Cointegration and causality analysis of globalization and exports for Turkey

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Abstract. As the degree of globalization of a country increases, the volume of external trade (i.e., exports and imports) of that country rises as well. In order to check the validity of this association, in this study I investigate cointegrating and causality relationship between globalization and exports in Turkey by using a time series sample containing period of 1970- 2014. In the analysis stage I firstly check if the series are stationarity or not and after that I perform ARDL boundary test to find out whether series of globalization and exports have a long run association. Following the cointegration test, I estimate both short and long run coefficients of the variables by utilizing an error corrected form of ARDL Model. Finally, I conduct a causality test to see the existence and direction of causality among variables. Empirical estimation results hint that series of globalization and exports are cointegrated and therefore they move together in long run. Also a long run but not a short run relationship between the series is identified. As to causality results, it is found that there is a unidirectional causality running from exports to globalization.

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

JEL. C32, O47, F62.

1. Introduction

The term globalization was not widely used in academic and public discussion until the early 1990s. By the end of the decade there were countless articles and books on globalization. Although it has many dimensions and the theories of globalization have long historical trajectories, the locus of globalization is the change in the world economy over the past two or three decades (Kaya, 2010). Addressing globalization, at least in terms of international economic development during the last decades, cannot be conceived without taking into account the crucial relationship between this phenomenon and international trade (Litvin & Dobrovolschi, 2013).

The globalization of the economy is due to market economy, supply and demand, and therefore production and consumption gain a cross border dimension (Koyuncu, & Okşak, 2017).

The economic aspect of globalization also influenced the division of labor among countries. As it is known, specialization in different production areas of different countries and leaving to the division of labor left a positive impact on the return they provide. However, considering today's world, it is almost impossible to find the only country that does not make foreign trade on the world; we see that some of the countries have brought the group of high-income developed countries to the water, others are developing or underdeveloped countries. From this, we also realize that foreign trade does not provide the same rate of return for all countries.

Commercial globalization is a phenomenon that is characterized by the following: financial globalization refers to the increase and intensity of financial capital movements in the international arena. The globalization of production can

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be explained by the fact that different sub-units belonging to the production process are realized in different countries through multinational enterprises.

According to Gözgör & Can (2017), globalization has diverse outcomes on economic and financial parameters that can significantly affect the economic growth and the export basket, particularly in the low- and the middle-income economies. The most important reason for this comes from the handling of globalization. The emergence of differences is quite natural, because the components of globalization are complicated, i.e. globalization has economic, social and political aspects. Although all country groups, particularly developing and developed ones, have bereted from the contribution of economic globalization to economic growth, they have also faced the adverse effects of globalization from time to time.

In this study I investigate cointegrating and causality relationship between globalization and exports in Turkey by using a time series sample containing period of 1970- 2014. Empirical estimation results hint that series of globalization and exports are cointegrated and therefore they move together in long run. Also a long run but not a short run relationship between the series is identified. As to causality results, it is found that there is a unidirectional causality running from exports to globalization.

In the following sections of the study, the literature will be discussed briefly in terms of globalization, exports and external trade first and then I check if the series are stationarity or not and after that I perform ARDL boundary test to find out whether series of globalization and exports have a long run association. Following the cointegration test, I estimate both short and long run coefficients of the variables by utilizing an error corrected form of ARDL Model. Finally, I conduct a causality test to see the existence and direction of causality among variables. Then the results of the estimation will be reported and discussed. The final part will be included in the result section.

2. Literature Review

Table 1. *Literature Review*

Author	Period / Countries	Empirical Results
Litvin & Dobrovolschi (2013)	2003-2011 6 different region	Continuous development of the globalization process influenced and determined considerably global foreign trade performance, the absolute value of which increased significantly.
Koyuncu, & Ünver (2017)	2002-2012 African countries	Results imply that over all globalization, economic globalization, and social globalization reduce corrupt activities in an economy
Koyuncu, & Yılmaz (2015)	1989-2008 25 transition economies	Identified a positive correlation between privatization and exports
Angels *et al.,* (2011)	Pre-liberalization (1974-1991) Post-liberalization (1991-2009) Annual Reports, Yearbooks etc.	The liberalization and globalization had a well-defined impact on the turmeric export and this gives a positive signal.
Koyuncu, & Koyuncu (2017)	1989-2015 79 countries	Multivariate estimation results imply that there is a positive statistically significant association between components of ICT (ie internet, cellular phone, and fixed broadband) and export and import.
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
Barghandan *et al.,* (2011)	1974-2007 İMF, UN Data etc.	Used Autoregressive Distributed Lag Method (ARDL). The results showed that domestic production of caviar have significant and positive effects on its export with globalization.
Koyuncu, &	1994-2006	Report evidence that increases in the share of one country's

