

**REPUBLIC OF TURKEY  
YILDIZ TECHNICAL UNIVERSITY  
GRADUATE SCHOOL OF SOCIAL SCIENCES  
DEPARTMENT OF ECONOMICS  
MASTER’S PROGRAMME IN ECONOMICS**

**MASTER’S THESIS**

**THREE ESSAYS ON THE RELATIONSHIP BETWEEN INTEREST  
RATES AND THEIR EFFECTS ON CREDIT VOLUMES IN SELECTED  
SECTORS IN TÜRKİYE**

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**THESIS SUPERVISOR  
ASSOC. PROF. ASUMAN OKTAYER BUZLUCA**

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Yunus Devran ÖZKAN tarafından hazırlanan “THREE ESSAYS ON THE RELATIONSHIP BETWEEN INTEREST RATE TYPES AND THEIR EFFECTS ON CREDIT VOLUMES IN SELECTED SECTORS IN TÜRKİYE” başlıklı çalışma, **07.07.2023** tarihinde yapılan savunma sınavı sonucunda oybirliği ile başarılı bulunmuş ve jürimiz tarafından İktisat Ana Bilim Dalı İngilizce İktisat Programında **YÜKSEK LİSANS** tezi olarak kabul edilmiştir.

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## **ABSTRACT**

### **THREE ESSAYS ON THE RELATIONSHIP BETWEEN INTEREST RATE TYPES AND THEIR EFFECTS ON CREDIT VOLUMES IN SELECTED SECTORS IN TÜRKİYE**

This thesis presents a trilogy of research papers that investigate the relationship between interest rates and credit dynamics in Türkiye. Interest rates play a critical role in shaping the dynamics of credit markets, impacting borrowing costs, lending practices, and access to credit across different sectors of the economy. Understanding the complex interplay between interest rates and credit dynamics is essential for policymakers, investors, and practitioners seeking to promote sustainable economic growth and development in Türkiye.

The first paper in this trilogy is Chapter 4, "The Effects of Policy Rates on Commercial Credit Rates in Türkiye". The relationship between policy interest rates and credit interest rates is a critical topic in monetary economics. This study investigates the relationship between policy interest rates and commercial credit rates in Türkiye, focusing on the impact of the policy rates set by the Central Bank of the Republic of Türkiye on commercial credit rates offered by the banks. Using quarterly data from 2011 Q1 to 2022 Q4, an ARDL bounds model is employed, with a dummy variable between 2019 Q1 and 2021 Q1 to observe any exogenous shocks or policy changes. In the long run, the findings reveal that changes in policy interest rates significantly affect commercial credit interest rates. In the short run, the policy rate was found to have a positive effect on commercial credit rates but, the previous periods have lower but negative effects on commercial credit rates, suggesting that the impact of policy rate changes diminishes over time as market expectations about future interest rates solidify. Overall, the study establishes a statistically significant association between changes in policy interest rates and commercial credit interest rates in both the short and long run, while considering other factors. These findings hold relevance for policymakers aiming to manage interest rates to promote economic growth and stability in Türkiye.

Chapter 5, "The Determinants of Credit Volume of SMEs in Türkiye" explores the relationship between real interest rates, demand side factors, and the amount of credit extended to small and medium-sized enterprises (SMEs) in Türkiye. Small and medium-sized enterprises (SMEs) play a crucial role in the economic development of many countries around the world, including Türkiye. The study analyzed the relationship between the real total credit amount granted to SMEs and the real interest rate and other demand-side factors in Türkiye. We used the autoregressive distributed lag (ARDL) bounds testing approach and analyzed quarterly data from 2011 Q1 to 2022 Q4 providing insights into how changes in real interest rates and other determinants impact the availability of credit for SMEs in Türkiye. In the long term, the study finds that the real commercial credit interest rate and the credit spread of SMEs relative to overall bank credits affect the total real

credit amount available to SMEs. Additionally, the turnover index of all producers and the net number of SMEs also influences credit supply in the long term. The short-run dynamics of the model demonstrate that the variables have significant impacts on the real commercial credit supply for SMEs, but the real turnover index does not have a significant short-term effect. In conclusion, this study underscores the importance of comprehending the factors affecting borrowing statutes for SMEs in Türkiye. The findings offer valuable insights for policymakers, lending institutions, and SMEs, empowering them to make informed decisions.

Finally, Chapter 6 is "The Determinants of Credit Volume of The Construction Sector in Türkiye". The construction sector is a crucial contributor to economic growth and job creation, but its access to credit is often hindered, particularly during periods of economic uncertainty. This study examines the relationship between the real credit supply of the construction sector and various determinants, including real commercial credit interest rates, credit spread of the construction sector relative to overall bank credits, real turnover of the construction sector, number of construction permits for dwellings, and the total house sold. Using the ARDL bounds test, the study analyzes data from the first quarter of 2011 to the last quarter of 2022 to investigate the long-run relationship between these variables. The findings reveal a positive and statistically significant long-run association between real commercial credit interest rates and the construction sector's credit volume. The real turnover of the construction sector demonstrates a positive and statistically significant long-run relationship with the construction sector's credit volume. Conversely, credit spread and construction permits show no effect in the long run. Examining short-run coefficients, the study reveals statistically significant results. Summing up, these results underscore the significant challenge faced by the construction industry in accessing credit, particularly during times of economic uncertainty. Policymakers and financial institutions must collaborate to address these challenges, given the sector's crucial role in driving economic growth and job creation.

Overall, this trilogy of research papers provides important insights into the dynamics of the Turkish economy and the interplay between interest rates and credit dynamics in different sectors of the economy. The studies highlight the importance of considering both short-term and longer-term effects of changes in policy interest rates and the macroeconomic environment in shaping credit access in Türkiye. The findings have significant implications for policymakers seeking to promote financial stability and economic growth in the country. Further research could build on these findings by examining the relationship between interest rates and other economic variables, such as inflation and exchange rates, to gain a more complete understanding of the factors driving the Turkish economy.

**Keywords:** Policy Rate, Real Commerical Credit Interest Rate, Real Credit Supply, SMEs, Construction Sector, ARDL Bounds Test, Time Series Analysis, Türkiye.

## ÖZET

### TÜRKİYE'DE FAİZ TÜRLERİ ARASINDAKİ İLİŞKİ VE BUNLARIN SEÇİLİ SEKTÖRLERE VERİLEN KREDİ HACİMLERİNE ETKİLERİ ÜZERİNE ÜÇ DENEME

Bu tez, Türkiye'de faiz oranları ile kredi dinamikleri arasındaki ilişkiyi araştıran bir araştırma makalesi üçlemesi sunmaktadır. Faiz oranları, kredi piyasalarının dinamiklerini şekillendirmede, borçlanma maliyetlerini, borç verme uygulamalarını ve ekonominin farklı sektörlerinde krediye erişimi etkilemede kritik bir rol oynamaktadır. Faiz oranları ile kredi dinamikleri arasındaki karmaşık etkileşimi anlamak, Türkiye'de sürdürülebilir ekonomik büyüme ve kalkınmayı teşvik etmek isteyen politika yapıcılar, yatırımcılar ve uygulayıcılar için çok önemlidir.

Bu üçlemenin ilk makalesi, Bölüm 4, "Türkiye'de Politika Faizlerinin Ticari Kredi Oranları Üzerindeki Etkileri" dir. Politika faiz oranları ile kredi faiz oranları arasındaki ilişki, para ekonomisinde kritik bir konudur. Bu çalışma, Türkiye'de politika faizleri ile ticari kredi oranları arasındaki ilişkiyi inceleyerek, Türkiye Cumhuriyet Merkez Bankası tarafından belirlenen politika faizlerinin bankalar tarafından sunulan ticari kredi oranlarına etkisine odaklanmaktadır. 2011 Q1'den 2022 Q4'e kadar üç aylık veriler kullanılarak, herhangi bir dışsal şoku veya politika değişikliğini gözlemlemek için 2019 Q1 ile 2021 Q1 arasında kukla bir değişken oluşturulmuş ve bir ARDL sınır modeli kullanılmıştır. Uzun vadede, bulgular politika faiz oranlarındaki değişikliklerin ticari kredi faiz oranlarını önemli ölçüde etkilediğini ortaya koymaktadır. Kısa vadede, politika faizinin ticari kredi faizleri üzerinde olumlu bir etkiye sahip olduğu tespit edilmiş, ancak önceki dönemlerin ticari kredi oranları üzerinde daha düşük ancak olumsuz etkileri olduğu tespit edilmiş, bu da gelecekteki faiz oranlarına ilişkin piyasa beklentilerinin sağlamlaşmasıyla politika faizi değişikliklerinin etkisinin zaman içinde azaldığını düşündürmektedir. Genel olarak, çalışma, diğer faktörleri göz önünde bulundurarak hem kısa hem de uzun vadede politika faiz oranlarındaki değişiklikler ile ticari kredi faiz oranları arasında istatistiksel olarak anlamlı bir ilişki kurmaktadır. Bu bulgular, Türkiye'de ekonomik büyümeyi ve istikrarı teşvik etmek için faiz oranlarını yönetmeyi amaçlayan politika yapıcılar için önemlidir.

"Türkiye'de KOBİ'lerin Kredi Kullanımının Belirleyicileri" başlıklı 5. Bölüm, reel faiz oranları, talep yan faktörleri ve Türkiye'deki küçük ve orta ölçekli işletmelere (KOBİ'ler) verilen kredi miktarı arasındaki ilişkiyi araştırmaktadır. Küçük ve orta ölçekli işletmeler (KOBİ'ler), Türkiye de dahil olmak üzere dünyadaki birçok ülkenin ekonomik kalkınmasında çok önemli bir rol oynamaktadır. Çalışmada, Türkiye'de KOBİ'lere kullandırılan reel toplam kredi tutarı ile reel faiz oranı ve diğer talep yönlü faktörler arasındaki ilişki analiz edilmiştir. Otoregresif dağıtılmış gecikme (ARDL) sınır testi yaklaşımı kullanılmıştır ve 2011 Q1'den 2022 Q4'e kadar üç aylık verileri analiz edilmiştir. Reel faiz oranlarındaki ve diğer

belirleyicilerdeki deęişikliklerin Türkiye'deki KOBİ'ler için kredi kullanılabilirliğini nasıl etkilediğine dair anlamlı sonuçlara ulaşılmıştır. Çalışma, uzun vadede, reel ticari kredi faiz oranının ve KOBİ'lerin toplam banka kredilerine göre kredi yayılımının KOBİ'lere sunulan toplam reel kredi tutarını etkilediğini ortaya koymaktadır. Ayrıca, tüm üreticilerin ciro endeksi ve net KOBİ sayısı da uzun vadede kredi arzını etkilemektedir. Modelin kısa vadeli dinamikleri, deęişkenlerin KOBİ'ler için reel ticari kredi arzı üzerinde önemli etkileri olduğunu, ancak reel ciro endeksinin kısa vadede önemli bir etkisi olmadığını göstermektedir. Sonuç olarak, bu çalışma Türkiye'deki KOBİ'ler için borçlanma yasalarını etkileyen faktörlerin anlaşılmasının önemini vurgulamaktadır. Bulgular, politika yapıcılar, borç veren kurumlar ve KOBİ'ler için deęerli bilgiler sunarak bilinçli kararlar almalarını sağlıyor.

Son olarak, 6. Bölüm "Türkiye'de İnşaat Sektörünün Kredi Arzının Belirleyicileri" dir. İnşaat sektörü, ekonomik büyümeye ve istihdam yaratmaya çok önemli bir katkıda bulunmaktadır, ancak özellikle ekonomik belirsizlik dönemlerinde krediye erişimi sıklıkla engellenmektedir. Bu çalışmada, inşaat sektörünün reel kredi arzı ile reel ticari kredi faiz oranları, inşaat sektörünün genel banka kredilerine göre kredi yayılımı, inşaat sektörünün reel cirosu, konutlar için inşaat ruhsatı sayısı ve satılan toplam konut gibi çeşitli belirleyiciler arasındaki ilişki incelenmiştir. Çalışma, ARDL sınırlar testini kullanarak, bu deęişkenler arasındaki uzun vadeli ilişkiyi araştırmak için 2011'in ilk çeyreğinden 2022'nin son çeyreğine kadar olan verileri analiz etmektedir. Bulgular, reel ticari kredi faiz oranları ile inşaat sektörünün kredi hacmi arasında pozitif ve istatistiksel olarak anlamlı uzun vadeli bir ilişki olduğunu ortaya koymaktadır. İnşaat sektörünün reel cirosu, inşaat sektörünün kredi hacmi ile pozitif ve istatistiksel olarak anlamlı uzun vadeli bir ilişki olduğunu göstermektedir. Ayrıca, kredi yayılımının ve inşaat ruhsatının uzun vadede bir etkisine rastlanmamıştır. Kısa dönem katsayıları incelenen çalışma, istatistiksel olarak anlamlı sonuçlar ortaya koymaktadır. Özetle, bu sonuçlar, özellikle ekonomik belirsizlik dönemlerinde, inşaat sektörünün krediye erişimde karşılaştığı önemli zorluğun altını çizmektedir. Politika yapıcılar ve finansal kurumlar, sektörün ekonomik büyümeyi ve iş yaratmayı yönlendirmedeki kritik rolü göz önüne alındığında, bu zorlukların üstesinden gelmek için iş birliği yapmalıdır.

Genel olarak, bu araştırma makaleleri üçlemesi, Türk ekonomisinin dinamikleri ve ekonominin farklı sektörlerindeki faiz oranları ile kredi dinamikleri arasındaki etkileşim hakkında önemli bilgiler vermektedir. Çalışmalar, Türkiye'de kredi erişiminin şekillenmesinde politika faiz oranlarındaki deęişikliklerin ve makroekonomik ortamın hem kısa hem de uzun vadeli etkilerinin dikkate alınmasının önemini vurgulamaktadır. Bulgular, ülkedeki finansal istikrarı ve ekonomik büyümeyi teşvik etmek isteyen politika yapıcılar için önemli çıkarımlara sahip. Türkiye ekonomisini yönlendiren faktörlerin daha eksiksiz bir şekilde anlaşılması için faiz oranları ile enflasyon ve döviz kurları gibi dięer ekonomik deęişkenler arasındaki ilişkiyi inceleyerek bu bulgular üzerine daha fazla araştırma yapılabilir.

**Anahtar Kelimeler:** Politika Faizi, Reel Ticari Kredi Faiz Oranı, Reel Kredi Arzı, KOBİ'ler, İnşaat Sektörü, ARDL Sınır Testi, Zaman Serileri Analizi, Türkiye.

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## ÖN SÖZ

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## ABBREVIATIONS

|        |                                                 |
|--------|-------------------------------------------------|
| ARDL   | : Auto Regressive Distributed Lag               |
| BDDK   | : Banking Regulation and Supervision Agency     |
| CBRT   | : Central Bank of The Republic of Türkiye       |
| CCIR   | : Commercial Credit Interest Rate               |
| CCR    | : Construction Sector Credit Spread             |
| CPND   | : Construction Permit Number of Dwellings       |
| CRSME  | : SMEs Sector Credit Spread                     |
| ECT    | : Error Correction Term                         |
| EVDS   | : Electronic Data Delivery System               |
| NNSME  | : Net Number of SMEs                            |
| OECD   | : Organization for Co-Operation and Development |
| PIR    | : Policy Interest Rate                          |
| RCCIR  | : Real Commercial Credit Interest Rate          |
| RCTI   | : Real Turnover Index of Construction Sector    |
| RECM   | : Restricted Error Correction Model             |
| RTCC   | : Real Total Credits of Construction Sector     |
| RTCSME | : Real Total Credits of SMEs Sector             |
| RTISME | : Real Turnover Index of SMEs                   |
| SMEs   | : Small and Medium-Sized Enterprises            |
| THS    | : Total House Sales                             |
| TUIK   | : Turkish Statistical Institute                 |
| UECM   | : Unrestricted Error Correction Model           |
| YTU    | : Yıldız Technical University                   |
| BIS    | : Bank for International Settlements            |

## 1. INTRODUCTION

This thesis presents a trilogy of research papers that investigate the relationship between interest rates and credit dynamics in Türkiye. Interest rates play a critical role in shaping the dynamics of credit markets, impacting borrowing costs, lending practices, and access to credit across different sectors of the economy. Understanding the complex interplay between interest rates and credit dynamics is essential for policymakers, investors, and practitioners seeking to promote sustainable economic growth and development in Türkiye.

Chapter 4, "The Effects of Policy Rates on Commercial Credit Rates in Türkiye," investigates the dynamics of policy interest rates and commercial credit interest rates in Türkiye, highlighting how changes in policy interest rates impact commercial lending interest rates. With this study, we aimed to better understand the interest rate transmission mechanism in Türkiye as a recent study. There exist many studies that examined the interest rate channel but, in this study, we used a relatively less examined parameter which is nominal credit interest rates offered by the local banks. The results of this study will enlighten the following two research. Because, in the second and the third research we will deal with the real commercial credit interest rates. In this context, the existence of a relationship between nominal credit and nominal policy rates will be very crucial to understand the indirect effects of policy interest rates on the real economy throughout the credit rate channel of the monetary policy transmission mechanism. This paper provides valuable insights into the mechanisms through which monetary policy impacts the credit market in Türkiye, offering important implications for policymakers seeking to promote financial stability and economic growth.

Chapter 5, "The Determinants of Credit Volume of SMEs in Türkiye" explores the relationship between real interest rates, demand side factors, and the amount of credit extended to small and medium-sized enterprises (SMEs) in Türkiye. SMEs are a critical component of the Turkish economy, accounting for a significant share of economic activity and employment. Access to credit is essential for SMEs to grow

and expand, yet the high cost of borrowing can be a significant barrier to credit access. Of course, several factors affect the credit availability of SMEs such as creditability but in this study, we will use the credit supply of SMEs as the dependent variable and real commercial credit interest rate as the main independent variable. We aimed to understand in what way the real interest rate affects credit use in the economy and what determines this way. We expect the real interest rates should become very profitable for SMEs because of the inflationist macroeconomic structure in Türkiye but this could not be deterministic because of the attitudes of lenders (banks) that are the only intermediates of credit access for the SMEs. This paper provides a comprehensive analysis of the factors shaping SMEs' credit access in Türkiye, highlighting the importance of real interest rates and other factorial variables in driving credit dynamics in this critical sector.

Finally, chapter 6, "The Determinants of Credit Volume of The Construction Sector in Türkiye " examines the relationship between real interest rates, demand side factors, and the amount of credit provided to the construction sector in Türkiye. The construction sector is a vital component of the Turkish economy, contributing to employment, economic growth, and development. However, the high cost of credit can be a significant barrier to investment in the construction sector, limiting growth and development. As a main independent variable, we aimed to understand whether the decreasing trend of the real commercial credit interest rate affects the sector's credit supply inversely or not in Türkiye concerning the general literature. This paper provides a detailed analysis of the factors driving credit access in the construction sector in Türkiye, highlighting the importance of interest rates and other sectoral variables in shaping lending practices in this critical sector.

