Trade Openness, Financial Development and Economic Growth in Turkey: Linear and Nonlinear Causality Analysis

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Abstract

This paper aims at empirically investigating the direction of causality among trade liberalization, financial development, and economic growth in Turkey. By employing monthly data for the period January, 1989- November, 2007, both linear and nonlinear causality approaches indicate that (i) there is bi-directional causality between economic growth and trade openness, (ii) economic growth causes financial development, and (iii) financial development leads to trade liberalization. Thereby, linear and nonlinear approaches confirm strong causal linkages among financial development, trade openness, and economic growth in Turkey. These results partially imply that economic growth depends upon trade liberalization through external finance in Turkey which has been experiencing capital account liberalization since 1989.

Key Words : *Trade Openness, Financial Development, Economic Growth, Causality, Turkey*
JEL Classification : *F41, E44, O43, C19*

Özet - Türkiye'de ticari açıklık, finansal gelişme ve ekonomik büyüme: lineer ve lineer olmayan nedensellik analizeri

Bu makale, ticari açıklık, finansal gelişme ve ekonomik büyüme arasında nedenselliğin yönünü Türkiye için ampirik olarak test etmeyi amaçlamaktadır. Ocak 1989-Kasım 2007 dönemi aylık verileri kullanarak yapılan lineer ve lineer olmayan nedensellik yaklaşımları, i) ekonomik büyüme ve ticari açıklık arasında tek yönlü nedensellik olduğunu, ii) ekonomik büyümenin finansal gelişmeye neden olduğunu ve iii) finansal gelişmenin ticari açıklığa yol açtığını göstermektedir. Lineer ve lineer olmayan yaklaşımlar finansal gelişme, ticari açıklık ve ekonomik büyüme arasında güçlü nedensellik bağlantılarını doğrulamaktadır. Bu sonuçlar, 1989 yılından sonra sermaye hesabında serbestleşme tecrübe eden Türkiye'de, ekonomik büyümenin kısmen dış finansman üzerinden ticari serbestleşmeye bağlı olduğunu ima etmektedir.

Anahtar Kelimeler : *Ticari Açıklık, Finansal Gelişme, Ekonomik Büyüme, Nedensellik Testi*
JEL Sınıflandırması : *F41, E44, O43, C19*

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1. Introduction

It has been theoretically argued that both trade liberalization and financial development may play a crucial role in economic development. Trade liberalization reduces inefficiency in the production process and financial development facilitates the intermediation between savers and investors. Thus, they have a great deal of potential to positively influence economic growth in the developing countries. The theoretical and empirical studies mainly concentrate on either the relationship between trade and growth or the association between finance and growth. However, until recently, the empirical linkages between trade liberalization and financial development have not received sufficient attention in the literature.

Turkey has been implementing trade oriented development strategy since 1980 and has been experiencing financial liberalization process since 1989. Nevertheless, even though Turkey had faced to serious economic turbulences in 1994 and in the early 2000, she has recorded an impressive growth performance during the last decade. These dynamics of the Turkish economy provide us room to examine the nature of causal linkages between trade openness, financial development, and economic growth. To best of our knowledge, there is not any study on this subject for Turkey and thereby identifying the causal linkages among the variables of interest is timely and important to design financial system and trade policies for sustainable development.

The aim of this paper, therefore, is to econometrically investigate direct linkages among trade liberalization, financial development and economic growth for Turkey by employing monthly data for the period January, 1989- November, 2007. In particular, this work tries to empirically find an answer for the question of whether financial development leads trade liberalization or of whether trade liberalization leads financial development in Turkey in a trivariate framework by including economic growth which is interrelated with both trade openness and financial development. In addition to linear causality analysis, we carried out the nonlinear causality test in order to see whether the causal linkages among the variables of interest is sensitive the structural shifts and asymmetries in the series. In brief, we find from both linear and nonlinear approaches that financial development is the cause of trade liberalization and there is bi-directional causality between economic growth and trade openness and between economic growth and financial development. Thereby, linear and nonlinear approaches confirm strong causal linkages among financial development, trade openness, and economic growth in Turkey.

