastromarco & Simar (2018)	1970-2007 44 countries	Productivity analysis recognizes the importance of considering the spillover effects of global shocks and business cycles due to increasing globalization and interconnection among countries.
Cincera & Ravet (2014)	2009 Top 1,000 R&D-active firms in the EU-27 and the top 1,000 outside the EU-27.	The results indicate a positive impact from globalization on firms' R&D productivity, especially in the US, while a negative impact for industrial diversification is found.

Koyuncu & Yılmaz (2010)	1994-2006 64 countries	Statistically significant, positive relationship is found between the country's imports from China and labor productivity.
Bussmann (2009)	1970-2000 134 countries	Found that the trade deficit positively affects female employment in developing countries and negatively affects OECD countries.
Koyuncu & İşcan (2017)	2000-2013 157 countries	A strong and statistically significant positive association between intelligence and labor productivity level.
Pradeep et al., (2017)	1994-2008 1000 Indian manufacturing firms	Findings indicate that foreign presence has a significant positive spillover effect on the productivity of Indian manufacturing firms when compared to alternative spillovers from R&D and export initiatives
Koyuncu, & Yılmaz (2018)	1989-2008 19 transition economies	A statistically significant positive correlation between privatization and labor productivity.
Basile & Benedictis (2007)	1995-2001 10 countries, 129 sample	Gives evidence of a nonlinear relationship between productivity and regional unemployment in Europe.
Koyuncu, Yılmaz & Ünver (2016)	185-2010 110 countries	The results suggest that female labor force participation increases labor productivity
Kim & Lim (2010)	1985-2003	Find that productivity-enhancing technology shocks reduce hours worked in the short run.
Yıldırım et al., (2009)	1997-2006 111 countries	Results indicate that there is statistically significant negative relationship between temperature and labor productivity
Rena et al., (2009)	1995-2002 9 South African Agricultural Commodities	Analysis confirm that export shares and capital formation were found to be positive and significant; whereas, import shares and real exchange rate were found to be related negatively.
Koyuncu, Yılmaz & Yıldırım (2017)	2000-2013 162 countries	A positive correlation between internet penetration and productivity.

3. Data and methodology

In the study, I investigate short and long term relationship between globalization and productivity with a sample of Turkey for the period of 1970-2014. Globalization variable (GLOB) is overall globalization index of KOF globalization index and gathered from Zurich Technology Institute. Productivity variable is in terms of per capita and computed by dividing Gross value added at factor cost (current US$) to total population and related data is collected from WDI. The logarithmic value of the per capita productivity (LOGPCPROD) is used in analyses.

Time series may move together in long-run and in order to identify this type of long term association among series cointegration analysis is utilized. In the literature there are several cointegration test procedure. In the study, I adopt ARDL Boundary Test Approach to reveal the long-run relationship among the series since ARDL Boundary Test Approach does not require that series must be integrated order one (i.e., I(1)) unless they are integrated order two or higher.

The model utilized for ARDL boundary test is as follows:

$$\Delta LOGPCPROD_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta LOGPCPROD_{t-i} + \sum_{i=0}^{q} \alpha_i \Delta GLOB_{t-i} + \theta_0 LOGPCPROD_{t-1} + \theta_1 GLOB_{t-1} + \varepsilon_t$$

While θ_0 and θ_1 terms show the coefficients of long-term relationship between the series; β_i and α_i terms show the coefficients of short-term relationship between the series. Δ is first degree difference operator, β_0 is constant term of the model, and ε_t is white noise error term of the model.

In the context of ARDL Boundary Test Approach the null hypothesis is $H_0: \theta_0 = \theta_1 = 0$, which claims that there is no long-term relationship (co-integration) between GLOB and LOGPCPROD variables; while the alternative hypothesis is $H_1: \theta_0 \neq \theta_1 \neq 0$, which assert that there is a long term relationship (co-integration) between GLOB and LOGPCPROD variables. In this test, F-statistic value is compared with upper and lower boundary values. If the F-statistic value exceeds the upper limit, H_1 is accepted; if F-statistic value is smaller than lower limit then H_0 hypothesis is accepted. On the other hand we are in indecisive region if F-statistic falls in the region between the lower and upper boundary values.

