

Research Article

Analyzing the Relationship Between the Capacity Utilization Rate, the Real Effective Exchange Rate, and Foreign Trade Price Indices in Turkey: An ARDL Approach

Türkiye’de Kapasite Kullanım Oranı ile Reel Efektif Döviz Kuru ve Dış Ticaret Fiyat Endeksleri Arasındaki İlişkinin ARDL Yaklaşımıyla Analizi

Sinan GÜLENÇER

Dr. Öğr. Üyesi, Osmangazi Üniversitesi

Sağlık Hizmetleri Meslek Yüksekokulu

sinang@ogu.edu.tr

<https://orcid.org/0000-0001-7406-1023>

Makale Geliş Tarihi	Makale Kabul Tarihi
25.03.2026	05.09.2026

Abstract

The capacity utilization rate (CUR) of the manufacturing industry serves as a critical leading indicator for growth cycles, inflation dynamics, and financial stability. This study aims to analyze the dynamic relationships between CUR and the real effective exchange rate (REER), export unit value index (EUVI), and import unit value index (IUVI) using quarterly data covering the period 2013Q1–2025Q3. The econometric analysis, employing the Pesaran et al. (2001) ARDL bounds test approach, confirms the existence of a statistically significant long-term cointegration relationship among the variables. The long-run coefficients indicate that a real appreciation in REER positively affects CUR, likely by reducing production costs due to the industry's high import dependency, whereas increases in export unit values negatively impact capacity utilization. The effect of import prices is found to be positive but relatively limited. Furthermore, the estimated error correction model reveals that approximately 65% of short-term disequilibria are corrected in the subsequent period, indicating a rapid adjustment mechanism. These findings confirm the sensitivity of CUR to external price and exchange rate shocks, offering significant implications for macro-financial stability policies.

Keywords: Capacity Utilization, Real Effective Exchange Rate, External Price Indices, ARDL Bounds Test, Error-Correction Model.

Jel Classification: C22, E31, F14

Öz

Türkiye ekonomisinde imalat sanayi kapasite kullanım oranı (CUR), büyüme döngüleri, enflasyon dinamikleri ve finansal istikrar açısından yakından izlenen kritik bir öncü göstergedir. Bu çalışma, CUR ile reel efektif döviz kuru (REER), ihracat birim değer endeksi (EUVI) ve ithalat birim değer endeksi (IUVI) arasındaki dinamik ilişkileri 2013Ç1–2025Ç3 dönemine ait çeyreklik verilerle analiz etmeyi

Önerilen Atıf /Suggested Citation

Gülençer, S., 2026, Analyzing the Relationship Between the Capacity Utilization Rate, the Real Effective Exchange Rate, and Foreign Trade Price Indices in Turkey: An ARDL Approach, *Üçüncü Sektör Sosyal Ekonomi Dergisi*, 61(3), 3584-3600.

amaçlamaktadır. Pesaran vd. (2001) ARDL sınır testi yaklaşımı kullanılarak yapılan ekonometrik analizler, değişkenler arasında istatistiksel olarak anlamlı, uzun dönemli bir eşbütünleşme ilişkisi bulunduğunu kanıtlamaktadır. Uzun dönem katsayıları, REER'deki reel değerlenmenin, sanayinin ithal girdi bağımlılığı nedeniyle üretim maliyetlerini düşürerek CUR'yu pozitif; ihracat fiyatlarındaki artışın ise rekabet gücü veya talep kanalıyla negatif etkilediğini göstermektedir. İthalat fiyatlarının etkisi ise pozitif ancak daha sınırlı düzeydedir. Ayrıca tahmin edilen hata düzeltme modeli, kısa dönemli dengesizliklerin %65 oranında bir sonraki dönemde giderildiğini, yani sistemin şoklara karşı hızlı bir uyum mekanizmasına sahip olduğunu ortaya koymaktadır. Bu bulgular, CUR'nun dışsal fiyat ve kur şoklarına karşı duyarlılığını teyit ederek makro-finance istikrar politikaları için önemli çıkarımlar sunmaktadır.

Anahtar Kelimeler: Kapasite Kullanım Oranı, Reel Efektif Döviz Kuru, Dışsal Fiyat Endeksleri, ARDL Sınır Testi, Hata Düzeltme Modeli.

Jel Sınıflandırması: C22, E31, F14

1. Introduction

Over the past thirty years, the global economy has evolved into a structure characterised by increasing financial integration, deepening trade and liberalisation of capital movements, alongside a growing interaction between production and financial systems. In this process, economic fluctuations have begun to exert a decisive influence on the real economy not only through demand-side shocks but also through exchange rate movements, global price fluctuations and sudden changes in financial conditions. Particularly after the 2008 global financial crisis, how production capacity is utilised, the extent to which firms' cost structures are sensitive to external shocks, and the implications of these processes for financial stability have become a central area of debate for both developed and developing economies (Corrado & Matthey, 1997; Gopinath et al., 2020). In this context, the capacity utilisation rate (CUR) stands out as a strategic macroeconomic indicator that reflects not only cyclical fluctuations but also the structural resilience of economies, the flexibility of their production structure, and their links with the financial system. By indicating the extent to which the existing capital stock is being used efficiently, the capacity utilisation rate points to the supply-side constraints on production; in this respect, it plays a critical role in the analysis of growth, inflation, employment, and investment decisions (Garner, 1994; Emery & Chang, 1997).

Globally, the importance of the capacity utilisation rate is particularly evident in three key dimensions. First, increases and decreases in capacity utilisation, as an important component of production cycles and business cycles, provide early signals of economic expansion and recession periods. Secondly, capacity utilisation approaching potential levels can lead to increased marginal costs and changes in pricing behaviour, thereby intensifying inflationary pressures. Thirdly, fluctuations in capacity utilisation have indirect but powerful effects on the stability of the financial system by affecting firms' profitability and cash flows (Dotsey & Stark, 2005; Bruno & Shin, 2020). Particularly in the post-global crisis period, the relationship between capacity utilisation rates and the financial system has become more apparent. During periods of low capacity utilisation, firms' production volumes and sales revenues decline, weakening their debt repayment capacity and potentially leading to an increase in non-performing loans in the banking sector. Conversely, high capacity utilisation rates support firms' revenues and profitability, contributing to the limitation of risks in the financial system. Therefore, the CUR has become an indicator closely monitored not only by the real sector but also by the banking system and financial stability (Bruno & Shin, 2020).

Recent developments in the global economy have also highlighted the relationship between the capacity utilisation rate and external prices and exchange rates. The proliferation of global value chains has increased the share of imported intermediate goods in production processes, strengthening the impact of exchange rate movements and international price fluctuations on production costs. In this context, the real effective exchange rate has evolved beyond being merely an indicator of competitiveness to become a fundamental macroeconomic variable influencing production costs and capacity utilisation decisions (Gopinath et al., 2020). Within this global framework, the Turkish economy occupies a special position in terms of the importance of capacity utilisation rates. Due to its high external trade deficit, dependence on imported inputs in the manufacturing industry, and bank-centred financial structure, Turkey exhibits

a relatively fragile economic outlook in the face of exchange rate and external price shocks. The growth performance achieved with the support of reforms implemented after the 2001 crisis and global liquidity conditions has been severely tested by the 2008 global financial crisis, exchange rate shocks after 2018, the pandemic process, and increasing geopolitical risks in recent years (Berument, 2007; Gökcü, 2024).

