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The Asymmetric Relationship between Financial Development and Economic Growth in Turkish Economy

Türkiye Ekonomisinde Finansal Gelişme ile Ekonomik Büyüme Arasındaki Asimetrik İlişki

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ÖZ

Bu çalışmanın amacı da finansal gelişme ve iktisadi büyüme arasındaki simetrik ve simetrik olmayan ilişkiyi 2003.Ç1-2023.Ç4 zaman aralığında Türkiye ekonomisi için test ederek, literatüre katkı sağlamaktır. Finansal gelişmeyi test edebilmek için özel sektöre verilen toplam kredi hacmi, özel sektöre verilen toplam kredi hacmi ve para arzı değişkenleri tercih edilmiş ve Simetrik Gecikmesi Dağıtılmış Otoregresif (ARDL) Modeli ve Simetrik Olmayan Gecikmesi Dağıtılmış Otoregresif (NARDL) Modeli tahmin edilerek, finansal gelişme ve iktisadi büyüme arasındaki ilişki incelenmiştir. Bu yöntemlere ek olarak, finansal gelişme ve büyüme arasındaki nedensellik ilişkisi Granger Nedensellik yöntemiyle araştırılmıştır. Elde edilen sonuçlara göre finansal gelişmeyle ekonomik büyüme arasında hem kısa dönemde hem de uzun dönemde pozitif bir ilişki tespit edilmiştir. Ayrıca finansal gelişme göstergesi olarak seçilen değişkenlerden toplam kredi ve para arzının, ekonomik büyüme arasında asimetrik ilişki bulunmaktadır. Bu sonuçlara ek olarak, Granger nedensellik testiyle Türkiye ekonomisinde, uzun dönemde, arz yanlı teoriyi destekleyen bir sonuç elde edilmiştir.

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ABSTRACT

With this study, symmetric and asymmetric relation between growth and financial system is investigated for Turkish economy over the period 2003.Q1-2021.Q4. Total credit private credit, total domestic credit and broad money are selected as a proxy for development of financial system and Autoregressive Distributed Lag (ARDL) method and Non-linear Autoregressive Distributed Lag (NARDL) method is employed to capture the existence of asymmetric relation between financial variables and growth. In addition to these methods, the causality between growth and financial system is investigated using Granger causality test. Results imply that there is a positive relation both in long time and in short time periods between development of financial system and growth. Furthermore, changes in total credit and broad money supply have asymmetric effect on growth. Granger causality test results indicate that 'the supply-leading hypothesis' is valid for Turkish economy in long time period.

1. Introduction

Economic growth in a country is propelled by various factors, including physical capital, labor force, human capital, natural resources, population growth, and technological progress. In addition to these elements, the financial system plays a crucial role in shaping the trajectory of an economy. Financial system brings together those who supply funds and those who demand funds and contributes to economic growth by increasing efficiency in resource allocation. In the related literature, there are different approaches of the effect of financial system and growth. According to the empirical literature, there is a strong effect from development of financial system to growth (Schumpeter (1934), Hicks (1969), Miller (1998)). According to Valickova et al. (2014), who analyzed 1334 estimates from 67 studies, when countries are taken together, the relation was positive and significant. Furthermore, the results could be changed from country to

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country.

Some studies argue that development of financial system has indirect effects on growth in contrast with the above research. For example, Levine (2004) classified these indirect effects as follows: "i-) provide information about investment expenditure and allocation of resources, ii-) adviser of investments after providing funds, iii-) diversify and manage the risk, iv-) raise and distribute savings, v-) facilitate the transfer of goods and services" (Levine (2004), p: 5). Moreover, the insignificant relation between development of financial system and growth in the empirical literature. Some researchers find there is not a significant relationship between development financial system and growth as stated in Patrick (1966).

Patrick (1966) implied that the relation is ambiguous because the results can be change according to the stage of development of the countries. Because of the variety of this relation, Patrick (1966) proposed four hypothesis for the theoritical explanation for this relationship. The first one is 'the supply-leading hypotheses'. This hypothesis indicate that development of financial system increases growth through two functions. Firstly, in order to increase efficiency of resource allocation, financial system directs funds to modern sector instead of traditional sectors. Increased efficiency in resource allocation increases economic productivity and increase in productivity leads to growth in economic activity. Secondly, fund owners increase supplying their savings to the financial intermediaries through financial system. Increasing for the amount of funds in the financial markets stimulate investments that affect economic growth positively. McKinnon (1973) and Shaw (1973) were the first studies that present experimental outcomes on the supply-leading hypothesis.

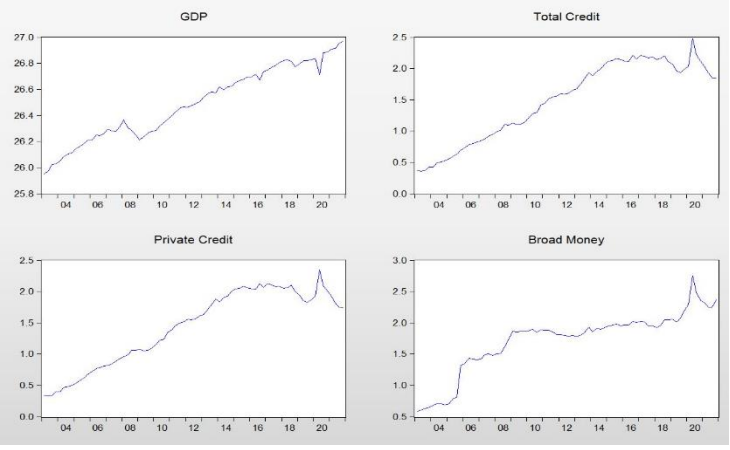
The second view of theoritical explanation for the relation between financial system and growth is 'demand-following hypotheses'. This view indicate that development of financial system follows economic growth because economic growth increases expectations in a positive way. An improvment in expectations will increase investment expenditures which developed supply of funds in financial markets. The theoritical framework of this view is provided by Robinson (1952). The claims made in Robinson (1952) have been supported by the subsequent empirical studies like Curley and Shaw (1960), Goldsmith (1969) and Jung (1986).

Third view of theoritical explanation for the relation between financial system and growth is 'neautrality hypotheses'. Lucas (1988) emphasizes the overestimated the consequences of development of financia system on economic activity in the empirical literature. Although there is few studies, this idea is also supported in the literature. Stern (1989) supports this argument. This idea is also supported by some studies in the related literature. Furthermore, 'the feedback hypothesis' implies that the relation between financial system and growth is interdependent.

