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The Relationship Between Manufacturing Industry Bank Loans and Manufacturing Industry D-PPI: Loan-Inflation Spiral

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ABSTRACT

It has been observed that the manufacturing industry D-PPI rates, interest rates applied commercial loans (TL) by the banking sector, bank loans extended to the manufacturing industry and NPLs of these loans have increased since 2020. In terms of the sustainability of the manufacturing industry, which has an important place in Turkey's economic development, the manufacturing industry D-PPI ratios and bank loans extended to the manufacturing industry are of great importance. In this research, it is aimed to investigate the relationship between the manufacturing industry D-PPI rates, the weighted average of the interest rates applied to commercial loans (TL) by the banking sector, bank loans extended to the manufacturing industry and NPLs of these loans. For this purpose, the Engle-Granger cointegration test and the Granger causality test were applied to the variables in question and the relationships between the variables were analyzed. As a result of the analyzes, it has been detected that all variables are mutually cointegrated in the long term and there is a mutual relationship between the non-performing manufacturing industry loans with the manufacturing industry D-PPI rate and the interest rate applied to commercial loans (TL). In addition, it has been determined that there is a one-way causality relationship from bank loans extended to the manufacturing industry to the manufacturing industry D-PPI rate, the interest rate applied to commercial loans (TL) and non-performing manufacturing industry loans. In the research, it was concluded that the manufacturing industry inflation and loans have become a spiral, and policy recommendations have been made for the banking sector and decision-makers.

Keywords
Manufacturing Industry, Bank Loans, NPLs, D-PPI, Causality.

JEL Classification
E31, E5, G21, L60.

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İmalat Sanayii Banka Kredileri ile İmalat Sanayii Yİ-ÜFE Arasındaki İlişki: Kredi-Enflasyon Sarmalı

ÖZ

2020 yılından bu yana imalat sanayii Yİ-ÜFE oranları, bankacılık sektörü tarafından ticari kredilere (TL) uygulanan faiz oranları, imalat sanayiine yönelik kullandırılan banka kredileri ve bu kredilere yönelik tahsili gecikmiş alacakların yükseldiği gözlenmektedir. Türkiye'nin ekonomik gelişiminde önemli bir yer tutan imalat sanayiinin sürdürülebilirliği açısından imalat sanayii Yİ-ÜFE oranları ve imalat sanayiine yönelik kullandırılan banka kredileri büyük önem arz etmektedir. Bu araştırmada imalat sanayii Yİ-ÜFE oranları, bankacılık sektörü tarafından ticari kredilere (TL) uygulanan faiz oranlarının ağırlıklı ortalaması, imalat sanayiine yönelik kullandırılan banka kredileri ve bu kredilere ait tahsili gecikmiş alacaklar arasındaki ilişkinin araştırılması amaçlanmıştır. Bu amaçla söz konusu değişkenlere Engle-Granger eşbütünleşme testi ve Granger nedensellik testi uygulanarak değişkenler arasındaki ilişki analiz edilmiştir. Analizler sonucunda tüm değişkenlerin uzun dönemde karşılıklı olarak eş bütünleşik olduğu ve tahsili gecikmiş imalat sanayii kredileri ile imalat sanayii Yİ-ÜFE oranı ve ticari kredilere (TL) uygulanan faiz oranı arasında karşılıklı nedensellik ilişkisinin olduğu tespit edilmiştir. Bununla birlikte imalat sanayiine kullandırılan banka kredilerinden, imalat sanayii Yİ-ÜFE oranına, ticari kredilere uygulanan faiz oranına ve tahsili gecikmiş imalat sanayii kredilerine doğru tek yönlü bir nedensellik ilişkisinin olduğu tespit edilmiştir. Araştırmada imalat sanayii enflasyonu ve kredilerinin bir sarmal halini aldığı sonucuna varılmış ve bankacılık sektörü ile karar alıcılara yönelik politika önerilerinde bulunulmuştur.

Keywords
İmalat Sanayii, Banka Kredileri, Tahsili Gecikmiş Alacaklar, Yİ-ÜFE, Nedensellik.

JEL Kodu
E31, E5, G21, L60.

1. Introduction

The banking sector contributes to the economic growth of countries by transferring the deposits it has collected from units with surplus funds as loans to real and legal persons in need of funds. In developing countries such as Turkey, where the capital required for investments is not sufficient, the banking sector's intermediation process is of great importance in terms of making investments quickly. On the other hand, since the non-bank financial sector is not widespread in the financial markets of developing countries, most of the financial services are provided by the banking sector. According to 2021Q3 data, the share of the banking sector in the Turkish financial sector is 88.72%[1].

[1] The data on the share of the banking sector in the financial sector were obtained by using the balance sheet information of the banking sector and non-bank financial institutions in the CBRT electronic data distribution system.