Growth dynamics in Turkey have largely been based on domestic demand and credit expansion for many years. The bank-centred financial system has emerged as the primary source of financing for real sector investments and working capital; credit growth has been decisive in production and capacity utilisation decisions. While this structure allows capacity utilisation rates to increase rapidly during periods of economic expansion, it can also cause capacity utilisation to decline sharply during periods of tightening financial conditions or currency shocks. Consequently, the capacity utilisation rate is considered an important indicator of cyclical fluctuations and financial fragility in the Turkish economy (Bruno & Shin, 2020).

The structural characteristics of Turkey's manufacturing industry also increase the sensitivity of the capacity utilisation rate to external shocks. High dependence on imported intermediate and capital goods leads to production costs becoming directly dependent on changes in the exchange rate and import prices. This situation demonstrates that, in addition to the 'competitiveness channel' emphasised in traditional economic literature, the 'cost channel' is also extremely important for Turkey. Appreciation in the real exchange rate can support production and capacity utilisation by reducing imported input costs; however, sudden and sharp depreciation can create cost shocks and suppress capacity utilisation (Erduman et al., 2020; Akkay, 2021). Furthermore, the capacity utilisation rate plays a critical role in monetary policy and inflation dynamics in Turkey. In the literature, the CUR is discussed in the context of output gaps and the non-accelerating inflation capacity utilisation rate (NAICU); it has been shown that capacity utilisation exceeding certain thresholds increases inflationary pressures (Garner, 1994; Sakarya & Yurtoğlu, 2000; Abdioğlu, 2013). In economies such as Turkey, where the fight against inflation is central to macroeconomic stability, the correct interpretation of the capacity utilisation rate is of vital importance for monetary policy design.

However, in the Turkish economy, the determinants of the capacity utilisation rate are often addressed through domestic demand, credit conditions and interest rates; the effects of exchange rates and foreign trade prices on capacity utilisation decisions are examined to a relatively limited extent. Yet, the exchange rate shocks and global price fluctuations experienced in recent years have clearly demonstrated that the capacity utilisation rate is shaped not only by internal factors but also, to a significant extent, by external shocks. This situation further increases the strategic importance of the capacity utilisation rate for both the real sector and the financial system. In light of these global and national debates, the empirical examination of the relationship between the capacity utilisation rate and the real effective exchange rate and foreign trade prices fills an important gap in both the economic literature and for policymakers. The real effective exchange rate reflects international competitiveness on the one hand, while influencing production and capacity utilisation decisions through imported input costs and firm balance sheets on the other. Export and import unit value indices provide complementary information on external demand conditions and cost structures, enabling a more comprehensive understanding of capacity utilisation dynamics (Gopinath et al., 2020).

Against this background, the central research question is whether external price and exchange-rate shocks systematically shape manufacturing capacity utilisation in Türkiye, beyond the domestic-demand channel. The study is motivated by Türkiye's import-intensive production structure and by the need to understand whether the cost effects of real appreciation can offset the conventional competitiveness effect.

This study positions the capacity utilisation rate (CUR) as a directly explained variable, rather than treating it as an explanatory variable of inflation, industrial production or output gap, as is common in most empirical research, and thus differs significantly from the prevailing approach in the literature. While CUR is generally treated in existing studies as a result of macroeconomic stability or a cyclical indicator, the question of which external and structural factors determine CUR itself has been examined to a relatively limited extent (Garner, 1994; Abdioğlu, 2013). This study fills this gap by treating the capacity utilisation rate as a strategic macroeconomic variable sensitive to external shocks such as

exchange rates and foreign trade prices. The first important contribution of the study is that it analyses the relationship between the capacity utilisation rate and the real effective exchange rate (REER) beyond the traditional competitiveness approach, within the framework of cost and financial channels. In the literature, the exchange rate–production relationship is mostly addressed through export competitiveness; it is assumed that a depreciation in the real exchange rate increases production. However, the proliferation of global value chains and increased dependence on imported inputs have significantly altered the direction and magnitude of this relationship, particularly in developing economies (Campa & Goldberg, 1997; Gopinath et al., 2020). In economies such as Turkey, where imported intermediate goods account for a high proportion of manufacturing, a limited number of studies highlight findings suggesting that real exchange rate appreciation may increase capacity utilisation by reducing production costs; however, studies that test this relationship directly through CUR are quite limited (Erduman et al., 2020; Akkay, 2021). This study makes a unique empirical contribution to the literature by directly modelling the REER–CUR relationship.

The second important contribution is that the capacity utilisation rate is considered not only in terms of the exchange rate but also in the context of foreign trade prices through the export and import unit value indices. While the export unit value index (EUVI) provides information about external demand conditions and competitive strength, the import unit value index (IUVI) affects capacity utilisation decisions through production costs and imported input prices. In the existing literature, these indices are mostly associated with export volume, foreign trade balance or industrial production; their direct relationship with the capacity utilisation rate is neglected (Bahmani-Oskooee & Aftab, 2017; Aydaş & Canbaloglu, 2024). This study addresses these indices within the same model, comprehensively revealing how capacity utilisation is shaped through external demand–cost–competition channels.

Thirdly, the study's methodological contribution stands out. The ARDL bounds test approach used offers significant advantages for economies such as Turkey, where data sets are relatively limited, as it allows for variables with different integration degrees ($I(0)$ and $I(1)$), provides reliable results in small samples, and enables the simultaneous analysis of long- and short-term relationships (Pesaran et al., 2001).

Furthermore, analysing the speed at which short-term imbalances are corrected through the error correction model adds a new dimension to the literature by revealing the adjustment dynamics of the capacity utilisation rate in response to external shocks. The fourth contribution is the examination of the capacity utilisation rate from a financial stability perspective.

Fluctuations in capacity utilisation have indirect but powerful effects on the quality of banking sector assets by affecting firms' cash flows, profitability, and debt repayment capacity. In this context, the CUR is not only a real sector indicator but also a critical leading indicator in terms of credit risk and financial stability (Bruno & Shin, 2020). This study reveals how the CUR is shaped by exchange rates and foreign trade prices, providing an empirical basis for why capacity utilisation should be closely monitored in financial stability analyses.

Finally, the study highlights the effects of structural characteristics specific to the Turkish economy, such as high import input dependency, exchange rate volatility, and a bank-centred financial structure, on capacity utilisation decisions. In this respect, the study positions the capacity utilisation rate not merely as a reflection of cyclical fluctuations, but also as a strategic indicator revealing the structural vulnerabilities and sensitivity to external shocks of the Turkish economy. The findings indicate that the capacity utilisation rate should be assessed within a comprehensive framework in the design of monetary policy, exchange rate policy, and industrial policy.

2. Conceptual Framework

The capacity utilisation rate is a fundamental supply-side indicator that theoretically shows the extent to which the existing capital stock in an economy is being used efficiently. At the micro level, the CUR is directly related to the intensity of production factors, unit costs and profitability expectations for firms. At the macro level, the capacity utilisation rate is closely linked to output gaps, inflationary pressures and investment cycles (Corrado & Matthey, 1997). Conceptually, the mechanisms affecting the capacity utilisation rate can be grouped under three main channels: the demand channel, the cost channel, and the financial channel. The demand channel argues that changes in domestic and foreign demand determine firms' production volume and, consequently, capacity utilisation. Particularly in export-

oriented sectors, external demand conditions are decisive for capacity utilisation through order volumes; exchange-rate volatility may affect trade flows asymmetrically across industries (Bahmani-Oskooee & Aftab, 2017). The cost channel highlights the impact of exchange-rate and import-price changes on production costs. In economies with high dependence on imported intermediate and capital goods, imported-input intensity makes production costs especially sensitive to exchange-rate movements. Evidence on the import content of Turkish production and exports confirms the relevance of this channel for Turkey (Erduman et al., 2020).

