Determining the Relationships Between Domestic Credits, Economic Growth and Inflation in Turkiye by Nonlinear Cointegration Analysis

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Abstract

The aim of this study is to determine the relationship between GDP and inflation and domestic loans given by banks to the private sector by using time series models. In this study, in which the 1972-2020 annual data for Turkiye were used, Harvey et al. (2008) Harvey and Leybourne (2007) linearity tests, traditional unit root tests for linearly determined series and Kapetanios, Shin and Snell (2003) (KSS) unit root tests for nonlinear series were performed. After the series were determined to be stationary, Kapetanios, Shin and Snell (KSS) (2006) cointegration test was performed. According to the results of the analysis, no cointegrated relationship was found between the GDP and inflation and domestic loans given by banks to the private sector in Turkiye. As a result, it can be said that there is no pass-through effect on GDP and inflation rates as a result of the increase/decrease in loans given by banks to the private sector in Turkiye.

Keywords: Domestic Loans, GDP, Inflation, Linearity Test, Nonlinear Cointegration Analysis.

JEL Classification: F43, E31, F41.

Öz - Türkiye'de Yurtiçi Krediler ile Ekonomik Büyüme ve Enflasyon Arasındaki İlişkilerin Doğrusal Olmayan Eşbütünleşme Analizi ile Tespiti

Bu çalışmanın amacı, GSYİH ile enflasyon ve bankaların özel sektöre verdikleri yurt içi krediler arasındaki ilişkiyi zaman serisi modelleri kullanarak belirlemektir. 1972-2020 Türkiye yıllık verilerinin kullanıldığı bu çalışmada Harvey vd. (2008) ile Harvey ve Leybourne (2007) doğrusallık testleri, doğrusal olarak belirlenmiş seriler için geleneksel birim kök testleri ve doğrusal olmayan seriler için Kapetanios, Shin ve Snell (2003) (KSS) birim kök testleri yapılmıştır. Serilerin durağan olduğu belirlendikten sonra Kapetanios, Shin ve Snell (KSS) (2006) eşbütünleşme testi yapılmıştır. Analiz sonuçlarına göre Türkiye'de GSYİH ile enflasyon ve bankaların özel sektöre verdikleri yurt içi krediler arasında eşbütünleşik bir ilişki bulunamamıştır. Sonuç olarak, Türkiye'de bankaların özel sektöre verdiği kredilerdeki artış/azalış sonucunda GSYİH ve enflasyon oranları üzerinde bir geçiş etkisinin olmadığı söylenebilir.

Anahtar Kelimeler: Yurtiçi Krediler, GSYİH, Enflasyon, Doğrusallık Testi, Doğrusal Olmayan Eşbütünleşme Analizi.

JEL Sınıflandırması: F43, E31, F41.

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Article Received: 18.07.2022 Article Accepted: 26.08.2022 DOI: http://doi.org/10.46520/bddkdergisi.1178334

1. Introduction

The main goal of national economies is to ensure sustainable growth. In order to make the said growth trend real, states are trying to direct economic actors with both policy determination and policy implementations in investment and production.

At this point, sustainable resources and competence in resource use are essential facts for sustainable growth. If we accept funds as a source for production, which is the main dynamic of growth, loans also take a place in the dynamics of production, as they mean transferring funds from institutions with high funds to institutions in need of funds. For this reason, the relationship between bank loans and economic growth has been the subject of many empirical studies, especially in recent years. The main question of these analyzes is the existence and level of the effect of the financial system on basic macroeconomic variables, especially economic growth.

Studies on the credit and growth relationship in question can be carried out both theoretically and empirically. At this point, it is possible to obtain different results in empirical studies on the basis of countries or periods. When the relationship between loans and economic growth is evaluated in general, it is seen that the analyzes are carried out in empirical studies, especially in terms of causality. In this context, in this study, in addition to the studies on the relationship between economic growth and credit volume in the literature, the relationship between inflation, which is an extremely important macroeconomic factor, with credit volume and economic growth is discussed. In order to examine the relationship in question, the GDP and inflation data and domestic loans given by banks to the private sector for the period 1972-2020 are used on an annual basis for Turkiye, and to determine the linearity of the series, Harvey et al. (2008) Harvey and Leybourne (2007) linearity tests, traditional unit root tests for linearly determined series and Kapetanios, Shin and Snell (2003) (KSS) unit root tests for nonlinear series were performed.