The manufacturing industry, which is in the industrial sector, also includes many sub-sectors. In addition, the manufacturing industry provides the development of different sectors with its supply chain, contributes to innovation with R&D studies, and contributes to the employment level and exports of countries. According to the laws expressed as the laws of Kaldor (1966; 1968); It is stated that the growth in the manufacturing industry will also affect other sectors with which it interacts and increase their productivity (Pons-Novell & Viladecans-Marsal, 1998: 444; Mamgain, 1999: 296), therefore the manufacturing industry acts as a catalyst in the growth rate of the national economies (Ateşoğlu, 1993: 68; Necmi, 1999: 654). In other words, it is stated that the manufacturing industry, which interacts with many different sectors, increases the resilience of the country's economies against both systemic and sectoral shocks (Ritchie, Thomas, & Welpton, 2012:4) and is in a strategic position that contributes to economic growth.

In developing countries, banking sector loans and cost inflation (D-PPI) are of great importance in terms of the sustainability of manufacturing industry activities, and the ratio of NPLs and interest rates in terms of the sustainability of banking sector activities. It is stated that if inflation increases in economies, the volume of NPLs in the banking sector will also increase (Parasız, 2000: 126) and the intermediary function of banks will be adversely affected by this situation (Landskroner, Ruthenberg, & Zaken, 2005:28). In addition, Tarı, Yiğitbaş, & Kurt (2012) state that there is a relationship between the interest rate to be applied to loans extended by banks and the NPL conversion of loans, while Akinboade & Makina (2010) state that there is a relationship between the increase in production volume and bank loans. It is stated that high inflation may adversely affect the interest rates to be applied to loans and thus the borrowing costs of enterprises (Okay, 2002: 104), while increasing borrowing costs may adversely affect the collection of bank loans (Arslan & Yapraklı, 2008: 92). As a result of these effects, it is stated that the fragility level of both enterprises and the banking sector may increase (Bölükbaşı, Ürkmez, & Karamustafa, 2018:493).

Turkey, which has been struggling with the high inflation problem for many years, has managed to control inflation, albeit partially. On the other hand, it is seen that inflation has increased rapidly, especially as of 2021Q3. In addition to this, it is observed that the loans extended by the banking sector to the manufacturing industry and the NPLs related to these loans have also increased. It is stated that the increase in the manufacturing industry D-PPI ratio may adversely affect the CPI rates thanks to the price pass-through (Koçak, 2021: 12). In other words, the increase

in the manufacturing industry D-PPI ratios is a development that may adversely affect both the manufacturing industry sector and the banking sector. Considering the importance of the loans extended by the manufacturing industry and the banking sector in terms of economic growth and stability, it is important to investigate the questions of whether the loans extended to the manufacturing industry and NPLs related to these loans increased due to the increase in the manufacturing industry D-PPI ratio, or whether the manufacturing industry D-PPI ratio increased due to the loans extended to the manufacturing industry and the NPLs of these loans, or whether the manufacturing industry sector has entered a credit-inflation spiral and take the necessary measures according to the results of the research.

In this research, it is aimed to investigate the relationships between the manufacturing industry D-PPI ratio, the interest rates applied to TL commercial loans by the banking sector, the loans extended to the manufacturing industry, the NPLs of these loans. For this purpose, Engle-Granger cointegration and Granger causality tests were applied using the data between the periods 2017:01 and 2022:02. Based on the findings obtained as a result of the analyzes, suggestions were made to the banking sector, manufacturing industry and decision-makers. In the literature research, no research was found on the manufacturing industry D-PPI ratio, bank loans extended to the manufacturing industry and manufacturing industry NPLs. Because of this it is thought that this research will contribute to the literature.

2. Share of Manufacturing Industry in GDP and Structure of Manufacturing Industry Bank Loans

The manufacturing industry sector has an important place in the Turkish economy as well as in all national economies. The manufacturing industry sector, which is in a very strategic position in terms of sustainable economic growth, can continue its economic activities with the funds provided by the banking sector and realize its investments without losing time. The real growth rates of the manufacturing industry sector and GDP between the years 2011-2021 in the Turkish economy and the share of the manufacturing industry in GDP are given in Figure 1.