Eroğlu and Yeter (2021) implied that development of finacial system on growth is positive in the pioneering studies which are mostly based on neo-classical growth theories. According to this theory, technological progress is considered as exogenous and financial system is not included explicitly in any model. According to the empirical literature, financial markets have a positive effects on economic growth by reducing transaction costs and risks, mobilizing services, and increasing resource allocation efficiency for potential investors. In addition to these studies, after the development of endogenous growth theories, the effects of financial system on economic activity have been investigated much more than previous periods ((Bencivenga and Smith (1991), King and Levine (1993a), King and Levine (1993b)). However, this relationship has been investigated using different methods and emprical tests in the related literature over decades, there is not a consensus and further investigations shoul be done (Ferreira, 2021).

This relationship has been also investigated for Turkish economy using various methods but there is not a common view. Thus, in this study, how development of financial system effects growth is examined over the period 2003.Q1-2021.Q4 using both linear and non-linear methods, namely linear Autoregressive Distributed Lag (ARDL) and Non-linear Autoregressive Distributed Lag Method (ARDL) model to consider possibility of asymmetric shocks to financial system. One of the key advantage of ARDL model is that all variables should not be I(1) and this method can be performed unless variables are I(2). The other advantage of ARDL model is that it has the higher robustness in small sample when it is compared with traditional co-integration models. Moreover, Nonlinear ARDL model allows us to analyse the co-integration and asymmetric dynamics between variables, which has many advantages over other co-integration methods. Because of these superiorities, ARDL model is selected to search the possible asymmetric changes of development of financial system.

Figure 1. The Evolution of GDP, Total Domestic Credit, Domestic Private Credit, and Broad Money Supply



Different variables are preferred as a proxy for development of financial system in the empirical literature. The most preferred variable are the total domestic credit, domestic

private credit, and the broad money supply. These three variables are preferred as a proxy for financial variable in this study: the ratio of total credit to GDP, the ratio of domestic credit to private sector to GDP, and the ratio of broad money supply to GDP. From the Figure 1, it can be seen that the evolution of the amount of total credit has a similar movements to GDP from 2003 to the second half of the 2010's. Therefore, it can be said that there is a cointegration relation between financial development variables and economic growth for Turkish economy.

In the related literature, the relation between development of financial indicators and growth is investigated mostly employing linear methods. Thus, the possible asymmetric effects of proxy variables for financial system on growth cannot be detected. The contribution of this paper to the empirical literature is that the effect of development financial variables on growth in the Turkish economy is analysed using nonlinear ARDL method.

The paper is organized as follows: Section 2 represents the review of related studies, Section 3 introduces data and models, Section 4 discusses the empirical outcomes, and conclusion is represented in Section 5.

2. Literature Review

According to the empirical studies, there is no final decision about the relation between changes in financial system and growth. The results are changed when country groups, period, and methodology is varied. In the related literature, this relation is investigated using different estimation methods to examine the Patrick (1966)'s theory. The relation is considered by Narayan and Narayan (2013) for 65 developing countries, Naik and Padhi (2015) for 27 emerging countries, Bist (2018) for low income countries, Yang (2019) searches this relation for 3 different country groups: high income economies, developed middle income countries and trapped middle income countries, and Odugbesan et al. (2021) for MINT countries. Although most of these studies indicate that financial development effects economic growth positively, the results vary when the level of development of countries and country groups change.

The relation has been also examined for more homogenous groups. This relationship is analyzed by Adarov and Tchaidze (2011) for CE4 nations (the Czech Republic, Hungary, Poland, and the Slovak Republic), Yıldırım et al. (2013) for emerging European countries, Sönmez and Sağlam (2017) for developed and developing European countries, Stojkoski et al. (2017) for 16 South-Eastern and Central European countries, and Matei (2020) for 11 Emerging European Countries. Moreover, Bittencourt (2012) analyzes for Latin American countries, Zang and Kim (2007) for China, Japan and South Korea, Krishnankutty (2011) for Indian states, Bayar (2014) for seven Asian emerging countries, Rana and Barua (2015) for South Asian countries, Qamruzzaman and Jianguo (2018) for Asian countries, Sudip and Dastidar (2018) for five South Asian countries, and Bong and Premaratne (2019) for 10 South Asia countries. The results indicate that both the supply leading and the demand following ideas are supported according to selected country groups.

In the related literature, there are some studies which investigate the the relation for less developed countries. For less developed countries, the nature of the relation differs much more than for developed and developing countries. For example, Ahmed (2013) searches this relationship for 21 Sub-Sahran African countries and negative relation between financial liberalisation and income growth is found in these countries. Opoku et al. (2019) emloy the frequency domain spectral causality method for 47 African countries and, they find strong neutrality between development o financial system and economic growth even they find some evidence for supply leading, demand following and bidirectional causality between selected variables in the selected time period.

There are studies with a single country and support the supply leading hypthesis in the literature. Bojanic (2012) searches the effects of ratio of M2 and the finance depth ratio on economic growth for Bolivia. Results indicate that there is a relation between these variables and growth and a unidirectional causality form these variables to economic growth. Bakang (2015) investigates the impact of financial variabls on growth for Kenyan economics and these variables have significant and positive effects on economic facilities. Zhang et al. (2012) uses several financial indicators to analyze the relation between the selected variables and growth for China. They find that all selected variables have a positive effects on growth. Khan (2008) investigates the relation for Pakistan over the sample 1996-2005 using ARDL method and the results indicates that the long-run relation is significant. Jalil and Feridun (2011) also employs ARDL method between 1975-2008 for Pakistan using three different variables. According to results, there is a positive and siginificant relation. Giri and Sehrawat (2015) investigate the for Indian economy using different financial indicators and ARDL test results imply that these indicators effect economic activity positively. Furthermore, Pradhan et al. (2017) explores the relation between financial variables, inflation and growth in India and Paksitan using both ARDL and Vector Error Correction model. A unidirectional relation between domestic credit to economic growth is found and this results imply 'supply-leading' view for both countries. Kumar and Paramanık (2020) also examines the effects of broad money to economic growth for Indian economy over the sample 1996.Q1-20108.Q3 using non-linear ARDL method. The positive relation is found between money supply and economic growth in long time period. The effect of inflation and money supply on growth over the period 1990-2017 is investigated by Ngoc (2020) using non-linear ARDL approach for Vietnam. The results imply that money supply has a positive effects both in the sort and long-run. Camba and Camba (2020) examines the the relation for the Philippines using ARDL method. A long time period relationship between these variables and growth is found.