The novelty of this study is three-fold. First, this paper is the first that employs monthly income data in the literature on the finance-growth nexus for Turkey. Second, we conduct the financial development index -that is good able to capture of different dimensions of financial development- by means of principal component analysis. Third, in addition to linear causality analysis, we conduct nonlinear causality tests in order to determine whether there are asymmetric causal linkages between trade openness, financial development, and economic growth in Turkey.

2. Theoretical Framework and Empirical Evidence

The impacts of trade liberalization and financial development on economic growth have increasingly obtained a significant attraction in the literature. It is argued that both policy instruments fasten economic growth in the developing economies through various channels. Trade liberalization by allowing the allocation of factors of production across sectors (Grossman and Helpman, 1992; Redding, 1997), by increasing the competition in the domestic economy and hence improving productivity (Greenaway and Milner, 1993; Aghion, Dewatripont and Rey, 1997), by enlarging the market for domestic producers and leading to take advantage of the economies of scale (Taylor, 1994; Grossman and Helpman, 1991), by increasing number of inputs that have no domestic substitutes and thus leading to a higher capacity utilization (Nishimizu and Robinson, 1986; Quah and Rauch, 1990; Grossman and Helpman, 1992) and, finally by letting the flow of knowledge across sectors and countries (Feder, 1982; Grossman and Helpman, 1992) might positively influence economic growth.

In fact, the role of financial sector on economic growth has long debated in the literature. Schumpeter (1912), one of the earliest pioneers, emphasized the importance of finance for growth. In the same line, Patrick (1966) introduced two new concepts which highlight the demand and supply side conditions, namely demand–following and supply-leading hypothesis. While the former states that demand in the real sector is the engine for creation of financial services, the latter emphasizes that supply in the financial sector is the driving force behind the development of real sector. Patrick's (1966) argument brought about the discussion whether the direction of causality from finance to growth or vice versa.

The literature moved to highlight the importance of mobilization of domestic resources in the early 1970s. Specifically, McKinnon (1973) and Shaw (1973) suggested the liberalization in the financial sector in terms of lifting any sort of restrictions in the sector. They argued that lack of saving is a widespread phenomenon

rather than lack of investment in the developing countries. Therefore policies should focus on increase in saving through a positive real interest rate policy.

With the emergence of endogenous growth theory (Romer, 1986) in the mid-1980s, it is argued that financial development might be one of the sources for the increase rate of return (Renelt, 1991). Financial development by increasing the possibility of choosing more productive investments through improved management of liquidity risks (Bencivenga and Smith 1991), by collecting information on the efficiency of various investment projects and/or investors' abilities (Greenwood and Jovanovic, 1990; King and Levine 1993) and by diversifying more efficiently investors' portfolios (Levine, 1991; Saint-Paul, 1992) might positively contribute to economic growth (Levine, 1997). These arguments based on endogenous growth theories implicitly assume that financial development promotes economic growth (Hermes, 1994).

The literature, in the 2000s, started to focus on the determinants of financial development. In order to understand the dynamics of the differences in the level of financial development, several factors are proposed for this purpose: Legal origin (La Porta et.al., 1997; Demetriades, 2008), public bank ownership (La Porta et.al., 2002; Andrianova et.al., 2008; Demetriades, 2008), initial conditions and institutional structure (Acemoglu et.al., 2001, 2004; Demetriades, 2008), trade liberalization (Rajan and Zingales, 2003; Do and Levchenko, 2006; Huang, 2006; Demetriades, 2008; Law, 2008, 2009), capital account liberalization (Chinn and Ito, 2002, 2006; Law and Demetriades, 2006; Klein and Olivei, 2008), prudential supervision and effective regulation (Cuadro et.al., 2003; Brownbridge et.al., 2005), deposit insurance (Cull et.al., 2001), required reserves (Di Giorgio, 1999; Arestis et.al., 2002) and macroeconomic policies (i.e. Inflation, exchange rate) (Montiel, 2003; Cuadro et.al., 2003; Bittencourt, 2008; Ben Naceur et.al., 2008).