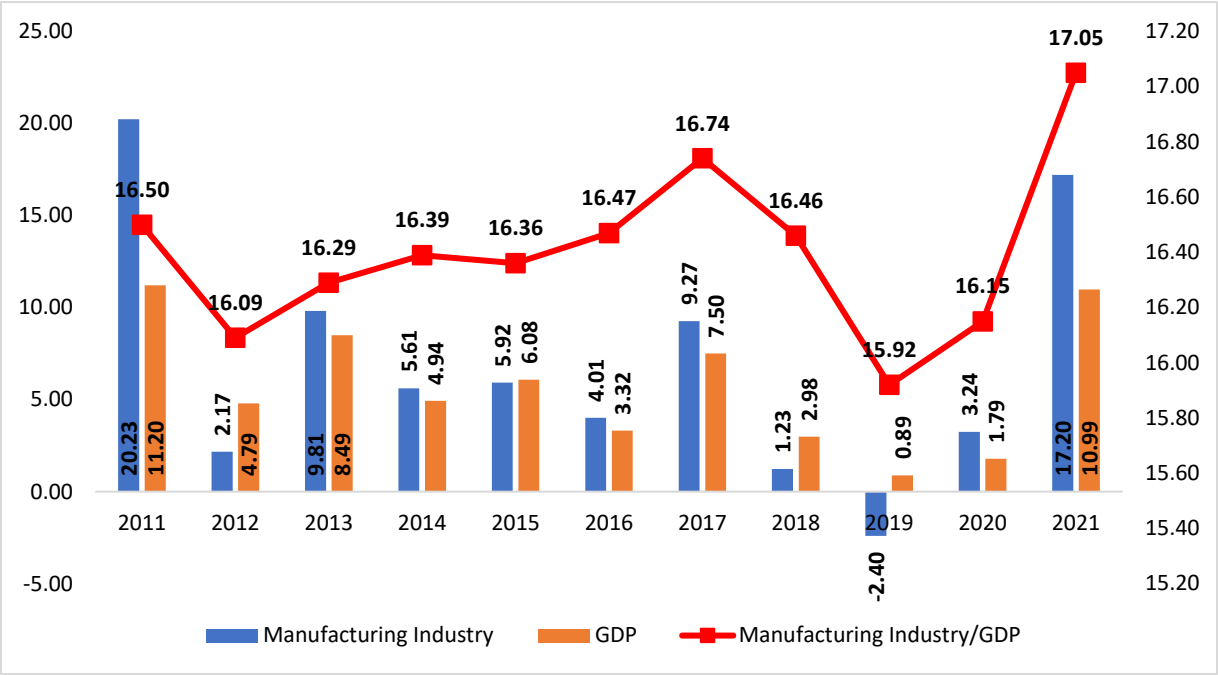

Figure 1. Manufacturing Industry and GDP Real Growth Rates & The Share of Manufacturing Industry in GDP (**Source:** It was created by using the annual GDP volume data published by the CBRT according to the economic activity branches. Url: https://evds2.tcmb.gov.tr/index.php?/evds/serieMarket. Access Date: 07.04.2022).

In Figure 1, the left axis indicates the real growth rates of the manufacturing industry and GDP, and the right axis indicates the share of the manufacturing industry in GDP. Although the growth rate of the manufacturing industry has remained at a low level in some years compared to the GDP growth rate, it is generally above the GDP growth rate. Especially in 2021, it is seen that the growth rate of the manufacturing industry increased rapidly and reached the level of 17.20%. In addition, it is seen that the share of the manufacturing industry in GDP increased rapidly after the decline between 2017-2019 and reached the level of 17.05%.

In order to avoid the problem of maturity mismatch between income and expense periods, businesses finance their current assets with short-term liabilities and their fixed assets with long-term liabilities. The characteristics of bank loans used by the manufacturing industry are given in Figure 2.

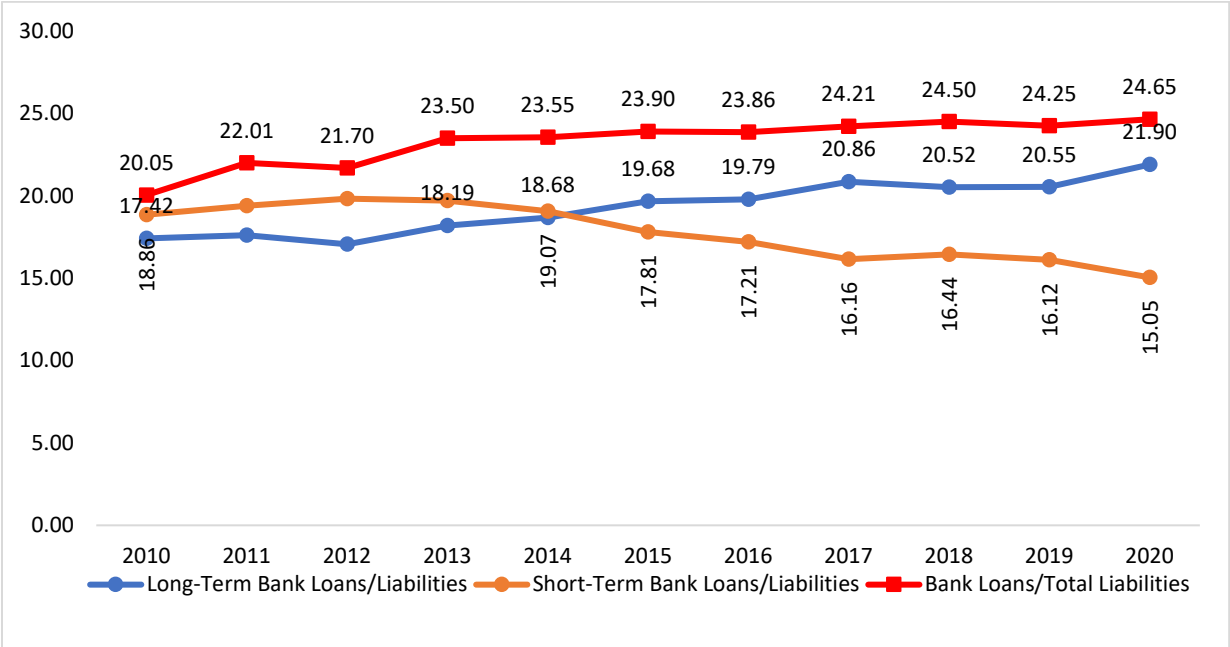

Figure 2. Structure of Manufacturing Industry Bank Loans (Source: It was created by using the information of the manufacturing industry sector balance sheets published by the CBRT. Url: https://www3.tcmb.gov.tr/sektor/#/tr/C/imalat. Access Date: 07.04.2022).

