The Nexus between Financial Development and Economic Growth: The Case of Turkey

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Abstract: Examining the possible nexus between financial development and economic growth is one of the hot topics in the finance. The relationship between financial development and economic growth is studied for the case of Turkey in this paper. Data interval includes from third quarter of 2002 to first quarter of 2015. Vector Autoregressive Model, Johansen Cointegration and Granger causality tests are used to get evidence for the possible relationship between those variables. Results showed that there is a bidirectional Granger causes in the short run and there is a one way Granger causes from economic growth to financial development in the long-run.

Key Words: Financial Development, Economic Growth, VAR Model, Causality

1. Introduction

The relationship between financial development and economic growth has been studied over the past decade extensively. However empirical studies are supporting supply leading hypothesis, demand following hypothesis, bidirectional relationship, and even no relationship at all. The reasons for the differences in the results can be explained by the choice of proxies and methodology (Soytaş & Küçükkaya, 2011). In this study, the relationship between financial development and economic growth is examined by the proxies' credit to private sector and GDP respectively for Turkey between the periods of third quarter of 2002 to first quarter of 2015. Vector Autoregressive Regression, Johansen Cointegration Method, and Vector Error Correction Model are used to examine the possible relationship between financial development and economic growth.

2. Literature Review

It can be said that the discussion was started by the book with title *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest and the Business Cycle* by Schumpeter (1911) according to majority. Patrick (1966) suggested two names for the hypothesis of possible relationship between financial development and economic growth as the supply-leading and demand-following.

There is an extensive interest on the relationship between financial development and economic growth and a huge literature exists on this hot topic that supporting supply-leading hypothesis, demand-following hypothesis or nonexistence of the relationship. Financial development as providing bank credit

leads producing new products and innovations which are the two of five cases for the economic growth. Therefore, in some cases the relationship between financial development and economic growth is expressed as an indirect relationship. The number of empirical and theoretical studies has increased after Schumpeter. Most common proposition is that financial development causes economic growth (Dritsakis & Adamopoulos, 2004). The empirical studies can be categorized according to data sample as single country case studies, developed countries, developing countries, OECD countries, African countries, Asian countries, large number of countries and so on. There is a large empirical study for Turkish economy case in recent years to figure out the possible relationship and direction of the relationship if it exists. Since this study is a case study of Turkey, the author extensively examines the literature for the case of Turkey instead of scanning large empirical studies that contain plenty of different countries with many different conclusions.

The empirical studies were concluded with different results like the cases seen in general. Mercan (2013) studied monthly data included the years between 1992 and 2010. He examined the causality and found evidence that supporting financial development causes economic growth. Another study includes the time interval between 1998 and 2009 found that economic growth causes financial development (Ozcan & Ari, 2011). The nonexistence of the nexus of financial development and economic growth is also a final conclusion that we faced for the case of Turkey (Soytaş & Küçükkaya, 2011). Soytaş and Küçükkaya chosed the years between 1991 and 2005 in their empirical study. The bidirectional nexus in the long-run is also showed by the study consisting of years between 1970 and 2001 (Ünalmış, 2002). Turkey faced to several economic and financial crises in its recent history dated at 1994, 1998-1999, and 2001. However Turkish economy and financial market and institutions performed a consistent development after 2002. Banking sector's total assets increased from 2002 to 2015 (TCMB, 2015). The time interval chosen in the study does not have any anomalies and sharp decreases or increases due to financial or economic crises.

3. Data

In this study economic growth is taken as gross domestic product (purchaser's price) at basic price at 1998 and financial development is taken as credit to private sectors given by deposit banks, investment banks and Islamic banks in Turkey. Both data are obtained from Central Bank of the Republic of Turkey. Frequency of the data is 3-month data and including from third quarter of 2002 to first quarter of 2015.

4. Methodology and Results

4.1. Unit Root Test

In this section Augmented Dicky Fuller (ADF) unit root test is performed for the series. The series GDP refers gross domestic product (purchaser's price) at basic price at 1998 between 2002 third quarter and 2015 first quarter and credit refers credit to private sectors given by deposit banks, investment banks and Islamic banks in Turkey between 2002 third quarter and 2015 first quarter.