The financial channel, on the other hand, suggests that exchange rate movements affect capacity utilisation through firm balance sheets and credit conditions. During periods of local currency depreciation, firms with high foreign currency debt face increased balance sheet constraints and reduced access to credit, which constrains investment and capacity utilisation. Bruno and Shin (2020) define this mechanism as the ‘financial exchange rate channel’ and show that capacity utilisation is significantly affected by this channel, particularly in developing economies. The real effective exchange rate lies at the intersection of these three channels; as an indicator that simultaneously reflects both competitiveness and cost structure, it shapes capacity utilisation decisions. Export and import unit value indices, in turn, provide information on external demand conditions and production costs, respectively, thereby complementing the dynamics of the capacity utilisation rate (Gopinath et al., 2020). This study empirically tests how the capacity utilisation rate is determined not only by internal cyclical factors but also by external price and exchange rate shocks, addressing the aforementioned theoretical channels within a comprehensive framework. Thus, the capacity utilisation rate is positioned as a strategic macroeconomic variable that bridges production, foreign trade, and financial stability.

2. Literature Review

2.1. Capacity Utilisation, Inflation, and Output Literature

Bauer (1990), In his study revisiting the relationship between capacity utilisation and inflation in the US, Bauer compared the effects on inflation using capacity utilisation indicators based on different definitions and data adjustments. He emphasised that results can vary significantly depending on the capacity utilisation measure used, and therefore, policymakers should carefully evaluate the use of capacity utilisation alone as a reliable indicator for inflation forecasts.

Garner (1994) estimated Phillips curve models enriched with expectations within the NAICU framework using long-term capacity utilisation rate and inflation series for the US economy. He found that a capacity utilisation rate of around 82 per cent corresponds to the natural capacity utilisation rate, which does not accelerate inflation; while utilization rates above this threshold strengthen inflationary pressures, particularly in terms of producer prices.

Emery and Chang (1997) examined the predictive power of industrial capacity utilisation rates for inflation changes using long-term data for the United States after the 1960s through econometric regression models and found that, prior to 1983, capacity utilisation significantly predicted CPI inflation, but that after 1982, the capacity utilisation–inflation relationship weakened, ceasing to be a stable indicator, particularly in terms of consumer prices.

Dotsey and Stark (2005), re-evaluated the power of capacity utilisation to predict inflation using linear forecasting models based on capacity utilisation rates and various inflation indicators for the US manufacturing industry. They found that the relationship was not stable over time, with capacity utilisation being a meaningful leading indicator for inflation until the early 1980s, but its predictive power significantly weakened thereafter.

Zhao and Ren (2023) investigated the relationship between corporate digital transformation and capacity utilisation rate using firm-level panel data from 2010–2018 for manufacturing firms listed on the Chinese stock exchange, employing fixed-effects panel regression models. The results show that digital transformation significantly increases capacity utilisation and that the effect is U-shaped; that is, digitalisation improves capacity utilisation up to a certain threshold, but the marginal effect weakens at excessive levels of digitalisation.

Xie and Yu (2024) examined the effect of participation in the global value chain (GVC) on the capacity utilisation rate using firm-level and customs transaction-level data from Chinese manufacturing firms

for the period 2000–2006. measuring capacity utilisation with a translog cost function and employing the difference-in-differences (PSM–DID) approach combined with propensity score matching. The findings reveal that participation in the GVC significantly and sustainably increases firm capacity utilisation, which occurs through the channels of expanding domestic demand and technological progress, thereby helping to alleviate the problem of excess capacity.

Ma, Chen and Liu (2024) investigated the effect of a ‘corporate digital sophistication’ index, derived from annual reports through text mining, on the capacity utilisation rate using a large panel data set of listed companies in China from 2010 to 2020. According to the results of panel models incorporating fixed effects and various robustness controls, digital advancement increases capacity utilisation both at the firm level and through intra-industry spillover effects; the impact is stronger in sectors with intense competition and lower financing constraints.

Odei, Ardito, and Soukal (2024) tested the effect of capacity utilisation on product innovation and the regulatory role of domestic, foreign, and public ownership structures in this relationship, using a large firm-level database covering 80,587 firms from several emerging economies during the period 2006–2022. Findings from multivariate econometric models indicate that high capacity utilisation reduces the likelihood of product innovation in the context of emerging economies; domestic ownership mitigates this negative effect, whereas the negative impact of capacity utilisation on innovation intensifies as the share of foreign and public ownership increases.

2.2. Exchange Rates, External Trade Prices, and Production/Employment Literature

Bahmani-Oskooee and Aftab (2017) examined the asymmetric effects of exchange-rate volatility on US–Malaysia industry-level trade flows using a nonlinear ARDL framework. Their results show that increases and decreases in exchange-rate volatility can have different effects across industries, indicating that exchange-rate uncertainty may influence external demand and trade volumes through asymmetric adjustment mechanisms.

Gopinath et al. (2020), in their comprehensive study examining the ‘Dominant Currency Paradigm’ in the pricing of global trade and production capacity, stated that the elasticity of import and export prices to the exchange rate is low, but the pass-through of imported input prices to local production costs is high; emphasising that the impact of exchange rate shocks on production decisions varies depending on the country's import input intensity.

Bruno and Shin (2020) examined the impact of exchange rates on real sector firms through the ‘financial channel’ and showed through panel data analysis that when the dollar appreciates (the local currency depreciates), balance sheet constraints increase for firms in developing countries, lending appetite decreases, and as a result, investment expenditure and capacity utilisation rates are negatively affected.

Iyke and Ho (2017) examined the relationship between exchange-rate uncertainty and domestic investment in Ghana. Their findings indicate that greater exchange-rate uncertainty can discourage domestic investment, supporting the broader theoretical view that exchange-rate uncertainty may delay firms' investment and production decisions.

2.3. Türkiye-Focused Evidence and Research Gap

Sakarya and Yurtoğlu (2000) estimated Phillips curve-type OLS models within the NAICU framework using monthly capacity utilisation and inflation data for the period 1991:02–2000:04. Their findings indicate that inflationary pressures increase when capacity utilisation exceeds its non-accelerating level, which they estimate at approximately 79% for Turkey.

Arabacı and Arabacı (2008) estimated the optimal capacity utilisation rate that does not accelerate inflation for the Turkish economy after 2002 using time series analysis of capacity utilisation rate and price index series. They found that when the capacity utilisation rate approached 80%, significant upward pressure on inflation emerged.

Abdioğlu (2013), used monthly capacity utilisation rate and inflation data for Turkey to estimate the non-accelerating inflation capacity utilisation rate (NAICU) through different econometric models and found that the long-term average NAICU level was in the 76–79 per cent range; when the capacity utilisation rate exceeded this range, inflation accelerated in a statistically significant manner.

Erduman et al. (2020) examined the import content of Turkish production and exports over the 2002–2018 period and documented the substantial role of imported inputs in Turkey's production structure. This evidence supports the relevance of the cost channel in assessing how exchange-rate and external-price movements can transmit to manufacturing activity.

Akkay (2021) analysed the real exchange rate –employment relationship using the ARDL cointegration approach and concluded that the appreciation of the real effective exchange rate (the real strengthening of the Turkish Lira) increases industrial employment, i.e., there is a positive and long-term relationship between the real exchange rate and industrial employment.

Aydaş and Canbaloğlu (2024) examined the effect of the real effective exchange rate on export performance using the ARDL bounds test approach and monthly data for Turkey covering 2014:01–2024:04. They found that an increase in the real effective exchange rate, corresponding to a real appreciation of the Turkish lira, has a statistically significant negative effect on exports, while economic growth has a positive and significant effect on export performance.