2. Literature

When the literature is examined, there are studies that examine financial development and growth well, as well as studies that analyze the relationship between direct bank loans and economic growth. When both study subjects are evaluated, it has been determined that current studies will make different contributions to the literature in terms of the evaluation of the triple relationship in terms of inflation and growth and domestic loans. Patrick (1966), who can be considered as one of the pioneers of studies in this field and examines the relations between bank loans and economic growth, emphasizes that the liberalization and development of financial markets will diversify financial investment instruments. In this context, it is stated in the study that loans accelerate the conversion of savings into investments and increase economic growth. The literature on the studies carried out in the following periods is mentioned in the table below.

Tablo 1: Literatur Review

Author	Scope	Term	Method	Result
King and Levine (1993)	80 Country	1960-1989	Panel regression analysis	A strong positive relationship was found between financial development-economic growth and money supply.
Kar and Pentecost	Turkiye	1963-1995	Causality Test	A unidirectional causality relationship from growth to financial development has been determined.
Shan and Jianhong	China	1978-2001	VAR	Bidirectional causality has been determined between financial development and economic growth.
Ceylan and Durkaya	Turkiye	1998-2008	Granger causality test and error correction model	One-way causality relationship from economic growth to loans has been determined.
Özcan and Arı	Turkiye	1998-2009	Causality Test	A one-way causality relationship from economic growth to financial development has been determined.
Göçer, Mercan and Bölükbaş	Turkiye	2000:Q1-2012:Q4	Cointegration with Structural Break	It has been determined that 1% increase in loan volume increases economic growth by 0.28%.
Turgut and Ertay	Turkiye	2003:Q1-2013:Q4	Granger causality test	Medium and long-term aggregate loans have a causal effect on GDP.
Karamelikli and Keskingöz	Turkiye	1998-2014	Causality Test	A bidirectional causality relationship was found between credit volume and economic growth.
Kamacı, Ceyhan and Peçe	Turkiye	2005:Q4-2017:Q1	FMOLS and DOLS	A one-way causality relationship has been determined from money supply to domestic credit volume and from economic growth to domestic credit volume.
Pata and Ağca	Turkiye	1982-2016	ARDL, bounds test approach, Granger and Hacker-Hatemi-J bootstrap causality tests	According to the ARDL, bounds test, the increase in financial development has a positive effect on economic growth in the short and long run. According to the results of the causality tests, a unidirectional causality from financial development to economic growth has been determined in the short run.
Karahan and Öztekin	Turkiye	2002:1Q-2016:4Q	ADF, Granger causality test	A bidirectional causality relationship has been determined between the developments in the bank loan volume and the economic growth.
Akbulaev and Huseynova	Azerbaijan	2006-2017	Granger causality test	A bidirectional causality relationship was found between credit volume and economic growth.
Ayowole, Beton Kalmaz	Nigeria	1981-2016	ARDL, Completely Modified Ordinary Least Squares, and Dynamic Ordinary Least Squares estimator approaches	It has been determined that there is a long-term equilibrium relationship between credit market development and economic growth.

3. Methodology

Time series data shows the values of the variables in the time direction. In the development process of time series analysis, time series data includes processes in which the values of previous periods are determined, and it has gained importance to examine stochastic relationships. Many methods in time series have evolved over time. These are methods such as stationarity, unit root, cointegration, causality, and error correction models. With the development of these methods, time series has become very important in data analysis (Göktaş, 2005: 2).

In this study, the relationships between domestic loans given to the private sector by banks in Turkiye and economic growth and inflation were investigated with the help of time series analysis. This process was determined by nonlinear cointegration analysis and it was determined whether the series expressing the variables were stationary. Before that, it was concluded that whether they were linear or not in order to determine the methods by which stationarity would be determined.