In contrast with these studies, there are studies that support other hypothesis in the literature. Hasan et al. (2009) investigates the relation using the ratio of equity and non-financial corporate depth and bank sector depth for China. According to the results, although bank sector depth has not a significant effects on economic growth, other variables have a positive and significant effects. Wang (2019) also searches the relation for China's economy and growth has a significant effect on deepining of financial system after estimation. Lyoboyi (2013) examines for Nigerian economy using two variables, namely, total banking credit and stock market capitalization. However, a bidirectional relation between total banking credit and economic growth is found, causality relation can not be found between growth of stock market capitalization and growth. Adu et al. (2013) investigates the relation in Ghana and they found that the nature of the relation can vary depending on the selected financial variable. Although the private sector credit have positive effect, broad money supply has a negative effect. Adusei and Nkrumah (2013) also searches the relation for Ghana and they find contradictory results with the empirical literature. According to their results, domestic credit and broad money supply have negative effects and domestic credit to private sector has a insignificant effect on growth.

In the related literature, the relation between develeopment of financial system and economic growth have been also investigated for Turkish economy and there are studies that found the supply-leading view for Turkey such as, Acaravcı et al. (2007), Halıcıoğlu (2007), Türedi and Berber (2010), Karaca (2012), Mercan and Peker (2013), Aydın et al. (2014), Yüksel and Adalı (2017), Pata and Ağca (2018), Felek et al. (2018), Eyüboğlu and Akan (2020), Fendoğlu (2021), and Eroğlu and Yeter (2021). Karaca (2012) creates financial development index and searches the relation between this index and growth. According to results, there is a positive unidirection relation from the index to growth. Mercan and Peker (2013) investigates this relation using ARDL method and causality tests. They conclude that the long-run relation exist and the causality is form develeopment of financial variable to economic growth. Aydın et al. (2014), Yüksel and Adalı (2017) and Eroğlu and Yeter (2021) employ Toda-Yamamato causality test and the results indicate that unidirection causality from financial development to econonmic acitivity exists. Pata and Ağca (2018) searches the effects of domestic credits to economic growth using ARDL method and causality methods. They also find that the causality is from financial variables to economic activity. Felek et al. (2018) create financial development index using eleven different financial variables and they find that financial development stimulates the economic growth. Eyüboğlu and Akan (2020) employs cointegration tests, namely, Engle-Granger cointegration test and RALS-EG cointegration test and they conclude that the causality runs financial sector to economic activity. Fendoğlu (2021) employs Fourier Autoregressive Distributed Lag analysis and causality test for Turkish economy. Results support supply-leading hypothesis.

In contrast with these studies, Yılmaz and Kaya (2006), Kandır et al. (2007), Ozturk (2008), Ceylan and Durkaya (2010), Keskin and Karşıyakalı (2010), and Kar et al. (2014) point the demand-pull view. Kar et al. (2014), Ak et al (2016), and Taşseven and Yılmaz (2022) uses several variables as a proxy for development of financial system and they find unidirection relation from growth to development of financial system.

The bidirectional relation is also found for Turkish economy in the empirical literature, such as Oktayer (2008), Akkay (2010), Demirhan et al. (2011), Karahan and Yılgör (2011), and Kılıç et al. (2019). Akkay (2010) also search this relation for two different periods: 1989-2001 and 2001-2010. According to results, bidirectinal causality exists and causality runs from growth to changes in financial system for the second time period. In Kılıç et al. (2019) uses several variables and cointegration tests and the long-run relation exists for Turkish economy.

Literature review shows that the relatinship between development of financial system and growth varies according to countries development level, selected period, and employed methods. The results of the some studies in the empirical literature have supported supply-leading hypothesis, some studies have supported demand-following hypothesis and some of them supported bidirectional causality relation.

3. Research Method

3.1. Data Source and Description

We examine the effects of development of financial system on growth over the period 2003.Q1-2021Q4. The dataset contains gross domestic product (GDP), exchange rate ($/TL), consumer price index, the ratio of net export to GDP, the ratio of investment expenditure to GDP, the ratio of broad money supply to GDP, the ratio of the private sector credit to GDP, and the ratio of total domestic credit to GDP. The ratio of broad money supply to GDP, the ratio of the private sector credit to GDP, and the ratio of total domestic credit to GDP are proxy variables for financial development. Economic growth is calculated by taking the logarithmic difference of GDP. Electronic Data Delivery System of Central Bank of Republic of Turkey is the main data source. All variables are seasonally adjusted using Census X-12 method and the logarithm of consumer price index and exchange rate is taken.

3.2 Model Specification

In this paper, we employ linear and nonlinear ARDL models to examine the symmetric and asymmetric effects of changes of financial system on growth. However, there are several methods employs to find the cointegration relations, the linear ARDL method is the one of the most employed cointegration methods in the related literature because of advantages. First, the linear ARDL model performs better in the small and finite samples. Secondly, ARDL model is

employed if the variables are stationary or I(1) unlike other conventional methods which claim that variables have to be stationary at the same level. On the other hand, Peseran et al. (2001) specifies that ARDL model is not applicable if the variables are stationary at the second degree, or larger. Moreover, ARDL model allows different number of lag values of variables.

The ARDL model can be applied if some conditions are met. Firstly, unit root test is be employed to detect integration degree of variables. Secondly, lag numbers of all variables should be determined using information criteria. Then, the bound test should be employed whether long time exists between variables or not. Once the long-run relation is determined, diagnostic tests, such as Breusch-Pagan test, White test, Jarque-Bera test and CUSUM and CUSUM of squares test, should be performed to make sure that the model is correct or not.