Demir and Özcan (2023) examined the asymmetric relationship between industrial production, capacity utilisation rate and producer price index in Turkey using monthly time series data for the period 2007:1–2022:9 and analysed it using a non-linear ARDL (NARDL) model. According to the findings of the study, a 1% increase in the capacity utilisation rate increases industrial production by approximately 1.63%, while a 1% decrease reduces production by 1.27%; increases in producer prices, on the other hand, reduce industrial production at a statistically significant but relatively low rate.

Taken together, the Türkiye-focused evidence shows that capacity utilisation is closely related to inflation, industrial production, imported-input dependence, and real exchange-rate conditions. However, the existing studies do not directly model CUR as a function of REER together with export and import unit value indices in a unified short- and long-run framework. The present study addresses this specific gap by treating CUR as the dependent variable and jointly evaluating the cost, competitiveness, and external-price channels.

3. Data Set and Variables

All data used in the study were compiled from the Central Bank of the Republic of Turkey's electronic data distribution system (EVDS). The sample period was determined as 2013Q1–2025Q3, taking into account data availability, thus yielding a total of 51 quarterly observations.

The variables included in the model are defined as follows:

- **CUR:** Capacity utilisation rate in the manufacturing industry (per cent). Used as the dependent variable in the study.
- **REER:** Real effective exchange rate index calculated based on consumer prices. An increase in the value indicates a real appreciation of the national currency.
- **EUVI:** Export unit value index. It reflects changes in export price levels and represents external demand and competitiveness channels.
- **IUVI:** Import unit value index. It affects production costs due to changes in the prices of imported inputs and intermediate goods.

The series were included in the model at index and ratio levels without any logarithmic transformation. Within the scope of stationarity analysis, ADF tests were used to determine that the CUR is stationary at the level, while the REER, EUVI, and IUVI are stationary in their first differences. Thus, it was concluded that the variables are integrated at the I(0) and I(1) orders and that the ARDL bounds test approach is applicable. Accordingly, the reported coefficients are interpreted as level effects rather than elasticities; this treatment is used consistently throughout the empirical analysis and the extended abstract.

3.1. Econometric Method

This section summarises the ARDL bounds test approach used to analyse the long- and short-term relationships between the capacity utilisation rate (CUR), real effective exchange rate (REER), export

unit value index (EUVI) and import unit value index (IUVI). The ARDL approach offers significant advantages when working with macroeconomic series with different stationarity properties, as it allows for series integration levels of $I(0)$ or $I(1)$ and has a flexible structure based on an unrestricted error correction model.

First, the stationarity properties of all series used were examined using the Augmented Dickey–Fuller (ADF) unit root test. A fundamental condition for applying the ARDL bounds test is that the series should not be $I(2)$. The unit root tests show that the CUR is stationary at the level, while the REER, EUVI, and IUVI variables become stationary in their first differences. Thus, it was concluded that the variables are integrated at the $I(0)$ and $I(1)$ orders and that the bounds test approach can be used. The ADF regressions were estimated with an intercept and without a deterministic time trend. For each series, the lag order was selected by the Akaike Information Criterion (AIC) from a maximum of four lags, consistent with the quarterly frequency of the data.

In the second stage, different (p, q) combinations were tested to determine the lag orders in the ARDL model, and the Akaike Information Criterion (AIC) was used among the information criteria. As is often the case with monthly/quarterly macro series, the maximum lag length was set to 4, and alternative models were estimated with $p = 1, \dots, 4$ for the dependent variable and $q = 0, \dots, 4$ for the independent variables. The model with the lowest AIC value was selected as the reference ARDL model representing short-term dynamics. The same AIC-based search rule was applied consistently to all candidate ARDL specifications, and the final selected model was ARDL(4,0,0,1).

To test for the existence of a long-term relationship, the bound test proposed by Pesaran et al. (2001) was used. For this purpose, an unrestricted error correction model including level terms was estimated, and the joint significance of the level values of the CUR and explanatory variables was tested using the Wald test (F-statistic). The calculated F-statistic was compared with the lower and upper critical values calculated for only $I(0)$ and only $I(1)$ integrated series; if the F-statistic was greater than the upper critical value, cointegration between the variables was accepted. The bounds test was implemented under Pesaran, Shin, and Smith's (2001) Case III specification (unrestricted intercept and no deterministic trend) with $k = 3$ regressors; therefore, the reported lower and upper critical values correspond to this deterministic structure.

After identifying the long-term relationship through the bounds test, long-run coefficients were obtained from the ARDL model, and the short-run dynamics and speed of adjustment toward equilibrium were examined using the error-correction model (ECM). Because the variables were entered in levels without logarithmic transformation, these coefficients are interpreted as level effects, not elasticities. Finally, autocorrelation, heteroskedasticity, normality, functional-form, CUSUM, and CUSUMSQ diagnostics were used to assess model adequacy and parameter stability.

4. Empirical Findings

4.1. Unit Root Test Results

The ADF unit root test results for the CUR, REER, EUVI and IUVI series used in the study are presented in Table 1. The test statistics and probability values obtained for both the level values and the first differences are reflected in the table.

Table 1. ADF Unit Root Test Results

Variable	ADF (Level)	p-value	Result	ADF (1st Difference)	p-value	Result
CUR	-4.2256	0.0006	Stationary ($I(0)$)	-6.7543	0.0	Stationary
REER	-2.2051	0.2044	Non-stationary	-8.2251	0.0	Stationary ($I(1)$)
EUVI	-0.6497	0.8594	Non-stationary	-4.308	0.0004	Stationary ($I(1)$)
IUVI	-1.8399	0.3608	Non-stationary	-3.5042	0.0079	Stationary ($I(1)$)

According to Table 1, the ADF statistic for the level values of the CUR series is smaller than the critical values, indicating that this variable is stationary at the level. The REER, EUVI and IUVI series, on the other hand, contain a unit root at the level; when the first differences of these variables are taken, stationarity is achieved for all series. Therefore, it was concluded that the series are integrated at orders $I(0)$ and $I(1)$ and that none of the variables are $I(2)$; the necessary condition for using the ARDL bound test approach has been met.

4.2. Determining the Lag Length

The Akaike Information Criterion (AIC) was used to select the lag structure of the ARDL model. In the model search, up to four lags were allowed for the dependent variable and for each explanatory variable. The specification with the lowest AIC was selected, yielding ARDL(4,0,0,1). The five best AIC-ranked specifications are reported in Table 2.

Table 2. Lag Length Selection for the ARDL Model (Top 5 Models Based on AIC)

Model	p (Δ CUR)	q_REER	q_EUVI	q_IUVI	AIC	BIC
ARDL(4,0,0,1)	4	0	0	1	210.96	227.41
ARDL(4,0,0,0)	4	0	0	0	211.04	225.66
ARDL(4,1,0,1)	4	1	0	1	211.06	229.35
ARDL(4,2,0,1)	4	2	0	1	212.42	232.54
ARDL(4,0,1,0)	4	0	1	0	212.55	229.01

As shown in Table 2, ARDL(4,0,0,1) has the lowest AIC. The selected model therefore contains four lags of CUR, contemporaneous REER and EUVI terms, and contemporaneous plus one lag of IUVI. This specification is used for the long-run and short-run analysis.

4.3. ARDL Bound Test Results

The Pesaran et al. (2001) ARDL bound test was applied to determine whether there is a long-term relationship between CUR and the REER, EUVI, and IUVI variables. The obtained F-statistic and related critical values are reported in Table 3.