The two forms of ADF test is used to test unit root. First is one is $\Delta y_t = a_0 + \propto y_{t-1} + \sum_{i=1}^{p} b_i \, \Delta y_{t-i} + \varepsilon_t$ that refers intercept form and second one is $\Delta y_t = a_0 + \propto y_{t-1} + a_1 t + \sum_{i=1}^{p} b_i \, \Delta y_{t-i} + \varepsilon_t$ refers intercept and trend form.

Table 1: ADF unit root tests (quarterly data-level)

Variable	Intercept	Intercept and Trend
Credit	2.8624(1.0000)	0.8111(0.9997)
GDP	-0.7406(0.8264)	-1.8388(0.6701)

( )refers p-value

Critical values	1%	-3.5744	-4.1611
	5%	-2.9238	-3.5064
	10%	-2.5999	-3.1830

Since t-statistics values are greater than ADF test critical values null hypothesis (series has a unit root) cannot be rejected for the series credit and GDP. So the series credit and GDP are non-stationary series. In the second step first differences of the series are taken and ADF test is again used to test whether series become stationary or not.

Table 2: ADF unit root tests (quarterly data-first differences)

Variable	Intercept	Intercept and Trend
Credit	1.4856(0.5321)	-3.8240(0.0238)**
GDP	-7.8690(0.0000)*	-7.8534(0.0000)*

( )refers p-value

Critical values	1%	-3.5777	-4.1658
	5%	-2.9252	-3.5085
	10%	-2.6007	-3.1842

*significant at 1%
**significant at 5%

After taking first differences series become stationary therefore both series are integrated of order 1 i.e. I(1). In the following section vector autoregressive (VAR) model is used to figure out the possible relationship between economic growth and financial development in the short-run and long-run and also Granger causality. Since we are not sure variables in the model are really exogenous or not VAR model is preferred.

4.2. Vector Autoregressive (VAR) Model and Johansen Cointegration Test

First of all the following bivariate model is formed as:

$$\Delta gdp_t = \beta_{10} - \beta_{12}\Delta credit_t + \alpha_{11} gdp_{t-1} + \alpha_{12}\Delta credit_{t-1} + \varepsilon_{\Delta gdpt}$$

$$\Delta credit_t = \beta_{20} - \beta_{21}\Delta gdp_t + \alpha_{21}\Delta gdp_{t-1} + \alpha_{22}\Delta credit_{t-1} + \varepsilon_{\Delta creditt}$$

where it is found that ΔGDP and Δcredit are both stationary. Rewriting the system of these equations using matrix notation, we get

$By_t = \varphi_0 + \varphi_1 y_{t-1} + \varepsilon_t$ where $B=\begin{vmatrix} 1 & \beta_{12} \\ \beta_{21} & 1 \end{vmatrix}$ $y_t = \begin{vmatrix} gdp_t \\ credit_t \end{vmatrix}$ $\varphi_0 = \begin{vmatrix} \beta_{10} \\ \beta_{20} \end{vmatrix}$ $\varphi_1 = \begin{vmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \end{vmatrix}$ and

$\varepsilon_t = \begin{vmatrix} \varepsilon_{gdpt} \\ \varepsilon_{creditt} \end{vmatrix}$.

We use the Akaike, Schwarz and Hannan-Quinn information criteria (AIC, SC and HQ respectively) to decide lag order in the VAR model. VAR model estimated with n lags AIC is calculated as:

AIC(n)=ln|$\sum n$|+(2/T)N^2n
SC(n)= ln|$\sum n$|+(2lnT/T)N^2n
HQ= ln|$\sum n$|+(lnT/T)N^2n where N is the elective sample size, t=1,…,T
Table 3: VAR Lag Order Selection Criteria

Lag order	AIC	SC	HQ
0	68.78	68.86	68.81
1	68.08	68.32	68.17
2	65.97	66.36	66.12
3	65.96	66.52	66.17
4	65.28*	66.00*	65.55*

- Indicates lag order selected by the criterion

Akaike, Schwarz and Hannan-Quinn information criteria suggest to lag interval as four.