With the review of the literature, the linear form of long-run relation among variables can be constructed as follows:

$$lnGDP_t = \beta_0 + \beta_1 lnfx_t + \beta_2 lncpi_t + \beta_3 openness_t + \beta_4 inves_t + \beta_5 FD_t + u_t \quad (1)$$

where *lnGDP* represents GDP, *lnfx* represents exchange rate, *lncpi* represents consumer price index, *openness* represents the ratio of net export to GDP, *inves* represents the ratio of investment to GDP, *FD* represents the financial development indicators. There three variables are preferred as indicators for financial development (FD): the ratio of broad money supply to GDP, the ratio of the private sector credit to GDP, and the ratio of total domestic credit to GDP. β_0 is constant term, $\beta_1,\ \beta_2, \dots, \beta_5$, are the coefficient of model and u_t denotes the disturbance term. We can transform equation (1) into the generalized form of ARDL model as follow:

$$\Delta(lnGDP_t) = \alpha_0 + \varphi_1 lnGDP_{t-1} + \varphi_2 lnfx_{t-1} + \varphi_3 lncpi_{t-1} + \varphi_4 openness_{t-1} + \varphi_5 inves_{t-1} + \varphi_6 FD_{t-1} + \sum_{j=1}^{p} \omega_1 \Delta(lnGDP_{t-j}) + \sum_{j=1}^{q_1} \omega_2 \Delta(lnfx_{t-j}) + \sum_{j=1}^{q_2} \omega_3 \Delta(lncpi_{t-j}) + \sum_{j=1}^{q_3} \omega_4 \Delta(lnopenness_{t-j}) + \sum_{j=1}^{q_5} \omega_5 \Delta(inves_{t-j}) + \sum_{j=1}^{q_6} \omega_6 \Delta(FD_{t-j}) + \varepsilon_t \quad (2)$$

where $\varphi_1, \varphi_2, \dots, \varphi_6$ are to long-run coefficients and ω_1, $\omega_2, \dots, \omega_6$ are the short-run coefficients., The null hypothesis should be established as $H_0: \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = \varphi_5 = \varphi_6 = 0$ to detect the long-run relationship. Alternative hypothesis, H_1, indicate that the long-run relationship exists. According to the Pesaran et al. (2001), the value of F-statistics should be bigger than the upper bound critical value to confirm long time period relation.

The ARDL model also investigates short-run relation and for this purpose, the short-run relation is searched by using following regression:

$$\Delta(lnGDP_t) = \vartheta_0 + \sum_{i=1}^{p_1} \delta_i \Delta(lnGDP_t) + \sum_{i=1}^{p_2} \mu_i \Delta(lnfx_t) + \sum_{i=1}^{p_3} \tau_i \Delta(lncpi_t) + \sum_{i=1}^{p_4} \theta_i \Delta(openness_t) + \sum_{i=1}^{p_6} \omega_i \Delta(inves_i) + \sum_{i=1}^{p_7} \pi_i \Delta(FD_t) + \psi ECT_{t-1} + \eta_t \quad (3)$$

The ECM coefficient is the Error Correction Coefficient and it implies that speed of adjustment of dependent variables converging to its long-run mean. Its coefficient should be negative to verify the convergence to its mean.

The ARDL method determines the relation between selected variables making symmetric assumptions that the dependent variable linearly influenced by independent variables. Changes in the dependent variable can be either negative or positive. For this reason, Shin et al. (2014) developed the asymmetric ARDL model to analyse the negative and positive shocks of an independent variable. Decomposition of negative and positive shocks of financial development is represented by FD+ and FD-:

$$FD_t^+ = \sum_{L=1}^{t} \Delta FD_L^+ = \sum_{L=1}^{T} MAX(\Delta FD_L, 0)$$
$$FD_t^- = \sum_{L=1}^{t} \Delta FD_L^- = \sum_{L=1}^{T} MIN(\Delta FD_L, 0) \quad (4)$$

where FD_t^+ and FD_t^- are positive and negative shocks, respectively and they are partial sum of positive and negative changes in financial development indicators. Equation (2) can be rewritten in nonlinear form by adding FD_t^+ and FD_t^- as follows:

$$\Delta(lnGDP_t) = \alpha_0 + \varphi_1 lnGDP_{t-1} + \varphi_2 lnfx_{t-1} + \varphi_3 lncpi_{t-1} + \varphi_4 openness_{t-1} + \varphi_5 inves_{t-1} + \varphi_6^+ FD_{t-1} + \varphi_6^- FD_{t-1} + \sum_{j=1}^{p} \omega_1 \Delta(lnGDP_{t-j}) + \sum_{j=1}^{q_1} \omega_2 \Delta(lnfx_{t-j}) + \sum_{j=1}^{q_2} \omega_3 \Delta(lncpi_{t-j}) + \sum_{j=1}^{q_3} \omega_4 \Delta(lnopenness_{t-j}) + \sum_{j=1}^{q_5} \omega_5 \Delta(inves_{t-j}) + \sum_{j=1}^{q_6} \omega_6^+ \Delta(FD_{t-j}) + \sum_{j=1}^{q_7} \omega_6^- \Delta(FD_{t-j}) + \varepsilon_t \quad (5)$$

In equation 5, $\varphi_1,\ \varphi_2, \dots, \varphi_6$ are long-run coefficients; $\omega_1, \omega_2, \dots, \omega_6$ are short-run coefficients and $q_1, q_2, \dots, q_6$ are lag orders. Nonlinear ARDL model allows us to investigate the asymmetric relation both in the short and in long time period. To apply the nonlinear ARDL model, unit root tests should be applied to determine the integration degree of selected variables.

4. Empirical Results

4.1. Results of Estimation of ARDL and NARDL Model

Augmented Dickey Fuller (ADF) test and Phillips-Perron test are preferred to determine the integration degree of variables and the results of unit root tests are represented in Table 1. Results imply that second order integrated variables are not exist and bound test can be used to determine the long-run relation.

Pesaran et al. (2001) developed the bounds test under symmetric and asymmetric assumption. Results of the bound tests are represented in Table 2 and the F-statistics results are over the upper-bound of the test. These results imply that there is a cointegration relation between development of financial variables and growth for both linear and nonlinear models.