Yılmaz (2010)	Random effect regressions and data	imports from China is associated with higher Human Development Index and higher per capita GNP (both indicators of poverty).
Shahreki *et al.,* (2013)	1976-2011 Annual Reports, Yearbooks, İMF, UN Data etc.	Studied the globalization effect on the export of Persian carpet. The results showed that the income of importing countries, domestic production and real exchange rate have positive and significance effects on the export of Persian carpet.
Koyuncu & Yılmaz (2010)	1994-2006 64 countries	Positive relationship is found between the country's imports from China and labor productivity.
Gözgör & Can (2017)	1970-2010 139 countries	Observe that diversification of exports and economic globalization arepositively related with economic growth merely in the upper middle economies
Koyuncu, & Ünver (2018)	1960-2017 Turkey	The empirical results suggest that there is a co-integrating relationship between two series and also imports is positively and significantly related to economic growth in both short-term and long-term.
Kaya (2010)	1980-2003 64 developing countries	The results generally show that manufacturing employment increased with globalization impact in most developing countries. Second, economic globalization also influences manufacturing employment in developing countries, but mainly through trade.
Koyuncu, & Ünver (2018)	1960-2017 relationship between exports of goods and services and gross capital formation in Turkey	Empirical estimation results show that there is no a bidirectional relationship running from exports of goods and services to gross capital formation and from gross capital formation to exports of goods and services.
Sanderson & Kentor (2009)	1970-2000 less-developed countries FDI Datas and etc.	Along with globalization, foreign direct investment has an important, different effect among the sectors of the economy.
Koyuncu & Sarıtaş (2017)	1970-2013	Conducting causality test for three models, no causality relationship between growth and globalization was identified
Koyuncu, & Süyen (2018)	1980-2016 104 countries	Pointed out that the increase in portfolio investments is an increasing effect on the private investments
Maqsood (2014)	1990-2010 South Asian countries	Observed that globalization has boosted female employment and globalization has been found to reduce women's employment.

3. Data and Methodology

This study aims to reveal short and long term relationship between globalization and exports and any sort of causality association among them by using 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. Exports variable is exports of goods and services in terms of current US$ and it is gathered from WDI. I use the logarithmic value of exports (LOGEXPORT) in analyses. Even though in the literature there exists alternative cointegration tests for time series, in the study, I opt to chose ARDL boundary test method since ARDL boundary test, unlike its alternatives, does not require thet al., series must be integrated order one as long as they are not integrated order two or higher.

For ARDL boundary test I estimate the following model:

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

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 method 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 LOGEXPORT 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 LOGEXPORT 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, I estimate an error correction model to find both short and long run coefficients of variables by utilizing the following model:

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

In equations above, β_i and α_i terms refer to the dynamic coefficients that bring the model to the balance in long run; 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, by using VAR Granger Causality/Block Exogeneity Wald Test in the framework of Toda-Yamamoto approach I conduct a causality test to show the possible causality relationship between GLOB and LOGEXPORT 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 disclose any sort of causality relationship.

4. Empirical Results

The Phillips-Perron (PP) stationarity test is used to find out the stationary status of the series. While the null hypothesis of the PP test claims that the series are non-stationary, the alternative hypothesis asserts that the series are stationary. The results of the PP Unit Root Test for the level and first difference values of the series are reported in Table 1 below.

Table 2. *PP Unit Root Test Results*

Variable	Model	Test Statistic(P-value)
GLOB	None	3.211144 (0.9995)
	Constant	-0.369836 (0.9054)
	Constant, Linear Tr.	-1.960445 (0.6061)
$\Delta GLOB$	None	-5.443697 (0.0000)
	Constant	-6.587850 (0.0000)
	Constant, Linear Tr.	-6.508527 (0.0000)
LOGEXPORT	None	5.891032 (1.0000)
	Constant	-2.153158 (0.2258)
	Constant, Linear Tr.	-2.296069 (0.4272)
Δ LOGEXPORT	None	-3.762714 (0.0004)
	Constant	-6.091193 (0.0000)
	Constant, Linear Tr.	-6.459991 (0.0000)

