THE RELATIONSHIP BETWEEN THE REAL EFFECTIVE EXCHANGE RATE AND INDUSTRIAL PRODUCTION IN THE TURKISH ECONOMY

Okşan KİBRİTCİ ARTAR
Istanbul Commerce University, Turkey

Abstract:
The industrial sector is one of the key sectors for the Turkish economy in terms of production, employment and exports. The volatility in the exchange rate in the Turkish economy has important effects on industrial production, as well as many economic variables. The main purpose of this study is to empirically analyse the effects of real effective exchange rate on industrial production for the Turkish economy in the 2009M08-2022M01 period. According to the results of the study, the real effective exchange rate adversely affects the industrial production in the Turkish economy. Other things being equal, the depreciation of the domestic currency increases the foreign demand for industrial products, in line with the economic theory. Considering these relations between real effective exchange rate and industrial production while designing economic policies is important for sustainable economic growth.

Keywords:
Industrial Production, Real Effective Exchange Rate, Economic Policies

1. Introduction

Total industrial production and manufacturing industry production play a critical role in the Turkish economy in terms of production, employment and exports at the national level. Total industrial production is affected by changes in domestic and international demand. In particular, one of the important factors affecting export demand is the real effective exchange rate. The current account deficit, which arises due to the chronic savings deficit in the Turkish economy, has significant effects on exchange rates. The sustainability of the external financing deficit for the Turkish economy also significantly affects the exchange rate stability. The economic and financial stability of the Turkish economy may be adversely affected due to the internal and external economic and non-economic shocks it faces. In this study, it is aimed to analyse the relationship between the real effective exchange rate and total industrial production in the Turkish economy with econometric techniques. The original contribution of the study to the literature is to contribute to the effective design of industry and exchange rate policies by reanalyzing the relationship between the current data and the real effective exchange rate and total industrial production within the framework of the Covid-19 Epidemic.

2. Literature on Real Effective Rate of Exchange and Industrial Production in The Turkish Economy

Industrial production has a critical role for the Turkish economy. The sustainability of industrial supply depends on the sustainability of domestic and foreign demand on the one hand and on the input supply conditions and costs on the other. The real effective exchange rate is an important factor in the export of industrial goods. Table.1. gives the share of total industry and manufacturing industry GDP in the Turkish economy. Accordingly, for 2021, the share of Industrial Production in GDP is around 25% and the share of manufacturing industry in GDP is around 22%.

**Table.1. GDP Share of Total Industry and Manufacturing Industry in Turkish Economy**

Year/Quarter	Share of Industrial Production in GDP (%)				Share of Manufacturing Industry Production in GDP (%)			
	I	II	III	IV	I	II	III	IV
1998	28.82	26.31	22.22	24.28	25.78	23.66	19.70	21.49
1999	24.80	24.12	20.29	22.79	21.92	21.44	17.77	19.83
2000	23.18	22.68	19.57	21.35	20.08	20.03	17.03	18.33
2001	22.91	20.53	19.02	21.73	19.67	17.56	16.09	18.20
2002	22.08	20.98	18.28	19.81	18.28	17.85	15.50	16.70
2003	21.59	21.02	18.20	20.42	18.26	18.03	15.38	17.21
2004	21.61	20.54	18.06	19.52	18.49	17.76	15.45	16.62
2005	21.28	20.23	17.65	20.10	18.28	17.56	15.13	17.05
2006	20.59	20.26	18.35	20.14	17.64	17.67	15.84	17.29
2007	21.31	20.04	17.96	19.61	18.30	17.32	15.27	16.68
2008	20.89	19.91	17.89	19.09	17.87	17.07	14.96	15.50
2009	19.15	18.83	17.19	18.75	15.62	15.68	14.22	15.27
2010	19.40	19.14	16.80	18.75	15.69	15.82	13.58	15.37
2011	20.70	20.10	18.33	20.01	17.24	17.01	15.32	16.48
2012	21.02	20.12	17.52	18.73	17.17	16.75	14.47	15.33
2013	20.33	19.80	18.52	20.16	16.72	16.51	15.35	16.66
2014	21.48	20.84	18.60	19.67	17.76	17.57	15.54	16.48
2015	20.36	20.43	18.17	20.16	17.10	17.31	15.30	17.22
2016	21.02	20.19	17.61	19.82	17.67	17.27	14.72	16.88
2017	21.78	20.79	19.17	21.07	18.39	17.87	16.30	17.99
2018	22.25	21.92	21.45	23.47	19.02	18.85	18.37	19.91
2019	23.10	22.72	20.43	21.44	19.38	19.15	17.07	17.86
2020	23.43	21.48	21.51	24.36	19.66	17.78	18.13	20.60
2021	25.51	26.37	23.96	27.68	21.68	22.35	20.06	23.51