In Figure 2, it is seen that the share of bank loans used by the manufacturing industry in total liabilities has been in an increasing trend over the years and has reached the level of 24.65%. However, it is observed that the maturity structure of the loans used has changed, the ratio of short-term bank loans/total liabilities has decreased since 2014, while the share of long-term bank loans has increased.

3. Literature Review

In the literature search on the subject of the research, no research has been found in which the D-PPI ratio of the manufacturing industry, the interest rate applied to TL commercial loans by the banking sector, bank loans extended to the manufacturing industry and NPLs of these loans are used together. It has been determined that previous studies have been conducted to investigate the determinants of inflation rate (usually CPI), banking sector loan volume, banking sector NPLs ratio, industrial production index or interest rates. Studies using these variables were analyzed and studies related to the subject of this research were included in the literature review. The studies in the literature are as follows;

Özün & Çifter (2007); to investigated the relationship between industrial production and bank loan volume in Turkey with Wavelet analysis, they used the industrial production index and bank loan volume data between the periods 1992:03-2006:12. As a result of the research, they stated that there is a one-way causality relationship from the industrial production index to the bank loan volume in the first 2-year period. They also stated that there is a one-way causality relationship from the bank credit volume to the industrial production index at the end of the 2-year period.

Arslan & Yapraklı (2008); analyzed the relationship between the variables using the PPI and bank loans data between 1983-2007. As a result of Johanssen cointegration analysis, they stated that bank loans are negatively affected by inflation in the long run, and as a result of Granger causality analysis, there is a mutual causality relationship between bank loans and inflation rate.

Çifter, Yılmazer, & Çifter (2009); investigated the relationship between the industrial production index and the sectoral loan default rate in Turkey by wavelet network analysis in 2001:01-2007:11 periods. As a result of the research, they stated that credit defaults in different time periods are affected by the industrial production index.

Espinoza & Prasad (2010); used data from 80 banks operating in the Gulf Arab Cooperation Council Region to investigated the effect of macroeconomic variables on NPLs in bank loans. As a result of the research, they stated that the increase in loan interest rates caused an increase in NPLs.

Tarı, Yiğitbaş, & Kurt (2012); analyzed in an asymmetric information environment the lending behavior of commercial banks in Turkey and their relationship with the real sector. In the research, the data between 2002:01-2010:10 periods were subjected to VAR analysis. As a result of the research, they stated that bank loans affect the industrial production index, inflation rates and the difference between deposit and loan interest rates applied by banks affect bank loans.

Farhan et al. (2012); In order to investigate the factors affecting the NPLs in Pakistan between 2006 and 2012, conducted a survey to 201 bank employees. As a result of the research using regression analysis, they stated that NPLs were positively affected by loan interest rates and inflation rates.

Arsène & Guy-Paulin (2013); investigated the relationship between private sector loans, inflation rate and economic growth in Cameroon between 1965 and 2010 with the Granger

causality test. As a result of the research, they stated that the loans extended to the private sector cause inflation.

Messai & Jouini (2013); investigated the factors affecting NPLs between 2004 and 2008 with the help of correlation analysis using data from 85 banks in Italy, Greece and Spain. As a result of the research, they stated that economic growth and bank profitability decreased the NPLs rate, whereas loan interest rates increased the rate of NPLs.

Akosah (2013); investigated the relationship between private sector loans and inflation rates in Ghana between 1964 and 2012 with the help of Johanssen cointegration and Granger causality tests. As a result of the research, he stated that there is a mutually negative relationship between inflation and private sector loans in the short term, while there is a unidirectional and negative relationship from inflation to private sector loans in the long term.

Ghosh (2015); investigated the factors affecting the NPLs of US banks between 1984 and 2013 with panel data analysis. As a result of the research, he stated that interest rates and high inflation increased the NPLs.

Genç & Şaşmaz (2016); used the variables of GDP, real exchange rate, commercial loan interest rate and BIST100 index between 2005Q4 and 2015Q2 in their research to determine the factors affecting non-performing commercial loans in the banking sector. Kapetanios unit root, Hatemi-J cointegration and Least Squares tests were used in the research. As a result of the research, they stated that the commercial loan interest rate is among the determinants of non-performing commercial loans.

Sürekçi Yamaçlı & Saatçi (2016); investigated the determinants of CPI in Turkey with the help of ARDL analysis, using the data between 2004:01-2015:07. As a result of the analysis, they stated that the capacity utilization rate and PPI are the main determinants of CPI.

Göçer et al. (2016); investigated the factors affecting the CPI between the periods of 2006:01-2015:06 in Turkey with the help of multiple break cointegration analysis. As a result of the research, they stated that CPI is cointegrated with PPI, banking sector credit volume and consumer confidence index in the long run.

Demirci (2017); investigated the relationship between the manufacturing industry production index and the volumes of bank loans extended to the manufacturing industry using the

data between 1999 and 2015. Johanssen cointegration and Granger causality tests were used in the research, and as a result of the analysis, he stated that the manufacturing industry production index and bank loans are cointegrated in the long run, and there is a one-way causality relationship from the manufacturing industry production index to bank loans.