Taken together, these three papers offer a comprehensive analysis of the relationship between interest rates and credit dynamics in Türkiye, providing valuable insights that have important implications for policymakers, investors, and practitioners alike. The insights provided by these papers can inform policy decisions aimed at promoting sustainable economic growth and development in Türkiye, while also highlighting key areas for further research and intervention.

## **2. THEORETICAL BACKGROUND: TRANSMISSION MECHANISM OF MONETARY POLICY**

In this chapter, we will discuss the monetary transmission mechanism to understand the theoretical perspective of our empirical studies in the next chapters. The monetary transmission mechanism is a broadly investigated field that reveals how policymakers' decisions influence real economic conditions in terms of monetary policies. It is assumed a complex concept because there exist several channels that monetary policy affects throughout such as the exchange rate, the interest rate, the asset prices, the credit, and the expectations are some of the traditional channels (Kuttner, 2001; F. S. Mishkin, 1995). In this thesis, we will deal with the interest rate and the credit channels to comprehend our empirical analyses.

The most known approaches to monetary transmission are Keynesian and Monetarist views. According to the Keynesian liquidity preference theory, interest rates are sensitive to changes in money supply except in a liquidity trap. A decrease in interest rates will affect investments and lead to an increase in income levels. In the case of a liquidity trap, an increase in money supply will not lead to a decrease in interest rates due to the infinite elasticity of money demand (Altunöz, 2010).

On the other hand, the Monetarist transmission mechanism is explained through quantity theory. Monetarists believe that money stock is external and only depends on the behavior of the monetary authority. Money directly affects nominal expenditures and may affect real income in the short run if the economy is below full employment. However, in the long run, it only affects the general price level. According to the Monetarist view, changes in money supply can affect the composition of portfolio investments and, consequently, the real economy. In contrast, Keynesians believe that monetary aggregates and market conditions are crucial in guiding monetary policy (Paya, 2013).

The literature has extensively studied the monetary transmission mechanism under many subgroups such as interest rate channel, credit channel, asset price channel, and expectations channel to understand this framework (Rossi et al., 2019). In this thesis,

we will mostly contend with the credit channel and interest rate channel to cover our empirical analyses. We mostly explained these channels below.

## **2.1 Traditional Interest Rate Channel**

The interest rate channel is one of the most studied transmission mechanisms through which monetary policy affects the economy. This channel operates by affecting the cost of borrowing for households and businesses, ultimately influencing spending and investment decisions in the economy. When a central bank raises interest rates, it makes borrowing more expensive, which can lead to reduced consumption and investment. Lower real interest rates increase investment spending by reducing the cost of capital, leading to a rise in total demand and production. Consumers also tend to increase their consumption spending when real interest rates fall, further boosting total demand. Changes in short-term nominal interest rates by the central bank can affect both short- and long-term real interest rates. However, the impact of monetary policy on long-term real interest rates may differ from expectations, depending on market expectations of future interest rate changes. High public debt countries may experience an increase in their risk premium when central banks raise interest rates to fight inflation, potentially impacting the sustainability of public debt (CBRT, 2013).

In theory, even if the policy rates approach the zero lower bound, the transmission mechanism can still work in response to a shock in the money supply which rises the expected inflation and finally aggregate demand, but below the zero rates, the central bank's policies become inefficient through the transmission mechanism since banks can no longer shrink their deposit interest rates (Altavilla et al., 2022).

The interest rate channel is particularly effective in influencing the behavior of households. In the short term, changes in interest rates can have significant effects on household consumption (Galí, 1992). Similarly, changes in interest rates can affect the value of housing and other assets, which can in turn affect household spending, (Bernanke & Gertler, 1995).

The interest rate channel also has significant implications for business investment. Increases in interest rates can lead to reduced investment by businesses, particularly those that rely heavily on external financing (Campello et al., 2010). Changes in

interest rates can affect the cost of capital for firms, which can influence investment decisions (Bernanke & Gertler, 1995).

In addition to affecting households and businesses, the interest rate channel can also affect financial markets. Changes in interest rates can influence asset prices and lead to fluctuations in financial markets (Gertler & Karadi, 2015). Changes in interest rates can also affect the behavior of investors and lead to changes in the risk appetite of financial institutions (Bernanke & Gertler, 1995).

The interest rate channel can also affect credit interest rates. When a central bank raises interest rates, it increases the cost of borrowing for banks, which can then be passed on to consumers in the form of higher interest rates on loans and credit cards (Andries & Billon, 2016). This can in turn reduce borrowing and spending by households, as well as investment by businesses, leading to a slowdown in economic activity.

In short, the interest rate channel is an important transmission mechanism through which monetary policy affects the economy. Changes in interest rates can influence household consumption, business investment, financial markets, exchange rates, international capital flows, and credit interest rates. The interest rate channel has been found particularly effective in the short term, but its effects can also persist over longer periods.

## **2.2 Credit Channel**

The other most important channel of monetary policy transmission is the credit channel. The credit channel operates by affecting the lending behavior of banks and other financial intermediaries. When a central bank raises interest rates, it can make it more expensive for banks to borrow, leading to tighter lending standards and reduced credit availability. This, in turn, can affect spending and investment decisions in the economy.

The credit channel is particularly important in times of financial distress. Research by Kashyap & Stein (1995) found that the tightening of lending standards by banks in response to a monetary policy shock can lead to a contraction in economic activity. Similarly, Bernanke & Gertler (1995) found that the credit channel can

amplify the effects of monetary policy shocks, particularly in the presence of financial market imperfections.

The monetary policy may depend on the overall market strength. Higher market power in the banking sector can deter the effectiveness of the central bank's implications on credit supply (Rakshit & Bardhan, 2023).

The credit channel can also be especially important for small businesses, which rely heavily on bank financing. Bernanke & Blinder (1988) found that a contraction in bank lending can have a disproportionate impact on small firms, leading to a decline in investment and employment. Gertler & Gilchrist (1994) further found that small manufacturing firms face higher borrowing costs and tighter lending standards in response to monetary policy tightening, which can lead to reduced investment and employment. On the other hand, the credit channel has significant implications for financial stability. Jimenez et al. (2014) argued that monetary policy tightening leads to higher credit risk-taking by banks, which can have negative consequences for financial stability.

Summing up, the credit channel is an important transmission mechanism through which monetary policy affects the economy. Tightening of lending standards by banks in response to a monetary policy shock can lead to reduced credit availability and ultimately affect spending and investment decisions in the economy, particularly for small businesses.

### **2.2.1. Balance Sheet Channel**

The policies of central banks can affect the balance sheets and cash flows of the private sector, as well as the willingness of credit institutions to lend to intermediaries and the terms on which credit is granted. This mechanism highlights the role of asymmetric information in the financial system. An increase in borrowing risk can lead to a decrease in the global amount of credit, due to adverse selection and moral hazard problems. Borrowers may take on riskier spending projects before signing credit contracts but may default due to lower collateral and worsening financial positions after signing them (Blinder, 1987).

The balance sheet channel explains the role of the financial position of private entities in the transmission mechanism of monetary policy. Changes in monetary policy not only affect market interest rates but also the financial positions of private

economic units, which in turn affect bank balances, cash flows, and the net worth of corporations and consumers. High-interest rates, for instance, may lead to a decrease in cash flow, net worth, and credit, which can then lead to a decrease in overall demand (Cengiz, 2009).

### **2.2.2. Bank Lending Channel**

The bank lending channel works through the impact of monetary policy on bank loans. Changes in interest rates can impact the cost of borrowing for banks, which can, in turn, affect their willingness to lend. A decrease in interest rates can lead to lower borrowing costs for banks, which can encourage them to lend more, thereby increasing credit availability and stimulating economic activity (Altunöz, 2010; Bernanke & Blinder, 1988). Relatively smaller banks are more sensitive to the changes in policy implications when altering credit supply (Altavilla et al., 2020). If the central banks change their policy implications slowly and gradually, the smaller banks' sensitivities become less impulsive (Naqvi & Pungaliya, 2023).

The bank lending channel operation depends on meeting three conditions. Firstly, loans and bonds provided to the public should not be perfect substitutes. Secondly, the central bank should be able to influence credit supply by changing reserve requirements. Lastly, price adjustments should not nullify the effects of changes in monetary policy (Disyatat, 2011; Golodniuk, 2006; Oliner & Rudebusch, 1995).

### **2.2.3. Cash Flow Channel**

The cash flow channel is an essential aspect of the credit channel, playing a crucial role in the relationship between changes in the money supply and economic activity. It begins with the actions taken by the central bank, such as adjustments to the monetary policy rate or open market operations, which in turn influence interest rates in the economy. The efficiency of the cash flow channel's transmission is linked to the structure of lending institutions (Cooper et al., 2021). All following scenarios affect the firms' or households' cash flows, and it results in their creditability in financial intermediaries. Additionally, the cash flow channel affects credit availability, impacting the overall demand in the economy. Higher interest rates raise borrowing costs for businesses and households, impacting their spending and investment decisions. As borrowing becomes more expensive, businesses may face challenges in financing their operations and investing in new projects, leading to

slower economic growth. Similarly, households may reduce their consumption of big-ticket items and discretionary spending due to increased costs on mortgages, car loans, and other forms of credit. Conversely, when the central bank decreases interest rates or increases the money supply, borrowing becomes more affordable, potentially stimulating economic activity. The cash flow channel is different from the interest rate channel which affects the real interest rates in the market (F. Mishkin, 2016).

#### **2.2.4. Unanticipated Price Level Channel**

The unanticipated price level channel is a significant element of the credit channel, wherein the effectiveness of central bank monetary policy actions influences the broader economy through unexpected changes in the price level in both the short and long run (Özmen & Tuğan, 2022). When the central bank implements its policy measures to control inflation, stabilize the economy, or promote growth, the intended outcomes on the price level may not always align with reality due to various complex factors. This unanticipated outcome impacts the real value of wealth and purchasing power of individuals and businesses. Unexpected inflation erodes the purchasing power of money, reducing the real wealth of households and firms, while unexpected deflation increases real wealth and purchasing power. Consequently, changes in real wealth affect consumption and investment decisions, leading to adjustments in aggregate demand. Lower consumption and investment due to unexpected inflation could result in reduced economic activity, while increased consumption and investment due to unexpected deflation might stimulate economic growth (F. Mishkin, 2016).

#### **2.2.5. Household Liquidity Effects**

The household liquidity effects play a crucial role in the credit channel, as they represent the process through which changes in monetary policy influence households' financial conditions, spending behavior, and economic decisions. Consumer credit availability and spending behavior are influenced by changes in interest rates. When the central bank adjusts interest rates, it directly impacts borrowing costs for households, affecting their credit availability. Mortgage rates and housing market dynamics also respond to monetary policy, impacting housing demand and construction activity (F. Mishkin, 2016). Moreover, changes in asset

prices, driven by monetary policy actions, can influence household wealth and consumption through the "wealth effect" (Lee, 2023).

### **2.3 Asset Price Channel**

The asset price channel is closely linked with other transmission channels of monetary policy. Changes in interest rates can also impact the availability and cost of credit, influencing both the demand for assets and the ability to finance asset purchases (Bernanke et al., 1999). Additionally, central bank communications and forward guidance play a vital role in shaping investors' expectations regarding future monetary policy actions, further amplifying or dampening the effects of the asset price channel.

#### **2.3.1. Exchange Rate Effect**

The exchange rate channel is a crucial aspect of the monetary transmission mechanism, operating in economies with flexible exchange rates. When a central bank alters monetary policy by adjusting interest rates, it impacts the money supply and, consequently, interest rate differentials relative to other countries. Higher interest rates attract foreign capital, increasing demand for domestic currency and causing it to appreciate. This appreciation affects export competitiveness, import prices, inflation, and the trade balance, which, in turn, influence overall economic growth, employment, and inflation rates in the country, making the exchange rate channel a significant driver of economic outcomes (Bernanke & Gertler, 1995; Taylor, 1995). On the other hand, if household investments are abundant with foreign currency assets in a country, the monetary shocks that affect deeply the household wealth through the exchange rates can lead household behavior to change (Moenjak, 2014a).

#### **2.3.2. Wealth Effects**

The asset price channel is a significant mechanism through which monetary policy influences the prices of financial assets like stocks, bonds, and real estate. When central banks adjust their monetary policy, particularly through changes in interest rates, it has a profound impact on investors' behavior and their demand for different types of assets. Lowering interest rates stimulates economic activity as investors seek

higher returns by shifting their investments from low-yielding fixed-income instruments to riskier assets such as stocks. This increased demand for stocks pushes their prices upward. Similarly, lower interest rates reduce borrowing costs, making it cheaper for individuals and businesses to finance real estate purchases. This leads to increased demand for properties and drives up real estate prices. Rising asset prices create a wealth effect, making households and businesses feel wealthier and more inclined to spend and invest, contributing to overall economic growth. Conversely, when interest rates rise, investors may find fixed-income investments more attractive compared to stocks. This leads to a shift in investments away from equities and into bonds or other fixed-income securities, reducing the demand for stocks and potentially causing a decline in stock prices (F. S. Mishkin, 1996).

On the other hand, Chen et al., (2017) argue that the monetary transmission mechanism is not trusted to stimulate asset prices. Changes in asset prices have broader implications for the economy. Higher stock prices improve the financial position of companies, facilitating access to capital markets and enabling them to raise funds for investment. This can support business expansion, job creation, and overall economic growth. Conversely, fluctuations in real estate prices can significantly impact household wealth and consumer spending. Rising property values make homeowners feel wealthier and more willing to spend, whereas declining real estate prices can erode household wealth, leading to reduced spending and a potential slowdown in economic activity (Rossi et al., 2019).

### **2.3.3. Tobin's q Theory**

Tobin's q monetary transmission mechanism, named after economist James Tobin, explains how changes in the stock market and asset prices influence investment and economic activity (Yıldırım & Mirasedoğlu, 2015). The q ratio, representing the market value of a company's assets relative to their replacement cost, plays a key role. When central banks decrease interest rates, borrowing becomes cheaper, enticing businesses and investors to make more investments. This lowers the attractiveness of fixed-income investments like bonds, prompting investors to seek higher returns in riskier assets, causing stock prices to rise. The rising stock prices increase the market value of companies and elevate the q ratio, signaling abundant investment opportunities. Consequently, firms undertake new projects and expand

operations, leading to economic growth, job creation, and increased consumption. However, Tobin's  $q$  is just one-factor influencing economic behavior, and real-world complexities must be considered in its application (Gilchrist & Leahy, 2002; F. Mishkin, 2016).

## **2.4 Expectations Channel**

The expectations channel of the monetary transmission mechanism is a crucial aspect of how changes in monetary policy influence the economy. When central banks adjust interest rates or engage in quantitative easing, they send signals to the public about their future policy intentions, influencing expectations about inflation, economic growth, and interest rates (Bernanke & Blinder, 1992). These changes in expectations, in turn, impact individual and business behavior, affecting consumption, investment, saving decisions, and overall economic activity. For example, expectations about interest rates can influence borrowing and spending, while inflation expectations can impact pricing behavior and wage demands (Davoodi et al., 2013). Additionally, exchange rate expectations and asset price expectations can have significant effects on an economy's competitiveness and financial stability. Expectations for future economic circumstances have an impact on the public's confidence and animal spirits as well, which further shapes economic results (Moenjak, 2014b).

The inflation expectations can increase the volatility of long-term and short-term nominal interest rates for instance Treasury Inflation Protected Securities's interest rate (Bauer, 2014). When inflation expectations are anchored in an economy, the market interest rates tend to increase. For example, persistent low policy rates increase inflation expectations and lead credit or deposit interest rates to rise. This outcome is the opposite of what we described in the cash flow channel. But the short-term fundings of central banks are not the only determinant of corporate banks when altering their interest rates. This interest rate increase is not beyond inflation generally and slows down lowering real interest rates in the market but it usually declines with the effect of inflation. Following, this result increases the demand of firms for credit and prompts banks to cut the credit supply (Ropele et al., 2022). We will analyze these effects in the following chapters and we call it the second stage of the transmission mechanism.

### **3. METHODOLOGY**

The ARDL bounds test is a powerful and flexible econometric tool that allows for the examination of the long-run and short-run dynamics of a relationship between two or more variables while accounting for potential structural breaks and non-stationarity in the data. This is important in practice, as economic variables often exhibit a different order of integration. It is worth noting that while the ARDL bounds testing approach allows for the inclusion of both stationary and non-stationary variables in the same model, it is not immune to the problems of spurious regression and omitted variable bias that may arise from the inclusion of non-stationary variables in the analysis. Therefore, careful model selection and diagnostic testing should be conducted to ensure the validity and reliability of the results obtained from ARDL bounds tests.

The ARDL bounds test has some advantages over other time series techniques. For example, it does not require the variables to be normally distributed, and it can be used with small sample sizes. However, it has some limitations as well. One limitation is that it assumes that the variables have a linear relationship with each other, which may not always be the case in practice.

The coefficients of the ARDL bounds test can be interpreted as both short-run and long-run effects. The short-run effects represent the immediate response of the dependent variable to a one-time shock in the independent variable, while the long-run effects represent the equilibrium relationship between the variables in the long run. In this study, we are interested in both the long-run and short-run relationship between the policy interest rate and commercial credit interest rate, as well as the effect of SMEs credit and construction credit on the interest rate channel transmission mechanism.

It is important to note that the results of the ARDL bounds test are only valid if the model satisfies some diagnostic tests, such as the tests for autocorrelation, heteroskedasticity, and normality of residuals. These tests were performed in this study to ensure the validity of the results.

In the following, we explained the steps of proper ARDL bounds tests and some of the mathematical explanations.

### 3.1 Unit Root Test

The ADF (Augmented Dickey-Fuller) test is a widely used statistical tool that helps identify whether a time series is stationary or non-stationary. This test is a modified version of the Dickey-Fuller test and is particularly useful in detecting the presence of a unit root in a time series. The null hypothesis of the test proposes the existence of a unit root in the time series, which suggests that it is non-stationary. On the other hand, the alternative hypothesis posits that the time series is stationary. In summary, the ADF test is a powerful statistical technique that provides important insights into the stationarity of time series data. The ADF test can be specified as follows:

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \sum_{i=1}^p \delta_i \Delta y_{t-i} + \varepsilon_t$$

where:

- $\Delta$  is the first difference operator.
- $y_t$  is the dependent variable.
- $p$  is the number of lags to include in the test.
- $\alpha$  is a constant term.
- $\beta$  is the coefficient on a linear time trend.
- $\gamma$  is the coefficient on the lagged dependent variable.
- $\delta_i$  are the coefficients on the lagged first differences of the time series.
- $\varepsilon_t$  is the error term.

The test statistic for the ADF test is calculated as follows:

$$ADF = \frac{\hat{\gamma}}{SE(\hat{\gamma})}$$

where:

- $\hat{\gamma}$  is the estimate of the coefficient on the lagged dependent variable in the ADF regression.
- $SE(\hat{\gamma})$  is the standard error of the estimate.