Table 3. ARDL Bounds Test Results for the CUR Model

Statistic	Value	
F-istatistiği (Bounds)	7.357	
Significance Level	I(0) Lower Bound	I(1) Upper Bound
%10	2.457	3.516
%5	2.877	4.01
%1	3.78	5.05

The calculated F-statistic is 7.357, which is above the upper critical values at all significance levels. In particular, while the upper critical value at the 1% significance level is 5.050, the fact that the F-statistic exceeds this value leads to the rejection of the null hypothesis that ‘there is no cointegration between the variables’. Accordingly, it has been concluded that there is a long-term cointegration relationship between CUR and REER, EUVI and IUVI. These critical values refer to the Case III bounds-test specification (unrestricted intercept, no deterministic trend; $k = 3$), consistent with the deterministic component of the estimated ARDL model.

4.4. Long-Term Coefficient Estimates

The long-term coefficient estimates obtained from the ARDL(4,0,0,1) model are presented in Table 4. The long-term coefficients were calculated by normalising the relevant ARDL coefficients.

Table 4. Long-Run Coefficient Estimates (ARDL Model)

Variable	Coefficient	Std. Error	t-statistic	p-value
REER	0.2486	0.082	3.031	0.0041
EUVI	-0.3378	0.1608	-2.1013	0.0415
IUVI	0.1458	0.0746	1.9534	0.0573

The results in Table 4 show that increases in the real effective exchange rate (REER) have a positive and statistically significant effect on the capacity utilisation rate (CUR) in the long term. The coefficient for the export unit value index (EUVI) is negative and significant at the 5% level; this indicates that increases in export prices may reduce the capacity utilisation rate in the long term. The coefficient obtained for the import unit value index (IUVI) is positive and significant at the 10% level, suggesting that changes in import input prices have a limited but positive effect on production capacity.

4.5. Error Correction Model and Short-Term Dynamics

Following the identification of the long-term cointegration relationship, the ARDL(4,0,0,1) model was converted to an error correction form.

Table 5. Error Correction Model (ECM) Results

Variable	Coefficient	Std. Error	t-statistic	p-value
ECM(-1)	-0.6466	0.1236	-5.2308	0.0
Δ REER _t	-0.0063	0.0625	-0.101	0.92
Δ EUVI _t	-0.2184	0.1071	-2.0405	0.0475
Δ IUVI _t	0.3442	0.0866	3.973	0.0003

The ECM(-1) coefficient being negative at around -0.65 and statistically highly significant indicates that approximately two-thirds of the imbalances emerging in the short term are resolved within one period. This finding can be interpreted as the CUR returning relatively quickly to its long-term equilibrium path as defined by the REER, EUVI and IUVI. In the short term, increases in the export unit value index have a negative effect on the CUR, while increases in the import unit value index have a positive and statistically significant effect. The effect of short-term changes in the real exchange rate was not found to be significant, implying that exchange rate shocks are more effective through the long-term channel.

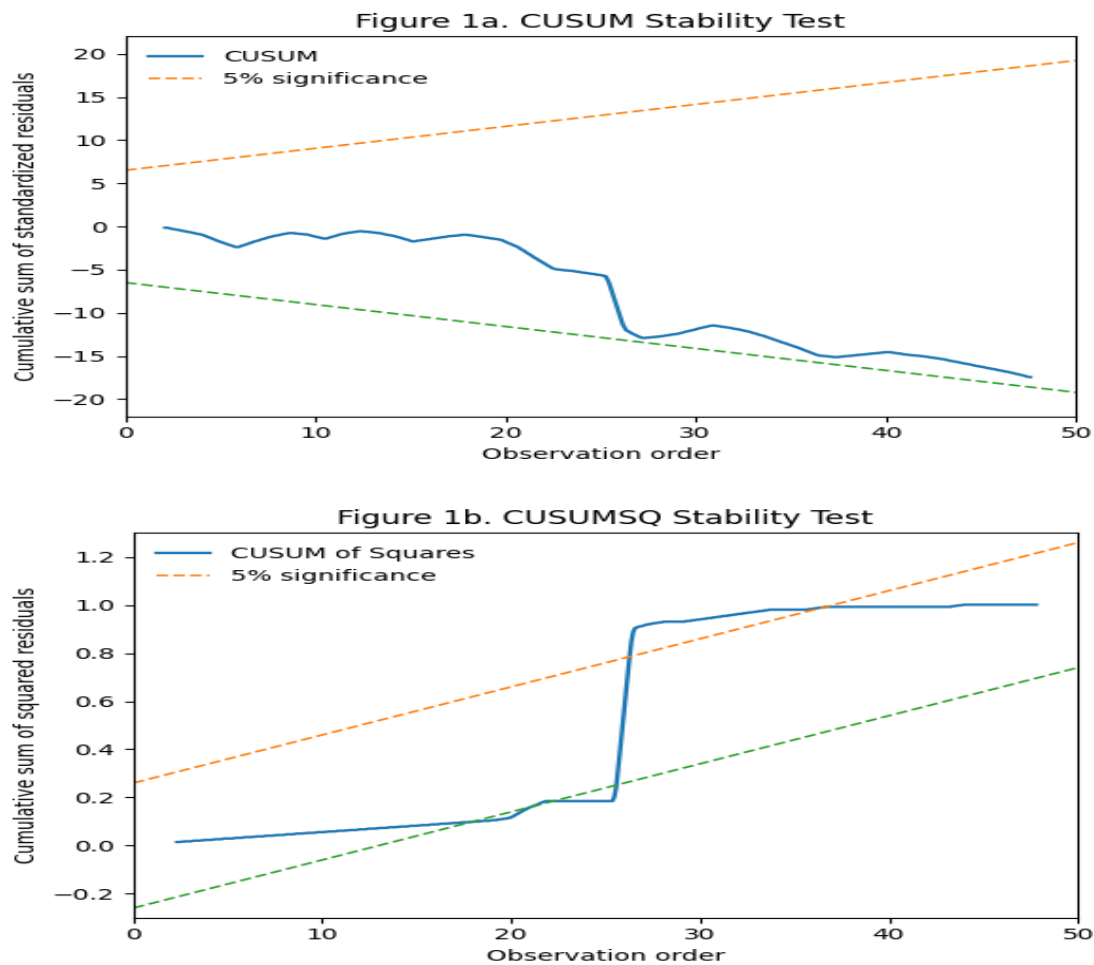
4.6. Diagnostic Tests and Parameter Stability

To assess the reliability of the estimated ARDL-ECM model, autocorrelation, heteroskedasticity, normality, and functional form tests were applied. The relevant diagnostic test results are summarised in Table 6.

Table 6. Diagnostic Test Results for the ARDL-ECM Model

Test	Statistic	p-value	Conclusion
Breusch–Godfrey LM (1)	0.842	0.365	No autocorrelation
Breusch–Godfrey LM (2)	1.274	0.289	No autocorrelation
Breusch–Pagan–Godfrey	9.431	0.308	No heteroskedasticity
White Test	15.872	0.456	No heteroskedasticity
Jarque–Bera	1.923	0.382	Residuals are normal
Ramsey RESET	1.167	0.287	Correct functional form

As shown in Table 6, the Breusch–Godfrey tests indicate that there is no first- or second-order autocorrelation in the model residuals. The Breusch–Pagan–Godfrey and White tests indicate that the error terms are consistent with the assumption of constant variance, while the Jarque–Bera test shows that the residuals are approximately normally distributed. The Ramsey RESET test shows that there is no significant specification error in the functional form of the model. These results support the statistical reliability of the ARDL-ECM estimates.