Source: TUIK

In Figure 1, The production level in the total industry and sub-sectors in the Turkish economy is given annually. Accordingly, in the second quarter of 2020, when the Covid-19 epidemic was dominant, the contraction in industrial production was observed around 30%, especially in April and May 2020.

Figure 1. Turkish Economy Total Industry and Sub-Sector Production (Annual%)
Source: TCMB, TUIK
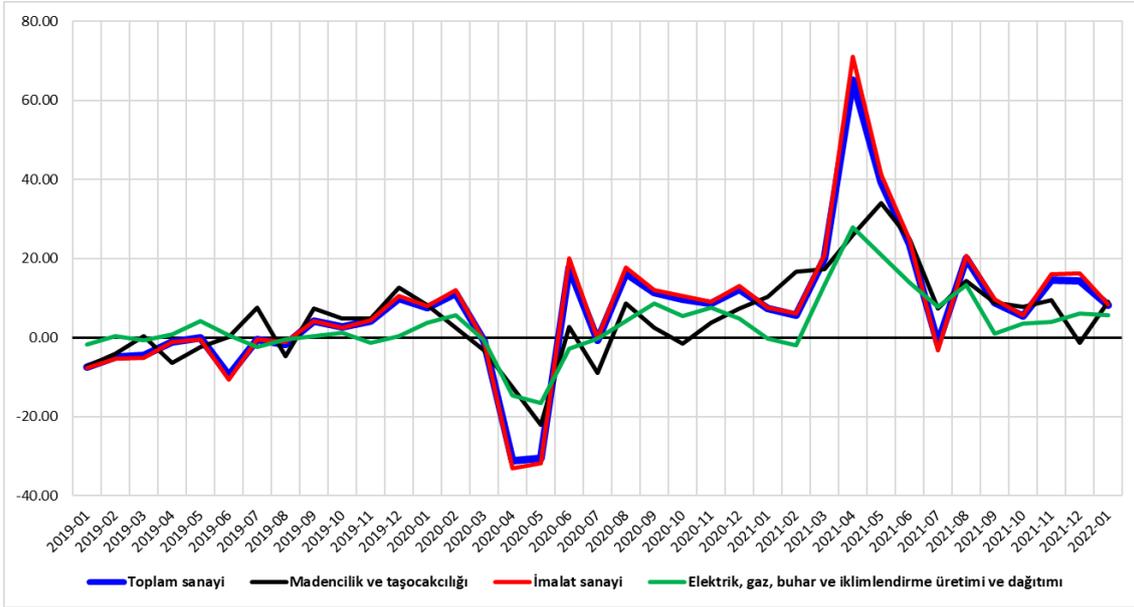
In Figure 2, graphs of industrial production and real effective exchange rate variables (log) are given. Accordingly, the real effective exchange rate and total industrial production exhibit a volatile trend in the opposite direction to each other.