Telçeken & Değirmen (2018); investigated the relationship between CPI, PPI, retail and commercial loan interest rates with data between 2002:01-2018:06 using ARDL and Granger causality tests. As a result of the research, they stated that there is a one-way causality relationship from CPI to individual loan interest rates and from PPI to commercial loan interest rates. Additionally, they stated that PPI and commercial loan interest rates are cointegrated in the long run, whereas CPI and individual loan interest rates are not cointegrated.

Alev (2019); investigated the determinants of CPI in Turkey between 2006Q1-2018Q2 with the help of ARDL limit test. As a result of the research, it was stated that there is a long-term relationship between the CPI and the interest rates applied to loans and deposits.

Uslu (2020); investigated the relationship between inflation and interest rates with the data of annual interest rate, one-year deposit interest rate and CPI rate applied to commercial loans between 2002:01-2019:01. As a result of the research, it is stated that the series are cointegrated in the long run, commercial loan interest rates increase the inflation rate in the short run, and inflation and deposit interest rates increase the interest rate applied to commercial loans.

Polat (2020); investigated the relationship between loan interest rates and inflation rates by using CPI, PPI, consumer and commercial loan interest rates with the data between 2004:01-2019:08. As a result of ARDL and Toda Yamamoto tests used in the research, it was stated that there is a mutual causality relationship between PPI and commercial loan interest rates, there is a one-way causality relationship from CPI to individual loan interest rates, and there is a mutual causality relationship between commercial loan interest rates and consumer loan interest rates.

4. Empirical Analysis

4.1. Data Set and Models

In this research, using monthly data between 2017:01 and 2022:02, it has been aimed to examine the causality relationships between the D-PPI ratio of the Turkish manufacturing industry (YIUFE), the weighted average of the interest rate applied to TL commercial loans by the banking

sector (TKFAIZ), the volume of cash loans extended by the Turkish banking sector to the manufacturing industry (IMKRE), and the NPLs of these loans (ITKRE). Descriptive information about the data sets used in the research and the list of sources from which the data were obtained are given in Table 1.

Table 1

Descriptive Information and Sources of the Data Set Used in the Research

Data Set	Descriptive Information	Source
YIUFE	Manufacturing Industry Producer Price Index (D-PPI Ratio)	Turkish Statistical Institute (TUIK)
TKFAIZ	Weighted Average Interest Rate Applied to TL Commercial Loans Opened by Banks	Central Bank of the Republic of Turkey (CBT)
IMKRE	Volume of Cash Loans Extended to Manufacturing Industry by the Banking Sector	Banking Regulation and Supervision Agency (BRSA)
ITKRE	NPL Volume of Cash Loans Extended by the Banking Sector to the Manufacturing Industry	Banking Regulation and Supervision Agency (BRSA)

In order to investigate the relationships between the variables in the research, six different models were created, and the models created are given below.

Model 1 $YIUFE_t = \alpha_0 + \alpha_1 IMKRE_t + \varepsilon_1$

Model 2 $YIUFE_t = \beta_0 + \beta_1 ITKRE_t + \varepsilon_2$

Model 3 $YIUFE_t = \delta_0 + \delta_1 TKFAIZ_t + \varepsilon_3$

Model 4 $TKFAIZ_t = \gamma_0 + \gamma_1 IMKRE_t + \varepsilon_4$

Model 5 $TKFAIZ_t = \vartheta_0 + \vartheta_1 ITKRE_t + \varepsilon_5$

Model 6 $IMKRE_t = \Theta_0 + \Theta_1 ITKRE_t + \varepsilon_6$

4.2. Methodology

The datasets used in the research were firstly subjected to the Augmented Dickey-Fuller (ADF) developed by Dickey and Fuller (1979,1981) and the Phillips-Perron (PP) unit root tests developed by Phillips and Perron (1988). It has been determined that the series contain a unit root at the level and become stationary when first-degree differences are taken. For this reason, the Engle-Granger cointegration test developed by Engle and Granger (1987) was applied to test the long-term relationships between the series. Finally, the Granger causality test developed by

Granger (1969) was used to determine the direction of the short-term relationship between the series.

4.3. Unit Root Tests

In time series-based econometric analyzes, first of all, the stationarity levels of the series should be examined before the relationship tests between the variables are performed. In this research, Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests were used to determine the stationarity levels of the series.