Next, the error correction model is estimated in order to get short and long term coefficients. The error correction model established in this context as follows:

$$LOGPCPROD_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta LOGPCPROD_{t-i} + \sum_{i=0}^{q} \alpha_i \Delta GLOB_{t-i} + \varphi ECM_{t-1} + \varepsilon_t$$

In equations above, β_i and α_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 balance after a shock occurred in short-term. The speed of adjustment term should be negative and statistically significant.

Finally, VAR Granger Causality/Block Exogeneity Wald Test in the sense of Toda-Yamamoto approach is conducted in order to disclose the possible causality relationship between GLOB and LOGPCPROD variables. Toda-Yamamoto approach firstly requires determining the maximum integration level (i.e., dmax) of series. Secondly, by setting an unrestricted VAR model at levels and utilizing one of the model selection criteria, the optimal lag length (i.e. P) is determined. Thirdly, VAR (P+dmax) model is estimated under the assumption that the most appropriate model is VAR (P). After that, this predicted VAR (P+dmax) model is tested with the VAR Granger Causality/Block Exogeneity Wald Test to reveal any sort of causality relationship.

4. Empirical results

The Augmented Dickey-Fuller (ADF) stationarity test is used to find out the stationary status of the series. While the null hypothesis of the ADF test claims that the series are non-stationary, the alternative hypothesis asserts that the series are stationary. The results of the ADF test for the level and first difference values of the series are reported in Table 3 below.

Table 3. *ADF Unit Root Test Results*

Variable	Model	Test Statistic(P-value)
GLOB	None	3.247034 (0.9995)
	Constant	-0.374559 (0.9046)
	Constant, Linear Tr.	-1.814871 (0.6805)
Δ GLOB	None	-5.237856 (0.0000)
	Constant	-6.587767 (0.0000)
	Constant, Linear Tr.	-6.508581 (0.0000)
LOGPCPROD	None	2.795125 (0.9983)
	Constant	-1.066010 (0.7208)
	Constant, Linear Tr.	-2.517725 (0.3186)
Δ LOGPCPROD	None	-5.576387 (0.0000)
	Constant	-6.655132 (0.0000)
	Constant, Linear Tr.	-6.636904 (0.0000)

As seen from Table 1, the both variables are I (1). Since none of the series are integrated at two or higher degree, I can use ARDL boundary test approach to test co-integrating relationship. Next I used Schwarz criterion to determine the optimal leg length of the model. Figure 1 below indicates that the best model is ARDL (1,1) out of all possible combinations.
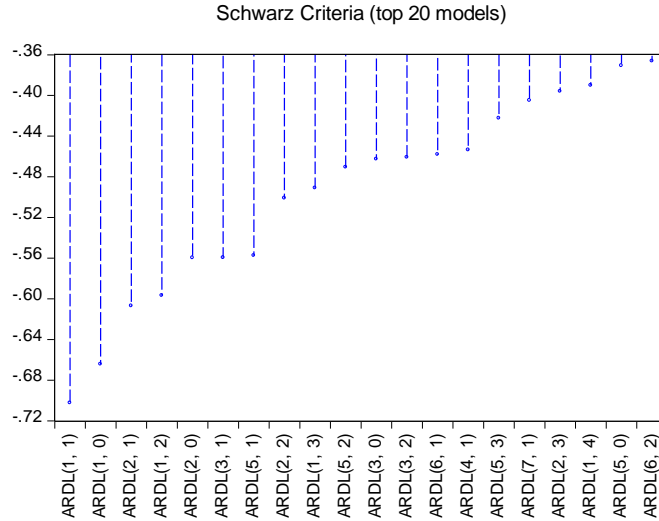
Figure 1. *Optimal Lag Length Selection*

The results of the ARDL bound test investigating long-run association between GLOB and LOGPCPROD variables are given in Table 4. As seen from Table 4., since the computed F-statistic value is higher than upper bound critical values et al.,significance level, there exists a long-run association between the series. In other words, GLOB and LOGPCPROD variables are co-integrated.