3.1. Linearity Tests

Harvey and Leybourne (2007) and Harvey, Leybourne and Xiao (2008), which are among the stationarity tests used extensively in the literature, were used in this study to determine the stationarity of the series. ESTAR (exponential smooth transition autoregressive model) and LSTAR (logistics smooth transition autoregressive model) type nonlinearity are detected in both 2007 and 2008 tests.

3.1.1. Harvey and Leybourne (2007) Linearity Tests

In the study by Harvey and Leybourne (2007), no assumptions are made about the stationarity of the series. In this model, the level states of the squares and cubes of the variables and their first differences are included together in the test regression where linearity is tested. There is fitness for the chi-square distribution. Due to constraints on 4 parameters, the calculated chi-square test statistic is compared with the 4-degrees-of-freedom chi-square table value. Test statistics are calculated separately for 1%, 5% and 10%. The following equation is used to test the linearity null hypothesis:

$$y_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 y_{t-1}^2 + \beta_3 y_{t-1}^3 + \beta_4 \Delta y_{t-1} + \beta_5 (\Delta y_{t-1})^2 + \beta_6 (\Delta y_{t-1})^3 + \varepsilon_t$$

When the linearity test is performed within the relevant equation, the main and alternative hypothesis is as follows:

$$H_0: \beta_2 = \beta_3 = \beta_5 = \beta_6 = 0 \qquad H_1: \beta_2 \neq \beta_3 \neq \beta_5 \neq \beta_6 \neq 0$$

3.1.2. Harvey, Leybourne and Xiao (2008) Linearity Tests

Harvey et al. (2008), stationarity of the series is evaluated separately under the assumption of stationary I(0) and non-stationary I(1). A separate test regression is considered for the levels of the series, and a separate test regression for the first differences. Accordingly, taking into account the uncertainty experienced by the series, the following models have been created as to whether it contains a unit root:

$$y_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 y_{t-1}^2 + \beta_3 y_{t-1}^3 + \sum_{j=1}^{p} \beta_{4,j}\, \Delta y_{t-j} + \varepsilon_t$$

$$\Delta y_t = \lambda_1 \Delta y_{t-1} + \lambda_2 (\Delta y_{t-1})^2 + \lambda_3 (\Delta y_{t-1})^3 + \sum_{j=1}^{p} \lambda_{4,j}\, \Delta y_{t-j} + \varepsilon_t$$

$$H_0: \lambda_2 = \lambda_3 = 0 \rightarrow W_1$$

Harvey et al. (2008) shows compliance with the chi-square distribution. Due to constraints on 2 parameters, the calculated chi-square test statistic is compared with the 2-degrees-of-freedom chi-square table value. There is only one test statistic and separate test statistics are not calculated for 1%, 5%, 10%.

The null hypothesis in the equations refers to linearity, while the alternative hypothesis refers to nonlinearity.

3.2. Linear Unit Root Tests

First of all, the linearity of the series was determined, and after this determination, unit root tests were carried out according to the series. Conventional linear unit root tests were applied for series with linear structure. In this direction, Augmented Dickey-Fuller (ADF), Philips-Perron (PP) and Kwiatkowski-Philips-Schmidt-Shin (KPSS) unit root tests were performed.

3.2.1. Augmented Dickey-Fuller (ADF) Unit Root Test

The Augmented Dickey-Fuller unit root test was created to solve the autocorrelation process in the series, and the test statistic result should be negative. This test states that the time series will not be stationary if they interact with their lagged

values. Accordingly, it is based on the assumption that there is an autoregression process for the relevant time series and that they are derived from this process.

$$\Delta y_t = \delta y_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta y_{t-1} + \varepsilon_t \qquad \Delta y_t = \mu + \delta y_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta y_{t-1} + \varepsilon_t$$

$$\Delta y_t = \mu + \beta_t + \delta y_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta y_{t-1} + \varepsilon_t \quad H_0: \delta = 0 \qquad H_1: \delta =< 0$$