Figure 2. Industrial Production and Real Effective Exchange Rate Variables Graphs (Log)

200
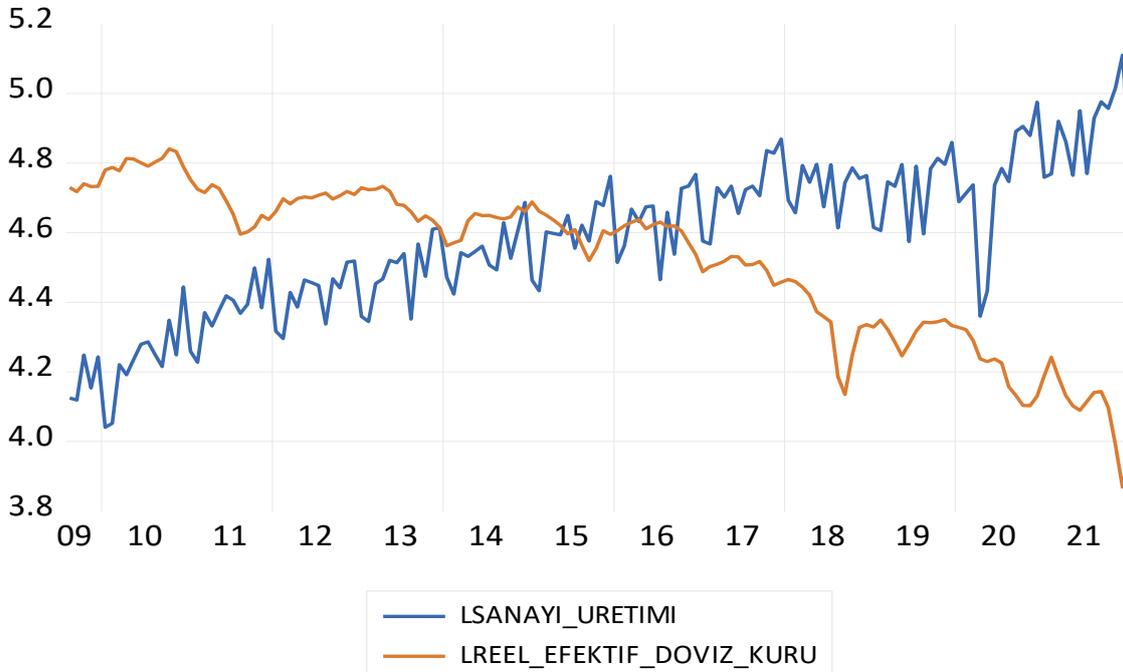
Within the framework of the literature review, the findings of the related studies examining the relationship between industrial production and exchange rate in the Turkish economy are summarized as follows.

Balaylar (2011) stated in his study that the rise in real exchange rates in the Turkish economy weakens the relations between industrial production and employment.

In the study of Barışık and Yayar (2012), it was determined that the exchange rate for the Turkish economy adversely affected industrial production in accordance with the theory.

Aytekin and Doyar (2019) study found that there is a long-term relationship between industrial production and exchange rate, while there is a mutual causality relationship in the short-term.

Şanlı and Petek (2019) study examined that the exchange rate increases the capacity utilization rate in the manufacturing industry.

In the study of Aytekin (2020), it was stated that there is a long-term relationship between industrial production and exchange rate, and there is a causality relationship from exchange rate to industrial production in the short run.

Petek et al. (2020) found a strong and inverse relationship between the Real Effective Exchange Rate and the number of manufacturing for the Turkish economy.

Çalışci and Gögül (2021) study found an inverse relationship between the Turkish economy's exchange rate and industrial production in the long run.

In international studies, the effects of exchange rates on industrial production or GDP may differ from country to country (see Akinlo and Lawal, 2015; Tang, 2015)

3. Econometric Analysis

3.1. Data and Methodology

The variables used in the analysis were obtained from the Central Bank of the Republic of Turkey. Variables are,

- Total Industrial Production Index (2015=100)
- CPI Based Real Effective Exchange Rate (2003=100)

The data period is the period 2009M08-2022M01 and is monthly data. The variables are logarithmic.