VAR model is estimated as unrestricted VAR since the series GDP and credit are nonstationary at level and they are stationary after first differencing. Therefore both series are same order of integration. The theory suggests that they can move together in the long-run that is they can be cointegrated. Johansen cointegration test is applied to test cointegration. If the cointegration is detected then we have to use Vector Error Correction model that is designed to use for nonstationary series which are known cointegrated. Johansen cointegration test specification consists of five different assumptions.

Johansen test consist of maximum likelihood procedures is used to test cointegration. The following equation is formed to test the presence of integration in the VAR model with n variables integrated of order 0, 1, and 2:

$y_t = b_1 y_{t-1} + b_2 y_{t-2} + \cdots + b_k y_{t-k} + \Gamma D_t + \varepsilon_t$

D_t is a set of deterministic variables including a constant, trend and dummies, and ε_t is a vector of normally distributed errors with White noise. y_t represents a vector capturing economic growth and financial development.

The following summary is helpful to choose the model under which assumption. Akaike information criterion (AIC) is used to select the model.

Table 4: Summary of Johansen Cointegration Test

Data Trend	None	None	Linear	Linear	quadratic
No. of cointegration	No intercept No trend	Intercept No trend	Intercept No trend	Intercept Trend	Intercept Trend
	AIC by rank and model				
0	65.24	65.24	65.27	65.27	65.33
1	65.28	65.26	65.26	65.15*	65.20
2	65.44	65.43	65.43	65.23	65.23

(*) indicates the minimum value of AIC

So AIC suggests us to use Linear model with intercept and trend for use of Johansen Cointegration test. When Johansen cointegration test is performed the following results we get:

Table 5: Johansen Cointegration Test

Hypothesized no. of cointegration	Eigenvalue	Trace Statistic	0.05 Critical Value	P-value
None *	0.3773	30.406	25.87211	0.0127
At most 1	0.1708	8.618	12.51798	0.2053

*Null hypothesis can be rejected at 5% significance level

The result shows that the null hypothesis that there is no cointegration between the series GDP and credit is rejected at 5% significance level. However there is no sufficient evidence to reject the null hypothesis that there is at most one cointegration. Therefore it is concluded that there is one cointegration.

Since cointegration is detected Vector Error Correction (VEC) Model with n-dimensions can be used instead of unrestricted VAR model. The VEC model is formed as:

$$GDP_t = \partial_1 + \sum_{i=1}^{n-1} \rho_{1,i}\, \Delta CREDIT_{t-i} + \sum_{i=1}^{n-1} \gamma_{1,i}\, \Delta GDP_{t-i} + \theta_1 (CREDIT_{t-1} - \alpha_1 GDP_{t-1}) + \varepsilon_{1,t} \quad (1)$$

$$CREDIT_t = \partial_2 + \sum_{i=1}^{n-1} \rho_{2,i}\, \Delta CREDIT_{t-i} + \sum_{i=1}^{n-1} \gamma_{2,i}\, \Delta GDP_{t-i} + \theta_2 (GDP_{t-1} - \alpha_2 CREDIT_{t-1}) + \varepsilon_{2,t} \quad (2)$$

α_1 and α_2 are the coefficient of the cointegrating vector. $\theta_1$and $\theta_2$are the coefficient of the lagged error correction term.