The critical values for the ADF test depend on the sample size, the number of lags included in the test, and the level of significance. These critical values can be found in literature or using statistical software. If the calculated ADF statistic is less than the critical value, the null hypothesis is rejected, and the time series is considered stationary. If the calculated ADF statistic is greater than the critical value, the null hypothesis cannot be rejected, and the time series is considered non-stationary (Dickey & Fuller, 1979; Said & Dickey, 1984).

The Phillips-Perron unit root test is a modification of the Dickey-Fuller test that takes into account the possibility of serial correlation in the data. It is used to determine whether a time series has a unit root or not, which indicates whether the series exhibits a random walk pattern with no underlying trend. The test statistic is computed similarly to the ADF test statistic, but it is adjusted to account for the serial correlation that may exist in the data. To perform the test, an augmented Dickey-Fuller regression is estimated, and the test statistic is calculated as the t-ratio of the estimated coefficient on the lagged dependent variable, adjusted for the bias and the serial correlation of the residuals. The critical values of the test statistic are obtained from tables provided by Phillips and Perron or Monte Carlo simulations. The Phillips-Perron unit root test is a useful tool for assessing the stationarity of a time series and its suitability for statistical inference and forecasting (Banerjee et al., 1998; Phillips & Perron, 1988).

### **3.2 ARDL Bounds Test**

The Autoregressive Distributed Lag (ARDL) bounds test is a statistical test used to determine whether a long-run relationship exists between two or more variables in a time series. The test involves estimating an ARDL model, which includes both lagged values of the dependent variable and lagged values of the independent variables. The test then uses F-statistics to determine whether there is a significant long-run relationship between the variables (Narayan, 2005; Pesaran et al., 2001).

First, we start with generating the traditional ARDL test. The traditional ARDL model can be written as:

$$y_t = c_0 + c_1 t + \sum_{i=1}^p b_{y,i} y_{t-i} + \sum_{j=1}^k \sum_{l=0}^{q_j} b_{j,l} x_{j,t-l} + \varepsilon_t$$

Where:

- $y_t$  is the dependent variable at time  $t$ .
- $c_0$  is a constant term in the regression equation.
- $c_1$  is the coefficient of the trend variable,  $t$ , which represents the linear trend in the dependent variable over time.
- $\sum_{i=1}^p b_{y,i} y_{t-i}$  represents the lagged values of the dependent variable,  $y_t$ , up to  $p$  periods.
- $\sum_{j=1}^k$  represents the summation of  $k$  explanatory variables.
- $\sum_{l=0}^{q_j} b_{j,l} x_{j,t-l}$  represents the lagged values of the  $j$ .th explanatory variable,  $x_j$ , up to  $q_j$  periods.
- $\varepsilon_t$  represents the error term, which captures the variation in  $y_t$  that is not explained by the other variables in the model.

There are 5 cases of the ARDL model and its following forms.

- Case 1: No *intercept* and no *trend*.
- Case 2: Restricted *intercept* and no *trend*.
- Case 3: Unrestricted *intercept* and no *trend*.
- Case 4: Unrestricted *intercept* and restricted *trend*.
- Case 5: Unrestricted *intercept* and unrestricted *trend*.

The unrestricted error correction model (UECM) or ARDL model long run form can be written as:

$$\begin{aligned} \Delta y_t = c_0 + c_1 t + \pi_y y_{t-1} + \sum_{j=1}^k \pi_j x_{j,t-1} + \sum_{i=1}^{p-1} \psi_{y,i} \Delta y_{t-i} + \sum_{j=1}^k \sum_{l=1}^{q_j-1} \psi_{j,l} \Delta x_{j,t-l} \\ + \sum_{j=1}^k \omega_j \Delta x_{j,t} + \varepsilon_t \end{aligned}$$

Where:

- $\Delta y_t$  is the first difference of the dependent variable at time  $t$ .
- $c_0$  is a constant term in the regression equation.
- $c_1$  is the coefficient of the trend variable,  $t$ , which represents the linear trend in the dependent variable over time.

- $\pi_y$  is the coefficient of the lagged dependent variable,  $y_{t-1}$ .
- $\pi_j$  is the coefficient of the  $j$ th lagged explanatory variable,  $x_{j,t-1}$ .
- $\sum_{i=1}^{p-1} \psi_{y,i} \Delta y_{t-i}$ : This represents the contribution of the  $p-1$  lagged differences of the dependent variable to the current value of  $\Delta y_t$ .  $\psi_{y,i}$  is the coefficient of the  $i$ -th lagged difference of  $\Delta y_t$ , and it captures the effect of past changes in the dependent variable on the current change in  $\Delta y_t$ .
- $\sum_{j=1}^k \sum_{l=1}^{q_j-1} \psi_{j,l} \Delta x_{j,t-l}$ : This represents the contribution of the  $q_j - 1$  lagged differences of the  $j$ th explanatory variable,  $x_j$ , to the current value of  $\Delta y_t$ .  $\psi_{j,l}$  is the coefficient of the  $l$ th lagged difference of  $\Delta x_{j,t}$ , and it captures the effect of past changes in the  $j$ th explanatory variable on the current change in  $\Delta y_t$ .
- $\sum_{j=1}^k \omega_j \Delta x_{j,t}$ : This represents the contribution of the contemporaneous changes in the explanatory variables to the current value of  $\Delta y_t$ .  $\omega_j$  is the coefficient of the contemporaneous change in  $\Delta x_{j,t}$ , and it captures the effect of current changes in the  $j$ th explanatory variable on the current change in  $\Delta y_t$ .
- $\varepsilon_t$  represents the error term, which captures the variation in  $\Delta y_t$  that is not explained by the other variables in the model.
- $\psi_{j,l} = 0$  for all  $q_j \leq 1$ . This means that lagged differences in the explanatory variable  $x_j$  are not included in the model if  $q_j$  is less than or equal to 1.
- $\psi_{y,i} = 0$  if  $p = 1$ . This means that lagged differences of the dependent variable are not included in the model if  $p$  is equal to 1.

The bounds test involves calculating the F-statistic for testing the null hypothesis of no long-run relationship between the variables.

The Bounds F-statistic is then calculated as follows:

$$F = \frac{(RSS_r - RSS_u)/p}{RSS_u/(T - k - p - q - 1)}$$

Where:

- $RSS_r$  is the residual sum of squares from a restricted model with  $\alpha_1 = 0$ .
- $RSS_u$  is the residual sum of squares from an unrestricted model with  $\alpha_1 \neq 0$ .
- $q$  is the number of lagged differences of the independent variable included in the model.
- $p$  is the number of lagged differences of the dependent variable included in the model.
- $T$  is the sample size.

The critical values of the F-statistic depend on the sample size, the significance level, and the number of lagged differences included in the model. If the calculated F-

statistic is greater than the upper bound critical value, the null hypothesis of no long-run relationship is rejected, and a long-run relationship is deemed to exist. If the calculated F-statistic is less than the lower bound critical value, the null hypothesis of no long-run relationship is not rejected, and a long-run relationship is deemed not to exist. If the calculated F-statistic falls between the upper and lower bounds, the test is inconclusive, and the researcher must rely on additional diagnostic tests or economic theory to decide. (Narayan, 2005; Pesaran et al., 2001)

The Error Correction Term (ECT) is a key feature of the ARDL model, which captures the speed of adjustment toward the long-run equilibrium after a shock to the system. The ECT represents the deviation from the long-run equilibrium and is included as an additional explanatory variable in the ARDL model. The ECT is estimated by taking the difference between the actual and predicted values of the dependent variable in the previous period.

If the estimated coefficient of the ECT is negative and statistically significant, it indicates the presence of a long-run relationship among the variables. The negative sign of the coefficient implies that the system will adjust to deviations from the long-run equilibrium in the previous period. In other words, if the system was not in equilibrium in the previous period, it will adjust towards equilibrium in the current period.

The ECM model can be represented as follows:

$$\Delta y_t = c_0 + c_1 t + \sum_{i=1}^{p-1} \psi_{y,i} \Delta y_{t-i} + \sum_{j=1}^k \sum_{l=1}^{q_j-1} \psi_{j,l} \Delta x_{j,t-l} + \sum_{j=1}^k \omega_j \Delta x_{j,t} + \pi_y ECT_t + \varepsilon_t$$

$$\psi_{j,l} = 0 \quad \forall \quad q_j = 1, \quad \psi_{j,l} = \omega_j = 0 \quad \forall \quad q_j = 0$$

- Under Case 1:
  - $c_0 = c_1 = 0$
  - $ECT = y_{t-1} - (\sum_{j=1}^k \theta_j x_{j,t-1})$
- Under Case 2:
  - $c_0 = c_1 = 0$
  - $ECT = y_{t-1} - (\mu + \sum_{j=1}^k \theta_j x_{j,t-1})$
- Under Case 3:
  - $c_1 = 0$

- $ECT = y_{t-1} - (\sum_{j=1}^k \theta_j x_{j,t-1})$
- Under Case 4:
  - $c_1 = 0$
  - $ECT = y_{t-1} - (\delta(t-1) + \sum_{j=1}^k \theta_j x_{j,t-1})$
- Under Case 5:
  - $ECT = y_{t-1} - (\sum_{j=1}^k \theta_j x_{j,t-1})$
- In all cases,  $x_{j,t-1}$  in  $ECT$  is replaced by  $x_{j,t} \quad \forall q_j = 0$

Where:

- $\Delta y_t$ : This is the first difference of the dependent variable at time  $t$ , which represents the change in  $y_t$  from its previous value.
- $c_0$ : This is the intercept term, which represents the expected value of  $\Delta y_t$  when all other variables in the model are equal to zero.
- $c_1$ : This is the coefficient of the trend variable,  $t$ , which represents the linear trend in the dependent variable over time.
- $\sum_{i=1}^{p-1} \psi_{y,i} \Delta y_{t-i}$ : This represents the contribution of the  $p-1$  lagged differences of the dependent variable to the current value of  $\Delta y_t$ .  $\psi_{y,i}$  is the coefficient of the  $i$ -th lagged difference of  $\Delta y_t$ , and it captures the effect of past changes in the dependent variable on the current change in  $\Delta y_t$ .
- $\sum_{j=1}^k \sum_{l=1}^{q_j-1} \psi_{j,l} \Delta x_{j,t-l}$ : This represents the contribution of the  $q_j - 1$  lagged differences of the  $j$ th explanatory variable,  $x_j$ , to the current value of  $\Delta y_t$ .  $\psi_{j,l}$  is the coefficient of the  $l$ -th lagged difference of  $\Delta x_{j,t}$ , and it captures the effect of past changes in the  $j$ th explanatory variable on the current change in  $\Delta y_t$ .
- $\sum_{j=1}^k \omega_j \Delta x_{j,t}$ : This represents the contribution of the contemporaneous changes in the explanatory variables to the current value of  $\Delta y_t$ .  $\omega_j$  is the coefficient of the contemporaneous change in  $\Delta x_{j,t}$ , and it captures the effect of current changes in the  $j$ th explanatory variable on the current change in  $\Delta y_t$ .
- $\pi_y ECT_t$ : This represents the long-run equilibrium relationship between the dependent variable and its lagged value.  $ECT_t$  is the error correction term, which captures the speed at which the dependent variable adjusts to deviations from the long-run equilibrium relationship.  $\pi_y$  is the coefficient of  $ECT_t$ , and it captures the effect of the deviation from the long-run equilibrium on the current change in  $\Delta y_t$ .
- $\varepsilon_t$ : This is the error term, which captures the variation in  $\Delta y_t$  that is not explained by the other variables in the model.

The coefficients  $\psi_{j,l}$  and  $\omega_j$  are subject to the following constraints:  $\psi_{j,l} = 0$  for all  $q_j = 1$ , which means that lagged differences in the explanatory variable  $x_j$  are not included in the model if  $q_j$  is equal to 1.  $\psi_{j,l} = \omega_j = 0$  for all  $q_j = 0$ , which means

that the  $j$ th explanatory variable is not included in the model if it has no lagged or contemporaneous effect on  $\Delta y_t$ .

### 3.3 Diagnostics Tests

**Breusch-Pagan (BP) Test:** The BP test is a test for heteroscedasticity, which is the presence of unequal variances in the error term across different levels of the independent variables. The test checks whether the variance of the error term is related to the values of the independent variables. If the null hypothesis of homoscedasticity is rejected, it suggests that the variance of the error term is not constant across the range of the independent variables (Breusch & Pagan, 1979).

**Jarque-Bera (JB) Test:** The JB test is a test for normality, which is the assumption that the error term follows a normal distribution. The test checks whether the skewness and kurtosis of the error term are close to the values expected under a normal distribution. If the null hypothesis of normality is rejected, it suggests that the error term may not be normally distributed, which can affect the validity of the estimated coefficients and hypothesis tests (Jarque & Bera, 1980).

**Lagrange Multiplier (LM) Test:** The LM test is a test for autocorrelation, which is the presence of correlation between the error term at different points in time. The test checks whether there is any residual autocorrelation in the error term after controlling for the lagged values of the dependent variable and independent variables. If the null hypothesis of no autocorrelation is rejected, it suggests that the error term may be correlated across time, which can affect the precision and efficiency of the estimated coefficients (Davidson et al., 2004).

**Ramsey's RESET Test:** The RESET test is a test for misspecification of the functional form, which is the assumption that the relationship between the dependent variable and independent variables is correctly specified. The test checks whether there is any remaining nonlinear relationship between the dependent variable and independent variables after including the linear terms. If the null hypothesis of no misspecification is rejected, it suggests that the functional form of the model may not be correctly specified, which can affect the validity of the estimated coefficients and hypothesis tests (Ramsey, 1969).

**Cumulative Sum (CUSUM) Test:** The CUSUM test is a test for structural stability, which is the assumption that the relationship between the dependent variable and independent variables is stable over time. The test checks whether there is any significant deviation from the stable relationship over time. If the null hypothesis of structural stability is rejected, it suggests that there may be a structural change in the relationship between the dependent variable and independent variables, which can affect the validity of the estimated coefficients and hypothesis tests.

**Cumulative Sum of Squares (CUSUMSQ) Test:** The CUSUMSQ test is also a test for structural stability, but it is more powerful than the CUSUM test in detecting gradual changes in the relationship between the dependent variable and independent variables. The test checks whether there is any significant deviation from the stable relationship over time, considering both the level and the slope of the relationship. If the null hypothesis of structural stability is rejected, it suggests that there may be a gradual change in the relationship between the dependent variable and independent variables, which can affect the validity of the estimated coefficients and hypothesis tests (Brown et al., 1975).

## **4. THE EFFECTS OF POLICY RATES ON COMMERCIAL CREDIT RATES IN TÜRKİYE**

### **4.1 Introduction**

In this chapter, we will analyze the effects of the monetary policy implemented by the Central Bank of the Republic of Türkiye (CBRT) in terms of the policy interest rates on the commercial credit interest rates offered by the banks throughout the monetary policy transmission mechanism.

The relationship between policy interest rates and commercial credit rates is a topic of great importance in the field of monetary economics. Understanding the nature and strength of this relationship is critical for policymakers seeking to manage interest rates in a way that supports economic growth and stability. In Türkiye, this relationship has been of particular interest given the country's ongoing economic challenges, including high inflation and currency fluctuations.

We aim to contribute to the existing literature on this topic. To achieve this goal, we use the ARDL bounds model to analyze quarterly data covering the period from the first quarter of 2011 to the last quarter of 2022. By identifying the extent to which changes in the policy rate are transmitted to the wider economy through the banking sector, we hope to inform ongoing debates about the appropriate monetary policy for Türkiye and provide insights that may be useful for policymakers and other stakeholders in the years ahead.

The use of a dummy variable in the model can help to capture the effect of an exogenous shock or policy change on the relationship between the variables of interest, which had a significant impact on the economy and financial markets.

### **4.2 An Overview of Monetary Policies in Türkiye**

Monetary policy in Türkiye is primarily governed by the Central Bank of the Republic of Türkiye (CBRT), which is responsible for maintaining price stability and promoting financial stability within the country. The CBRT employs various tools

and strategies to control inflation, manage interest rates, and regulate the money supply to achieve its objectives. Over periods, Türkiye has faced significant economic challenges, including high inflation rates, financial crises, and fluctuations in exchange rates. This part provides an overview of the key monetary policies adopted by Türkiye during this period, highlighting the major shifts and measures undertaken by the CBRT.

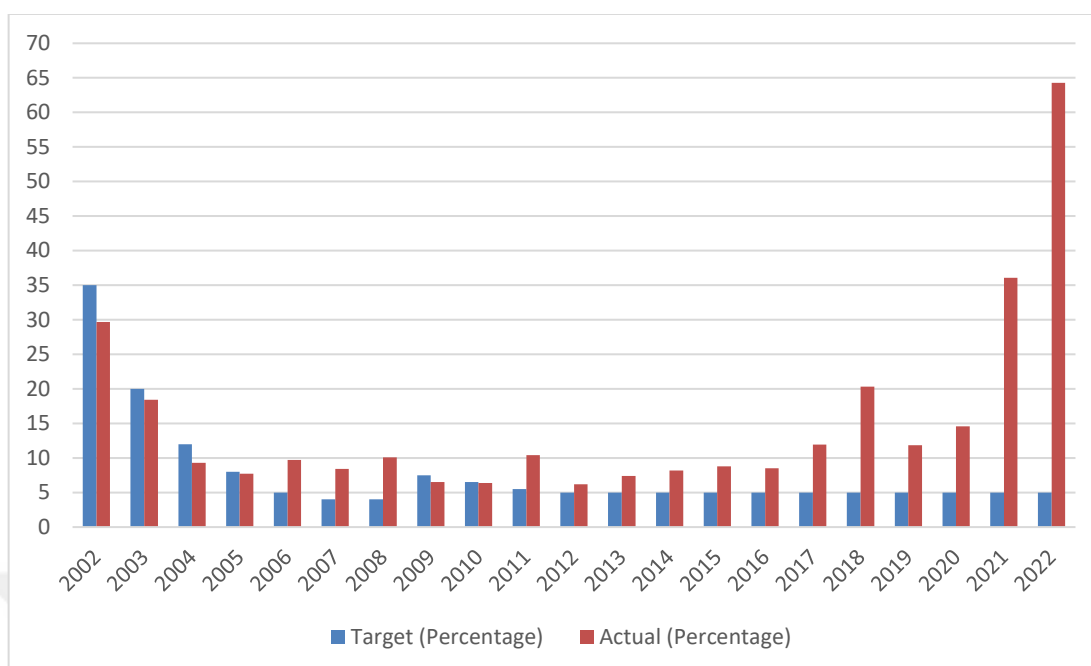
In January 2002, the CBRT officially adopted implicit inflation targeting as its monetary policy framework. This strategic shift aimed to establish a clear focus on controlling inflation and anchoring inflation expectations. In Figure 1, we can observe the inflation rate was pulled down from implicit inflation targeting in 2002 to explicit targeting in 2005 from 29.70% to 7.70% and the gap between actual and targeted inflation rates shrank. Generally, the CBRT has never achieved its target where the bias determined 3% from the target rate.