Table 1. Results of Unit Root Tests

Variables	Test	Level		First Difference		Integration Degree
		Constant	Constant and Trend	Constant	Constant and Trend	
GDP	**ADF**	-0.874	-2.732	-11.396***	-11.342***	I(1)
		(0.791)	(0.227)	(0.000)	(0.000)	
	Phillips-Perron	-0.914	-3.364*	-11.396	-11.342	
		(0.777)	(0.064)	(0.000)	(0.000)	
CPI	**ADF**	3.249	2.242	-3.539***	-4.600***	I(1)
		(1.000)	(1.000)	(0.009)	(0.002)	
	Phillips-Perron	3.650	3.226	-3.444**	-4.579***	
		(1.000)	(1.000)	(0.012)	(0.002)	
Exchange Rate	**ADF**	3.791	-0.224	-6.588***	-5.078***	I(1)
		(1.000)	(0.991)	(0.000)	(0.000)	
	Phillips-Perron	3.945	-0.876	-6.588***	-8.306***	
		(1.000)	(0.953)	(0.000)	(0.000)	
Investment Expenditure/GDP	**ADF**	-2.267	-1.805	-4.249***	-4.125***	I(1)
		(0.185)	(0.691)	(0.001)	(0.009)	
	Phillips-Perron	-3.210**	-2.568	-7.081***	-7.454***	
		(0.023)	(0.296)	(0.000)	(0.000)	
Openness/GDP	**ADF**	-1.213	-3.262*	-2.983***	-3.115***	I(1)
		(0.664)	(0.080)	(0.042)	(0.114)	
	Phillips-Perron	-0.760	-3.264*	-12.177***	-12.134***	
		(0.824)	(0.080)	(0.000)	(0.000)	
Total Domestic Credit/GDP	**ADF**	-2.097	0.668	-8.239***	-9.374***	I(1)
		(0.246)	(0.999)	(0.000)	(0.000)	
	Phillips-Perron	-1.942	0.257	-8.820***	-9.362***	
		(0.319)	(0.998)	(0.000)	(0.000)	
Private Sector Credit/GDP	**ADF**	-2.027	0.156	-8.619***	-9.237***	I(1)
		(0.275)	(0.997)	(0.000)	(0.000)	
	Phillips-Perron	-2.028	0.339	-8.626***	-9.224***	
		(0.275)	(0.998)	(0.000)	(0.000)	
Broad Money Supply/GDP	**ADF**	-1.929	-2.207	-8.475***	-8.538***	I(1)
		(0.318)	(0.479)	(0.000)	(0.000)	
	Phillips-Perron	-2.289	-1.966	-8.464***	-8.682***	
		(0.178)	(0.610)	(0.000)	(0.000)	

Table 2. Bound Test Results for Cointegration

Model Specification	F-Statistic	Critical Values of Bound Test		Conclusion
Linear		I(0)	I(1)	
Total Domestic Credit/GDP	10.566	3.12	4.25	Cointegration
Private Sector Credit/GDP	10.566	3.12	4.25	Cointegration
Broad Money Supply/GDP	8.128	3.12	4.25	Cointegration
Non-Linear				
Total Domestic Credit/GDP	9.263	2.87	4.00	Cointegration
Private Sector Credit/GDP	6.800	2.87	4.00	Cointegration
Broad Money Supply/GDP	6.436	2.87	4.00	Cointegration

Note: Critical values for linear models F-Statistics are 3.12 for lower-critical value and 4.25 for upper-critical value at % 5 significance level. Critical values for non-linear models F-Statistics are 2.87 for lower-critical value and 4.00 for upper-critical value at % 5 significance level.

Bound test results confirmed that cointegration relation exists between development of financial indicators and growth. Then, both long and short time period effects of development of financial indicators on growth is estimated and estimation results for linear models in the long-run is represented in Table 3, estimation results for linear models in the short-run is represented in Table 4. According to the results for linear models in long time period, CPI has negative impacts for all regression and effects of CPI is significant except second regression on growth.

Table 3. Estimation Results for Linear Models in the Long-Run

Variables	(1) ARDL Model for Total Domestic Credit (3, 1, 1, 1, 3, 1)	(2) ARDL Model for Private Sector Credit (3, 1, 1, 1, 3, 1)	(3) ARDL Model for Broad Money Supply (3, 1, 1, 3, 3, 3)
CPI	-0.163*	-0.138	-0.266**
	(0.079)	(0.125)	(0.020)
Exchange Rate	-0.088***	-0.09***	-0.080***
	(0.000)	(0.000)	(0.006)
Openness/GDP	0.688***	0.688***	0.324
	(0.000)	(0.000)	(0.346)
Investment Expenditure/GDP	1.698***	1.707***	2.175***
	(0.000)	(0.000)	(0.000)
Total Domestic Credit/GDP	0.075**	--	--
	(0.014)		
Private Sector Credit/GDP	--	0.069**	--
		(0.0145)	
Broad Money Supply/GDP	--	--	0.096**
			(0.016)
Constant	20.463***	25.508***	24.196***
	(0.000)	(0.000)	(0.000)
Trend	0.025***	0.0250***	0.015***
	(0.000)	(0.000)	(0.000)
Diagnostic Tests			
Autocorrelation	1.361	1.152	0.081
	(0.261)	(0.210)	(0.922)
Heteroscedasticity	1.069	1.194	0.246
	(0.405)	(0.301)	(0.622)
Jarque-Bera Test	3.973	3.955	3.721
	(0.137)	(0.138)	(0.135)

Note: ***, **, * represents significance level for % 1, % 5, and % 10, respectively. Probability values in parentheses. Breusch-Godfrey Test is employed for autocorrelation and the lag number is determined using Akaike Information Criteria (AIC). 4 lags are selected for ARDL Model for Total Domestic Credit regression, 4 lags for ARDL Model for Private Credit regression and 2 lags for ARDL Model for Broad Money Supply regression. White Test is employed for heteroscedasticity.

The effects of exchange rate are negative, openness and investment expenditure is positive for all regressions in the long-run. In the first regression, total domestic credit is added to the regression and the results indicate that total domestic credit has a positive effect. In the second regression, the effects of private sector credit is investigated and it has a positive impact. Furthermore, the third regression shows that broad money supply is also positive in long time period. Estimation results for linear models indicate that all financial variables have positive impacts on growth from 2003 to 2021 in Turkish economy and these results support 'the supply-leading hypotheses'.

There are some contradictions between estimation results for both periods. However, inflation and exchange rates have positive effects as opposed to the long-run, inflation has not significant effects in short time period. Moreover, effects of investment expenditure and openness have positive for both periods. When we analyse the effects of total domestic credit, there is a positive effect as in the long-run. Other financial development variables also have positive and significant effects for both time span.

The Error Correction Term (ECT) performs the speed of convergence to equilibrium when a shock hits the economy. The sign of the ECT is negative for all regressions as expected and the values of the coefficient of ECT are -0.797, -0.802, and -0.993, respectively. These results indicates that the convergence to equilibrium quickly.

The asymmetric relation is considered employing Non-linear ARDL model developed by Shin et al. (2014). Estimation outcomes of non-linear models in the long-run is represented in Table 5. In contrast with the results of linear models, CPI has no significant effect on economic growth for all regressions. Exchange rate, openness and investment expenditure have significant effects in line with results of linear models. According to the results, there is no general conclusion on effects of financial variables on growth in long time period. Positive shock to total credit shows negative coefficient with statistically insignificant. This implying that any positive development in financial variable, namely, total credit to GDP has no effect in contrast with results of linear model. On the contrary, negative shock of total credit has negative impact. Another financial variable is private credit and neither positive shock nor negative shock of this variable have significant effect.