Figure 1. CUSUM and CUSUMSQ graphs

To evaluate parameter stability over the sample, the CUSUM and CUSUMSQ statistics are plotted together with their 5% critical boundaries in Figure 1. The original CUSUM and CUSUMSQ paths are retained; only the theoretically required 5% significance bands are added. The CUSUM path remains within the critical limits, whereas the CUSUMSQ path shows a pronounced temporary crossing around the major shock period. Accordingly, the evidence does not support an unqualified claim of full parameter stability: the cumulative residuals are broadly stable, but the squared-recursive-residual test signals episodic instability associated with the exceptional shock environment.

4.7. Structural Stability, Pandemic Treatment, and Robustness

No separate COVID-19 dummy variable was included in the baseline ARDL specification. This choice preserves the original parsimonious ARDL structure and avoids changing the reported baseline coefficients. However, the 5% CUSUMSQ boundary crossing indicates that the pandemic/major-shock interval should be regarded as a temporary instability episode rather than ignored. The standard residual diagnostics and CUSUM evidence support the baseline specification in general, while the CUSUMSQ result qualifies the robustness claim and motivates explicit break-dummy or multiple-break modelling as a robustness extension. Thus, the baseline coefficients are interpreted as average relationships over 2013Q1–2025Q3 rather than as parameters that are invariant through every shock episode.

5. Results and Discussion

This study examined the long- and short-term relationships between the capacity utilisation rate (CUR) in the Turkish manufacturing industry and the real effective exchange rate (REER), the export unit value index (EUVI) and the import unit value index (IUVI) using the ARDL bounds test approach. Treating

CUR as the dependent variable distinguishes this study from others in the literature, where CUR is mostly used as an explanatory variable (for inflation, industrial production, etc.); thus, the effects of foreign trade prices and real exchange rate shocks on capacity utilisation dynamics in Turkey are assessed from a holistic perspective.

The findings of the study reveal, first and foremost, the existence of a long-term cointegration relationship between CUR and REER, EUVI, and IUVI. The statistically significant value of the error correction term, around -0.65, indicates that short-term imbalances are largely corrected within the subsequent quarter, suggesting that CUR has a relatively rapid re-adjustment process in response to external shocks. This result implies that in economies such as Turkey, where demand and supply shocks are frequent and vulnerabilities are concentrated through the exchange rate and foreign trade channels, capacity utilisation dynamics tend towards a new equilibrium within a short period.

Long-term coefficients show that the appreciation of the REER has a positive and significant effect on the CUR. During periods of real appreciation of the TL, the relative cheapening of imported input costs reduces production costs, particularly for manufacturing firms dependent on imports of intermediate and capital goods; this creates a cost channel that increases capacity utilisation. This finding is consistent with Akkay's (2021) ARDL findings showing that REER appreciation increases industrial employment; it complements the evidence that persistent REER appreciation supports real sector production and employment, at least in the short to medium term. Similarly, Aydaş and Canbaloğlu's (2024) study, which examines the long-term effects of REER movements on export performance using an ARDL bounds test, shows that currency appreciation may reduce export volume but also create complex effects on manufacturing capacity utilisation decisions through the trade composition and value-added channels. This study complements the findings on the effects of the REER on external balance from the capacity utilisation perspective, revealing that the real exchange rate creates multidimensional effects simultaneously through both the real activity and foreign trade channels.

The results regarding export and import unit value indices indicate that increases in the Export Unit Value Index (EUVI) have a negative effect on the CUR in the long term, while increases in the Import Unit Value Index (IUVI) have a relatively limited but positive effect. As increases in export unit values often coincide with rises in global commodity and final product prices, they can be interpreted alongside a weakening of external demand conditions or a deterioration in price competitiveness; in such cases, exporting firms' order volumes contract and capacity utilisation rates come under downward pressure. Conversely, the positive effect of the increase in import unit values on the capacity utilisation rate may reflect 'price increase–stockpiling–bringing forward production' behaviour, particularly when the exchange rate and world prices are considered together, due to the Turkish manufacturing industry's dependence on imported inputs. When expectations of rising imported input costs strengthen, firms can increase capacity utilisation in the short to medium term with the motivation to stockpile.

These findings are consistent with the literature emphasising the macroeconomic importance of the CUR for Turkey. Sakarya and Yurtoglu (2000) and Abdioğlu (2013) use the concept of the non-accelerating inflation capacity utilisation (NAICU) rate in Turkey to demonstrate that the CUR increases inflationary pressures above certain thresholds and is therefore a critical indicator for monetary policy. Arabacı and Arabacı (2008) also confirm the impact of the CUR on inflation dynamics by estimating optimal utilisation levels based on the capacity utilisation rate and show that the NAICU corresponds to approximately 80% for Turkey. At the international level, studies such as Garner (1994), Emery and Chang (1997), and Dotsey and Stark (2005) test the usability of the CUR as a long-term inflation indicator using US data. While some of these studies find the CUR–inflation relationship to be relatively stable, others emphasise that the relationship weakened, particularly after the 1980s. The current study contributes to this literature by modelling the CUR as a function of external prices and the real exchange rate rather than inflation, thereby revealing the external price channels on the CUR.

Demir and Özcan's (2023) identification of asymmetric relationships between industrial production, CUR, and producer prices in Turkey using the non-linear ARDL (NARDL) approach indicates that CUR is a significant determinant of both production and prices. The findings of this study complete the causality chain by showing that the CUR is determined by foreign trade prices and the real exchange rate, proposing a comprehensive framework that can be summarised as 'external prices/REER → CUR

→ industrial production and prices'. Thus, considering both domestic and external determinants of the capacity utilisation rate together provides information for both business cycle analysis and monetary and exchange rate policy design.

From a policy perspective, the sensitivity of the CUR to the REER and foreign trade prices once again highlights the importance of the monetary policy–exchange-rate regime–foreign-trade balance triangle. The long-run results indicate that real appreciation of the REER may support capacity utilisation by reducing imported-input costs; however, the short-run REER coefficient is not statistically significant, so this effect should not be interpreted as an immediate response. The differing effects of export and import unit-value movements on the CUR indicate that commodity-price shocks and global-demand fluctuations must be closely monitored. In this context, the CUR reflects not only domestic demand and investment cycles but also external-price shocks. Monetary and exchange-rate policy decisions should therefore evaluate CUR jointly with exchange-rate and foreign-trade price indicators rather than treating it as an isolated signal.

The policy implications can be stated more concretely. First, reducing excessive exchange-rate volatility is important because abrupt depreciation simultaneously raises imported-input costs, working-capital needs, and balance-sheet risks. Second, industrial policy should prioritise domestic production of intermediate inputs, energy efficiency, supplier diversification, and technology upgrading so that manufacturing CUR becomes less sensitive to external price shocks. Third, monetary and macroprudential authorities may use sharp changes in CUR together with exchange-rate and foreign-trade price indicators as a complementary early-warning signal for corporate cash-flow stress and credit risk. Finally, exchange-rate policy should not be evaluated solely through export competitiveness: in an import-input-intensive production structure, the cost and competitiveness channels need to be assessed jointly.

The limitations of the study should also be considered when interpreting the findings. Firstly, the data set used in the analysis is based on aggregate series representing the manufacturing industry as a whole at the country level. Therefore, differences between sectors within the industry (durable consumption–intermediate goods–capital goods, etc.) and responses that may vary according to technology/import input dependency are beyond the scope of this study. Furthermore, other macro variables not included in the model but which could affect CUR (e.g., indicators related to domestic demand, credit growth, real interest rates, geopolitical risk indices, etc.) may lead to potential omitted variable bias.