A milestone in Türkiye's monetary policy occurred in January 2005 with the introduction of the one-week repo rate. This policy rate became the cornerstone of the CBRT's toolkit, serving as a benchmark for lending and borrowing rates in the economy. Adjustments to the one-week repo rate enable the central bank to influence borrowing costs, credit conditions, and overall economic activity (CBRT, 2005).

The CBRT adopted an inflation targeting framework in 2006 explicitly with a target range of 3-5% for annual consumer price inflation, which aimed to anchor inflation expectations and improve the transparency and accountability of the central bank's policy (CBRT, 2023e). Under the inflation targeting framework, the CBRT sets a medium-term inflation target and increased one-week repo rates in 2006 and 2007 by around 17% and 21.5% respectively to bring inflation down but faced criticism from some quarters for its tight monetary policy stance. Inflation occurred during this period at 9.70% and 8.40% respectively (CBRT, 2006, 2007).

Since the global financial crisis of 2008 led to a sharp economic slowdown and a decline in the value of the Turkish lira, the Central Bank of the Republic of Türkiye (CBRT) undergo significant changes in its policies and operations. In the aftermath of the financial crisis, the CBRT lowered its policy interest rates to around 18% to stimulate economic growth and support financial stability (CBRT, 2008).

**Figure 1. Inflation Targeting of the CBRT**



*Source: The graph was generated by the author himself (CBRT, 2023d).*

Recognizing the need for enhanced liquidity management and flexibility in the banking sector, the CBRT expanded its monetary policy toolkit in April 2010. This expansion included the late liquidity window, providing banks with an additional borrowing facility. The CBRT's borrowing and lending rates were reported at 2.5% and 12% correspondingly. The move aimed to improve the effectiveness of liquidity management and ensure stability in the financial system (CBRT, 2010).

After 2011, the CBRT fixed the inflation target as 5% but the gap between the target and realized inflation ever increased and in practice, the CBRT seems left the inflation targeting framework. It's closely related to government policies that seek competitive exchange rates by lowering policy rates. Inflation remained stubbornly high, averaging around 7% during this period. The central bank also faced criticism and controversy over its handling of the "interest rate lobby" affair in 2011. After this period, the CBRT slightly increased the policy rates to around 9% lowering the inflation rate until middle of the 2012 and they again reduced policy rates to around 6.5% until the middle of 2013 to stimulate economic activities because of the financial fluctuations were experienced in developing countries as the US Federal Reserve entered the tapering process in 2013. The CBRT tightened its monetary policy by raising interest rates to prevent the exchange rates from falling.

In 2014, the CBRT increased its policy interest rates by around 8.5% sharply in response to a sharp decline in the value of the Turkish lira, which was caused by a combination of global economic conditions and domestic political uncertainty.

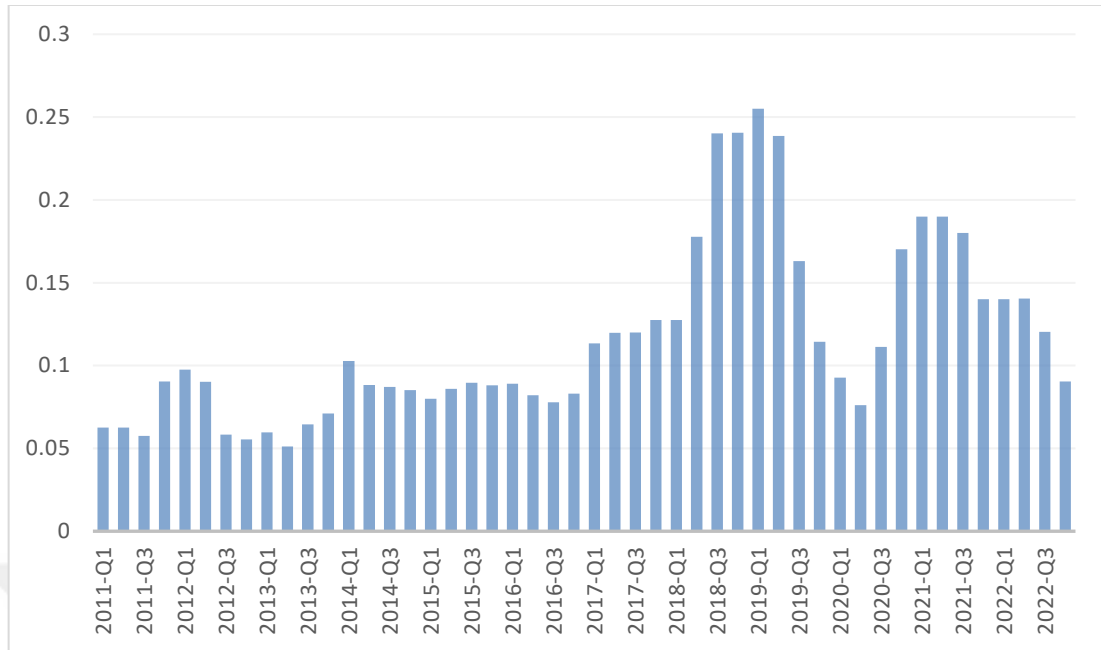
If we consider the periods between 2006 and 2017 the inflation rate is tolerably high between around 7% and 12% and we can infer that even if the CBRT couldn't achieve its aims, its price stability stance restrained inflation to hype.

In 2018, the exchange rate shocks were started in Türkiye. As a result of the depreciation in the value of the Turkish Lira, the inflation rates began to increase from this period reported as 20.3% at the end of the year by the CBRT and Türkiye began to face increasing exchange rates and inflation to now. In 2018, the 1-week-repo interest rate became the CBRT's main policy rate target and the CBRT raised its policy interest rates again from 17.75% to 24% in response to a renewed decline in the value of the lira that is shown in Figure 2.

In 2019 and 2020, the pandemic COVID-19 impacted the whole economy, and the general prices were affected negatively. In this period, the CBRT faced difficulty to keep inflation stable against the general increasing trend of inflation. The CBRT lowered its policy interest rates to around 16% in 2019 Q3 and 7.6% in 2020 Q2 in response to a slowdown in economic growth and the impact of the COVID-19 pandemic. However, inflation remained high in 2020, leading to concerns about the central bank's commitment to its inflation-targeting framework. and the inflation was officially reported as 11.84% and 14.60% in these years respectively. Its negative effects are still coming out up to now. In the next quarters, the CBRT increased the policy interest rates sharply from 17% to 19% to bring inflation under control (CBRT, 2023b; İdil, 2022).

After 2021, the price stability goals of the CBRT seem abandoned because of their persistence on low short-term interest rate policy to support higher production and export rates and this stance kept the inflation high because of the increasing prices of imported goods. The official inflation rates were reported as 36.08% in 2021 and 64.27% in 2022. In this period, the CBRT increased interest rates by around 19% to combat high inflation. These steps led to discussions on the policy consistency of the CBRT.

**Figure 2. Weighted Average of Policy Rate**



*Source: The graph was generated by the author himself (CBRT, 2023b).*

Under its goals of maintaining price stability and financial stability, the CBRT employed the required reserve ratio as a means of support. As part of this approach, the Reserve Option Mechanism entirely discontinued in 2022, with a focus on prioritizing mechanisms that boosts the growth of Turkish lira deposits while simultaneously raising the costs associated with foreign currency obligations (CBRT, 2021). Thereafter, the CBRT gradually decreased the policy rate up to 9% until the middle of 2023. Between these periods, Türkiye faced very high inflation rates above 70% and very high negative real interest rates well below -60% which we will deal with in the next chapters. Recently, the CBRT decided to rise the policy rate to 15% with a decision to clear the long last economic uncertainty (CBRT, 2023g).

During the period, the credit and deposit interest rates differentiated because the low policy rate stance of CBRT hit inflation through rising exchange rates and this finally resulted lower credit interest rates. But the banks should finance themselves and they began to increase deposit interest rates to attract more investors. The gap became wide at the middle of 2023, the commercial credit rate was around 15% but the deposit interest rates varied around 30% among the banks. We can see the monetary policy mechanism is very important to understand the effects of lowering the policy rate below the inflation rate become reversed in the long run (CBRT, 2023a, 2023c).

Over the last decades, the CBRT has undergone significant changes in its policies and operations, as it has sought to promote financial stability and economic development in Türkiye. While the central bank has achieved some success in achieving its objectives, it has also faced various challenges and issues, particularly concerning its independence, credibility, and transparency.

### **4.3 Empirical Literature**

The policy interest rate set by the central bank is a key tool in monetary policy that affects the economy by influencing borrowing and lending rates. Commercial banks adjust their lending and deposit rates in response to changes in the central bank's policy rate. Numerous studies have examined the relationship between the central bank's policy rate and commercial bank interest rates.

In Türkiye, the interest rate channel of monetary policy transmission has been the subject of much debate and analysis, particularly given the country's ongoing economic challenges. Understanding the nature of this channel, and the factors that may be limiting its effectiveness, is an important task for policymakers and other stakeholders in the years ahead.

In Aydin's (2007) study, the level of alignment and responsiveness of bank lending rates to changes in policy rates in Türkiye between 2001 and 2005 was investigated. Using panel error correction models, the study found that there was an incomplete pass-through in commercial lending rates, but a high pass-through in consumer lending rates. It was also found that changes in policy rates affected lending rates on average within three months and that the Central Bank had a significant impact on consumer lending rates.

In their study, R. Becker et al. (2012) examined the interest rate pass-through in the UK, considering the periods between January 1995 and August 2008. They used a nonlinear threshold error correction model as their method. The analysis revealed significant asymmetries in the transmission of monetary policy from official interest rates to money market interest rates and from money market interest rates to housing loan interest rates.

Mojon (2000) examined the differences in the transmission mechanism of the interest rate channel in Eurozone economies with different financial structures. The study

compared how monetary policy interest rates were transmitted to bank interest rates in pre- and post-monetary union periods. Panel analyses showed that the cross-country asymmetry in the response of bank interest rates to monetary policy interest rates decreased with the adoption of a single monetary policy and the integration of money markets. Additionally, it was suggested that financial structure differences played a significant role in the transmission of monetary policy interest rates to bank interest rates.

The Central Bank of Türkiye implemented an unconventional interest rate corridor policy in 2010 to respond to financial volatility. This policy involved changing the composition of short-term funds provided to the market and allowing market rates to deviate from the official policy rates. Kara & Binici (2016) aimed to better understand the transmission mechanism of this policy. The difference between the official policy rates and the actual rates faced by banks (effective rates) was found to have more significance in the transmission of monetary policy to the banking system. The overnight interbank market rate was observed to play a decisive role in the pricing of loans and deposits.

Güneş (2022) investigated the effect of the Central Bank of Türkiye's weighted average funding cost on bank interest rates using weekly data from January 2012 to January 2022. A VAR model and variance decomposition analysis were used, revealing that the impact of the funding cost on deposit interest rates is higher than its impact on loan interest rates. The results also show that the effect of the funding cost on bank interest rates remains positive for about 5 months after the initial impact, although its strength decreases over time.

Güler (2021) analyzed the short-term dynamic relationship between official funding rates and actual interest rates of banks for loans and deposits. Findings suggest that banks are more sensitive to actual interest rates than official rates, although there is a partial transmission from the latter. The BIST overnight market rate is more effective for commercial and consumer loan pricing, while the Central Bank's average funding rate is more effective for deposit pricing. Banks are also sensitive to macroeconomic developments such as exchange rates and inflation when determining interest rates. Non-farm unemployment rate significantly affects loan interest rates but not deposit rates, while global volatility has a weak effect on loan rates and no effect on deposit rates.

Uğur & Bingöl (2018) researched the pass-through effect between policy interest rates and banking loan rates. The study utilized monthly data from January 2002 to December 2016 and conducted unit root tests, conventional and bootstrap process-based Toda Yamamoto tests, and frequency domain causality tests. The results of the conventional and bootstrap Toda Yamamoto causality tests showed that policy interest rates and vehicle loan rates did not have an impact on each other. However, the frequency domain causality test indicated that banking loan rates had a wide-term effect on policy interest rates.

Can et al. (2020) examined the effectiveness of monetary policy transmission in Türkiye under an inflation-targeting regime. Various models, including VAR and SVAR, are constructed to analyze the impact of different factors on output and inflation. The findings indicate that the Central Bank of the Republic of Türkiye (CBRT) has the power to influence output through the nominal exchange rate and policy rates. External factors have a stronger impact on output than inflation. The most influential channels for output and prices are the exchange rate and interest rate channels for inflation, and the asset price channel, money supply, and liquidity for output. These results contribute to our understanding of how monetary policy affects the Turkish economy.

Binici et al. (2018) investigated the transmission of monetary policy when policy rates and market rates diverge, using Türkiye's experience with a flexible interest rate corridor. Panel regressions with bank-level data reveal that bank rates are more sensitive to effective interest rates (interbank market rate and central bank average funding rate) than official interest rates. Interbank rates have the greatest impact on loan rates and monetary transmission. The findings suggest that financial institutions prioritize the central bank's actual actions over official announcements. These insights are relevant for countries facing divergent policy and market rates, particularly in the context of unconventional monetary policies.

In brief, the relationship between policy interest rates and bank interest rates is a key aspect of monetary policy that policymakers must understand to promote economic growth and stability. The studies discussed above have shown that the transmission of monetary policy through interest rates can be complex and depend on a range of factors, including financial structure, market volatility, and macroeconomic conditions. Nonetheless, the policy interest rate set by central banks remains a

critical tool for influencing borrowing and lending rates, and studies have consistently demonstrated a relationship between the central bank's policy rate and commercial bank interest rates.

#### **4.4 Dataset**

The dataset consists of two variables: the Policy Interest Rate (PIR) and the Commercial Credit Interest Rate (CCIR) for Türkiye. The data were obtained from the Electronic Data Delivery System (EVDS) and covers the period from 2011 Q1 to 2022 Q4, with a quarterly frequency. Both variables are expressed in percentage terms.

The PIR is a nominal variable that measures the weighted average of funding costs of the CBRT for the banking system and is designed by the CBRT itself. The data is collected from Electronic Data Delivery System (EVDS). The daily data PIR was converted into quarterly by taking the average method in EVDS (CBRT, 2023b).

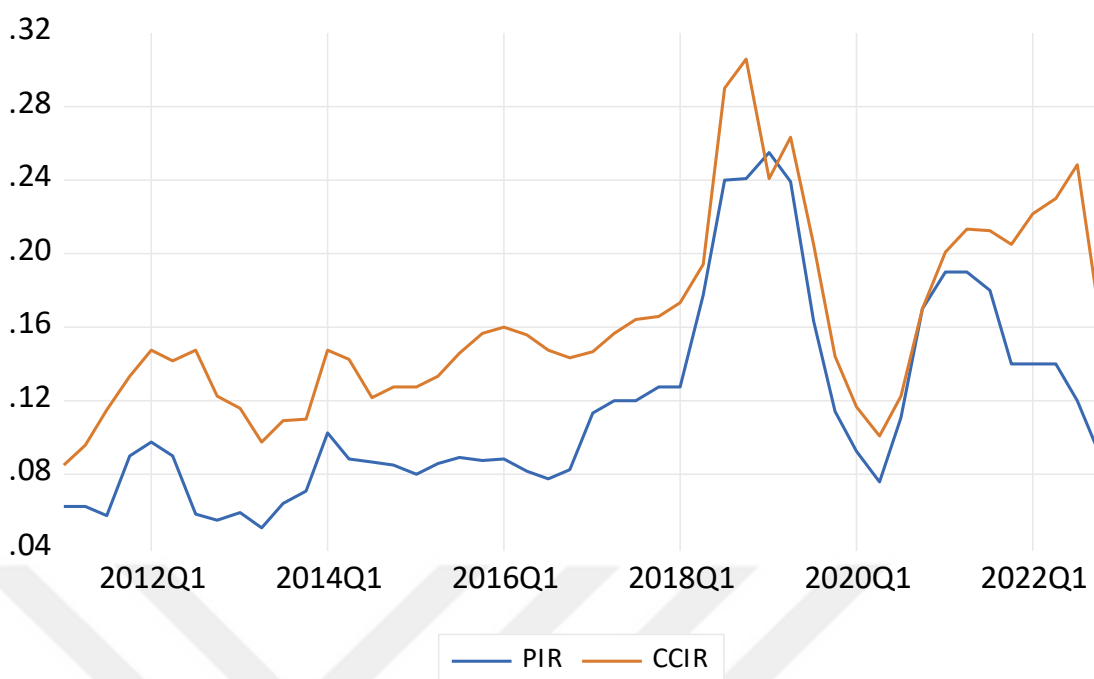
The CCIR is also a nominal variable that measures the weighted average of commercial credit rates of the Turkish banking sector that is issued in Turkish currency and reported by CBRT. The CCIR is weekly data gathered quarterly by taking the average method in EVDS (CBRT, 2023c).

In addition to PIR and CCIR, a dummy variable (Dummy1) is created to capture the effects of crucial policy changes in Türkiye. The dummy variable takes a value of 1 for the periods between the 2019 first quarter and 2021 first quarter, which is when significant policy interventions were made in response to the economic challenges faced by Türkiye during that period.

The PIR and CCIR are important indicators of the monetary policy stance and credit market conditions in Türkiye. The PIR is directly controlled by the CBRT and reflects its policy decisions on interest rates. The CCIR, on the other hand, is influenced by various factors such as the level of economic activity, inflation expectations, and banking sector competition.

In Figure 3, one can observe the correlation between nominal values of policy interest (PIR) and commercial credit (CCIR) interest rates between the periods 2011 and 2022 in Türkiye.

**Figure 3. Time Series Graph of the Variables**



*Source: The graph generated by the author himself.*

The summary statistics of the variables are shown in Table 1 below:

**Table 1. Properties of the Dataset**

| Summary            | Variables |          |
|--------------------|-----------|----------|
|                    | CCIR      | PIR      |
| <b>N</b>           | 48        | 48       |
| <b>Mean</b>        | 0.162283  | 0.115392 |
| <b>Median</b>      | 0.147861  | 0.091550 |
| <b>Max</b>         | 0.305554  | 0.255000 |
| <b>Min</b>         | 0.085392  | 0.051100 |
| <b>Std. Dev.</b>   | 0.050924  | 0.053565 |
| <b>Skewness</b>    | 0.973146  | 1.142223 |
| <b>Kurtosis</b>    | 3.435156  | 3.456804 |
| <b>Jarque-Bera</b> | 7.954828  | 10.85472 |
| <b>Probability</b> | 0.018734  | 0.004395 |

Notes: The descriptive statistics were generated by EViews 12 program.

The summary statistics show that both variables have a positive trend by their means are 0.16 and 0.12, respectively. The variables are non-normally distributed because their Jarque-Bera P values are below the 5% significance level of 0.019 and 0.0044, respectively. The study variables are positively leptokurtic because of their Kurtosis value, which is 3.44 and 3.46, respectively.

## 4.5 Empirical Analysis

In this section, we will perform the econometric tests described in the methodology part above and interpret the outcomes. We divide this section into five parts to analyze test results properly.

### 4.5.1. Unit Root Test Results

The Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) unit root test results are given in Table 2 and Table 3 below indicating that both variables are stationary for a 5% significance level when we look at the P-values which are below 5% where their first difference is whether a trend exists or not.