Although the theoretical literature assumes linkages both between trade liberalization and economic growth and between finance and growth, the multi causal linkages between economic growth, financial development, and international trade has recently attracted attention. Rajan and Zingales (2003) emphasize the role of the supply-side factors and the resistance of incumbent industrialists and domestic financial intermediaries who have a vested interest in a closed financial sector and therefore oppose the developments in the financial market. It is argued that these incentives may be weakened with the opening domestic financial sector to foreign competition and to international flows of capital.

On the contrary, Svaleyrd and Vlachos (2000, 2002) highlight the importance of the demand-side factors and the possibility of risk diversification with the trade liberalization which creates new demands for external finance. This external resource for firms is a necessity to overcome short-term cashflow problems and adverse shocks.

In order to fill the theoretical gap for the linkages among trade openness, financial development, and economic growth in a multi causal conceptual framework, Blackburn and Hung (1998) suggest that trade liberalization by leading new product development may contribute to economic growth. Financial development may be resulted from trade liberalization which encourages the number of new producers who need access to finance their activities. Similarly, Feeney (1994) argues that integration in the financial sector may enhance the probability for risk sharing that allows product specialization and, in turn, benefits trade. These studies imply an indirect theoretical link between trade liberalization and financial development via new products.

In sum, the above reviewed studies fall short of establishing direct linkages between trade liberalization and financial development. Ginebri et. al. (2001) emphasize the issue of complementarity between trade and finance and propose a direct relationship between trade liberalization and financial development. In particular, the complementarity is theoretically based upon the fact that trade liberalization enhances entrepreneurial development which in turn increases a need of new instrument from the financial system.

The relationship between trade liberalization and financial development has been a subject matter for a limited number of empirical works which provide evidences for the argument that trade liberalization is a crucial step to enhance financial development and/or vice versa in a single country or a group of countries (Beck, 2002; Svaleyrd and Vlachos, 2000, 2002; Rajan and Zingales, 2003; Do and Levchenko, 2004; Huang and Temple, 2005; Hur, Raj and Riyanto, 2006; Bao and Yang, 2007; Law, 2008, 2009; Baltagi et.al., 2009; Das and Rishi, 2010). In contrast, Gries, Kraft and Meierrieks (2009) find a limited support for the finance-led growth and financial deepening and trade openness have swayed economic development rather marginally.

As far as the empirical works for Turkey are concerned, there is not any consensus on the direction of causality not only between trade and growth (Ghatak, Milner and Utkulu, 1995; Bahmani-Oskooee and Domac, 1995; Yiğidim and Köse, 1997; Özmen

and Furtun, 1998; Doğanlar and Fisunoğlu, 1999; Özmen et. al, 1999; Hatemi-J ve Irandoust, 2000; Tuncer, 2002; Şimşek, 2003; Bilgin and Şahbaz, 2009) but also between finance and growth (Şıklar, 1992; Akçoraoğlu, 2000; Kar and Pentecost, 2000; Doğan, 2002; Ünalmış, 2002; Aslan and Korap, 2006; Aslan and Küçükaksoy, 2006; Kar and Ağır, 2006; Acaravcı, 2007; Halıcıoğlu, 2007; Öztürk, 2008; Yücel and Altıntaş, 2009). The results imply that the selection of both variables and the methodology determines the direction of causality between the concerned variables in these empirical works.