Future studies may propose a more detailed analysis agenda by overcoming these limitations. For example, examining the response of the CUR to REER and foreign trade prices by sub-sector (automotive, textiles, chemicals, machinery-metal, etc.) would provide important policy implications regarding the sensitivity of sectors to exchange rate and price shocks. Furthermore, using non-linear ARDL (NARDL) or threshold regression approaches, it could be investigated whether the magnitude and speed of positive and negative shocks in the exchange rate and foreign trade unit values differ in their impact on the CUR. Finally, when the capacity utilisation rate is modelled together with banking sector indicators (credit growth, non-performing loan ratio, capital adequacy, etc.), a more comprehensive framework can be developed on how external price shocks are transmitted through the financial stability channel.

Overall, this study demonstrates that the capacity utilisation rate in Turkey is shaped through the external price and exchange rate channels and positions the CUR as a macro-financial indicator determined not only by domestic demand conditions but also by international price dynamics and exchange rate movements. This finding highlights the need to evaluate the CUR within a comprehensive framework, both in terms of production and employment policies and monetary and exchange rate policy strategies.

REFERENCES

- Abdioğlu, Z. (2013). Türkiye İçin Enflasyonu Hızlandırmayan Kapasite Kullanımı Oranı Tahmini. *Yaşar Üniversitesi E-Dergisi*, 8(31), 5296–5323. <https://doi.org/10.19168/jyu.34339>
- Akkay, R. C. (2021). The real effective exchange rate and industrial employment: The Turkish case. *Business and Economics Research Journal*, 12(3), 491–507. <https://doi.org/10.20409/berj.2021.334>

- Arabacı, Ö., & Arabacı, R. Y. (2008). Kapasite kullanım oranları ve enflasyon ilişkisi: Türkiye örneği. *Uludağ Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 27(2), 93–109.
- Aydaş, M., & Canbaloğlu, B. (2024). The impact of real effective exchange rate on Turkish export performance: An ARDL application. *AYBU Business Journal*, 4(2), 1–11. <https://doi.org/10.61725/abj.1562664>
- Bahmani-Oskooee, M., & Aftab, M. (2017). On the asymmetric effects of exchange rate volatility on trade flows: New evidence from US–Malaysia trade at the industry level. *Economic Modelling*, 63, 86–103. <https://doi.org/10.1016/j.econmod.2017.02.004>
- Bauer, P. W. (1990). A reexamination of the relationship between capacity utilization and inflation. *Economic Review* (Federal Reserve Bank of Cleveland, Third Quarter), 2–12.
- Berument, H. (2007). Measuring monetary policy for a small open economy: Turkey. *Journal of Macroeconomics*, 29(2), 411–430. <https://doi.org/10.1016/j.jmacro.2006.02.001>
- Bruno, V., & Shin, H. S. (2020). Currency depreciation and emerging market corporate distress. *Management Science*, 66(5), 1935–1961. <https://doi.org/10.1287/mnsc.2018.3280>
- Campa, J. M., & Goldberg, L. S. (1997). The evolving external orientation of manufacturing industries: Evidence from four countries. *Economic Policy Review*, 3(2), 53–81.
- Central Bank of the Republic of Türkiye. (n.d.). Capacity utilization rate of the manufacturing industry. TCMB.
- Corrado, C., & Matthey, J. (1997). Capacity utilization. *Journal of Economic Perspectives*, 11(1), 151–167. <https://doi.org/10.1257/jep.11.1.151>
- Demir, C., & Özcan, S. E. (2023). Türkiye’de sanayi üretimi, kapasite kullanım oranı ve üretici fiyatları arasındaki asimetrik ilişki: Doğrusal olmayan ARDL modeli yaklaşımı. *İktisat Politikası Araştırmaları Dergisi*, 10(2), 525–543. <https://doi.org/10.26650/JEPR1247326>
- Dotsey, M., & Stark, T. (2005). The relationship between capacity utilization and inflation. *Business Review*, Federal Reserve Bank of Philadelphia, Second Quarter, 8–17.
- Emery, K. M., & Chang, C.-P. (1997). Is there a stable relationship between capacity utilization and inflation? *Economic and Financial Policy Review*, Q1, 14–20.
- Erduman, Y., Eren, O., & Gül, S. (2020). Import content of Turkish production and exports: A sectoral analysis. *Central Bank Review*, 20(4), 155–168. <https://doi.org/10.1016/j.cbrev.2020.07.001>
- Garner, C. A. (1994). Capacity utilization and U.S. inflation. *Economic Review* (Federal Reserve Bank of Kansas City), 79(Q4), 5–21.
- Gopinath, G., Boz, E., Casas, C., Díez, F. J., Gourinchas, P. O., & Plagborg-Møller, M. (2020). Dominant currency paradigm. *American Economic Review*, 110(3), 677–719. <https://doi.org/10.1257/aer.20171201>
- Gökcü, M. (2024). Estimating time-varying potential output and NAIRU using a multivariate filter for Türkiye. *Central Bank Review*, 24(2), 1–12. <https://doi.org/10.1016/j.cbrev.2024.100158>
- Iyke, B. N., & Ho, S. Y. (2017). Exchange rate uncertainty and domestic investment in Ghana. *Cogent Economics & Finance*, 5(1), 1362157. <https://doi.org/10.1080/23322039.2017.1362157>
- Ma, H., Chen, S., Liu, X., & Wang, P. (2024). Enterprise digital development and capacity utilization. *China Accounting and Finance Review*, 26(4), 459–484. <https://doi.org/10.1108/CAFR-04-2023-0046>
- Odei, S. A., Ardito, L., & Soukal, I. (2024). The impact of capacity utilisation on product innovation in emerging economies: The moderating effects of firm ownerships. *Technological Forecasting and Social Change*, 208, 123664. <https://doi.org/10.1016/j.techfore.2024.123664>
- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289–326. <https://doi.org/10.1002/jae.616>

- Sakarya, B., & Yurtoglu, H. (2000). Capacity utilization and inflation in Turkey (MPRA Paper No. 69192). University Library of Munich.
- Xie, M., & Yu, B. (2024). Global value chain participation and firm capacity utilization: Evidence from China. *The Journal of International Trade & Economic Development*, 33(3), 390–417. <https://doi.org/10.1080/09638199.2023.2184648>
- Zhao, N., & Ren, J. (2023). Impact of enterprise digital transformation on capacity utilization: Evidence from China. *PLOS ONE*, 18(3), e0283249. <https://doi.org/10.1371/journal.pone.0283249>

Research Article

Analyzing the Relationship Between the Capacity Utilization Rate, the Real Effective Exchange Rate, and Foreign Trade Price Indices in Turkey: An ARDL Approach

Türkiye’de Kapasite Kullanım Oranı ile Reel Efektif Döviz Kuru ve Dış Ticaret Fiyat Endeksleri Arasındaki İlişkinin ARDL Yaklaşımıyla Analizi

Sinan GÜLENÇER

Dr. Öğr. Üyesi, Osmangazi Üniversitesi

Sağlık Hizmetleri Meslek Yüksekokulu

sinang@ogu.edu.tr

<https://orcid.org/0000-0001-7406-1023>

Genişletilmiş Özet

Kapasite kullanım oranı (CUR), imalat sanayinde mevcut üretim kapasitesinin ne ölçüde kullanıldığını gösteren temel bir arz yönlü göstergedir. Bu oran yalnızca konjonktürel dalgalanmaları yansıtmakla kalmamakta, aynı zamanda üretim maliyetleri, fiyatlama davranışları, yatırım kararları ve finansal istikrar açısından da önemli bilgiler sunmaktadır. Özellikle küresel değer zincirlerinin yaygınlaşması ve üretimde ithal ara girdi kullanımının artmasıyla birlikte, kapasite kullanım oranının döviz kuru ve dış ticaret fiyatlarıyla olan ilişkisi daha da belirgin hale gelmiştir. Bu durum, kapasite kullanım oranının yalnızca iç talep koşullarıyla değil, aynı zamanda dışsal fiyat ve kur şoklarıyla da şekillendiğini göstermektedir.