**Table 2. Augmented Dickey-Fuller Test Results**

| Variables | Trend + Constant |                 |            | Constant |                 |            |
|-----------|------------------|-----------------|------------|----------|-----------------|------------|
|           | P value          | Test statistics | Lag length | P value  | Test statistics | Lag length |
| CCIR(0)   | 0.0770           | -3.312154       | 1          | 0.0527   | -2.903245       | 1          |
| PIR(0)    | 0.0684           | -3.368151       | 1          | 0.0534   | -2.897257       | 1          |
| CCIR(1)   | 0.0028           | -4.640716       | 0          | 0.0004   | -4.681971       | 0          |
| PIR(1)    | 0.0011           | -4.981637       | 3          | 0.0002   | -4.977430       | 3          |

Notes: All lags are automatically selected by the Schwarz information criteria at 5 maximum lag selection via EViews 12 program. The (0) and (1) represent the level and first differences of the variables, respectively. The log prefix means the neutral logarithm of the variable.

**Table 3. Philips-Perron Unit Root Test Results**

| Variables | Trend + Constant |                 |           | Constant |                 |           |
|-----------|------------------|-----------------|-----------|----------|-----------------|-----------|
|           | P value          | Test statistics | Bandwidth | P value  | Test statistics | Bandwidth |
| CCIR(0)   | 0.1876           | -2.850195       | 2         | 0.1113   | -2.547012       | 2         |
| PIR(0)    | 0.5379           | -2.089724       | 1         | 0.2750   | -2.026268       | 1         |
| CCIR(1)   | 0.0028           | -4.640716       | 0         | 0.0004   | -4.681971       | 0         |
| PIR(1)    | 0.0212           | -3.875819       | 0         | 0.0047   | -3.862189       | 0         |

Notes: All bandwidths are automatically selected by the Newey-West information using the Bartlett kernel via EViews 12 program. The (0) and (1) represent levels and first differences of the variables, respectively. The “log” prefix means the neutral logarithm of the variable.

As traditionally, we performed unit root tests above, but if there exist structural breaks in the data, the results can deteriorate. For that reason, we additionally performed breakpoint unit root tests for more robust results depicted in Table 4

below. The results show us CCIR is stationary at the level with a breakpoint in 2019 Q2 and its p-value is 0.01. On the other hand, PIR is stationary at first difference with a structural break in 2019 Q1 and has a p-value of 0.01. To eliminate the breakpoint effects, we add 2019 Q1 and 2019 Q2 dates into our dummy variable.

**Table 4. Breakpoint Unit Root Results**

| Variables | Trend + Constant |                 |             |            |
|-----------|------------------|-----------------|-------------|------------|
|           | P value          | Test statistics | Time Breaks | Lag length |
| CCIR(0)   | 0.01             | -5.462531       | 2019 Q2     | 1          |
| PIR(0)    | 0.1659           | -4.403721       | 2018 Q1     | 3          |
| CCIR(1)   | 0.0404           | -4.929829       | 2019 Q4     | 0          |
| PIR(1)    | 0.01             | -5.979716       | 2019 Q1     | 3          |

Notes: All lags are automatically selected based on F-statistics selection at 5 maximum lags via EViews 12 program. Break specification is based on intercept selected by minimize Dickey-Fuller t-statistics. The (0) and (1) represent the level and first differences of the variables, respectively. The “log” prefix means the neutral logarithm of the variable.

#### 4.5.2. Traditional ARDL Test

In our case, we use the ARDL bounds test to examine the relationship between the commercial credit interest rate and the policy interest rate in Türkiye, as well as the impact of a dummy variable for the period between the 2019 first quarter and 2021 first quarter. Initially, we start with generating the traditional ARDL test.

The traditional ARDL model can be written as:

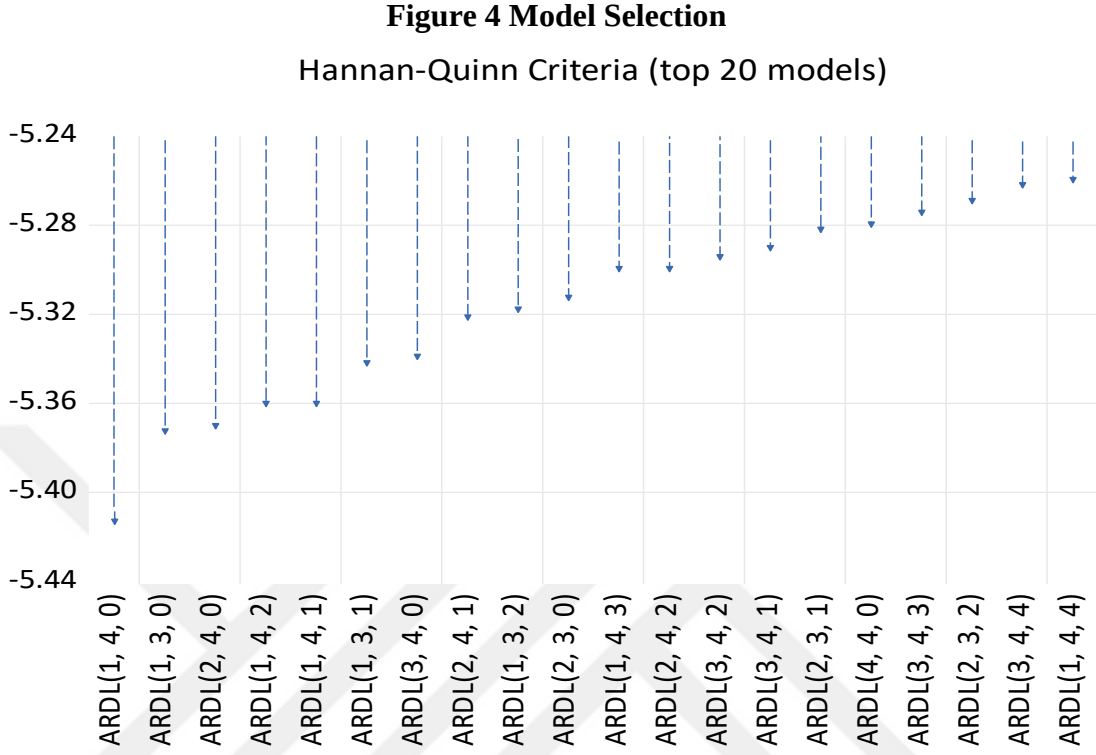
$$CCIR_t = c_0 + \sum_{i=1}^p b_{CCIR,i} CCIR_{t-i} + \sum_{l=0}^q b_{PIR,l} PIR_{t-l} + \sum_{k=0}^r b_{Dummy1,k} Dummy1_{t-k} + \varepsilon_t$$

Where:

- $c_0$  is the constant term and “b” is the coefficient of the lagged variables.
- p, q, and r are the optimal lag length determined by the Hannan-Quinn Information Criterion (HQ).
- $\varepsilon_t$  is the error term.

To set up our traditional ARDL model lag selection was performed by using Hannan-Quinn selection criteria automatically via EViews 12 program at maximum lag 4. For

CCIR 1, PIR 4, and Dummy1 0 lags were selected from the top 20 models below, Figure 4. The model was performed without a trend because of the insignificance of the trend term.



Source: The figure generated by EViews 12 program.

#### 4.5.3. Unrestricted Error Correction Model (UECM)

After conducting the traditional ARDL test, the next step was to estimate the long-run and short-run coefficients of the model. The long-run relationship between the dependent variable (CCIR) and the independent variable (PIR) can be estimated using the ARDL Bounds form. The ARDL bounds form can be written as:

$$\begin{aligned}
 \Delta CCIR_t = & c_0 + \pi_{CCIR} CCIR_{t-1} + PIR_{t-l} + Dummy1_{t-k} + \sum_{i=1}^{p-1} \psi_{CCIR,i} \Delta CCIR_{t-i} \\
 & + \sum_{l=1}^{q-1} \psi_{PIR,l} \Delta PIR_{t-l} + \sum_{k=1}^{r-1} \psi_{Dummy1,k} \Delta Dummy1_{t-k} + \omega_{PIR} \Delta PIR_t \\
 & + \omega_{Dummy1} \Delta Dummy1_t + \varepsilon_t
 \end{aligned}$$

Where:

- $\omega$  is the long-run coefficients of the lagged variables.
- $c_0$  is the constant term and  $\psi$  is the short-run coefficients of the lagged variables.
- $\varepsilon_t$  is the error term. The error term ( $\varepsilon_t$ ) is assumed to be white noise.
- $\Delta$  represents the first difference.

The results of the long-run form of the ARDL bounds test have depicted in Table 5 below. In the long-run terms section, the coefficient for PIR has an estimated value of 1.213286. This suggests that in the long run, a one-point increase in PIR is associated with an increase of 0.01213286 points in the dependent variable, all else being equal. The coefficient for the dummy variable in the long-run terms section (Dummy1) has an estimated value of -0.064594, which indicates that when the dummy variable is equal to 1 in the long run, the dependent variable is expected to be 0.064594 points lower than when the dummy variable is equal to 0.

**Table 5. Unrestricted Error Correction Model (UECM)**

| <b>ARDL (1, 4, 0) Case 3: Unrestricted constant and No trend</b> |                    |                       |                     |                    |
|------------------------------------------------------------------|--------------------|-----------------------|---------------------|--------------------|
| <b>Long-Run terms</b>                                            |                    |                       |                     |                    |
| <b>Variable</b>                                                  | <b>Coefficient</b> | <b>Standard error</b> | <b>t-statistics</b> | <b>Probability</b> |
| PIR                                                              | 1.213286           | 0.105794              | 11.46840            | 0.0000             |
| Dummy1                                                           | -0.064594          | 0.011924              | -5.417232           | 0.0000             |
| EC = CCIR - (1.1723*PIR -0.0676*Dummy1)                          |                    |                       |                     |                    |

Notes: EC refers to the error correction term.

#### 4.5.4. ARDL Bounds Test F Statistics Result

Next, let's move on to the Bounds test. The bounds test examines the existence of a long-run relationship between the dependent and independent variables. In Table 6, the results of the ARDL bounds test are shown. The F statistics (12.45) has been found to be greater than all the upper bound critical levels on the table means that there is a long-run relationship between the dependent (CCIR) and independent (PIR) variables.

**Table 6. Bounds F Test Results**

| <b>Significance</b> | <b>I(0) Lower bound</b> | <b>I(1) Upper bound</b> | <b>F statistics</b> | <b>K</b> |
|---------------------|-------------------------|-------------------------|---------------------|----------|
| Level 10%           | 3.17                    | 4.14                    | 12.44956            | 2        |
| Level 5%            | 3.79                    | 4.85                    |                     |          |
| Level 1%            | 5.15                    | 6.36                    |                     |          |

Notes: "K" denotes the number of variables.

#### 4.5.5. Restricted Error Correction Model (RECM)

Now, let's move on to the ECM model. The short-run relationship between CCIR and PIR can be estimated using the error correction model (ECM) can be represented as follows:

$$\begin{aligned}\Delta CCIR_t = c_0 &+ \sum_{i=1}^{p-1} \psi_{CCIR,i} \Delta CCIR_{t-i} + \sum_{l=1}^{q-1} \psi_{PIR,l} \Delta PIR_{t-l} \\ &+ \sum_{k=1}^{r-1} \psi_{Dummy1,k} \Delta Dummy1_{t-k} + \omega_{PIR} \Delta PIR_t \\ &+ \omega_{Dummy1} \Delta Dummy1_t + \pi_{CCIR} ECT_t + \varepsilon_t\end{aligned}$$

Where:

- $\pi$  is the coefficient of the error correction term (ECT).
- $ECT_t$  represents the error correction term and  $\Delta$  represents the first difference.
- $c_0$  is the constant term and  $\psi$  is the short-run coefficients of the lagged variables.
- $\varepsilon$  is the error term and  $\omega$  is the long-run coefficients of the lagged variables.

The short-run and error correction values are revealed in Table 7 below.

**Table 7. Restricted Error Correction Model (RECM)**

| <b>ARDL (1, 4, 0) Case 3: Restricted constant and No trend</b> |                    |                       |                     |                    |
|----------------------------------------------------------------|--------------------|-----------------------|---------------------|--------------------|
| <b>Variable</b>                                                | <b>Coefficient</b> | <b>Standard error</b> | <b>t-statistics</b> | <b>Probability</b> |
| Constant                                                       | 0.023730           | 0.004267              | 5.560704            | 0.0000             |
| D(PIR)                                                         | 0.591260           | 0.096786              | 6.108947            | 0.0000             |
| D(PIR(-1))                                                     | 0.186830           | 0.125570              | 1.487853            | 0.1455             |
| D(PIR(-2))                                                     | -0.321237          | 0.106977              | -3.002873           | 0.0048             |
| D(PIR(-3))                                                     | -0.226798          | 0.107336              | -2.112968           | 0.0416             |
| CointEq(-1)                                                    | -0.646347          | 0.102941              | -6.278821           | 0.0000             |

Notes: "D" denotes the first difference operator.

The intercept coefficient (Constant) has an estimated value of 0.023730, which means that the dependent variable is expected to be equal to 0.023730 when all other independent variables are equal to 0, and it's meaningful for 0 probability value.

The coefficient for the first difference of PIR (D(PIR)) has an estimated value of 0.591260. This suggests that a one-point increase in the contemporary value of PIR is associated with an increase of 0.00591260 units in the dependent variable, holding all other variables constant. The first lag of PIR is found insignificant where the

probability value (0.1455) is above the 5% significance level. The coefficients for the second and third lags of PIR ( $D(PIR(-2))$ ,  $D(PIR(-3))$ ) are found statistically meaningful which probabilities are 0.0048 and 0.0416 respectively. They both have a negative effect on the dependent variable in that a one-point increase causes 0.00321 and 0.002268 decreases in CCIR, respectively.

The error correction coefficient ( $CointEq(-1)$ ) has an estimated value of -0.646347. This coefficient suggests that in the short run, a one-unit deviation from the long-run equilibrium relationship between the dependent variable and the independent variables is corrected by about 0.646347 units in the next period, all else being equal.

Overall, these coefficients suggest that the first difference of PIR has a positive effect on the dependent variable in the short run, whereas the higher-order differences of PIR have a negative effect on the dependent variable. This can be attributed to expectations on the policy rate affects the commercial credit rates negatively over time. Additionally, the error correction term indicates that there is a tendency for the dependent variable to return to its long-run equilibrium relationship with the independent variables.

#### 4.5.6. Diagnostic Tests Results

Finally, the diagnostic tests are conducted to ensure the validity and reliability of the ARDL bounds test results. These tests include the normality test, the heteroscedasticity test, the autocorrelation test, and the stability test. If the results of these diagnostic tests are satisfactory, then the ARDL bounds test can be considered a robust method for analyzing the relationship between the policy interest rate and the commercial credit interest rate in Türkiye. In Table 8 below, the results of the diagnostics tests are depicted.

**Table 8. Diagnostic Test Results**

| Diagnostic tests. | Kind of statistics                | Lags | Test scores         |
|-------------------|-----------------------------------|------|---------------------|
| B.G. LM test      | Obs. R-squared (Prob. Chi-Square) | 2    | 0.042994 (0.9787)   |
| B.P.G. test       | Obs. R-squared (Prob. Chi-Square) |      | 5.197368 (0.6359)   |
| J.B. test         | Jarque-Bera score (Probability)   |      | 4.212916 (0.121668) |
| Ramsey RESET      | F-statistics (Prob. F-statistics) | 1    | 0.102694 (0.7505)   |

Notes: Values within parenthesis denote p-values.

The B.G. LM test is used to check for the presence of residual autocorrelation. The test statistic has an observed R-squared value of 0.042994 and a p-value of 0.9787.

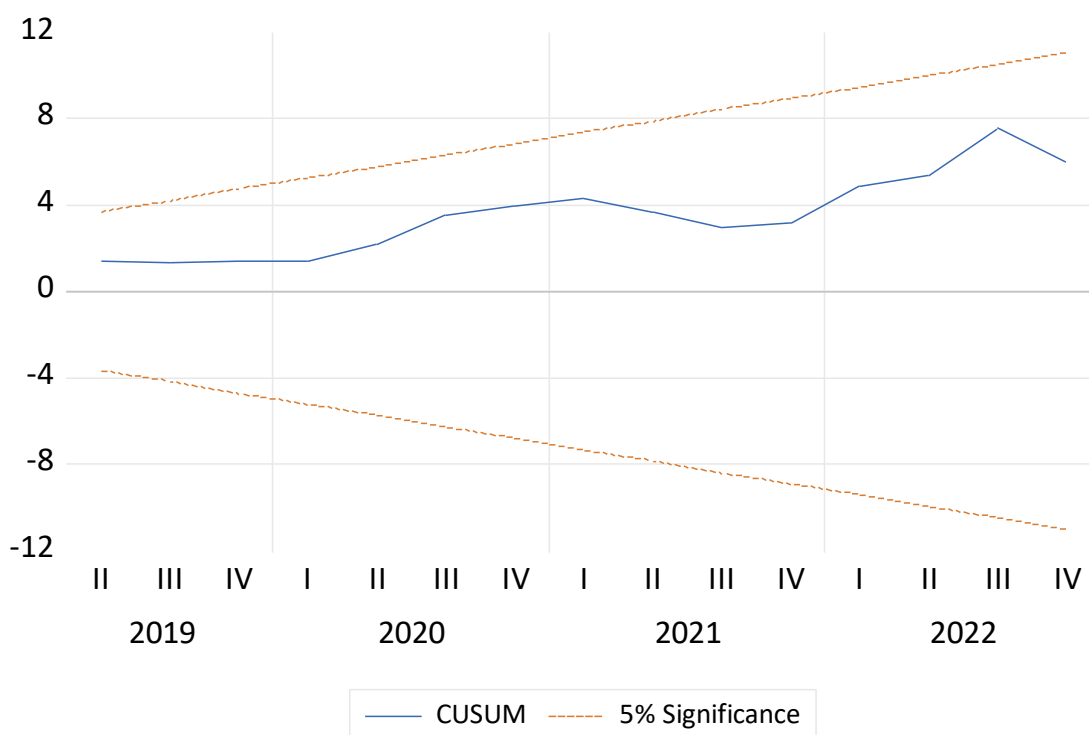
Since the p-value is greater than 0.05, we fail to reject the null hypothesis that there is no residual autocorrelation in the model. This suggests that the residuals are not serially correlated.

The B.P.G. test is another test for residual autocorrelation that is more robust to heteroscedasticity. The observed R-squared value is 5.197368 and the p-value is 0.6359. Since the p-value is greater than 0.05, we fail to reject the null hypothesis of no residual autocorrelation.

The J.B. test is used to test the normality of the residuals. The test statistic has a Jarque-Bera score of 4.212916 and a p-value of 0.121668. Since the p-value is greater than 0.05, we fail to reject the null hypothesis that the residuals are normally distributed. This suggests that the residuals are normally distributed.