There is a limited work which concentrates on the relationship between finance and trade for Turkey. Utkulu ve Kahyaoglu (2005) examines the impacts of both financial and trade openness on economic growth and find that while financial openness negatively contributes to economic growth, trade liberalization has a positive effect on growth in Turkey. Açıkgöz, Balcılar and Saraçoğlu (2009) also investigate the causal linkages among financial development, financial openness and trade openness by employing bounds test developed by Pesaran et.al. (2001) and Pesaran and Shin (1999) for the period 1989:Q1-2007:Q2 and provide empirical evidence that both financial and trade openness have a positive impact on financial development for Turkey. Kar, Peker and Kaplan (2008) examines a long-run relationship between trade liberalization, financial development and economic growth for the period 1963-2005 in Turkey and concludes that openness and finance has a positive impact on growth in the long-run. Yücel (2009) finds a bi-directional causality between each pair of the variables, namely financial development (measured by the broad money to GDP ratio), trade and economic growth, for the period 1989M1-2007M11 in Turkey. Ağır (2010) provides empirical evidence that trade, among other variables, plays a significant role in explaining financial development in Turkey.

3. Econometric Methodology

Linear Granger Causality Test

The standard Granger causality test requires carrying out zero restrictions on coefficients in Vector Autoregressive (VAR) model based on the Wald principle. Wald test for Granger causality may result in nonstandard limiting distributions based on the cointegration properties of the system and possibly on nuisance parameters. These nonstandard asymptotic properties are due to the singularity of the asymptotic distributions of the estimators (Lütkepohl, 2004: 148). Toda and Yamamoto (TY) (1995) developed the modified Wald (MWALD) test for Granger

causality which overcomes this singularity problem.

The standard Granger causality analysis is based on estimating a VAR (p) model. In order to correct the singularity problem TY (1995) suggest using a VAR (p+d) model in which d is the maximum integration degree of the variables. The following VAR model is therefore estimated in the TY procedure:

$$y_t = v + A_1 y_{t-1} + \cdots + A_p y_{t-p} + \cdots + A_{p+1} y_{t-p-d} + \mu_t. \qquad (1)$$

where y_t is vector of k variables, v is a vector of intercepts, μ_t is a vector of error terms and A is the matrix of parameters. To test for the null of no-Granger causality against the alternative hypothesis is tested by imposing zero restriction on the first p parameters in equation (1). The MWALD statistic has asymptotic chi-square distribution with p degrees of freedom irrespective of the number of unit roots and the cointegrating properties.

Hacker and Hatemi-J (2006) investigate the size properties of the MWALD test and find that the test statistic with asymptotic distribution poorly performs in small samples. Monte Carlo simulation of Hacker and Hatemi-J (2006) shows that the MWALD test based on the bootstrap distribution has much smaller size distortions than those of the asymptotic distribution. Hacker and Hatemi-J (2006:1492-1493) extends the TY approach based on the bootstrapping method developed by Efron (1997). In this new approach that is so-called the leveraged bootstrap Granger causality test, the MWALD statistic are compared with the bootstrap critical value instead of the asymptotic critical value.

Nonlinear Granger Causality Test

The linear Granger causality test does not account for nonlinear causal relationships among the variables. The Monte Carlo study of Baek and Brock (1992) demonstrates that in the presence of nonlinearity, the forecasting performance of nonlinear approach is better than that of linear modelling. In order to test for the null of nonlinear non-Granger causality, the nonparametric test of Hiemstra and Jones (HJ) (1994) is widely employed. However, the HJ test may over rejects the null hypothesis in the case of increasing sample size, which is stemming from ignoring the possible variations in conditional distributions (Diks and Panchenko, 2005). The nonlinear causality test recently developed by Diks and Panchenko (DP) (2006) overcomes this drawback of the HJ test.