Table 4. Estimation Results for Linear Models in the Short-Run

Variable	(1) ARDL Model for Total Domestic Credit (3, 1, 1, 1, 3, 1)	(2) ARDL Model for Private Sector Credit (3, 1, 1, 1, 3, 1)	(3) ARDL Model for Broad Money Supply (3, 1, 1, 3, 3, 3)
Δ**(CPI)**	0.221	0.214	0.234
	(0.146)	(0.158)	(0.165)
$\Delta(\boldsymbol{GDP(-1)})$	0.070	0.092	0.068
	(0.329)	(0.201)	(0.517)
$\Delta(\boldsymbol{GDP(-2)})$	0.191**	0.198***	0.213**
	(0.003)	(0.002)	(0.017)
$\Delta(\boldsymbol{ExchangeRate})$	0.092***	0.094***	0.159***
	(0.006)	(0.005)	(0.000)
$\Delta(\boldsymbol{Openness/GDP})$	0.891***	0.902***	0.735***
	(0.000)	(0.000)	(0.000)
$\Delta(\boldsymbol{Openness/GDP(-1)})$	--	--	0.797***
			(0.000)
$\Delta(\boldsymbol{Openness/GDP(-2)})$	--	--	0.403**
			(0.011)
$\Delta(\boldsymbol{InvestmentExp./GDP})$	0.892***	0.910***	1.029***
	(0.000)	(0.000)	(0.000)
$\Delta(\boldsymbol{InvestmentExp./GDP(-1)})$	-0.415*	-0.420*	-0.968***
	(0.069)	(0.064)	(0.002)
$\Delta(\boldsymbol{InvestmentExp./GDP(-2)})$	-0.485**	-0.474**	-0.476*
	(0.023)	(0.025)	(0.051)
Δ**(Total Domestic Credit /GDP)**	0.256***	--	--
	(0.000)		
Δ**(Private Sector Credit/GDP)**	--	0.270***	--
		(0.000)	
Δ**(Broad Money Supply/GDP)**	--	--	0.180***
			(0.000)
Δ**(Broad Money Supply /GDP(−1))**	--	--	-0.036
			(0.169)
Δ**(Broad Money Supply /GDP(−2))**	--	--	0.053**
			(0.038)
Constant	20.463***	20.508***	24.195***
	(0.000)	(0.000)	(0.000)
Trend	0.025***	0.025***	0.015***
	(0.000)	(0.000)	(0.000)
CointEq(-1)	-0.797***	-0.802***	-0.993***
	(0.000)	(0.000)	(0.000)

Note: ***, **, * represents significance level for % 1, % 5, and % 10, respectively. Probability values in parentheses. Δ representes first-difference.

The positive shock of broad money has positive impacts and it implies that positive development in broad money has positive effect. In contrast with this result, negative shock of broad money negatively associated with the economic growth.

Estimation results for non-linear models in the short-run is represented in Table 6. In contrast with the results of linear models, inflation is not significant for all regressions. First lag of inflation in the NARDL model for total domestic credit is insignificant but second lag of inflation is positive. Thus, the effect of inflation does not have a positive effect on growth neither in linear models nor in nonlinear models. The result of changes in exchange rate, changes in investment expenditure, and changes in openness is similar with the linear models in the short-run and they have a positive impact on growth. These results are compatibility with results of NARDL models in the long-run. Lags of investment expenditure and openness are negative in contrast with the expectations.

The positive shock in total credit shows positive coefficient with statistically significant and the negative shock shows negative coefficient statistically insignificant. The lag of negative variable has positive impact on growth. This implying that any positive development in financial variable, namely, the total credit has positive effect on growth but level of negative shock has no effect on growth

in contrast with the NARDL model in the long-run. Another financial variable is private credit and neither positive shock nor negative shock of private credit has no significant effect on growth. Another financial variable is broad money. The positive shock to this variable shows positive coefficient with statistically insignificant and negative shock shows negative coefficient with statistically significant. These results coincide with those obtained from the estimation of NARDL models in the long-term.

Table 5. Estimation Results for Non-Linear Models in the Long-Run

Variable	(1) NARDL Model for Total Domestic Credit (3, 3, 1, 3, 3, 1, 4)	(2) NARDL Model for Private Sector Credit (3, 1, 1, 1, 3, 1, 1)	(3) NARDL Model for Broad Money Supply (3, 1, 1, 3, 3, 3, 3)
CPI	-0.163	-0.026	0.193
	(0.194)	(0.845)	(0.105)
Exchange Rate	-0.093***	-0.072***	-0.076***
	(0.000)	(0.000)	(0.003)
Openness	0.817***	0.648***	0.226
	(0.000)	(0.000)	(0.499)
Investment Expenditure	1.509***	1.665***	2.065***
	(0.000)	(0.000)	(0.000)
Total Credit_Positive	-0.049	--	--
	(0.199)		
Total Credit_Negative	-0.136***	--	--
	(0.006)		
Private Credit_Positive	--	0.017	--
		(0.461)	
Private Credit_Negative	--	-0.04	--
		(0.368)	
Broad Money_Positive	--	--	0.082**
			(0.028)
Broad Money_Negative	--	--	-0.155***
			(0.000)
Constant	23.866***	23.689***	23.103***
	(0.000)	(0.000)	(0.000)
Trend	0.029***	0.025***	0.015
	(0.000)	(0.000)	(0.000)
Diagnostic Tests			
Autocorrelation	1.362	1.119	0.830
	(0.167)	(0.367)	(0.367)
Heteroscedasticity	0.608	0.732	1.378
	(0.908)	(0.819)	(0.171)
Jarque-Bera Test	3.729	0.064	3.619
	(0.571)	(0.968)	(0.496)

Note: ***, **, * represents significance level for % 1, % 5, and % 10, respectively. Probability values in parentheses. Breusch-Godfrey Test is employed for autocorrelation and the lag number is determined using Akaike Information Criteria (AIC). 2 lags are selected for ARDL Model for Total Domestic Credit regression, 4 lags for ARDL Model for Private Credit regression and 1 lags for ARDL Model for Broad Money Supply regression. White Test is employed for heteroscedasticity.

The coefficient of the ECT is negative for all regressions as expected and the values of the coefficient of ECT are -0.932, -0.945, and -0.938, respectively. These results indicates that the convergence to equilibrium quickly when a shock hits the economy as in linear ARDL model.