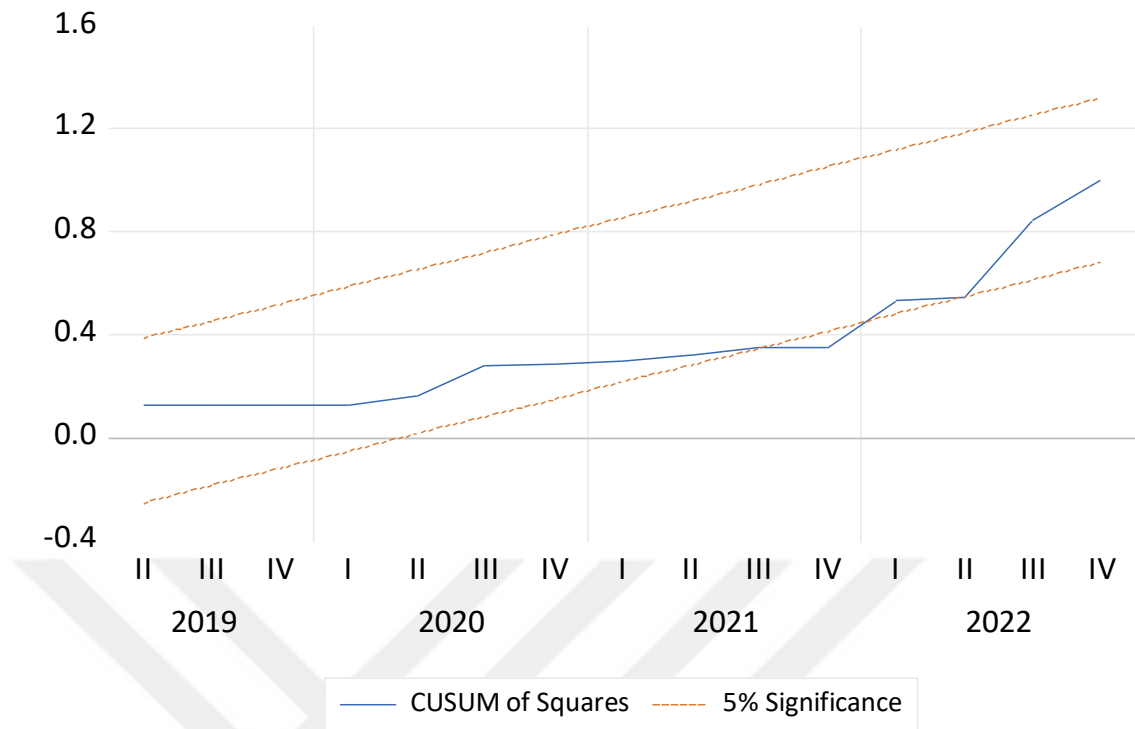
The Ramsey RESET test is used to test for the presence of omitted variable bias. The test statistic has an F-statistic value of 0.102694 and a p-value of 0.7505. Since the p-value is greater than 0.05, we fail to reject the null hypothesis that there is no omitted variable bias in the model. This suggests that the model is not suffering from omitted variable bias.

**Figure 5. CUSUM Graph**



Source: The figure generated by EViews 12 program.

**Figure 6. CUSUM of Squares Graph**



*Source: The figure generated by EViews 12 program.*

The stability diagnostics CUSUM and CUSUM of squares tests are given above in Figure 5 and Figure 6. They exhibit a stable trend between 5% significance level which means that the model has no structural breaks except one break in CUSUM of squares in 2021 Q4 which can be assumed nondetrerrent for the general stability diagnostics.

#### **4.6 Chapter Conclusion**

In conclusion, this study has examined the relationship between policy interest rates set by the Central Bank of the Republic of Türkiye and commercial credit rates offered by banks in the country, using the ARDL bounds model. The results suggest that changes in the policy interest rate have a statistically significant positive association with changes in commercial credit interest rates in both the short run and long run while controlling for other factors. These findings have important implications for policymakers seeking to manage interest rates in a way that supports economic growth and stability in Türkiye.

The use of a dummy variable in the model was particularly helpful in capturing the effect of an exogenous shock or policy change on the relationship between the variables of interest. The diagnostic tests conducted provided further evidence that the model is well-specified, and the residuals do not exhibit any major issues. The overall results of the model demonstrate that it is a reliable tool for analyzing the relationship between policy interest rates and commercial credit interest rates in Türkiye.

The findings of this study are consistent with the literature on the transmission mechanism of monetary policy, which has shown that changes in policy interest rates affect the broader economy through the banking sector. However, this study provides a more specific analysis of the relationship between policy interest rates and commercial credit rates in Türkiye, which has not been extensively studied in the existing literature.

The positive short-run relationship between policy interest rates and commercial credit rates suggests that changes in the policy rate can be transmitted relatively quickly to the banking sector, leading to changes in lending rates for consumers and businesses. Findings show a basepoint increase in PIR leads to a 0.0059126 points increase in CCIR. This has important implications for policymakers who are trying to manage interest rates in a way that supports economic growth and stability. For example, if the goal is to stimulate economic activity by lowering interest rates, policymakers may need to take steps to ensure that these changes are passed on to consumers and businesses through lower lending rates.

The negative effect of previous periods of the policy interest rate indicates that changes in policy rates can have diminishing effects over time, as expectations about future interest rates become more inflexibly entrenched in the market. The results indicate that a basepoint rise in the second lag of PIR causes CCIR to decrease by 0.003212 points and the third lag of PIR affects 0.002268 points decrease in CCIR. This suggests that policymakers may need to take a more nuanced approach to managing interest rates, considering not only the short-term impact of changes in the policy rate but also their potential longer-term effects on expectations.

In the long run, the results suggest that changes in the policy interest rate have a significant impact on commercial credit interest rates, with a one-point increase in

the policy interest rate associated with an increase of 0.01213286 points in the dependent variable, all else being equal.

The coefficient for the dummy variable in the long-run terms section suggests that when the dummy variable is equal to 1 in the long run, the dependent variable is expected to be 0.064594 points lower than when the dummy variable is equal to 0. We can infer that when any reason such as policy implications including their structural breaks causes a narrow gap between these two different interest rates, the commercial credit interest rates tend to be lower than they would be.

The error correction coefficient suggests that there is a tendency for the dependent variable to return to its long-run equilibrium relationship with the independent variables, indicating that changes in commercial credit rates will eventually adjust to changes in policy rates at the rate of 64.63%. This can help to provide stability in the credit markets and ensure that lending rates remain aligned with broader economic conditions.

Overall, the results of this study provide important insights into the dynamics of the Turkish economy and the transmission mechanism of monetary policy in the country. They suggest that changes in policy interest rates can have significant effects on commercial credit rates in the short run, but that these effects may diminish over time. Policymakers and other stakeholders can use this information to make more informed decisions about interest rate policy and to ensure that lending rates remain aligned with broader economic conditions in Türkiye. Further research could build on these findings by examining the relationship between interest rates and other economic variables, such as inflation and exchange rates, to gain a more complete understanding of the factors driving the Turkish economy.

## **5. THE DETERMINANTS OF CREDIT VOLUME OF SMEs IN TÜRKİYE**

### **5.1 Introduction**

Small and medium-sized enterprises (SMEs) play a crucial role in the economic development of many countries around the world, including Türkiye. These businesses are often the engine of job creation, innovation, and export growth, and they contribute significantly to GDP. However, SMEs often face numerous challenges when it comes to accessing financing, which can hinder their growth and development.

The high cost of borrowing for SMEs in Türkiye is primarily due to the country's macroeconomic environment, which has been characterized by high inflation and a volatile exchange rate. These factors have led to high real interest rates, making it difficult for businesses to access affordable financing. Additionally, the traditional banking sector in Türkiye has been reluctant to lend to SMEs, preferring instead to focus on larger, more established firms.

Given the critical role that SMEs play in the Turkish economy, it is essential to understand the factors that influence the cost of borrowing for these businesses. In this section of the thesis, we examine the relationship between the credit amount granted to SMEs and the real interest rate in Türkiye using the autoregressive distributed lag (ARDL) bounds testing approach. By analyzing quarterly data from 2011 to 2022, we aim to provide insights into how changes in real interest rates and other determinants impact the availability of credit for SMEs in Türkiye.

The findings from this study will have significant implications for policymakers, lending institutions, and SMEs themselves. By identifying the key drivers of SME lending rates, policymakers can implement measures to reduce borrowing costs and increase access to finance for these businesses. Lending institutions can also use these findings to develop targeted lending strategies for SMEs, while SMEs can use the insights gained from this study to better understand the financing landscape and make informed decisions about their borrowing options.

## **5.2 An Overview of Türkiye's Small and Medium Size Enterprises**

Small and Medium-sized Enterprises (SMEs) in Türkiye are a crucial part of the economy, driving job creation, innovation, and economic growth. These businesses, classified as micro-enterprises, small enterprises, and medium-sized enterprises, operate across various sectors and often have a close connection to their local communities. Over the past decades, the Turkish government has implemented various policy measures to support their development and contribute to sustainable economic progress., including offering tax incentives, providing access to finance, and improving business regulations. These efforts have contributed to a significant increase in the number of SMEs in the country and have also led to an expansion in the lending activities of Turkish banks especially after the 2008 crisis.

Despite this growth, there are still significant challenges facing SMEs in Türkiye, particularly when it comes to accessing credit. Many smaller firms lack the collateral and credit history required to secure bank loans, while others are discouraged by high-interest rates and complex application processes. To address these challenges, Turkish banks have developed a range of financing products specifically designed for SMEs. These include overdraft facilities, working capital loans, asset-based lending, and factoring and invoice discounting services. Many banks also offer specialist advice and support to help SMEs manage their finances and grow their businesses.

Some institutions support SMEs to increase their capabilities. One of the key initiatives is the Credit Guarantee Fund (KGF), which was established in 1991 to increase access to finance for SMEs. The KGF provides guarantees for loans made by partner banks to SMEs, reducing the risk for lenders and enabling SMEs to access credit on more favorable terms. Another important program is the Small and Medium-Sized Industry Development Organization (KOSGEB), which provides a range of support services for SMEs, including financing, training, and consultancy. KOSGEB offers low-interest loans to SMEs, as well as grants for innovation and R&D projects. The other institutions we can consider are the Ministry of Treasury and Finance, The Unions of Chambers and Commodity Exchanges of Türkiye (TOBB), and the Confederation of Turkish Tradesmen and Craftsmen (TESK)

The Turkish government has implemented various initiatives to support small and medium-sized enterprises (SMEs) over the past two decades. Following the global

financial crisis in 2008, the Central Bank of the Republic of Türkiye (CBRT) introduced measures to encourage lending to SMEs by lowering policy interest rates to around 18% and providing liquidity support to banks. With the Council of Ministers' decision, the private banks were included in KOSGEB credit support channels and the credit cap rose to 300.000 TL (Cansız, 2008).

In 2009, the government changed the law of the establishment of the Support Program for Small-Scale Enterprises (KOSGEB), which includes various measures such as interest-free loans, grants, training, loan guarantees, and interest rate subsidies for SMEs as the main target and granted 222 million TL credit in total to SMEs in that year (KOSGEB, 2009, 2022b). The share of value in production and contribution to employment was relatively high in this period around 45% and 75% respectively.

The CBRT implemented the Reserve Option Mechanism (ROM) to increase the supply of credit in foreign currency in end-2011, which could benefit SMEs engaged in export-oriented activities (CBRT, 2012). In the study of Altuntaş (2019), it is shown that the ROM positively affects the operating loans of banks when ROM increases by 1% the operating loans rise by 1.2061% in Türkiye between the years 2011 and 2019. The real credit use of SMEs in 2011 rose from 187 billion TL to 213 billion TL and the share of credits rose to 34% by the end of the year.

The government launched the Credit Guarantee Fund for Women Entrepreneurs in 2014 to support women-owned SMEs and 48,866,158 TL financed as new entrepreneurs (Credit Guarantee Fund, 2023).

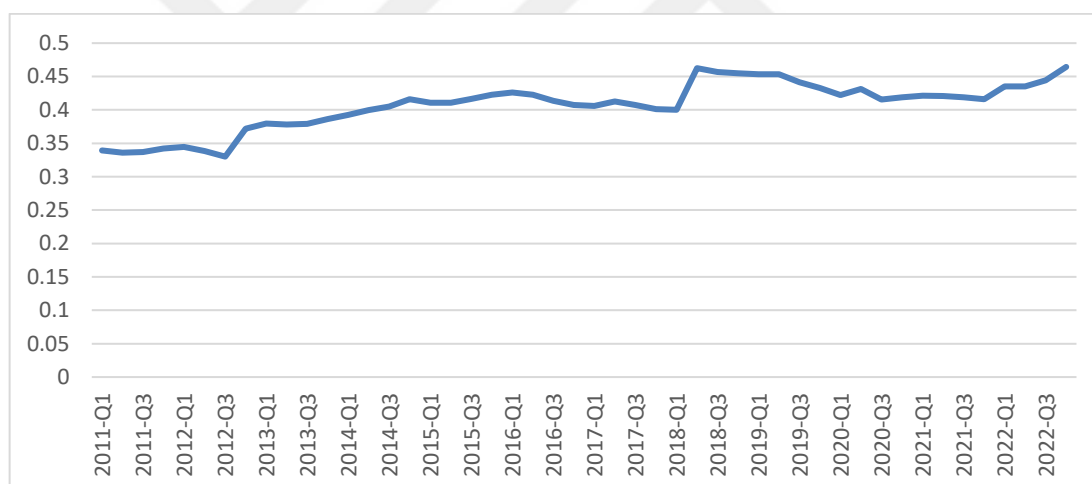
With the signature of the Secretariat of Treasury in March 2017, the Credit Guarantee Fund improved the access of Export-Oriented SMEs by 12 million TL to credit for support focusing on exports (Credit Guarantee Fund, 2017).

In 2018, the CBRT introduced the one-week repo rate as its main monetary policy tool and increased required reserve ratios to limit excessive credit growth (CBRT, 2023f). In the second quarter of 2018, the real credit use of SMEs rose to 521 billion TL from 450 billion but in the next periods, it goes down to around 440 billion TL depicted in Figure 10, and the credit share in bank balance sheets sharply rose from 40% to 46% in the first quarter.

In response to the economic downturn caused by the COVID-19 pandemic, the CBRT implemented measures to support credit growth, including reducing policy interest rates and increasing liquidity support facilities. As of June 2021, TOBB and KGF launched a program called “Can Suyu” which means “the water of life”. It was aimed to supply SMEs affected by COVID-19 which is a member of the chamber with credit support of up to 10 million TL (Credit Guarantee Fund, 2021).

In 2021, the government announced the Microcredit Support Program to provide financing to micro-enterprises and self-employed individuals. However, the ongoing political and economic uncertainties in the country, including a weakening Turkish lira, rising inflation, and high-interest rates, have created a challenging environment for SMEs (KOSGEB, 2022a). But the support program was conducted periodically and also in 2022. In the first quarter of 2022, the credit share of SMEs began to rise and it reached again around 46% at the end of 2022.

**Figure 7. Share of SMEs in Bank Credits**



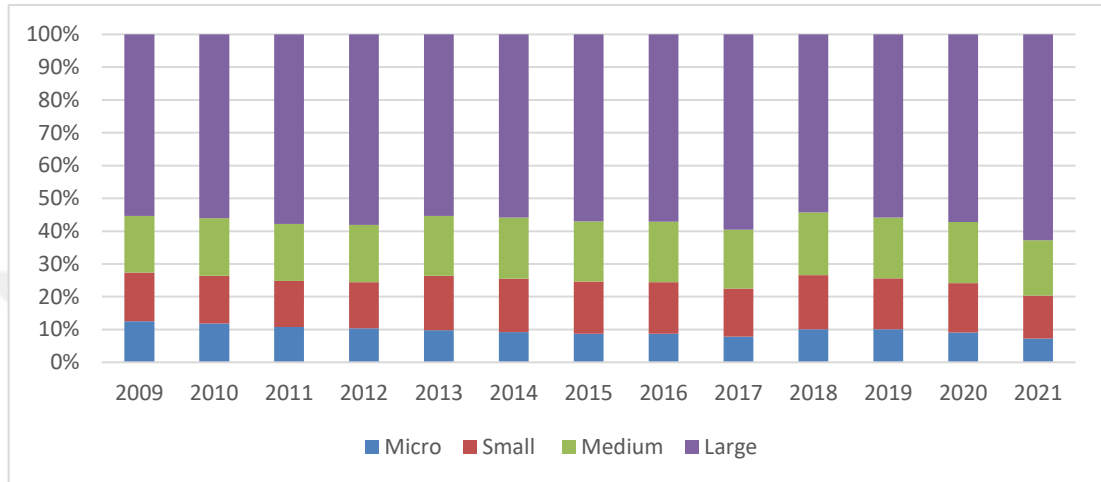
*Source: The graph was generated by the author himself from the dataset.*

Figure 7 illustrates the credit shares of the SMEs in banking sector. With many subsidies granted by the government and institutions, the credit share of the SMEs impose an increasing trend over the years. But their credit accessibility is still a big obstacle despite many incentives. In 2011, their credit share was around 35% and in 2022 it increased to around 45% which can be related to an increase in their number and supply programs throughout bank lending channels.

SMEs are very important for the country's economic growth, especially for developing countries. They engage in a very big part of the production and grant

economic growth. In Figure 8, the production value shares of the SMEs are shown for Türkiye. For the periods, the SMEs contributed to general production between 40% and 50%. This makes SMEs very important for Türkiye when considering economic growth. With high inflation rates in recent years, we can see their share in production exhibits a decreasing trend.

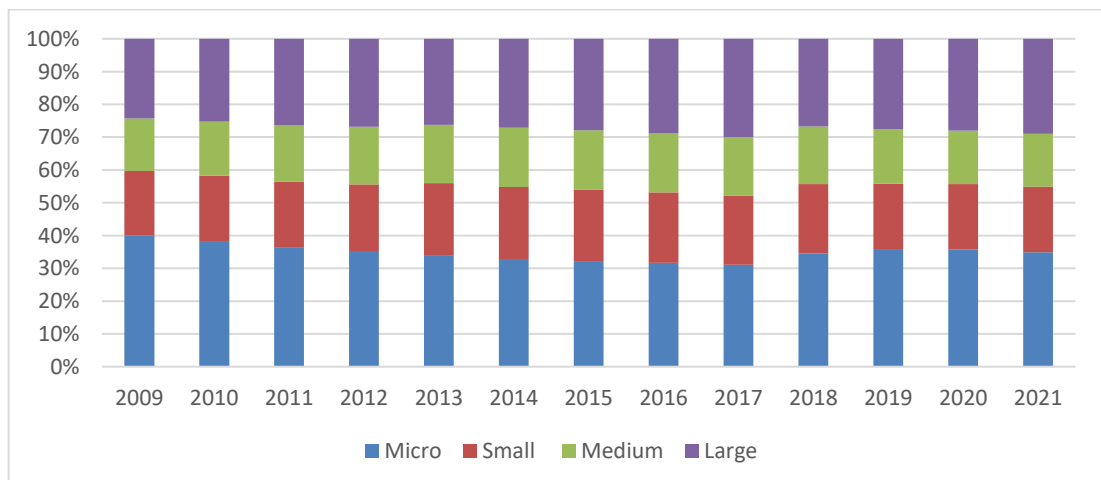
**Figure 8. Share of SMEs in the Value of Production**



*Source: The graph was generated by the author himself (TUIK, 2022b).*

One of the other contributions of SMEs to a country's economy is the employment rate. Figure 9 shows shares of the firms in total employment by their sizes in Türkiye. The SMEs have a huge share in the total employment over the years around 70% which is remarkable for economic development.