The method used in the analysis is time series econometric techniques.

3.2.Econometric Analysis Results

Descriptive statistics for the logarithmic values of the variables used in the study are given in Table.1. Accordingly, while the industrial production average was 4.581, the average real effective exchange rate was 4.519.

Table 1. Descriptive Statistics (Log)		
	Industrial Production	Real Effective Exchange Rate
Mean	4.581	4.519
Median	4.597	4.605
Maximum	5.109	4.840
Minimum	4.040	3.868
Std.Dev.	0.216	0.222
Skewness	- 0.220	- 0.770
Kurtosis	2.569	2.574
Jarque-Bera	2.378	15.945
Probability	0.305	0.000
Total	687.1	677.8
Observation	150	150

According to the ADF unit root test results in Table 2, it has been determined that the variables are stationary at the first difference according to the most appropriate model result.

Table 2: ADF Unit Root Test Results for Variables

Data/Model		Industrial Production	Real Effective Exchange Rate
Level/Trends	t-stat	-2.5155	-2.4051
	Prob.	0.3203	0.3754
First Difference/Constant	t-stat	-5.0516	-9.9642
	Prob.	0.0000	0.0000

Since the variables were not stationary at the level, the Johansen cointegration test was performed in Table 3 and it was determined that the variables were cointegrated in the long run.

Table 3: Johansen Cointegration Test Results
Trace Test Results

Rank	Eigenvalue	Trace Stats	0.05 Critical Value	Prob.**
r = 0, r ≥ 1	0.155807	32.34675	25.87211	0.0068
r = 1, r ≥ 2	0.049409	7.448754	12.51798	0.3000

Maximum Eigenvalue Results

Rank	Eigenvalue	Eigenvalue Stats	0.05 Critical Value	Prob.**
r = 0, r ≥ 1	0.155807	24.89800	19.38704	0.0071
r = 1, r ≥ 2	0.049409	7.448754	12.51798	0.3000

Since the long-term relationship between the variables was determined by cointegration analysis, the long-term equation between the variables was estimated with the Dynamic OLS estimator. The results in Table 4 show that the real effective exchange rate adversely affects industrial production. As the value of the Turkish lira decreases, industrial production increases depending on foreign demand. This is an economically expected result. The depreciation of the domestic currency leads to an increase in foreign demand, an increase in exports and an increase in industrial production.

Table 4: Dynamic OLS Regression Results for Industrial Production Dependent Variable

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Real Effective Exchange Rate	-0.820572	0.062885	-13.04879	0.0000
C	8.300751	0.275533	30.12618	0.0000
D_2020M04	-0.411128	0.024588	-16.72068	0.0000
R-squared	0.716966	Mean dependent var		4.587075
Adjusted R-squared	0.709049	S.D. dependent var		0.210560
S.E. of regression	0.113576	Sum squared resid		1.844614

HAC standard errors & covariance (Prewhitening with lags = 1 from SIC maxlags = 5, Bartlett kernel, Newey-West fixed bandwidth = 5.0000), Cointegrating equation deterministics: C D_2020M04, Automatic leads and lags specification (lead=0 and lag=1 based on SIC criterion, max=13), Jarque-Bera (Prob) = 0.192

4. Conclusion

In this study, the relationship between the industrial sector, which has a critical role in the Turkish economy in terms of production, employment and exports, and the real effective exchange rate has been investigated. As a result of the analysis, it has been empirically determined that the real effective exchange rate affects industrial production in the opposite direction. In terms of ceteris paribus condition, the depreciation of the domestic currency increases the foreign demand for industrial products. The important result in terms of economic policy is that observing the effects of the economic policies implemented in the Turkish economy on industrial production over the real effective exchange rate can play a key role for economic growth within the framework of sustainability.

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