Table 6. Estimation Results for Non-Linear Models in the Short-Run

Variable	NARDL Model for Total Domestic Credit (3, 3, 1, 3, 3, 1, 4)	NARDL Model for Private Sector Credit (3, 1, 1, 1, 3, 1, 1)	NARDL Model for Broad Money Supply (3, 1, 1, 3, 3, 3, 3)
Δ(CPI)	0.334** (0.036)	0.335** (0.016)	0.228 (0.182)
Δ(CPI(-1))	-0.223 (0.185)	--	--
Δ(CPI(-2))	0.278* (0.09)	--	--
Δ(GDP(-1))	0.126 (0.232)	0.049 (0.477)	-0.042 (0.752)
Δ(GDP(-2))	0.288*** (0.003)	0.143** (0.016)	0.315*** (0.004)
Δ(ExchangeRate)	0.019 (0.623)	0.062** (0.041)	0.155*** (0.000)
Δ(Openness)	0.938*** (0.000)	0.862*** (0.000)	0.795*** (0.000)
Δ(Openness(-1))	-0.281* (0.06)	--	0.800*** (0.000)
Δ(Openness(-2))	-0.189 (0.178)	--	0.328** (0.033)
Δ(InvestmentExpenditure)	0.786*** (0.000)	0.978*** (0.000)	0.889*** (0.000)
Δ(InvestmentExpenditure(-1))	-0.430* (0.088)	-0.474** (0.026)	-0.943*** (0.005)
Δ(InvestmentExpenditure(-2))	-0.551** (0.011)	-0.462** (0.020)	-0.536** (0.036)
Δ(TotalCreditPositive)	0.340*** (0.000)	--	--
Δ(TotalCreditPositive(-1))	--	--	--
Δ(TotalCreditPositive(-2))	--	--	--
Δ (TotalCreditNegative)	-0.062 (0.291)	--	--
Δ (TotalCreditNegative(-1))	0.096 (0.187)	--	--
Δ (TotalCreditNegative(-2))	0.223*** (0.001)	--	--
Δ (TotalCreditNegative(-3))	0.135*** (0.003)	--	--
Δ(PrivateCreditPositive)	--	-0.016 (0.580)	--
Δ(PrivateCreditNegative)	--	-0.038 (0.353)	--
Δ(BroadMoneyPositive)	--	--	0.161*** (0.000)
Δ(BroadMoneyPositive(-1))	--	--	0.048 (0.172)
Δ(BroadMoneyPositive(-2))	--	--	0.044 (0.226)
Δ(BroadMoneyNegative)	--	--	-0.252*** (0.004)
Δ(BroadMoneyNegative(-1))	--	--	0.027 (0.786)
Δ(BroadMoneyNegative(-2))	--	--	0.213** (0.027)
Constant	23.867*** (0.000)	23.689*** (0.000)	23.103*** (0.000)
Trend	0.029*** (0.000)	0.025*** (0.000)	0.015*** (0.000)
CointEq(-1)	-0.932*** (0.000)	-0.945*** (0.000)	-0.938*** (0.000)

Note: ***, **, * represents significance level for % 1, % 5, and % 10, respectively. Probability values in parentheses.

4.2. Granger Causality Test

The estimation results of ARDL and NARDL model imply that there is causality relation between selected variables in the selected model. To ensure the causality relation between selected variables, Granger causality test is employed and results for short-term are represented in Table 7.

Table 7. Granger Causality Results

	Causality							
	Δ(GDP)	Δ(CPI)	Δ(ExchangeRate)	Δ(Openness)	Δ(Investment)	Δ(TotalCredit)	Δ(PrivateCredit)	Δ(BroadMoney)
Δ(GDP)	--	12.926**	6.069**	1.168	10.025***	3.888**	3.964*	0.139
		(0.042)	(0.014)	(0.194)	(0.001)	(0.049)	(0.065)	(0.709)
Δ(CPI)	31.284**	--	11.062***	1.104	1.912	65.049***	64.437***	19.727**
	(0.000)		(0.004)	(0.293)	(0.384)	(0.000)	(0.000)	(0.011)
Δ(ExchangeRate)	0.216	7.012**	--	17.148**	0.360	24.053***	23.164***	2.073
	(0.642)	(0.030)		(0.017)	(0.548)	(0.002)	(0.003)	(0.150)
Δ(Openness)	3.024*	0.192	13.298**	--	6.630	2.150	0.865	1.115
	(0.082)	(0.661)	(0.065)		(0.356)	(0.143)	(0.352)	(0.291)
Δ(Investment)	0.616	1.325	5.677**	2.888	--	1.711	0.799	2.177
	(0.432)	(0.516)	(0.018)	(0.823)		(0.191)	(0.371)	(0.140)
Δ(TotalCredit)	2.159	32.787***	20.287***	0.014	0.763	--	27.010***	1.372
	(0.142)	(0.000)	(0.009)	(0.905)	(0.382)		(0.000)	(0.241)
Δ(PrivateCredit)	3.269*	33.161***	21.220***	0.050	0.473	25.281***	--	1.000
	(0.071)	(0.000)	(0.007)	(0.822)	(0.492)	(0.000)		(0.801)
Δ(BroadMoney)	0.016	19.395**	0.009	0.013	0.404	1.194	2.440	--
	(0.901)	(0.013)	(0.925)	(0.908)	(0.525)	(0.274)	(0.486)	

Note: ***, **, * represents significance level for % 1, % 5, and % 10, respectively. Probability values in parentheses.

Table 7 shows the causality between selected variables in the short time period. Since we estimate the long-term relationship with ARDL and NARDL model, the results that estimated using error correction model are not included in the text. According to results included total credit variable, the value of ECT(-1) is -0.174 and t-statistic is -2.288. The value of ECT(-1) and t statistics of ECT(1-) is -0.348 and -2.583, respectively, if the private credit is added to the model. Furthermore, the value of ECT(-1) and t statistics of ECT(1-) is -0.459 and -2.128, respectively, if the broad money is added to the model. When the financial development variables are taken as a dependent variable, there is not any Granger causality from growth to development of financial variables. The value of ECT(-1) and t statistics of ECT(1-) is 0.165 and 0.974, respectively, if the total credit is dependent variable. Moreover, the value of ECT(-1) and t statistics of ECT(1-) is 0.139 and 0.740, respectively, if the private credit is dependent variable and the value of ECT(-1) and t statistics of ECT(1-) is -0.185 and- 0.640, respectively, if the broad money is dependent variable. Thus, it can be said that financial variables are Granger cause to growth in the long-run for Turkish economy. These results are parallel with Bara and Mudxingri (2016) and Qamruzzaman and Jiango (2016).