As seen from Table 1, both GLOB and LOGEXPORT variables are I (1). Since none of the series are integrated at two or higher degree, ARDL boundary test approach can be used 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 (1,0) out of all possible combinations.
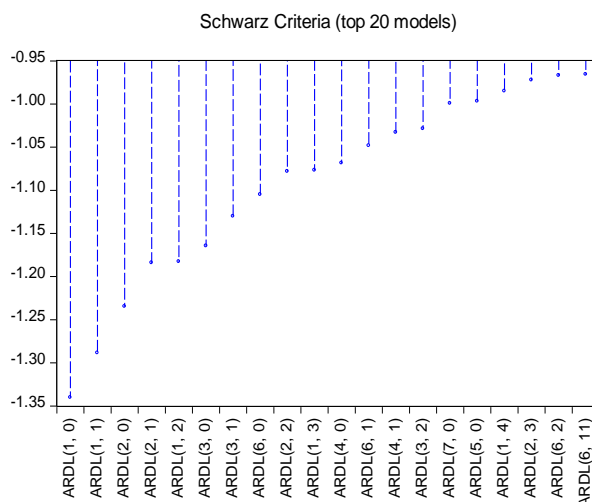
Figure 1. *Optimal Lag Length Selection*

The results of the ARDL bound test investigating long-run association between GLOB and LOGEXPORT variables are given in Table 2. As seen from Table 2., since the computed F-statistic value is higher than upper bound critical values et al., significance level, there exists a long-run association between two series.

Table 3. *ARDL Bound Test Estimation Results*

F-statistic	16.93546	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 3, the long-run coefficient of GLOB variable is positive and statistically significant and this finding is parallel to the conclusion of ARDL bound test. On the other hand, as in Table 4, short term coefficient of GLOB variable is negative and statistically insignificant. Therefore globalization has just long run impact on exports and its influence is positive in Turkey.

Table 4. *Long Term Coefficients Of ARDL (1,0) Model*

Dependent Variable: LOGEXPORT			
Variable	Coefficient	t-statistic	Prob.
GLOB	0.078357	2.937061	0.0054
Constant	21.325791	8.980161	0.0000

The ECM coefficient in Table 4 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 5. *Error Correction Estimation (ECM) Results of ARDL (1,0) Model*

	Dependent Variable: LOGEXPORT		
	Coefficient	t-Statistic	Prob.
$\Delta GLOB$	-0.004074	-0.377639	0.7076
ECM_{t-1}	-0.079587	-6.801623	0.0000
ECM = LOGEXPORT - (0.0784*GLOB + 21.3258)			

Diagnostic Tests Results

Diagnostic Tests	Test Value (P-value)
Breusch-Godfrey Serial Correlation LM Test	0.042022 (0.8376)
Heteroskedasticity Test: Breusch-Pagan-Godfrey	2.265412 (0.3222)
Ramsey RESET Test	0.031582 (0.8598)
Jarque-Bera Test	0.976005 (0.6138)

Lastly, Granger causality test is applied in the context of Toda Yamamoto approach to figure out direction of causality relation between GLOB and LOGEXPORT 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=2.912996 for one lag and Schwarz criterion=3.259834 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 5 by estimating the VAR (p=1+dmax=1) model, VAR (2).

Table 6. *VAR Granger Causality/Block Exogeneity Wald Test Results*

Dependent Variable: LOGEXPORT			
Excluded	*Chi-sq*	*df*	*Prob.*
GLOB	2.877985	2	0.2372
All	2.877985	2	0.2372
Dependent Variable: *GLOB*			
Excluded	*Chi-sq.*	*df*	*Prob.*
LOGEXPORT	5.943544	2	0.0512
All	5.943544	2	0.0512

As indicated by Table 5, there is a unidirectional causality relationship between two series running from exports to globalization.

5. Conclusion

As long as the degree of globalization of a country increases, the volume of external trade (i.e., exports and imports) of that particular country rises as well. Therefore, in order to justify the validity of this claim, this study investigates long run and causality relationship between globalization and exports in Turkey by using a time series sample covering years between 1970 to 2014.

ARDL boundary test result implies that series of globalization and exports are cointegrated and thus move together in the long run. Besides it is found that globalization has an increasing impact on export in long run in Turkey while there exists no short run influence. Hence globalization augments exports in long term in Turkey.

In regard to causality association between GLOB and LOGEXPORT variables, causality test results display that there is a unidirectional causality association among the series running from exports to globalization whereas there is no significant causality relationship between the variables running from globalization to exports.

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