3.2.2. Phillips-Perron (PP) Unit Root Test

In the Phillips-Perron unit root test, the test statistic result should be negative. This test is based on non-parametric functions.

$$\Delta y_t = \delta y_{t-1} + \varepsilon_t \quad \Delta y_t = \mu + \delta y_{t-1} + \varepsilon_t \quad \Delta y_t = \mu + \beta_t + \delta y_{t-1} + \varepsilon_t$$

$$H_0: \delta = 0 \qquad H_1: \delta < 0$$

In the ADF test and the PP test, the null hypothesis determines that the series have unit roots, while the alternative hypothesis determines that the series are stationary.

In the Kwiatkowski-Philips-Schmidt-Shin (KPSS) unit root test, the aim is to purify the deterministic trend in the time series. In this way, the series is stabilized. The KPSS test is performed in accordance with the LM test statistics. The null hypothesis states that the series is trend stationary, and the alternative hypothesis states that there is a unit root process.

3.3. Nonlinear Unit Root Tests

In this study, Kapetanios, Shin and Snell (2003) unit root test, which is one of the nonlinear unit root tests, was applied.

3.3.1. Kapetanios, Shin and Snell (2003) (KSS) Unit Root Test

Kapetanios et al. (2003) unit root test was created as ESTAR (exponential smooth transition autoregressive model) model.

$$y_t = \beta y_{t-1} + \gamma y_{t-1}\left[1 - exp\left(-\theta\left(y_{t-1}^2 - c\right)\right)\right] + \varepsilon_t$$

$$\Delta y_t = \emptyset y_{t-1} + \gamma y_{t-1}[1 - exp(-\theta y_{t-1}^2)] + \varepsilon_t$$

$$\Delta y_t = \gamma y_{t-1}[1 - exp(-\theta y_{t-1}^2)] + \varepsilon_t$$

$$\Delta y_t = \gamma y_{t-1}[1 - exp(-\theta y_{t-1}^2)] + \varepsilon_t$$

$$\Delta y_t = \delta y_{t-1}^3 + \varepsilon_t \qquad H_0: \delta = 0 \qquad H_1: \delta < 0$$

$$\Delta y_t = \delta y_{t-1}^3 + \varepsilon_t \qquad H_0: \delta = 0 \qquad H_1: \delta < 0$$

C is the location parameter, γ is the transition rate between regimes, θ is the smoothing parameter. The nonlinear process is formed by adding the ESTAR process to the linearly expressed random walk process. The final test regression is reached assuming the location parameter is equal to zero.

Since the unit root cannot be tested directly in the null hypothesis, the test regression is reached by applying the first-order Taylor expansion to the test regression. In this way, the test regression in which the unit root can be tested directly has been reached.

The null hypothesis expresses the existence of a unit root, and the alternative hypothesis expresses nonlinear ESTAR stationarity. No deterministic component can be added to the final test regression in which the unit root hypothesis will be tested. Instead, you can work with either raw data (fixed and no trend), or de-constant data (demeaned data, presence of constant), or detrended data.

3.4. Non-Linear Cointegration Test – Kapetanios, Shin and Snell (KSS) (2006) Cointegration Test

The cointegration test developed by Kapetanios, Shin and Snell (KSS) (2006) is based on the error correction model based on the ESTAR model. In this test, as in the Engle Granger model, the cointegration test is performed on the residues obtained from the regression model. In the first stage, the assumption is made that the residues obtained from the long-term model will follow the ESTAR process.

$$\Delta y_t = \emptyset u_{t-1}\left(1 - e^{-\theta(u_{t-1}^2)} + \psi' \Delta x_t + \sum_{i=1}^{p} \omega_i' \Delta z_{t-i} + \varepsilon_t\right)$$

$$\Delta x_t = \sum_{i=1}^{p} \Gamma_i' \Delta z_{t-i} + \eta_t \qquad \hat{u}_t = \hat{y}_t - \hat{\beta}_x' x_t$$

The cointegration test developed by Kapetanios, Shin and Snell (KSS) (2006) can be expressed as the nonlinear version of the Engle Granger test.