Optimal lag length is chosen as 4 by using the criterion of AIC and SC and then we form the VEC model. We get the following results:

Error Correction Model=$\Delta GDP(-1)+0.0570\Delta CREDIT(-1)+662866*trend-15565845$

From the cointegration equation above, it is concluded that economic growth and financial development has a long-run equilibrium relationship. Vector Error Correction estimates are found for the series GDP and CREDIT as follow:

I. Δ(GDP) = C(1)*(GDP(-1) - 0.0570*CREDITSON(-1) - 662866.0476*@TREND(02Q3) + 15565844.6527) + C(2)*Δ(GDP(-1)) + C(3)*Δ(GDP(-2)) + C(4)*Δ(GDP(-3)) + C(5)*Δ(GDP(-4)) + C(6)*Δ(CREDITSON(-1)) + C(7)*Δ(CREDITSON(-2)) + C(8)*Δ(CREDITSON(-3)) + C(9)*Δ(CREDITSON(-4)) + C(10)

II. Δ(CREDITSON) = C(11)*(GDP(-1) - 0.0570*CREDITSON(-1) - 662866.0476*@TREND(02Q3) + 15565844.6527) + C(12)*Δ(GDP(-1)) + C(13)*Δ(GDP(-2)) + C(14)*Δ(GDP(-3)) + C(15)*Δ(GDP(-4)) + C(16)*Δ(CREDITSON(-1)) + C(17)*Δ(CREDITSON(-2)) + C(18)*Δ(CREDITSON(-3)) + C(19)*Δ(CREDITSON(-4)) + C(20)

Table 6: Coefficients of the VEC estimates

(I)

	Coefficient	t-statistics
C(1)	-0.020389	-1.475902
C(2)	0.038952	0.248835
C(3)	-0.270941	-1.809966
C(4)	0.057388	0.392683
C(5)	0.697067	4.614158
C(6)	0.004371	0.347101
C(7)	-0.011211	-1.027351
C(8)	-0.006390	-0.594813
C(9)	-0.020078	-1.749510
C(10)	846898.4	2.238592

(II)

	Coefficient	t-statistics
C(11)	-0.982841	-4.634432
C(12)	5.173008	2.152657
C(13)	3.350451	1.457959
C(14)	7.069887	3.151249
C(15)	3.460984	1.492325
C(16)	0.072397	0.374451
C(17)	0.228645	1.364819
C(18)	-0.489141	-2.965866
C(19)	-0.254312	-1.443451
C(20)	29391284	5.060668

The coefficients above C(1) and C(11) represent θ_1 and $\theta_2$respectively which are coefficients of the lagged error correction term in the cointegration equation ΔGDP(-1)=-0.0570ΔCREDIT(-1)-662866*trend+15565845. Since $\theta_1$is not significant (-1.48 as t-statistics) and $\theta_2$is significant (-4.63 as t-

statistics) we conclude that economic growth (as GDP) is the long-run Granger cause of financial development (as credit to private sector).

4.3. Granger Causality Test

We run the Granger causality/Block Exogeneity Wald tests based upon VEC model to determine the short-run causality between economic growth and financial development.

Table 7: Granger causality/Block Exogeneity Wald tests

(I) Dependent variable GDP

Excluded	Chi-square	df	P-value
Δ(CREDIT)	10.21792	4	0.0369
All	10.21792	4	0.0369

(II) Dependent variable CREDIT

Excluded	Chi-square	df	P-value
Δ(GDP)	18.43625	4	0.0010
All	18.43625	4	0.0010

Tests results set forth bidirectional short-run relationship between series GDP and CREDIT which refer economic growth and financial development respectively.

5. Conclusion

The followings can be concluded after econometric and statistical analysis in this study:

Firstly, there is a long-run equilibrium relation between economic growth and financial development for Turkey according to the chosen time interval in this study.

Secondly, we found that economic growth is the Granger cause of financial development in the long-run. Therefore study shows that credit to private sectors increases as GDP increases in the long-term.

Table 8: Summary of the Direction of Causality in the Short-run and Long-run

Direction of the Causality	
Short-run	Long-run
Bidirectional	From economic growth to financial development

Thirdly, according to the VEC model of economic growth and financial development it is concluded that when the disequilibrium appears in the previous period the series both credit and GDP converge to the equilibrium. Since the coefficients of error correction model is negative when there is an increase in credits to private sectors and GDP error correction model offsets rises and plays a role of convergence. We also conclude according to the Granger causality/Block Exogeneity Wald tests based upon VEC model there is bidirectional causality between economic growth and financial development in the short-run.

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