Table 2

Unit Root Tests (Augmented Dickey-Fuller, ADF & Phillips-Perron, PP)

Augmented Dickey-Fuller (ADF) Unit Root Test				
	Level		**1st Difference**	
Dependents	**ADF t-Statistic**	**Critical Values (%5)**	**ADF t-Statistic**	**Critical Values (%5)**
IMKRE	4.662	-1.946 (0)	-4.651	-1.946 (0)
IMKRE[a]	2.666	-2.910 (0)	-5.643	-2.910 (0)
IMKRE[b]	0.493	-3.485 (0)	-6.146	-3.486 (0)
ITKRE	1.053	-1.946 (0)	-6.552	-1.946 (0)
ITKRE[a]	-1.364	-2.910 (0)	-6.706	-2.910 (0)
ITKRE[b]	-0.161	-3.485 (0)	-6.900	-3.486 (0)
TKFAIZ	-0.581	-1.946 (1)	-4.643	-1.946 (0)
TKFAIZ[a]	-2.494	-2.910 (1)	-4.600	-2.910 (0)
TKFAIZ[b]	-2.471	-3.485 (1)	-4.562	-3.486 (0)
YIUFE	1.511	-1.946 (2)	-3.229	-1.946 (0)
YIUFE[a]	0.858	-2.911 (2)	-4.071	-2.911 (1)
YIUFE[b]	0.262	-3.487 (2)	-4.579	-3.487 (1)
Phillips-Perron (PP) Unit Root Test				
	Level		**1st Difference**	
Dependents	**PP t-Statistic**	**Critical Values (%5)**	**PP t-Statistic**	**Critical Values (%5)**
IMKRE	3.996	-1.946 (3)	-4.880	-1.946 (4)
IMKRE[a]	2.369	-2.910 (2)	-5.750	-2.910 (3)
IMKRE[b]	-0.023	-3.485 (3)	-6.207	-3.486 (3)
ITKRE	0.736	-1.946 (4)	-6.754	-1.946 (4)
ITKRE[a]	-1.344	-2.910 (4)	-6.881	-2.910 (4)
ITKRE[b]	-0.507	-3.485 (4)	-7.027	-3.486 (4)
TKFAIZ	-0.252	-1.946 (3)	-4.643	-1.946 (0)
TKFAIZ[a]	-1.982	-2.910 (3)	-4.600	-2.910 (0)
TKFAIZ[b]	-1.964	-3.485 (3)	-4.562	-3.486 (0)

YIUFE	2.106	-1.946 (3)	-3.192	-1.946 (4)
YIUFE[a]	1.627	-2.910 (2)	-3.336	-2.910 (4)
YIUFE[b]	0.745	-3.485 (2)	-3.564	-3.486 (5)

Note. The fields marked with "a" show the values of the intercept model, the fields marked with "b" show the values of the model where the trend and intercept are together. "**" is statistical significance at the 5% level. Maximum lag length of ADF test was determined as 10 and according to the Schwarz information criterion. Bartlett Kernell method was used in PP unit root test, Bandwidth width was determined by Newey-West method. The values in parentheses represent ADF test's lag length and PP test's Bandwidth width.

Table 2 shows that according to both ADF and PP unit root tests, all series contain a unit root at the level and if the first-degree differences are taken, they become statistically stationary at the 5% significance level. In other words, all series show I(1) property. The I(1) feature of the series will be taken into account in the choice of both cointegration and causality testing.

4.4. Engle-Granger Cointegration Test

The Engle-Granger cointegration test is used to investigate the existence of a long-term relationship between the series. Accordingly, first of all, the models are tested according to the least squares method and the error terms indicated by "ε" are obtained, and these error terms are subjected to the Augmented Dickey-Fuller (ADF) unit root test in the model where there is no constant and trend. In the unit root test performed for error terms, if the series are stationary at the level, it is accepted that there is a long-term relationship between the series (Engle & Granger, 1987: 268).

Table 3

Engle-Granger Cointegration Test Results

1-Engle-Granger Cointegration Test Between YIUFE and IMKRE				
Dependents	**ADF t-statistic**	**Mac Kinnon critical value**	**Lag Length**	**Cointegration Degree**
ε_1	-6.911	-1.946**	0	I(0)
ε_2	-4.494	-1.946**	0	I(0)
2- Engle-Granger Cointegration Test Between YIUFE and ITKRE				
Dependents	**ADF t-statistic**	**Mac Kinnon critical value**	**Lag Length**	**Cointegration Degree**
ε_1	-4.304	-1.946**	1	I(0)
ε_2	-7.031	-1.946**	0	I(0)
3- Engle-Granger Cointegration Test Between YIUFE and TKFAIZ				
Dependents	**ADF t-statistic**	**Mac Kinnon critical value**	**Lag Length**	**Cointegration Degree**
ε_1	-3.206	-1.946**	0	I(0)
ε_2	-4.548	-1.946**	0	I(0)
4- Engle-Granger Cointegration Test Between TKFAIZ and IMKRE				

Dependents	ADF t-statistic	Mac Kinnon critical value	Lag Length	Cointegration Degree
ε_1	-4.610	-1.946**	0	I(0)
ε_2	-5.661	-1.946**	0	I(0)
5- Engle-Granger Cointegration Test Between TKFAIZ and ITKRE				
Dependents	**ADF t-statistic**	**Mac Kinnon critical value**	**Lag Length**	**Cointegration Degree**
ε_1	-4.206	-1.946**	3	I(0)
ε_2	-6.855	-1.946**	0	I(0)
6- Engle-Granger Cointegration Test Between IMKRE and ITKRE				
Dependents	**ADF t-statistic**	**Mac Kinnon critical value**	**Lag Length**	**Cointegration Degree**
ε_1	-5.745	-1.946**	0	I(0)
ε_2	-6.805	-1.946**	0	I(0)