**Figure 9. Contribution of SMEs to Employment**



*Source: The graph was generated by the author himself (TUIK, 2022a).*

Overall, the growth of SMEs and the lending activities of Turkish banks have had a significant impact on the country's economy, contributing to job creation, innovation, and social mobility. However, there is still much work to be done to ensure that SMEs have access to the finance they need to thrive and that the lending practices of banks are sustainable and responsible.

### **5.3 Empirical Literature**

The relationship between interest rates and credit supply has been a topic of extensive research in the field of finance and economics. In particular, the impact of interest rates on the credit supply to small and medium-sized enterprises (SMEs) has attracted significant attention from researchers and policymakers. However, few studies have specifically analyzed the relationship between real commercial interest rates and real credit supply to SMEs in Türkiye. Therefore, this study aims to fill this gap in the literature by analyzing the impact of real commercial credit interest rates and other influencers on real credit supply to SMEs in Türkiye, using quarterly data from 2011Q1 to 2022Q4.

Small and medium-sized enterprises (SMEs) are crucial drivers of economic growth and job creation in many countries. Access to credit is critical for SMEs to invest in new equipment, technology, and infrastructure and expand their operations. However, access to credit remains a significant challenge for many SMEs, particularly in emerging markets where credit information and collateral requirements are not well established (Ayyagari et al., 2007).

Commercial credit is one of the primary sources of financing for SMEs, but the availability and terms of commercial credit can vary significantly across different countries and regions. Beck et al. (2006) found that SMEs in low- and middle-income countries have lower access to commercial credit than firms in high-income countries. They also found that SMEs in low-income countries pay higher interest rates on their loans than larger firms, which can lead to a higher cost of capital and reduce their competitiveness.

Several factors influence the availability and terms of commercial credit for SMEs. One of the primary factors is the macroeconomic environment. A stable macroeconomic environment with low inflation, low-interest rates, and a well-

functioning financial sector is positively associated with SME credit availability. In contrast, high inflation and interest rates, volatile exchange rates, and political instability can reduce the availability of credit and increase its cost for SMEs (Beck & Demirguc-Kunt, 2006).

The legal and regulatory framework is another critical factor in SME credit availability. A well-functioning legal system that protects property rights, enforces contracts, and provides a clear regulatory framework for financial institutions can improve SME credit access (Klapper et al., 2006). However, weak legal and regulatory frameworks can create significant barriers to SME credit access and increase transaction costs for both SMEs and financial institutions.

Balogun et al. (2016) claim that the lack of financial resources limits the participation of Small and Medium-sized Enterprises (SMEs) in the South African construction sector. The study looks at how business characteristics affect how easy it is for SMEs in the sector to acquire finance. Logistic regression was employed to examine the impact of demographic factors on credit accessibility after a survey of 179 construction SMEs. According to the findings, the traits of a company affect its ability to obtain financial resources. The study suggests that small and medium-sized enterprise owners should uphold favorable characteristics of their firms to encourage lenders to provide funding for their investments.

Other factors that influence SME credit availability include the level of competition in the financial sector, the availability of credit information, and the level of financial literacy among SMEs (Berger & Udell, 2006).

Amonoo et al. (2003) defined interest rate as the fee paid by the borrower to the lender for the use of capital. This fee has significant implications for businesses in three main ways. Firstly, when interest rates rise, the cost of credit increases for customers, causing a decrease in demand for products and services. Secondly, businesses often rely on borrowing to fund their daily transactions, leading to increased prices or decreased profits for managers. Finally, interest rates affect a company's ability to expand, as borrowing costs impact the decision to finance new equipment. During periods of fluctuating interest rates, there is a shift in the demand and supply of loanable funds. Demand increases when businesses seek credit for

expansion, leading to higher interest rates. Conversely, demand falls when expansion is complete, or sales decline.

Sheng (2021) investigated the effects of financial technology (fintech) on banks' capacity to lend to medium-sized enterprises (SMEs). The study demonstrates that fintech plays an effective role in boosting the amount of credit that the banking industry provides to SMEs by evaluating loan data from Chinese regions between 2011 and 2018. The study also looks at how the size of the bank may affect the influence of fintech. According to the data, larger banks than small banks are more significantly impacted by fintech on the availability of loans to SMEs. As a result, concentrating on fintech use rather than increasing the number of small banks may be more advantageous.

As shown by Wilcox & Yasuda (2019), their model defined the scenarios in which loan guarantee programs might either complement or substitute non-guaranteed loans. They also demonstrated how guaranteed loans typically gave banks more incentive to take risks. They found that non-guaranteed loans typically serve as complements rather than substitutes when banks have less initial guaranteed loans. The study demonstrated that loan guarantees could have "high-powered" effects by increasing non-guaranteed loans multiplied with an effect. The model's predictions regarding how guaranteed and unguaranteed loans relate to one another were supported by empirical estimates. Furthermore, the authors discovered that loan guarantees were "high-powered" and had significantly increased total lending in addition to the additional guaranteed loans.

In conclusion, access to credit is critical for SMEs to grow and expand their operations, but access to credit remains a significant challenge for many SMEs, particularly in emerging markets. Commercial credit is one of the primary sources of financing for SMEs, but the availability and terms of credit are influenced by a range of factors, including the macroeconomic environment, the legal and regulatory framework, the size and age of the SME, and the level of competition and financial literacy. Addressing these factors can help improve SME credit access and support their growth and development.

## 5.4 Dataset

Our dataset includes quarterly data from the periods between 2011 Q1 and 2022 Q4 for RTCsme, RCCIR, CRsme, NNsme, and RTIsme.

The RTCsme is the dependent variable and represents the real credit amount issued by the banks for the Turkish currency of micro, small, and medium size enterprises in Türkiye. The data was collected from Banking Regulation and Supervision Agency (BDDK) as monthly data that is total nominal loans of SMEs (total of cash, non-performing and non-cash issued in Turkish currency by domestic banks) and converted into quarterly data by taking the end of the period method for all quarters (Banking Regulation and Supervision Agency, 2023c). Then it was converted into real terms by using Türkiye's GDP deflator obtained quarterly from FRED (OECD, 2023b). The data is used in levels rather than millions amount.

RCCIR is one of the independent variables and represents the real commercial credit interest rate in Türkiye. It was generated by subtracting the inflation in producer prices from the CCIR which we used in the first study. The inflation was gathered quarterly from FRED as an annual percentage change from the same quarter of the domestic producer price index for 2015 (OECD, 2023a).

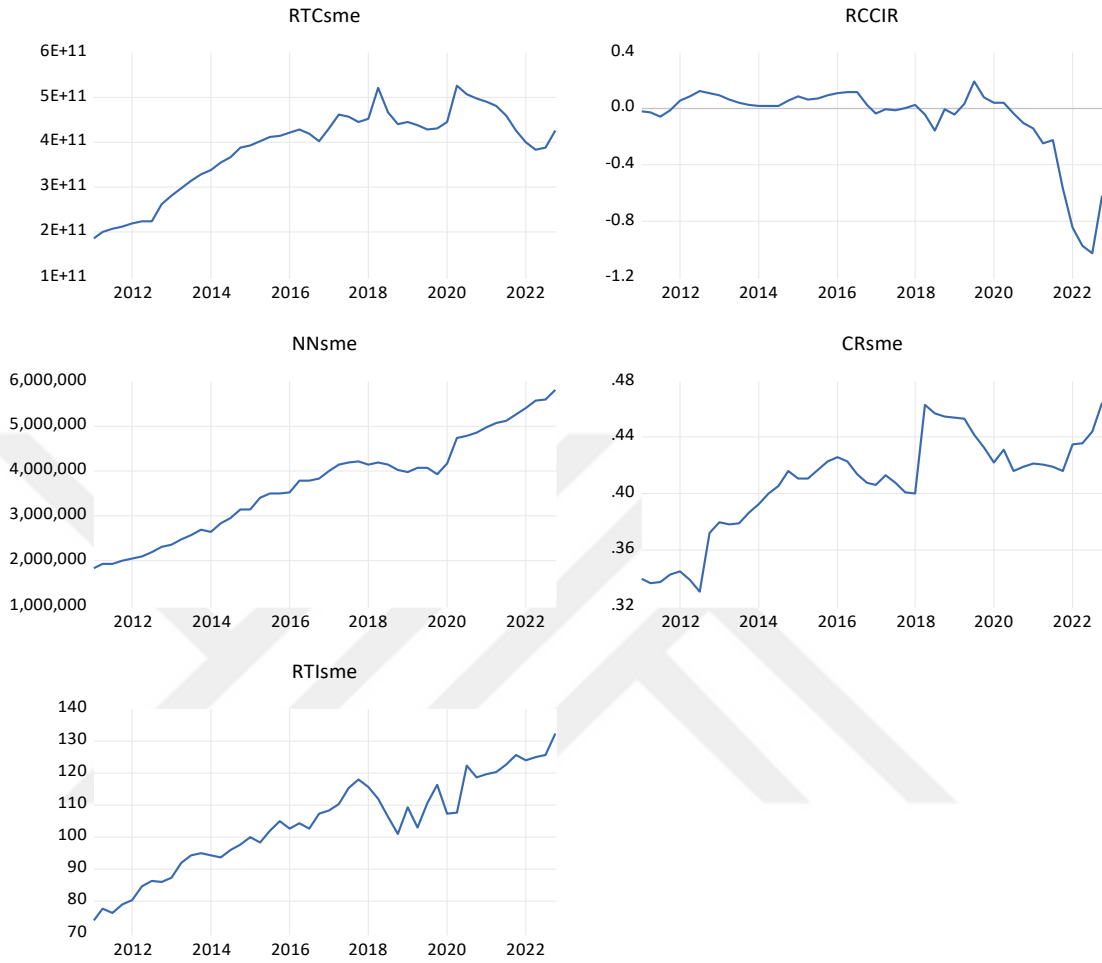
CRsme is another independent variable and represents the credit ratio of SMEs to the total credit issued in the economy for Turkish currency. It was generated by dividing the total nominal credit amount of the SMEs sector used for RTCsme and the total nominal credit amount issued by banks in Turkish currency, which were obtained as monthly data from BDDK and then converted to quarterly at the end of the period method (Banking Regulation and Supervision Agency, 2023a). Throughout this variable, we want to measure the effects of government support to SMEs via banks.

NNsme is the independent variable and represents the net number of SMEs in Türkiye. It was obtained as monthly data from BDDK and then converted to quarterly (Banking Regulation and Supervision Agency, 2023c).

The real turnover index of all sectors of production denoted as RTIsme was obtained as monthly data from the Turkish Statistical Institute (TUIK) and was converted into real terms using the PPI we used before (TUIK, 2023f). Because of the unavailability of the real amount of data, we will use the change in the index. Both data are indexed for 2015 so being 100 index of turnover was not deteriorated by converting into real

terms by using PPI. We will consider this variable as aggregate demand for all sectors.

**Figure 10. Time Series Graphs of the Variables**



*Source: The graph generated by the author himself.*

Figure 10 illustrates the trend of all variables. The real credit supply for small and medium-sized enterprises (SMEs) has increased steadily over the years, beginning at 187.4 billion TL, and reaching 524.4 billion TL in 2020, after which it decreased until mid-2022. The real commercial credit interest rates have remained near zero, with a slight decline from 0.04 to -1.03 between the third quarter of 2020 and mid-2022. The net number of small and medium-sized enterprises has also shown a positive trend, except for a breakdown between 2018 and the end of 2020, reaching 5,792,447 by the end of 2022. The credit spread of SMEs has shown a volatile positive trend, with sharp increases in the credit ratio after 2012 and 2018. The share of SMEs' credit amount over the whole credit has increased from 0.34 to 0.46

between 2011 and 2022. The real turnover index of all sectors has also displayed a positive trend, except for a breakdown around 2018. The indices start at 74 and end at 132.

The summary statistics are shown in Table 9 below. The table presents descriptive statistics for a dataset consisting of 48 observations and five variables, including logRTC<sub>sme</sub>, RCCIR, logNN<sub>sme</sub>, CR<sub>sme</sub>, and RTI<sub>sme</sub>. The mean values of the variables are 26.65 (logRTC<sub>sme</sub>), -0.07 (RCCIR), 15.07 (logNN<sub>sme</sub>), 0.41 (CR<sub>sme</sub>), and 4.63 (RTI<sub>sme</sub>). The skewness values suggest that the distributions of logRTC<sub>sme</sub>, logNN<sub>sme</sub>, CR<sub>sme</sub>, and RTI<sub>sme</sub> are slightly skewed to the left, while RCCIR is highly skewed to the left. Based on these results, we can conclude that logRTC<sub>sme</sub>, logNN<sub>sme</sub>, CR<sub>sme</sub>, and RTI<sub>sme</sub> variables have p-values greater than 0.05, indicating that their distributions are not significantly different from normal at the 5% level of significance. However, the RCCIR has a p-value of 0.000, indicating that its distribution significantly deviates from normality and the p-value for logRTC<sub>sme</sub> is 0.005, which is less than the standard level of significance of 0.05, indicating that its distribution also significantly deviates from normality. Overall, these descriptive statistics provide important insights into the characteristics of the dataset and could inform further analysis or modeling.

**Table 9. Properties of the Dataset**

| Summary            | Variables             |           |                      |                   |                    |
|--------------------|-----------------------|-----------|----------------------|-------------------|--------------------|
|                    | logRTC <sub>sme</sub> | RCCIR     | logNN <sub>sme</sub> | CR <sub>sme</sub> | RTI <sub>sme</sub> |
| <b>N</b>           | 48                    | 48        | 48                   | 48                | 48                 |
| <b>Mean</b>        | 26.64534              | -0.071396 | 15.07025             | 0.406959          | 4.634521           |
| <b>Median</b>      | 26.75695              | 0.018872  | 15.17286             | 0.414486          | 4.651637           |
| <b>Max</b>         | 26.98553              | 0.191016  | 15.57207             | 0.464380          | 4.883710           |
| <b>Min</b>         | 25.95670              | -1.028794 | 14.42115             | 0.330059          | 4.307468           |
| <b>Std. Dev.</b>   | 0.280475              | 0.274197  | 0.327583             | 0.035919          | 0.146890           |
| <b>Skewness</b>    | -1.142645             | -2.381912 | -0.462910            | -0.659876         | -0.477698          |
| <b>Kurtosis</b>    | 3.113850              | 7.822639  | 2.104679             | 2.743289          | 2.447028           |
| <b>Jarque-Bera</b> | 10.47103              | 91.90372  | 3.317488             | 3.615295          | 2.437118           |
| <b>Probability</b> | 0.005324              | 0.000000  | 0.190378             | 0.164040          | 0.295656           |

Notes: The “log” prefix means the neutral logarithm of the variable.

## 5.5 Empirical Analysis

This study employs the ARDL Bounds Testing approach to examine the long-run relationship between the real credit amount of SMEs and its determinants. The

independent variables used in this analysis are the net number of SMEs, real commercial credit interest rate, credit ratio of SMEs to total, and real turnover index of all sectors. The ARDL Bounds Testing approach involves the following steps.

### 5.5.1. Unit Root Test Results

To check the stationarity of the variables we used the Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) unit root tests. Table 10 and Table 11 present the results of the ADF and PP test results variables, under two different specifications: Trend + Constant and Constant only. The tables display the variables being tested, their respective p-values, test statistics, and bandwidths for both specifications. Additionally, it indicates whether the variables are tested at levels (0) or first differences (1). If any variable is found to be non-stationary, the first difference is taken to achieve stationarity.

Table 10 shows the results of the augmented Dickey-Fuller (ADF) test for all variables with both trend and constant, and constant only. For the variables with trend and constant, all of them have p-values greater than 0.05, indicating that we fail to reject the null hypothesis that the variables have a unit root and are non-stationary. However, for the constant-only case, the logRTC<sub>sme</sub> in levels, the variable has a p-value of 0.0331, which is less than 0.05, indicating that we can reject the null hypothesis and conclude that the variable is stationary. For all variables, when considering the first differences (represented by (1)), all have p-values less than 0.05, indicating that we can reject the null hypothesis and conclude that the variables are stationary in the first differences.

Interpreting the results in Table 11, for the variables tested at levels (0), logRTC<sub>sme</sub>, RCCIR, logNN<sub>sme</sub>, and CR<sub>sme</sub> all have p-values greater than 0.05 for both specifications. This suggests insufficient evidence to reject the null hypothesis of a unit root, indicating that these variables are likely non-stationary. However, logRTI<sub>sme</sub> shows a p-value less than 0.05 for the Constant specification, indicating evidence to reject the null hypothesis. Therefore, logRTI<sub>sme</sub> may be non-stationary when considering the Constant specification. For the variables tested with the first differences (1), all variables have a p-value of 0.000, suggesting strong evidence to reject the null hypothesis of a unit root. Therefore, these variables are stationary when considering the first differences.

We also conducted a breakpoint unit root test for a better estimation of the stationarity of the variables. The results of break dates and p-values are shown in Table 12. A dummy variable was put into the model to eliminate the effects of structural breaks in the model as 2018 Q2 for logRTIsme, 2012 Q3 for logRTC sme, 2021 Q3 for RCCIR, 2012 Q4 for logNNsme, 2018 Q2 for CRsme.

**Table 10. Augmented Dickey-Fuller Test Results**

| Variables     | Trend + Constant |                 |            | Constant |                 |            |
|---------------|------------------|-----------------|------------|----------|-----------------|------------|
|               | P value          | Test statistics | Lag length | P value  | Test statistics | Lag length |
| logRTC sme(0) | 0.8456           | -1.408618       | 0          | 0.0331   | -3.102841       | 0          |
| RCCIR(0)      | 0.9310           | -1.015866       | 4          | 0.3001   | -1.966683       | 1          |
| logNNsme(0)   | 0.7365           | -1.697917       | 0          | 0.4460   | -1.657193       | 0          |
| CRsme(0)      | 0.4437           | -2.265632       | 0          | 0.5355   | -1.478774       | 0          |
| logRTIsme(0)  | 0.1020           | -3.174579       | 0          | 0.5071   | -1.535544       | 0          |
| logRTC sme(1) | 0.0001           | -5.968782       | 0          | 0.0000   | -5.403202       | 0          |
| RCCIR(1)      | 0.0011           | -4.998859       | 3          | 0.0002   | -4.969936       | 3          |
| logNNsme(1)   | 0.0000           | -6.483237       | 0          | 0.0000   | -6.426016       | 0          |
| CRsme(1)      | 0.0000           | -6.824514       | 0          | 0.0000   | -6.888617       | 0          |
| logRTIsme(1)  | 0.0000           | -8.196076       | 0          | 0.0000   | -8.267693       | 0          |

Notes: All lags are automatically selected by the Schwarz information criteria at 5 maximum lag selection via EViews 12 program. The (0) and (1) represent the level and first differences of the variables, respectively. The “log” prefix means the neutral logarithm of the variable.