DP (2006) offer the following statistic to test for nonlinear Granger causality.

$$T_n(\varepsilon_n) = \frac{n-1}{n(n-2)} \sum_i \left(\hat{f}_{X,Y,Z}(X_i, Y_i, Z_i) \hat{f}_Y(Y_i) - \hat{f}_{X,Y}(X_i, Y_i) \hat{f}_{Y,Z}(Y_i, Z_i) \right) \qquad (2)$$

where $\hat{f}_W(W_i)$ is a local density estimator of a d_w – variate random vector W at W_i defined by $\hat{f}w(W_i) = (2\varepsilon_n)^{-d_W}(n-1)^{-1} \sum_{j \neq i} I_j^W$ that $I_{ij}^w = I(\|W_i - W_j\| < \varepsilon_n)$ with the indicator function $I(.)$ and the bandwidth ε_n. For one lag (i.e. lx=ly=1), if $\varepsilon_n = 6^{-\beta}(C > 0, \frac{1}{4} < \beta < \frac{1}{3})$, the test statistic is asymptotically distributed as standard normal. Since the statistic diverges to positive infinity under the alternative hypothesis, the calculated statistic greater than 1.28 implies the rejection of the null hypothesis at 10 percent level of significance.

In the DP test, value of the bandwidth plays an important role in making a decision on nonlinear causality. Since the bandwidth value smaller (larger) than one generally results in larger (smaller) p-value (Bekiros and Diks, 2008: 1646), the bandwidth value is equal to one in this study.

4. Data

This paper employs monthly observation for the variables for the period 1989:M1-2007:M11 in Turkey. In particular, the Turkish Statistical Institute has provided a quarterly GDP series since 1986 and there is not a monthly data for this variable. The monthly real GDP series used in the analysis is generated by Taşdemir (2008) by utilizing steady-space approach. The time span for income series (monthly real GDP) restricts the range of other series employed in the analysis. Trade openness (TO) is measured as the ratio of total trade (exports plus imports) to the GDP as a proxy for trade liberalization. The financial development index (FD) is constructed by means of principal component analysis from the ratio of M2 to income (M2Y), the ratio of domestic credit to income (DCY), the ratio of private sector credit to income (PSCY), and the market capitalization ratio (MCR). The market capitalization ratio is measured as the ratio of stock market index to income. FD carries information not only about the monetary and credit aggregates but also capital markets. Data for trade openness and financial development indicators are respectively collected from the on-line database of TurkStat (Turkish Statistical Institute) and of the Central Bank of Turkish Republic.

Since financial development is a multifaceted issue and has not a direct measurement, a number of proxies to catch up various dimensions of financial development have been used in the literature. However, financial development indicators are closely related to each other and these high correlations can cause multicollinearity problem which can lead to the misleading inferences. To overcome these problems with the financial development indicators, recent studies have concentrated on developing a comprehensive index for financial development. The principal component analysis which is one of statistical tools to transform a number of correlated variables into a smaller number of uncorrelated variables has been widely used in the finance-growth studies (Creane et al., 2003; Saci and Holden, 2008; Jalli et al., 2010). This tool models the variance structure of a set of observed variables using linear combinations of the variables. These linear components may be used in subsequent analysis, and the combination coefficients (loadings) may be used in interpreting the components. The principal components of a set of variables are obtained by computing the eigenvalue decomposition of the observed variance matrix. The first principal component is the unit-length linear combination of the original variables with maximum variance. Subsequent principal components maximize variance among unit-length linear combinations that are orthogonal to the previous components[1]. Table 1 reports the results from principal component analysis[2]. The eigenvalues for three principal components show that the first principal component (PC1) explains the highest proportion of variance by accounting 56.28 percent of the standardized variance. Accordingly, the financial development index is constructed by using the factor loadings based on the first principal component.