In this test, the null hypothesis states that there is no cointegrating relationship, while the alternative hypothesis suggests that there is an ESTAR cointegration relationship. In order to test the existence of the cointegrated relationship directly, the first-order Taylor expansion is applied in this model. There are 4 different test statistics.

$$\Delta y_t = \delta_1 \hat{u}_{t-1} + \delta_2 \hat{u}_{t-1}^2 + \delta_3 \hat{u}_{t-1}^3 + \psi' \Delta x_t + \sum_{i=1}^{p} \omega_i' \Delta x_{t-i} + \varepsilon_t$$

$$H_0: \delta_1 = \delta_2 = \delta_3 = 0 \rightarrow F_{NEC}$$

$$\Delta y_t = \delta_1 \hat{u}_{t-1} + \delta_3 \hat{u}_{t-1}^3 + \psi' \Delta x_t + \sum_{i=1}^{p} \omega_i' \Delta z_{t-i} + \varepsilon_t \qquad H_0: \delta_1 = \delta_3 = 0 \rightarrow F_{NEC}^*$$

$$\Delta y_t = \delta_3 \hat{u}_{t-1}^3 + \psi' \Delta x_t + \sum_{i=1}^{p} \omega_i' \Delta z_{t-i} + \varepsilon_t \qquad H_0: \delta_3 = 0 \rightarrow t_{NEC}$$

$$\Delta \hat{u}_t = \delta_1 \hat{u}_{t-1}^3 + \sum_{i=1}^{p} \omega_i \Delta \hat{u}_{t-i} + \varepsilon_t \qquad H_0: \delta_1 = 0 \rightarrow t_{NEG}$$

Test statistics can be sorted from strong to weak as $F^*_{NEC} > F_{NEC} > t_{NEC} > t_{NEG}$ Since no deterministic component can be added to these 4 test regressions, either raw data, unfixed data or trend-free data are studied.

4. Analysis Results

In this study, it is investigated whether domestic loans given by banks to the private sector in Turkiye between 1972 and 2020 are cointegrated between the variables by examining the relations between GDP and inflation. For this purpose, the data of domestic loans given to the private sector by banks in Turkiye, GDP and inflation rates are used in annual periods to determine the stationarity of the series. The data were obtained from the World Bank website database.

Tablo 2: Descriptive Statistics of Variables

Mean	Median	Max	Min	Standard Deviation	Skewness	Skewness	Kurtosis	Normality
Dom	28.21	20.32	70.92	13.58	17.41	1.33	3.20	14.58 (0.00)
GDP	3.44	1.81	9.58	2.04	3.22	0.71	1.85	6.87 (0.03)
Inf	37.66	29.14	105.21	6.25	28.99	0.59	2.08	4.58 (0.10)
LnDom	1.38	1.31	1.85	1.13	0.22	0.97	2.49	8.34 (0.01)
LnGDP	11.30	11.26	11.98	10.31	0.48	-0.08	1.78	3.04 (0.21)
LnInf	1.41	1.46	2.02	0.80	0.39	-0.11	1.51	4.61 (0.09)

Note: The value in parentheses is the probability value.

Domestic loans given to the private sector by banks in Turkiye, GDP and inflation rate series were tested for linearity before examining them with unit root tests. Linearity tests Harvey and Leybourne (2007) and Harvey et al. (2008) tests were examined in Table 3.

Tablo 3: Linearity Test Results

Variables	Harvey vd. (2008)	Harvey ve Leybourne (2007)		
		%10	%5	%1
Domestic	4.54	13.64*	13.77*	14.00*
GDP	10.38***	12.11**	12.43**	13.04*
Inflation	10.20***	14.15*	14.27*	14.49*

Note: Harvey et al. (2008) test critical values are calculated as 9.21, 5.99 and 4.60 for 1%, 5% and 10%, respectively. Harvey and Leybourne (2007) test critical values are calculated as 13.27, 9.48 and 7.77 for 1%, 5% and 10%, respectively. The expressions * are used for the value of 1%, ** for 5% and *** for 10%.