Results indicate that there is a unidirectional causality from total credit to growth and bidirectional causality relation between private credit and growth in the short-run. While broad money supply is selected, there is not a causality between broad money and growth. These results are parallel the studies that find 'the supply-leading' outcomes between financial variables and growth.

Table 7 also represents causality between financial variables and other selected variables. Results indicate that bidirectional causality between consumer price index and financial development indicators and exchange rate and financial development indicators except broad money. Furthermore, there are not any causality relationship between investment expenditure and openness variables and financial development in the short-run.

Results imply that there are unidirectional causality relationships from exchange rate and investment expenditure to growth and from growth to openness. Moreover, there is unidirectional relation between CPI and growth in the short-run in Turkish economy.

5. Conclusion

There are many factors affecting growth, such as technology, physical capital, human capital, trade, etc… Among these factors, the financial system has a key role to affect sustainable growth for any economy. The importance of financial system is that it optimizes the resource allocation and ensures the financial stability. For this reason, determining the relation between financial system and

growth is essential for political, the business, and the academic environment.

In the theoretical literature, Schumpeter (1911), Goldsmith (1969), Levine (1997), and McKinnon (1973) argued that financial development is important for economic growth. The researchers indicated that financial development has a crucial role decreasing the market frictions and increasing saving rate, investment expenditure, and technological innovation (Demirgüç-Kunt, 2006). Furthermore, King and Levine (1993a) supported that financial development increases capital accumulation and stimulates economic growth. In addition to the theoretical literature, positive effects of financial development on economic growth is proved by empirical studies. Beck et al. (2000) found that financial intermediaries has an impact on the total factor productivity growth, which effects economic growth. In the following years, the number of researches showing that financial development positively affects economic growth has increased in the related literature.

The aim of this study is to examine new evidence regarding the nexus between development of financial system and growth in Turkish economy over the period 2003Q1-2021Q4. We employ both linear ARDL and non-linear ARDL method to determine the short and the long-term relation. In contrast with the linear model, the asymmetric model indicates that the impact of positive and negative changes in financial variables could be different. In other words, the asymmetric model implies that positive impact of financial variables on growth may be different from the negative one. However, both ARDL and NARDL methods indicate long term relation between financial variables and growth in Turkish economy, differences are observed when the effects of financial variables are analysed. According to the linear model, all financial variables have positive effect on growth, which indicate supply-leading hypothesis. These results are similar to results of Khan (2008) for Pakistan, Bojanic (2012) for Bolivia, Bakang (2015) for Kenya, Zhang et al. (2012) for China, Giri and Sehrawat (2015) for India, and Camba and Camba (2020) for the Philippines. In the empirical literature, there are also studies which indicate 'supply-leading hypotheses' for Turkish economy. The results are in this paper are similar to the results of Mercan and Peker (2013) and Pata and Ağaca (2018).

The results of NARDL model gives contradictory results except supply of broad money. Positive shock to total credit has no significant effect but negative shock has a negative impact on growth. Positive and negative shock to broad money has significant effect and the effect of these shocks are asymmetric in the long-run. In the short term, broad money also has a significant positive and negative effect on economic growth for Turkish economy. It can be said that broad money has an asymmetric effect on economic growth in the short-run. These findings are in parallel to the results of Ngoc (2020) for Vietnam. Ngoc (2020) found that money supply had a positive effect both in the sort and in the long-run. The results that the significant and positive shock to the broad money is not similar to the results of Kumar and Paramanık (2020). However, they found that positive shock had a positive effect on economic growth for Indian economy in the long-run, money supply had no effect economic growth in the short-run. In addition to these results, total credit has asymmetric effects on growth. Private credit has no significant effect neither in long time nor in short time periods.

After estimating ARDL and NARDL models, the Granger causality is investigated between financial variables and growth. Results of causality tests are parallel with both linear ARDL and NARDL. There is unidirectional relationship from financial indicators to growth and these results imply 'the supply-leading hypotheses' for Turkish economy in long time period. These outcomes are similar to the results of Karaca (2012), Mercan and Peker (2013), Aydın et al. (2014), Yüksel and Adalı (2017), Eroğlu and Yeter (2021), and Pata and Ağaca (2018). There are some contradictions in short time period and results can be changed when the financial development indicators are changed. Bidirectional causality relationship from total credit to growth is determined. When private credit is employed instead of total credit, a bidirectional causality between financial variables and growth is found. While the broad money supply is selected, there is not a causality relation between financial variables and growth in short time period. Thus, results can be changed when the different variable is taken as an indicator for development of financial system.

This study outlines the importance of financial policies in Turkey and extend literature on the asymmetric effects of financial development on economic growth. According to the empirical results, financial development has a crucial role for economic growth of many nations with Turkey. Therefore, there is a strong relation between development of financial system and growth in Turkish economy that support the supply-leading hypothesis in long-term period. The principal policy recommendation is that improvement in financial system stimulate economic activity and growth. Thus, a stable and strong financial system is essential for economic growth for Turkish economy. There are asymmetric effects of total credit and private credit to economic growth. The policy-makers should also focus on developing the policies that provide a suitable environment for total and private credit to growth. Moreover, money supply stimulates the economic growth according to the results of models. Thus, the monetary authorities should developed the suitable monetary policy for Turkish economy.

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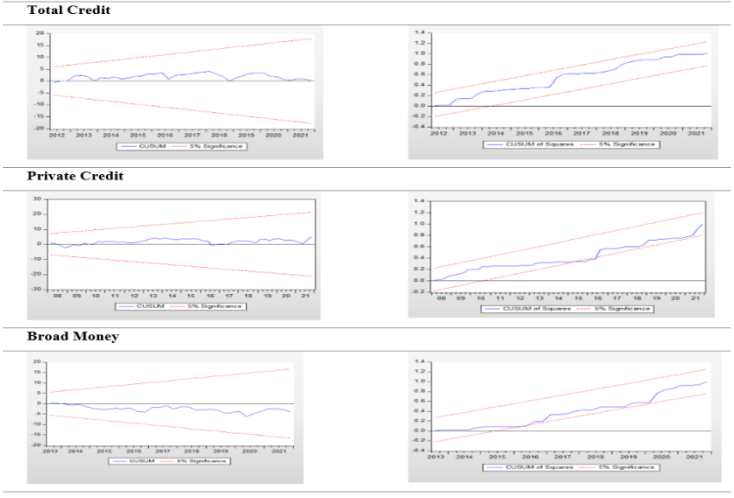
Appendix A. Stability Test Results of Linear Models



Appendix B. Stability Test Results of Non-Linear Models