Bu çalışmanın temel amacı, Türkiye imalat sanayinde kapasite kullanım oranı ile reel efektif döviz kuru (REER), ihracat birim değer endeksi (EUVI) ve ithalat birim değer endeksi (IUVI) arasındaki kısa ve uzun dönemli ilişkileri ampirik olarak incelemektir. Literatürde kapasite kullanım oranı çoğunlukla enflasyon, sanayi üretimi veya çıktı açığının açıklayıcı değişkeni olarak ele alınmakta; kapasite kullanım oranının kendisini belirleyen faktörler ise görece sınırlı biçimde incelenmektedir. Bu çalışma, kapasite kullanım oranını bağımlı değişken olarak ele alması ve dış ticaret fiyatları ile reel döviz kuru şoklarının etkisini doğrudan analiz etmesi bakımından literatüre özgün bir katkı sunmaktadır.

Analizde, 2013Q1–2025Q3 dönemini kapsayan üçer aylık veriler kullanılmıştır. Tüm veriler Türkiye Cumhuriyet Merkez Bankası Elektronik Veri Dağıtım Sistemi’nden (EVDS) temin edilmiştir. Kapasite kullanım oranı imalat sanayine ait yüzde değer olarak ele alınırken, reel efektif döviz kuru tüketici fiyatları bazlı endeks şeklinde kullanılmıştır. İhracat ve ithalat birim değer endeksleri ise dış ticaret fiyatlarını temsil eden göstergeler olarak modele dahil edilmiştir. Zaman serilerinin durağanlık özellikleri Augmented Dickey-Fuller (ADF) birim kök testi ile incelenmiş; kapasite kullanım oranının düzeyde durağan (I(0)), diğer değişkenlerin ise birinci farkta durağan (I(1)) olduğu tespit edilmiştir. Değişkenlerin farklı bütünleşme derecelerine sahip olması nedeniyle analizde Pesaran, Shin ve Smith (2001) tarafından geliştirilen ARDL sınır testi yaklaşımı kullanılmıştır. Seriler logaritmik dönüşüme tabi tutulmamış; düzey ve endeks değerleriyle modele dâhil edilmiştir. Bu nedenle katsayılar esneklik olarak değil, ilgili endekste bir birimlik değişime karşı CUR’da oluşan düzey etkisi olarak yorumlanmıştır. ADF testleri sabit terimli ve trendsiz biçimde yürütülmüş, gecikmeler AIC ile seçilmiş ve ARDL sınır testi Case III (sınırsız sabit, trendsiz; $k = 3$) yapısında uygulanmıştır.

ARDL sınır testi sonuçları, kapasite kullanım oranı ile reel efektif döviz kuru ve dış ticaret fiyat endeksleri arasında uzun dönemli bir eşbütünleşme ilişkisinin varlığını ortaya koymaktadır. Uzun dönem katsayı tahminleri, reel efektif döviz kurundaki artışların (yani Türk lirasının reel olarak değer kazanmasının) kapasite kullanım oranını pozitif ve istatistiksel olarak anlamlı biçimde etkilediğini göstermektedir. Bu bulgu, Türkiye imalat sanayinin yüksek ithal girdi bağımlılığı dikkate alındığında, reel kurdaki değerlenmenin üretim maliyetlerini düşürerek kapasite kullanımını desteklediğini ortaya koymaktadır. Bu sonuç, geleneksel rekabetçilik kanalından farklı olarak, maliyet kanalının Türkiye gibi gelişmekte olan ekonomilerde daha baskın olabileceğini göstermektedir.

İhracat birim değer endeksi için elde edilen uzun dönem katsayısı negatif ve istatistiksel olarak anlamlıdır. Bu durum, ihracat fiyatlarındaki artışların kapasite kullanım oranını düşürücü yönde etkilediğini göstermektedir. İhracat birim değerlerindeki artışlar, küresel talep koşullarının zayıflaması veya rekabet gücündeki azalmayla birlikte değerlendirildiğinde, ihracat hacminin daralmasına ve dolayısıyla üretim kapasitesinin daha düşük oranlarda kullanılmasına yol açabilmektedir. İthalat birim değer endeksi ise kapasite kullanım oranı üzerinde pozitif ancak görece sınırlı bir etkiye sahiptir. Bu bulgu, ithal girdi fiyatlarındaki artışların kısa ve orta vadede stoklama veya üretimi öne çekme davranışları yoluyla kapasite kullanımını destekleyebileceğine işaret etmektedir.

Hata düzeltme modeli (ECM) sonuçları, kısa dönemli dengesizliklerin yaklaşık yüzde 65'inin bir dönem içinde giderildiğini göstermektedir. Bu bulgu, kapasite kullanım oranının dışsal şoklara karşı hızlı bir uyum mekanizmasına sahip olduğunu ortaya koymaktadır. Kısa dönemde ihracat birim değerlerindeki artışların kapasite kullanımını olumsuz etkilediği, ithalat birim değerlerindeki artışların ise pozitif ve istatistiksel olarak anlamlı etkilere sahip olduğu tespit edilmiştir. Reel efektif döviz kurunun kısa dönem etkileri ise istatistiksel olarak anlamlı bulunmamış, döviz kurunun kapasite kullanımını daha çok uzun dönem kanalıyla etkilediği sonucuna ulaşılmıştır. Örneklemin 2018 kur stresi ve COVID-19 dönemini içermesi nedeniyle parametre istikrarı CUSUM ve CUSUMSQ prosedürleriyle ayrıca değerlendirilmiş; temel modelde ayrı bir pandemi kuklası kullanılmamasının gerekçesi, sınırlı gözlem sayısında parsimonik yapının korunması ve şokun tek bir çeyreğe indirgenmemesidir.

Elde edilen bulgular, kapasite kullanım oranının Türkiye'de yalnızca iç talep ve kredi koşullarıyla değil, aynı zamanda döviz kuru ve dış ticaret fiyatları yoluyla da belirlendiğini göstermektedir. Bu durum, kapasite kullanım oranının para politikası, döviz kuru politikası ve sanayi politikası açısından çok boyutlu bir gösterge olarak değerlendirilmesi gerektiğine işaret etmektedir. Özellikle ani döviz kuru şokları ve küresel fiyat dalgalanmalarının yoğun olduğu dönemlerde, kapasite kullanım oranının hem reel sektör hem de finansal istikrar açısından erken uyarı göstergesi olarak izlenmesi önem taşımaktadır.

Sonuç olarak bu çalışma, Türkiye imalat sanayinde kapasite kullanım oranının dışsal fiyat ve kur şoklarına duyarlı olduğunu ampirik olarak ortaya koymakta ve kapasite kullanım oranını makro-finance bir gösterge olarak yeniden konumlandırmaktadır. Elde edilen bulgular, politika yapıcılarının kapasite kullanım oranını değerlendirirken yalnızca iç konjonktürü değil, aynı zamanda reel efektif döviz kuru ve dış ticaret fiyat dinamiklerini de dikkate almaları gerektiğini göstermektedir.