H_0= linear structure

H_1= nonlinear structure

In Turkiye, Harvey et al. (2008) when the linearity test results are examined, it is seen that the domestic variable, which is the variable of the domestic loan rate given to the private sector from banks, is linear, while the GDP variable and the inflation rate series are non-linear. According to the linearity test of Harvey and Leybourne

(2007), it is seen that all series are non-linear. The Harvey and Leybourne 2008 test can be used as a basis when the series are in conflict.

Since the linearity test results of the series contain different results, both linear unit root tests and nonlinear unit root tests were applied for the domestic variable, which is the variable of the domestic loan rate given to the private sector from banks.

H_0 = has a unit root

H_1 = There is no unit root. The series is stationary.

Tablo 4: Linear Unit Root Tests

Domestic	**ADF**		**PP**		**KPSS**	
	Fixed	**Fixed and Trending**	**Fixed**	**Fixed and Trending**	**Fixed**	**Fixed and Trending**
Test Statistics	0.377776	-1.666280	0.209582	-1.307390	0.596509	0.203026
1%	-3.574446	-4.165756	-3.574446	-4.161144	0.739000	0.216000
5%	-2.923780	-3.508508	-2.923780	-3.506374	0.463000	0.146000
10%	-2.599925	-3.184230	-2.599925	-3.183002	0.347000	0.119000
GDP	**ADF**		**PP**		**KPSS**	
	Fixed	**Fixed and Trending**	**Fixed**	**Fixed and Trending**	**Fixed**	**Fixed and Trending**
Test Statistics	-2.043307	-2.048262	-1.963977	-2.429871	0.907764	0.071417
1%	-3.574446	-4.161144	-3.574446	-4.161144	0.739000	0.216000
5%	-2.923780	-3.506374	-1.923780	-3.506374	0.463000	0.146000
10%	-2.599925	-3.183002	-2.599925	-3.183002	0.347000	0.119000
Inflation	**ADF**		**PP**		**KPSS**	
	Fixed	**Fixed and Trending**	**Fixed**	**Fixed and Trending**	**Fixed**	**Fixed and Trending**
Test Statistics	-1.255985	-2.642814	0.427935	-2.123245	0.427935	0.171879
1%	-3.574446	-4.180911	0.739000	-4.161144	0.739000	0.216000
5%	-2.923780	-3.515523	0.463000	-3.506374	0.46300	0.146000
10%	-2.599925	-3.188259	0.347000	-3.183002	0.347000	0.119000

When Table 4 is examined, it has been determined that all variables have unit root at the level, according to the results of linear unit root tests. If the series have a

unit root at the level, their first difference is taken. In this way, the series are made stationary.

Tablo 5: Linear Unit Root Tests – First Differences

Domestic	**ADF**	**PP**	**KPSS**
Test Statistics	-4.979158	-4.964823	0.320666
1%	-2.615093	-2.615093	0.739000
5%	-1.947975	-1.947975	0.463000
10%	-1.612408	-1.612408	0.347000
GDP	ADF	PP	KPSS
Test Statistics	-3.570778	-5.792746	0.220337
1%	-2.616203	-2.615093	0.739000
5%	-1.948140	-1.947975	0.463000
10%	-1.612320	-1.612408	0.347000
INF	ADF	PP	KPSS
Test Statistics	-2.871569	-6.263066	0.200973
1%	-2.618579	-2.615093	0.739000
5%	-1.948495	-1.947975	0.463000
10%	-1.612135	-1.612408	0.347000

In the linearity tests, it was determined that the domestic variable, which is the variable of the domestic loan rate given to the private sector from the banks, is non-linear. From nonlinear unit root tests to series with nonlinear structure; Kapetanios, Shin and Snell (2003) unit root test was applied.