Note. "ε_1" in the first, second and third models represents the error term of the models where YIUFE is the dependent variable. "ε_2" in the first model represents the error term of IMKRE, "ε_2" in the second model represents the error term of ITKRE, and "ε_2" in the third model represents the error term of TKFAIZ. "ε_1" in the fourth and fifth models represents the error term of the models in which TKFAIZ is the dependent variable. "ε_2" in the fourth model represents the error term of IMKRE, and "ε_2" in the fifth model represents the error term of ITKRE. In the sixth model, "ε_1" represents the error term of IMKRE, and "ε_2" represents the error term of ITKRE. All variables were analyzed with the ADF unit root test, with no trends or constants. "**" denotes statistical significance at the 5% level. The lag length t-statistic values were chosen based on the Schwarz information criterion.

According to Table 3, it is determined that there is a long-term relationship between the manufacturing industry D-PPI ratio, the weighted average of the interest rate applied to TL commercial loans extended by banks, the volume of cash loans extended by the banking sector to the manufacturing industry and the volume of NPLs belonging to these loans.

4.5. Granger Causality Test

Granger causality test is used to determine the existence and direction of the short-term relationship between the variables. In the Granger causality test, the null hypothesis test is determined by the F-statistic.

Table 4

Granger Causality Test Results

1- Granger Causality Test Between IMKRE and YIUFE				
H_0	**F-statistic**	**Prob.**	**df**	**Included Observations**
ΔIMKRE is not the cause of ΔYIUFE	32.2155	6.E-10***	2	59
ΔYIUFE is not the cause of ΔIMKRE	0.4682	0.6286	2	59
2- Granger Causality Test Between ITKRE and YIUFE				
H_0	**F-statistic**	**Prob.**	**df**	**Included Observations**
ΔITKRE is not the cause of ΔYIUFE	3.5244	0.0213**	3	58
ΔYIUFE is not the cause of ΔITKRE	4.5274	0.0069***	3	58
3- Granger Causality Test Between TKFAIZ and YIUFE				

H_0	F-statistic	Prob.	df	Included Observations
ΔTKFAIZ is not the cause of ΔIYIUFE	1.1542	0.2872	1	60
ΔYIUFE is not the cause of ΔTKFAIZ	1.2173	0.2745	1	60
4- Granger Causality Test Between TKFAIZ and IMKRE				
H_0	**F-statistic**	**Prob.**	**df**	**Included Observations**
ΔTKFAIZ is not the cause of ΔIMKRE	0.8136	0.3708	1	60
ΔIMKRE is not the cause of ΔTKFAIZ	11.3410	0.0014***	1	60
5- Granger Causality Test Between TKFAIZ and ITKRE				
H_0	**F-statistic**	**Prob.**	**df**	**Included Observations**
ΔTKFAIZ is not the cause of ΔITKRE	7.2001	5.E-05***	5	56
ΔITKRE is not the cause of ΔTKFAIZ	3.1011	0.0173**	5	56
6- Granger Causality Test Between IMKRE and ITKRE				
H_0	**F-statistic**	**Prob.**	**df**	**Included Observations**
ΔIMKRE is not the cause of ΔITKRE	2.9075	0.0311**	4	57
ΔITKRE is not the cause of ΔIMKRE	1.2731	0.2936	4	57

Note. The appropriate number of delays have determined by checking the information criteria. The "Δ" symbol indicates that the analysis was performed by taking the 1st degree differences of the series. "**" and "***" indicate statistical significance at the 5% and 1% levels, respectively.

According to Table 4; It has been determined that there is a one-way causality relationship from the volume of cash loans extended by the banking sector to the manufacturing industry, to the manufacturing industry D-PPI rates, to the NPLs volume of the manufacturing industry and to the average of TL commercial loan interest rates. In addition, it has been determined that there is a mutual causality relationship between the NPLs volume of the manufacturing industry and both the manufacturing industry D-PPI rate and the average of TL commercial loan interest rate.

The summary representation of Table 3 and Table 4, which includes the findings on the long- and short-term relationship between the research variables, is given below.

Table 5

Summary Representation of Relationships Between Variables

Long-Term Relationship			Short-Term Relationship		
YIUFE	⟺	IMKRE	ITKRE	⟺	YIUFE
YIUFE	⟺	ITKRE	ITKRE	⟺	TKFAIZ
YIUFE	⟺	TKFAIZ	IMKRE	⟹	YIUFE
TKFAIZ	⟺	IMKRE	IMKRE	⟹	TKFAIZ
TKFAIZ	⟺	ITKRE	IMKRE	⟹	ITKRE
IMKRE	⟺	ITKRE			

5. Conclusion and Suggestions

The growth in the manufacturing industry in developing countries also affects the growth rates of other sectors that are in contact with the manufacturing industry. For this reason, the manufacturing industry acts as a catalyst in the growth of national economies. At the same time, businesses that do not have sufficient capital accumulation in developing countries obtain a large part of the financing needed for the acceleration of investments and operating expenses from the loans provided by the banking sector. Bank loans, on the one hand, accelerate the investments of the enterprises, on the other hand, they cause a financial burden that the enterprises have to bear. This financial burden causes the production costs of enterprises to increase.