Table 4. *ARDL Bound Test Estimation Results*

F-statistic	6.234540	Critical Values	
Significance		$I(0)$ Bound	$I(1)$ Bound
10%		3.02	3.51
5%		3.62	4.16
2.5%		4.18	4.79
1%		4.94	5.58

As seen from Table 5, the long-run coefficient of GLOB variable is positive and statistically significant and this finding is parallel to the conclusion of the bound test. Also, as in Table 5, short term coefficient of GLOB variable is negative and statistically significant. Therefore globalization negatively affects productivity in short-run but positively in long-run in Turkey.

Table 5. *Long Term Coefficients Of ARDL (1,1) Model*

Dependent Variable: LOGPCPROD			
Variable	Coefficient	t-statistic	Prob.
GLOB	0.049776	4.468212	0.0001
Constant	5.955158	8.067573	0.0000

The ECM coefficient in Table 6 takes the expected negative value and is statistically significant at 1% significance level. Diagnostic test results imply that there exists no problem in the model in terms of autocorrelation, heteroscedasticity, normality, and model specification error at 1% significance level.

Table 6. *Error Correction Estimation (ECM) Results of ARDL (1,1) Model*

Dependent Variable: LOGPCPROD			
	Coefficient	*t-Statistic*	*Prob.*
$\Delta GLOB$	-0.024070	-1.965859	0.0563
ECM_{t-1}	-0.139467	-4.431569	0.0001
ECM = LOGPCPROD - (0.0498*GLOB + 5.9552)			

Diagnostic Tests Results	
Diagnostic Tests	Test Value (P-value)
Breusch-Godfrey Serial Correlation LM Test	*0.102909 (0.7484)*
Heteroskedasticity Test: Breusch-Pagan-Godfrey	*1.306958 (0.7275)*
Ramsey RESET Test	*2.69E-05 (0.9959)*
Jarque-Bera Test	*7.409984 (0.0246)*

Lastly, Granger causality test is applied in the context of Toda Yamamoto approach to determine the causality relation GLOB and LOGPCPROD variables. The maximum integration level (dmax) for the series is 1 since both series are I(1) as a result of unit root tests. Due to the fact that Schwarz criterion=3.288167 for one lag and Schwarz criterion=3.549136 for two lags are obtained for unrestricted VAR models, the optimal lag length is one (i.e., P=1) based upon Schwarz criterion. After that, VAR Granger Causality/Block Exogeneity Wald Test results are gathered and displayed in Table 7 by estimating the VAR (p=1+dmax=1) model, VAR (2).

Table 7. *VAR Granger Causality/Block Exogeneity Wald Test Results*

Dependent Variable: LOGPCPROD			
Excluded	*Chi-sq*	*df*	*Prob.*
GLOB	6.023731	2	0.0492
All	6.023731	2	0.0492
Dependent Variable: *GLOB*			
Excluded	*Chi-sq.*	*df*	*Prob.*
LOGPCPROD	2.614900	2	0.2705
All	2.614900	2	0.2705

As indicated by Table 7, there is a unidirectional causality relationship between two series running from globalization to productivity.

5. Conclusion

Globalization level of a country may have influence on productivity level in that particular country. Therefore, in this study, I analyze both short and long-run possible relationships between globalization and productivity in Turkey by using a time series containing the years of 1970-2014. As productivity indicator I utilize the per capita gross value added measured in terms of current USD. According to ARDL boundary test result, it is seen that globalization and productivity move together in the long-run in Turkey and thus they are co-integrated. Meanwhile I identified that globalization has a reducing impact on productivity in short-run but it increases productivity in long-run. Hence globalization deteriorates productivity in short term whereas it enhances productivity in long term in Turkey. With regard to causality association, causality test results reveal that there is only one statistically significant causality relationship between GLOB and LOGPCPROD variables, which runs from globalization to productivity.

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