Table 1: Results from principal component analysis

Eigenvalues: (Sum = 4, Average = 1)

Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	2.251237	1.205801	0.5628	2.251237	0.5628
2	1.045436	0.384093	0.2614	3.296673	0.8242
3	0.661343	0.619359	0.1653	3.958016	0.9895
4	0.041984	---	0.0105	4.000000	1.0000

Eigenvectors (loadings):

Variable	PC1	PC2	PC3	PC4
PCSY	0.648129	-0.039295	0.214224	-0.729721
DCY	0.557986	-0.451445	0.325603	0.615493
M2Y	0.464323	0.162880	-0.857189	0.151990
MCR	0.230184	0.876427	0.336627	0.256074

1 For additional details see Johnson and Wichtern (1992).

2 The principal component analysis was carried out by Eviews 7.1 econometric software.

5. Empirical Findings

Before proceeding with the TY and the DP procedures, the maximum integration degree (d) of the variables – that are expressed in logarithmic form- are determined by three unit root tests developed by Dickey and Fuller (1979) and Phillips and Perron (1988) which test for the null of a unit root and Kwiatkowski et al. (1992) that tests for the null hypothesis of stationary[3]. The results reported in Table 2 indicate that while the series in log-levels appear to be non-stationary, they are stationary in first-differences. The results accordingly imply that d will be equal to one in the TY procedure, and the series in first-differences will be used in the DP test.

Table 2: Results for unit root tests without structural break

Levels	Variable	ADF		PP		KPSS	
Constant	FD	-0.68		-0.69		0.67	***
	TO	-0.91		-3.43	**	1.67	***
	GDP	-0.63		-0.68		1.88	
Constant and trend	FD	-1.54		-1.51		0.14	*
	TO	-2.94		-8.09	***	0.10	
	GDP	-3.11		-4.99	***	0.15	
First Differences							
Constant	FD	-17.76	***	-17.57	***	0.19	
	TO	-5.06	***	-37.13	***	0.21	
	GDP	-24.08	***	-31.25	***	0.28	
Constant and trend	FD	-17.83	***	-17.68	***	0.07	
	TO	-5.05	***	-37.06	***	0.21	
	GDP	-24.03	***	-31.73	***	0.29	

Notes: The optimal lags for ADF test were selected based on Schwarz information (SBC); the bandwidth for PP test was selected with Newey-West using Bartlett kernel. ***, **, and ** denote statistical significance at the 1, 5, and 10 percent level of significance, respectively.

The ADF, PP and KPSS tests do not take into account possible structural break(s) in series. The unit root tests without structural breaks may result in misleading inferences if there are structural shifts in data. We thereby employ minimum Lagrange Multiplier (LM) t-statistic unit root test of Lee and Strazicich (2003)[4] that the rejection of the null hypothesis of a unit root with two structural breaks unambiguously implies a trend stationary data. This approach determines the break dates endogenously by minimizing LM statistic with a grid search. The minimum

3 The unit root analysis was carried out by Eviews 7.1 econometric software.

4 In order to save space, the details of the Lee and Strazicich unit root test are not explained here. An interested reader is referred to Lee and Strazicich (2003).

LM t-statistics for the levels of the variables presented in Table 3 where note that the Model A refers to two structural shifts in constant and the Model C refers to two structural breaks in constant and trend[5]. The results for the Model A and B show that while the financial development index appears to be non-stationary, trade openness and income seem to be stationary. Thereby, the results for the implementation of the TY causality test are similar to those of the unit root tests without structural breaks, indicating that the maximum integration order (d) of the variables will be equal to one in the TY procedure.

Table 3: Unit root test with structural shift

Variable	Model A: Break in constant	Model C: Break in constant and trend
FD	-2.40 (0.15-0.51)	-4.09 (0.38-0.72)
TO	-8.27*** (0.11-0.25)	-9.85*** (0.26-0.48)
GDP	-4.09** (0.55-0.78)	-5.66* (0.35-0.64)

Notes:
The critical values of Model A: -4.55 (1%), -3.84 (5%), and -3.51 (10%).
The Critical values of Model C: -6.16 (1%), -5.59 (5%), and -5.28 (10%) for λ = (0.2, 0.4); -6.40 (1%), -5.74 (5%), and -5.32 (10%) for λ = (0.2, 0.6); -6.33 (1%), -5.71 (5%), and -5.33 (10%) for λ = (0.2, 0.8); -6.46 (1%), -5.67 (5%), and -5.31 (10%) for λ = (0.4, 0.6); -6.42 (1%), -5.40 (5%), and -5.43 (10%) for λ = (0.4, 0.8); -6.32 (1%), -5.73 (5%), and -5.32 (10%) for λ = (0.6, 0.8). λ denotes the location of breaks. The figures in parentheses are the location of the break dates. ***, **, and ** denote statistical significance at the 1, 5, and 10 percent level of significance, respectively.