According to the data of January 2022, it is observed that the share of the manufacturing industry, in which 33.03% of the wage-earners in Turkey are employed, in GDP increased rapidly in 2021 and reached the level of 17.05%. In addition, it is striking that the growth rate of the manufacturing industry in 2020 and 2021 is higher than the GDP growth rate. On the other hand, it is observed that the ratio of manufacturing industry cash loans/total cash loans increased to 21.37%, and the average of TL commercial loan interest rate to 24.37% annually. According to the data of March 2022, the ratio of D-PPI in the manufacturing industry has increased to 106.55% and the difference between D-PPI and CPI has increased to 53.83%.

The manufacturing industry has a very strategic importance for the Turkish economy, but the recent increases of the D-PPI ratio of the manufacturing industry, the increases of the cash loan volume of the banking sector and the increases of the loan interest rates attract the attention. For this reason, in this research, using the monthly data between the periods 2017:01 and 2022:01, it has been analyzed that the relationship between the manufacturing industry D-PPI ratio, the weighted average of the annual interest rate applied to TL commercial loans by the banking sector, the volume of cash loans extended to the manufacturing industry by the banking sector and the volume of these loans NPLs.

In the Engle-Granger cointegration test, in which the long-term relationships between the variables are analyzed, it has been determined that all the variables are cointegrated in the long run. In the Granger causality test, in which the short-term relationships between the variables were analyzed, it has been determined that there was a mutual causality relationship between the manufacturing industry NPLs and the manufacturing industry D-PPI ratio, and the average of TL

commercial loan interest rate. In addition, it has been determined that there is a one-way causality relationship from manufacturing industry loan volume to manufacturing industry D-PPI ratio, to TL commercial loan interest rate average, and to manufacturing industry NPLs.

The findings obtained as a result of the analysis show that the D-PPI ratio of the manufacturing industry and the cash loans extended by the banking sector to the manufacturing industry have turned into a spiral. This spiral causes higher financing costs in enterprises as a result of loans extended to the manufacturing industry, thus increasing D-PPI rates, increasing NPLs due to increasing costs, and increasing the demand for loans by the manufacturing industry again to eliminate these situations.

In Turkey, which has been struggling with inflation for many years, the focus is on CPI rates, which generally concern the general public, and policymakers take measures to reduce CPI. However, many researchers reveal that there is a transition from producer prices to consumer prices. For this reason, it is thought that lowering the price that consumers have to endure in order to reach goods and services without implementing a policy to reduce producer costs will not be a viable and sustainable policy. In addition, it is thought that the large difference between the D-PPI rates and the CPI rates in Turkey in recent years will reduce the producer profit levels, decrease the production appetite of the operators and cause damage to sustainable production. Because of this, it is recommended that policymakers focus on producer inflation rather than consumer inflation in the fight against inflation and act by creating policies that reduce producer inflation.

It has been determined that there is a tendency from short-term loans to long-term loans in the maturity structure of bank loans used by the manufacturing industry. Despite the share of long-term bank loans in the manufacturing industry's foreign resource structure increasing since 2014, the share of short-term bank loans has gradually decreased. If the maturity of the loan used is long, businesses are exposed to higher financing costs due to the compound interest applied to the loans. For this reason, it is recommended that manufacturing industry enterprises prefer long-term bank loans for investment financing and short-term bank loans for current asset financing. Thus, it is thought that the financing cost incurred by the manufacturing industry enterprises and thus the D-PPI ratios can be reduced.

Since the loans extended to the manufacturing industry will be included in the production process again, these loans are not expected to have an impact on inflation. However, there is no

control mechanism as to whether the loans made available to the manufacturing industry by the banking sector are used in accordance with their intended purpose. It is thought that these loans, which are made available to businesses by the banking sector for use in the manufacturing process, may cause inflation if they are evaluated in different expenditure areas other than the manufacturing process. In addition, it is thought that the 250 billion TL loan made available to businesses by the banking sector in 2017 with the support of the credit guarantee fund, without any control mechanism, is effective in the increase in inflation. For this reason, it is recommended to the banking sector to establish a control mechanism that will enable the use of loans for their intended purpose and to facilitate the access of enterprises to project-based finance.

The share of bank loans extended to the manufacturing industry in the total loans extended by the banking sector has an undeniable size. Considering that the manufacturing industry interacts directly or indirectly with many other sectors, timely repayment of the loans extended to the manufacturing industry becomes more important for the banking sector. Any deterioration that may occur in manufacturing industry loans may adversely affect the loans extended to other sectors. Such a deterioration in loan repayments will lead to an increase in the credit risk of the banking sector and a decrease in bank profits. Considering the interaction of the manufacturing industry and the banking sector with other sectors and the added value they provide to the country's economy together; it is thought that these sectors should grow by adding value to each other in the economic system. For this reason, it is recommended to the banking sector should consider the costs that the manufacturing industry has had to endure, especially in the last period, and provide more cost-effective financing to the manufacturing industry as much as possible. With this credit policy to be implemented by the banking sector, it is thought that both the credit losses in the banking sector can be prevented and the continuity of the activities of these two sectors, which are in close relationship with each other, can be ensured.

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