Tablo 6: Kapetanios, Shin and Snell (KSS) (2003) Nonlinear Unit Root Test

Variables	**Kapetanios, Shin ve Snell (KSS) (2003)**		
	Raw Data – Case 1	Demeaned Data Case 2	Detrended Data Case 3
	Calculated Test Statistic	CalculatedTest Statistic	Calculated Test Statistic
Domestic	1.44353*	0.54750*	-1.04826*
GDP	2.90725**	-2.41434**	-2.30171**
Inflation	0.86643*	-1.93715*	-2.28021**

Note: Critical table values for Case 1 were calculated as -1.92 , -2.22 and -2.82 for 0.10, 0.05 and 0.001, respectively. It was calculated as -2.66, -2.93 and -3.48 for Case 2, respectively. For Case 3, it was calculated as -3.13, -3.40 and -3.93, respec-

tively. H_0 acceptance is expressed with *, and H_1 acceptance is expressed with **.

H_0 = The serial has unit root.

H_1 = Series nonlinear ESTAR type is stationary.

As can be seen in Table 6, according to Kapetanios, Shin and Snell (2003) nonlinear unit root test, the domestic variable series, which is the variable of the domestic loan rate given to the private sector from banks, has been determined with unit root in all models.

Tablo 7: Kapetanios, Shin and Snell (KSS) (2006) Results of Cointegration Analysis

	Test Statistics	%1	%5	%10
F*nec raw	0.88652	14.54	10.83	9.00
F*nec demeaned	0.81897	17.66	14.09	11.72
F*nec detrended	0.60204	20.65	16.96	14.81
Fnec raw	0.63758	17.33	13.22	11.41
Fnec demeaned	0.56206	19.33	14.87	12.89
Fnec detrended	1.13590	22.88	17.83	15.70
tnec raw	-1.34258	-3.59	-3.01	-2.67
tnec demeaned	-1.28622	-4.00	-3.43	-3.12
tnec detrended	-0.84945	-4.40	-3.79	-3.46

H_0= There is no cointegrated relationship between the variables.

H_1= There is a cointegrated relationship between the variables.

When the calculated test statistic value is > the table value, the H_0 hypothesis is rejected. When the results in Table 7 were examined, it was determined that there was no cointegrated relationship between the variables, since the test statistic was smaller than the table value in all models. In other words, it is concluded that the relations between GDP and inflation and domestic loans given by banks to the private sector in Turkiye are not cointegrated.

5.Conclusion

Economic growth and sustainability of growth are among the main goals of countries. Adequacy of resources for growth, and investment and production processes, especially in terms of the private sector, are considered as important components of economic growth. For this reason, the studies in the literature are in line with the examination of national economies in terms of the relationship between bank loans and economic growth.

In this study, the relations between GDP and inflation and domestic loans given by banks to the private sector in Turkiye between 1972 and 2020 are examined. For this purpose, it has been determined whether there is a cointegrated relationship between the variables including domestic loans given to the private sector by banks in Turkiye, GDP and inflation rates.

Before examining the variables with unit root tests, Harvey and Leybourne (2007) and Harvey et al. (2008) tests were used to test whether they are linear or not. In Turkiye, Harvey et al. (2008), in the linearity test, it was determined that the domestic variable, which is the variable of the domestic loan rate given to the private sector from banks, is linear, while the GDP variable and the inflation rate series are non-linear.

According to the linearity test of Harvey and Leybourne (2007), it is seen that all series are non-linear. Based on the Harvey and Leybourne 2008 test, as the series are inconsistent. Since the linearity test results on the series contain different results, both linear unit root tests and nonlinear unit root tests were applied. In the linearity tests, it was determined that the domestic variable, which is the variable of the domestic loan rate given to the private sector from the banks, is linear. Kapetanios, Shin, and Snell (2003) unit root test was applied to the non-linear series, and the domestic variable, which is the domestic loan rate variable given to the private sector from banks, was determined with unit root in all models.

When the results were examined, it was determined that there was no cointegrated relationship between the variables, since the test statistic was smaller than the table value in all models. In other words, it is concluded that the relations between GDP and inflation and domestic loans given by banks to the private sector in Turkiye are not cointegrated.

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