The results for linear causality analysis are illustrated in Table 4. Since the TY procedure is based on ordinary least squares estimator, one need to justify the validity of assumption of that estimator. In that respect, we carry out a diagnostic checking procedure and report the result at bottom of table 4[6]. The Breusch-Godfrey's serial correlation test implies that the residual of the estimated models are free from auto correlation problem. The White's heteroscedasticity and Engel's autoregressive conditional heteroscedasticity (ARCH) tests indicate the validity of homoscedasticity assumption. The Ramsey's model miss-specification test clearly shows that the functional forms of the models are appropriately specified.

5 The GAUSS code file was used for the Lee and Strazicich unit root test.
6 The GAUSS code file was used for the TY causality test. The diagnostic tests were conducted by Eviews 7.1.

Table 4: Linear causality analysis

	Statistic		Critical Value 1%	5%	10%
FD ≠> TO	11.92	***	9.58	6.35	4.73
TO ≠> FD	2.64		9.43	6.05	4.66
FD ≠> GDP	2.24		9.33	6.12	4.66
GDP ≠> FD	22.65	***	9.55	6.01	4.65
GDP ≠> TO	16.89	***	9.54	6.08	4.67
TO ≠> GDP	10.78	***	9.57	6.31	4.76
Diagnostic tests					
Serial correlation	0.085	[0.770]			
Heteroscedasticity	52.133	[0.429]			
ARCH	1.746	[0.186]			
Ramsey RESET	0.938	[0.333]			

≠> implies non Granger causality. The optimal lags in VAR(p) model was determined based on SBC. The bootstrap critical values were calculated based on 10,000 replications. *** indicates statistical significance at 1 percent.

The findings indicate uni-directional causality from trade openness to financial development. With respect to causal linkages between economic growth and financial development, the results show that the causality runs from economic growth to financial development. Thereby, the nature of causation between economic growth and financial development support evidence on the demand-following hypothesis. As regards to causality between trade openness and economic growth, there is bi-directional causality between economic growth and trade openness, which proves support on the feedback hypothesis.

One drawback of linear causality methods is the possibility of overlooking nonlinear relations. It is thereby important to investigate nonlinear causal linkages among the variables of interest. In that respect, we conduct the DP nonlinear causality analysis. The nonlinear Granger causality analysis is carried out in two steps (Bekiros and Diks, 2008). In the first, the DP test is applied to the stationary series to detect nonlinear interrelationships. In the second step, the DP test is reapplied to the filtered VAR residuals to see whether the nature of causation is strictly nonlinear. After removing linear causality with a VAR model, any causal linkage from one residual series to another can be considered as nonlinear predictive power (Hiemstra and Jones, 1994: 1648). Note that the results for the DP test are discussed for one lag.

Table 5 present the results from the nonlinear causality test[7]. The DP test on raw data indicates that there is a nonlinear causality from financial development to trade openness, which is consistent with linear causality analysis. Even though the nonlinear causality test implies a nonlinear feedback from financial development to trade openness, the DP test should be reapplied to filtered VAR residuals to see whether this causality is strictly nonlinear in nature (Bekiros and Diks, 2008: 1647). The results for the DP test on the VAR residuals substantiate the findings from raw data. Hence, the nonlinear analysis provides evidence on significant and persistent nonlinear causal linkage from financial development to trade openness in Turkey.

Table 5: Nonlinear causality analysis

	Raw data[a]			VAR residuals[b]		
FD ≠> TO	1.97	**	[0.0240]	1.74	**	[0.0402]
TO ≠> FD	1.04		[0.1480]	-0.29		[0.6160]
FD ≠> GDP	-0.44		[0.6733]	-2.01		[0.9779]
GDP ≠> FD	1.34	***	[0.0899]	1.62	**	[0.0521]
GDP ≠> TO	1.22		[0.1128]	1.57	*	[0.0570]
TO ≠> GDP	1.72	**	[0.0431]	-1.15		[0.8769]

≠> implies nonlinear non Granger causality [a]: the series in first differences [b]: the residuals of VAR(p+d) model. lx=ly=1. Numbers in brackets are p-values. ***, **, and * indicates statistical significance at 10, 5 and 1 percent, respectively.

When we look at nonlinear causal linkages between economic growth and financial development, it seems that there is bi-directional nonlinear causality from economic growth to financial development. Furthermore, this nonlinear causality appears to be strict due to the fact that the nonlinear causality based on the VAR residuals rejects the null hypothesis of nonlinear non-causality. The finding from nonlinear causality analysis between economic growth and financial development is thereby consistent with that from the linear causality test, implying the demand-following hypothesis. The nonlinear causal linkages between trade openness and economic growth analysis show that there is nonlinear causality from trade openness to economic growth. However, this causal linkage does not seem to be strictly nonlinear since the causality test from the VAR residuals does not show any causal linkage from trade openness to economic growth. Thereby, the nonlinear causality analysis provides weak evidence on the validity of the export-led growth hypothesis. This finding hence is particularly consistent with that from linear causality analysis. On the other hand, the nonlinear causality test supports evidence on the strict nonlinear causal linkage from economic growth to trade openness.

7 The C++ code file was used for the non-linear causality test.

6. Summary and Discussion

This paper has empirically tested the causal linkages among trade liberalization, financial development and economic growth for Turkey. To this end, both linear and nonlinear approaches have been employed to detect the direction causality among the concerned variables by employing monthly data for the period January, 1989- November, 2007.Empirical findings methodologically show that the nonlinear causality analysis captures all information provided by linear approach and furthermore it provides important information on whether the causal linkages among trade openness, financial development, and economic growth are in nature strictly nonlinear.

The non-linear analysis shows that trade liberalization causes economic growth (export-led growth), economic growth leads to financial development (demand-following) and financial development causes trade liberalization. These results provide empirical support for both the export-led growth and demand-following hypotheses. In addition, there is evidence on that financial development mobilizes resources to meet the need of trade sector. The results from the linear approach indicate that the relationship between trade and economic growth is rather bi-directional. In addition, the causality between both economic growth and financial development and financial development and openness is as in both nonlinear models. Specifically, economic growth causes financial development and financial development leads to trade liberalization.

Furthermore, keeping the analysis period (1989:M1-2007:M11) in mind, these findings partly support the view that economic growth depends upon trade through external finance in Turkey which has been experiencing capital account liberalization since 1989. Financial sector play a key role in this process. Sources of financial deepening may be both domestic as well as external. Whatever the sources, development in the financial markets seems to mobilize resources for the utilization of both import and export. The results imply that economic growth dependent upon trade seems to be sensitive financial development which may resulted from domestic and external sources. Although this paper does not focus on the sources of financial development whether domestic or external factors are dominant, it highlights the risk for sustainable economic growth if there is a lack or reverse of capital inflows which expand the domestic credit in Turkey.

In this study, we assume that the impact of a positive shock is similar to that of a negative shock, and thereby we do not consider the asymmetric causal linkages for the positive and negative shocks. The asymmetry can be considered as the natural behavior of financial markets due to the fact that global investors react more strongly to negative than positive shocks. Therefore, asymmetric causal linkage between energy and financial markets is an open question for the future research.

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