**Table 11. Philips-Perron Unit Root Test Results**

| Variables     | Trend + Constant |                 |           | Constant |                 |           |
|---------------|------------------|-----------------|-----------|----------|-----------------|-----------|
|               | P value          | Test statistics | Bandwidth | P value  | Test statistics | Bandwidth |
| logRTC sme(0) | 0.853            | -1.38533        | 3         | 0.037    | -3.0605         | 2         |
| RCCIR(0)      | 0.74             | -1.69037        | 1         | 0.793    | -0.85762        | 2         |
| logNNsme(0)   | 0.728            | -1.71595        | 1         | 0.446    | -1.6572         | 0         |
| CRsme(0)      | 0.444            | -2.26563        | 0         | 0.577    | -1.39413        | 3         |
| logRTIsme(0)  | 0.131            | -3.04793        | 2         | 0.510    | -1.52921        | 2         |
| logRTC sme(1) | 0.000            | -5.85674        | 6         | 0.000    | -5.40768        | 1         |
| RCCIR(1)      | 0.020            | -3.89236        | 1         | 0.003    | -3.97058        | 0         |
| logNNsme(1)   | 0.000            | -6.48699        | 1         | 0.000    | -6.42990        | 1         |
| CRsme(1)      | 0.000            | -6.83879        | 3         | 0.000    | -6.90493        | 3         |
| logRTIsme(1)  | 0.000            | -8.52204        | 3         | 0.000    | -8.52011        | 2         |

Notes: All bandwidths are automatically selected by the Newey-West information using the Bartlett kernel via EViews 12 program. The (0) and (1) represent levels and first differences of the variables, respectively. The “log” prefix means the neutral logarithm of the variable.

**Table 12. Breakpoint Unit Root Results**

| Variables                 | Trend + Constant |                 |             |            |
|---------------------------|------------------|-----------------|-------------|------------|
|                           | P value          | Test statistics | Time Breaks | Lag length |
| logRTCsm <sub>e</sub> (0) | 0.8590           | -3.160468       | 2012 Q3     | 0          |
| RCCIR(0)                  | 0.01             | -9.209604       | 2021 Q3     | 3          |
| logNNsm <sub>e</sub> (0)  | 0.5935           | -3.655750       | 2017 Q4     | 5          |
| CRsm <sub>e</sub> (0)     | 0.4959           | -3.806916       | 2012 Q3     | 0          |
| logRTIsme(0)              | 0.01             | -6.404588       | 2018 Q2     | 0          |
| logRTCsm <sub>e</sub> (1) | 0.01             | -6.077885       | 2012 Q3     | 0          |
| RCCIR(1)                  | 0.01             | -6.538248       | 2020 Q3     | 3          |
| logNNsm <sub>e</sub> (1)  | 0.01             | -6.449400       | 2012 Q4     | 0          |
| CRsm <sub>e</sub> (1)     | 0.01             | -8.873175       | 2018 Q2     | 0          |
| logRTIsme(1)              | 0.01             | -8.120667       | 2020 Q1     | 0          |

Notes: All lags are automatically selected based on F-statistics selection at 5 maximum lags via EViews 12 program. Break specification is based on the intercept selected by minimize Dickey-Fuller t-statistics. The (0) and (1) represent the level and first differences of the variables, respectively. The “log” prefix means the neutral logarithm of the variable.

### 5.5.2. Traditional ARDL Test

First, we start with generating the traditional ARDL test to begin the ARDL bounds test. The traditional ARDL model can be written as:

$$\begin{aligned}
 \log RTCsm_e_t = & c_0 + \sum_{i=1}^p b_{\log RTCsm_e,i} \log RTCsm_e_{t-i} + \sum_{j=0}^q b_{RCCIR,j} RCCIR_{t-j} \\
 & + \sum_{l=0}^r b_{\log NNsm_e,l} \log NNsm_e_{t-l} + \sum_{k=0}^g b_{CRsm_e,k} CRsm_e_{t-k} \\
 & + \sum_{b=0}^c b_{\log RTIsme,b} \log RTIsme_{t-b} + \sum_{f=0}^u b_{Dummy2,f} Dummy2_{t-f} + \varepsilon_t
 \end{aligned}$$

Where:

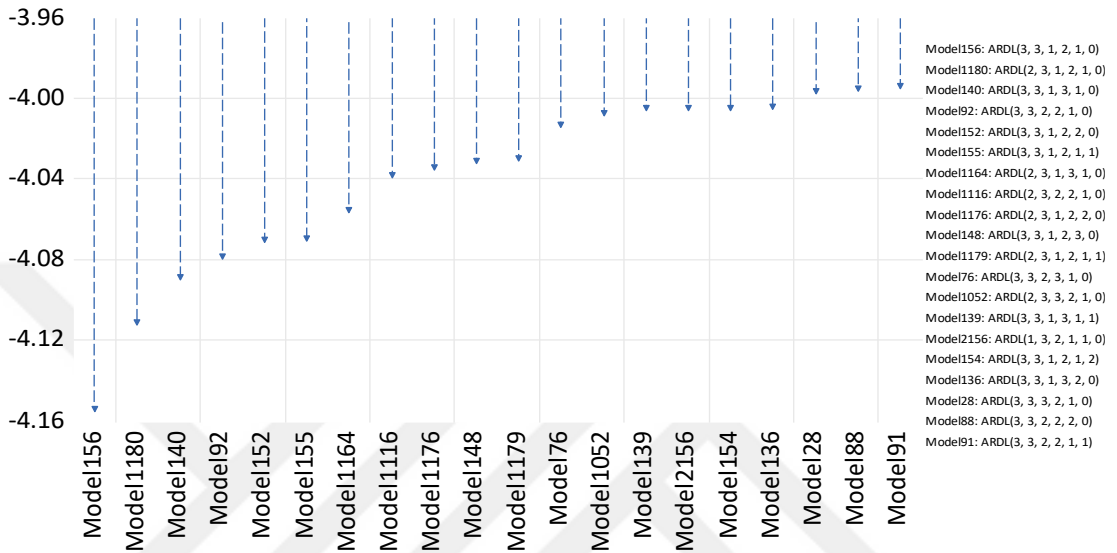
- $p, q, g, u, c,$  and  $r$  are the optimal lag length determined by the Schwarz Information Criterion (SIC).
- $c_0$  is the constant term and “ $b$ ” is the coefficient of the lagged variables.
- $\varepsilon_t$  is the error term.

To build our traditional ARDL model, the lag selection was performed by using the Schwarz selection criteria automatically via EViews 12 program at maximum lag for

dependent and independent variables as 2 in Figure 11. For logRTCsme 3 lag, RCCIR 3, for logNNsme 1 lag, for CRsme 2, for RTTI 1, and for dummy variable (Dummy2) 0 lags were selected from the top 20 models. The model was performed without a trend because of the insignificance of the trend term.

**Figure 11. Model Selection**

Schwarz Criteria (top 20 models)



Source: The figure generated by EViews 12 program.

### 5.5.3. Unrestricted Error Correction Model (UECM)

The ARDL bounds form can be written as:

$$\begin{aligned}
 \Delta \log RTCsme_t = & c_0 + \pi_{\log RTCsme} \log RTCsme_{t-1} + RCCIR_{t-j} + \log NNsme_{t-l} \\
 & + CRsme_{t-k} + \log RTIsme_{t-b} + Dummy2_{t-f} \\
 & + \sum_{i=1}^{p-1} \psi_{\log RTCsme, i} \Delta \log RTCsme_{t-i} + \sum_{j=1}^{q-1} \psi_{RCCIR, j} \Delta RCCIR_{t-j} \\
 & + \sum_{l=1}^{r-1} \psi_{\log NNsme, l} \Delta \log NNsme_{t-l} + \sum_{k=1}^{g-1} \psi_{CRsme, k} \Delta CRsme_{t-k} \\
 & + \sum_{b=1}^{c-1} \psi_{\log RTIsme, b} \Delta \log RTIsme_{t-b} + \sum_{f=1}^{u-1} \psi_{Dummy2, f} \Delta Dummy2_{t-f} \\
 & + \omega_{RCCIR} \Delta RCCIR_t + \omega_{\log NNsme} \Delta \log NNsme_t + \omega_{CRsme} \Delta CRsme_t \\
 & + \omega_{\log RTIsme} \Delta \log RTIsme_t + \omega_{Dummy2} \Delta Dummy2_t + \varepsilon_t
 \end{aligned}$$

Where:

- $\omega$  is the long-run coefficients of the lagged variables.
- $c_0$  is the constant term and  $\psi$  is the short-run coefficients of the lagged variables.
- $\varepsilon_t$  is the error term. The error term ( $\varepsilon_t$ ) is assumed to be white noise.
- $\Delta$  represents the first difference.

The UECM results are shown in Table 13. The variables that have less than 0.05 probability mean that they have a causal relationship with the dependent variable. In the long run, RCCIR has a meaningful coefficient that has a 0.00 p-value, and it can be interpreted as when real commercial credits increase by 0.01, the total real credit amount of SMEs increases by 0.6965%. CRsme has a p-value of 0.0007 which is statistically significant. We can say that when the credit share of the SMEs increases by 1% with respect to all credits provided by the banks, the real commercial credit amount of SMEs will increase by 2.9631%. However, logNNsme has no impact in the long run because its p-value (0.7432) is greater than 5%. The dummy variable is also statistically not meaningful because its p-value is 0.0580 which is higher than 5% so we can say the structural breaks in variables have no effect on the credit supply of SMEs in the long run. The logRTIsme is statistically meaningful because of its p-value (0.0026). We can induce that if the turnover index of all producers increases by 1 base point, the credit supply of SMEs increases by 1.61758% in the long term.

**Table 13. Unrestricted Error Correction Model (UECM)**

| <b>ARDL (3,3,1,2,1,0) Case 3: Unrestricted constant and No trend</b>                                    |                    |                  |                     |                    |
|---------------------------------------------------------------------------------------------------------|--------------------|------------------|---------------------|--------------------|
| <b>Long-Run terms</b>                                                                                   |                    |                  |                     |                    |
| <b>Variable</b>                                                                                         | <b>Coefficient</b> | <b>St. error</b> | <b>t-statistics</b> | <b>Probability</b> |
| RCCIR                                                                                                   | 0.696495           | 0.094277         | 7.387732            | 0.0000             |
| logNNsme                                                                                                | -0.087007          | 0.263099         | -0.330700           | 0.7432             |
| CRsme                                                                                                   | 2.963073           | 0.776476         | 3.816054            | 0.0007             |
| logRTIsme                                                                                               | 1.617577           | 0.490181         | 3.299960            | 0.0026             |
| Dummy2                                                                                                  | -0.085205          | 0.043159         | -1.974185           | 0.0580             |
| EC = LOG(RTCSME) - (0.6965*RCCIR -0.0870*LOG(NNSME) + 2.9631*CRSME + 1.6176*LOG(RTISME) -0.0852*DUMMY1) |                    |                  |                     |                    |

Notes: EC refers to the error correction term.

#### 5.5.4. ARDL Bounds Test F Statistics Result

Next, let's move on to the ARDL bounds test. The null hypothesis is that there is no long-run relationship between the variables, and the alternative hypothesis is that

there is a long-run relationship. Table 14 indicates that the F-statistic of the model (6.678) is greater than all the upper-bound critical levels. This means that there is a cointegration between the variables in our model and long-run coefficients are statistically meaningful.

**Table 14. Bounds F Test Results**

| Significance | I(0) Lower bound | I(1) Upper bound | F statistics | K |
|--------------|------------------|------------------|--------------|---|
| Level 10%    | 2.26             | 3.35             |              |   |
| Level 5%     | 2.62             | 3.79             | 6.677667     | 5 |
| Level 1%     | 3.41             | 4.68             |              |   |

Notes: “K” denotes the number of variables.

#### 5.5.5. Restricted Error Correction Model (RECM)

The ECM model is used to test the short-run dynamics and the speed of adjustment of the variables toward their long-run equilibrium. The ECM model can be represented as follows:

$$\begin{aligned}
\Delta \log RTCsme_t = & c_0 + \sum_{i=1}^{p-1} \psi_{\log RTCsme,i} \Delta \log RTCsme_{t-i} + \sum_{j=1}^{q-1} \psi_{RCCIR,j} \Delta RCCIR_{t-j} \\
& + \sum_{l=1}^{r-1} \psi_{\log NNsme,l} \Delta \log NNsme_{t-l} + \sum_{k=1}^{g-1} \psi_{CRsme,k} \Delta CRsme_{t-k} \\
& + \sum_{b=1}^{c-1} \psi_{\log RTIsme,b} \Delta \log RTIsme_{t-b} + \sum_{f=1}^{u-1} \psi_{Dummy2,f} \Delta Dummy2_{t-f} \\
& + \omega_{RCCIR} \Delta RCCIR_t + \omega_{\log NNsme} \Delta \log NNsme_t + \omega_{CRsme} \Delta CRsme_t \\
& + \omega_{\log RTIsme} \Delta \log RTIsme_t + \omega_{Dummy2} \Delta Dummy2_t \\
& + \pi_{\log RTCsme} ECT_t + \varepsilon_t
\end{aligned}$$

Where:

- $\Delta$  represents the first difference.
- $\pi$  is the coefficient of the error correction term (ECT).
- $ECT_t$  represents the error correction term.
- $c_0$  is the constant term and  $\psi$  is the short-run coefficients of the lagged variables.
- $\varepsilon$  is the error term and  $\omega$  is the long-run coefficients of the lagged variables.

The results in Table 15 show the RECM model with short-run coefficients of the variables. The initial value of  $\log RTC_{sme}$  has significant effects on the dependent variable. Its first lag has a coefficient of 0.395636 and a probability value of 0.0001 and the second lag has a coefficient of -0.142038 and a probability value of 0.0116. This indicates that the dependent variable is affected by its past values in the short run. We can infer there is autoregression and a 1% increase in the first lag of total commercial credits of SMEs causes a 0.3956% increase and a 1% increase in its second lag causes a 0.14204% decrease in its contemporary value.

Similarly,  $\log NN_{sme}$  and  $CR_{sme}$  have significant positive effects on the dependent variable, with coefficients of 0.502032 and 2.872750 respectively, and probability values of 0.0000. When they increase by 1%, the total commercial credits of SMEs increase by 0.5020% and 2.8728 % respectively.

However, the lagged value of  $CR_{sme}$  has a significant negative effect on the dependent variable, with a coefficient of -1.394801 and a probability value of 0.0004 means that when it increases by 1%, the credit amount of the construction sector shrinks by 1.3948%.

The contemporary value of  $RCCIR$  has a positive coefficient that 0.195610 with 0.0000 probability. This means if it increases by 1%, the dependent variable will increase by 0.1956% in the short run. For the first lag of  $RCCIR$ , it has an insignificant p-value (0.26), but for the second lag, it has a negative coefficient that is -0.3015 with a significant probability (0.0000). If the second lag of  $RCCIR$  increases by 1%, the total real credit amount of SMEs decreases by 0.3015%.

Lastly,  $\log RTI_{sme}$  has an insignificant p-value that 0.1932 with a coefficient of 0.138993 means that it has no effect in the short run.

The error correction term ( $CointEq(-1)$ ) has a negative coefficient of -0.334516 and a probability value of 0.0000, indicating that the dependent variable adjusts towards equilibrium with a speed of 33.45% in the next period.

In conclusion, the results suggest that the variables  $\log RTC_{sme}$ ,  $RCCIR$ ,  $\log NN_{sme}$ , and  $CR_{sme}$  have short-run effects on the dependent variable means that the dependent variable adjusts towards equilibrium with these variables in the short run, while the error correction term shows the speed of adjustment towards long-run equilibrium as well.

**Table 15. Restricted Error Correction Model (RECM)****ARDL (3,3,1,2,1,0) Case 3: Unrestricted constant and No trend**

| <b>Variable</b>               | <b>Coefficient</b> | <b>St. error</b> | <b>t-statistics</b> | <b>Probability</b> |
|-------------------------------|--------------------|------------------|---------------------|--------------------|
| D(logRTC <sub>sme</sub> (-1)) | 0.395636           | 0.089026         | 4.444044            | 0.0001             |
| D(logRTC <sub>sme</sub> (-2)) | -0.142038          | 0.052682         | -2.696128           | 0.0116             |
| D(RCCIR)                      | 0.195610           | 0.027943         | 7.000357            | 0.0000             |
| D(RCCIR(-1))                  | -0.058832          | 0.051247         | -1.148011           | 0.2603             |
| D(RCCIR(-2))                  | -0.301517          | 0.052149         | -5.781838           | 0.0000             |
| D(logNN <sub>sme</sub> )      | 0.502032           | 0.105386         | 4.763746            | 0.0000             |
| D(CR <sub>sme</sub> )         | 2.872750           | 0.232573         | 12.35202            | 0.0000             |
| D(CR <sub>sme</sub> (-1))     | -1.394801          | 0.345406         | -4.038150           | 0.0004             |
| D(logRTI <sub>sme</sub> )     | 0.138993           | 0.104338         | 1.332138            | 0.1932             |
| Constant                      | 6.449247           | 0.941337         | 6.851158            | 0.0000             |
| CointEq(-1)                   | -0.334516          | 0.048808         | -6.853753           | 0.0000             |

Notes: “D” denotes the first difference operator.

#### 5.5.6. Diagnostic Tests Results

Table 16 shows the results of several diagnostic tests used to assess the goodness-of-fit of the model. The first test is the Breusch-Godfrey LM test for autocorrelation, which checks whether there is any remaining autocorrelation in the residuals after fitting the model. The null hypothesis is no autocorrelation. The test result shows an observed R-squared value of 3.125157 with a p-value of 0.2096 for 2 lags, which suggests that we fail to reject the null hypothesis at a 5% significance level, indicating that there is no significant autocorrelation in the residuals.

The second test is the Breusch-Pagan-Godfrey test for heteroskedasticity, which checks whether the variance of the residuals is constant over time. The null hypothesis is constant variance. The test result shows an observed R-squared value of 11.87504 with a p-value of 0.6885, indicating that we fail to reject the null hypothesis at a 5% significance level, suggesting that there is no significant heteroskedasticity.

The third test is the Jarque-Bera test for the normality of the residuals. The null hypothesis is that the residuals are normally distributed. The test result shows a Jarque-Bera score of 5.618108 with a p-value of 0.06026, which suggests that we fail to reject the null hypothesis at a 5% significance level, indicating that the residuals are normally distributed.

The fourth test is the Ramsey RESET test for model specification errors. The null hypothesis is that the model is correctly specified. The test result shows an F-statistic

of 0.110626 with a p-value of 0.7419, which indicates that we fail to reject the null hypothesis at a 5% significance level, suggesting that the model is correctly specified.

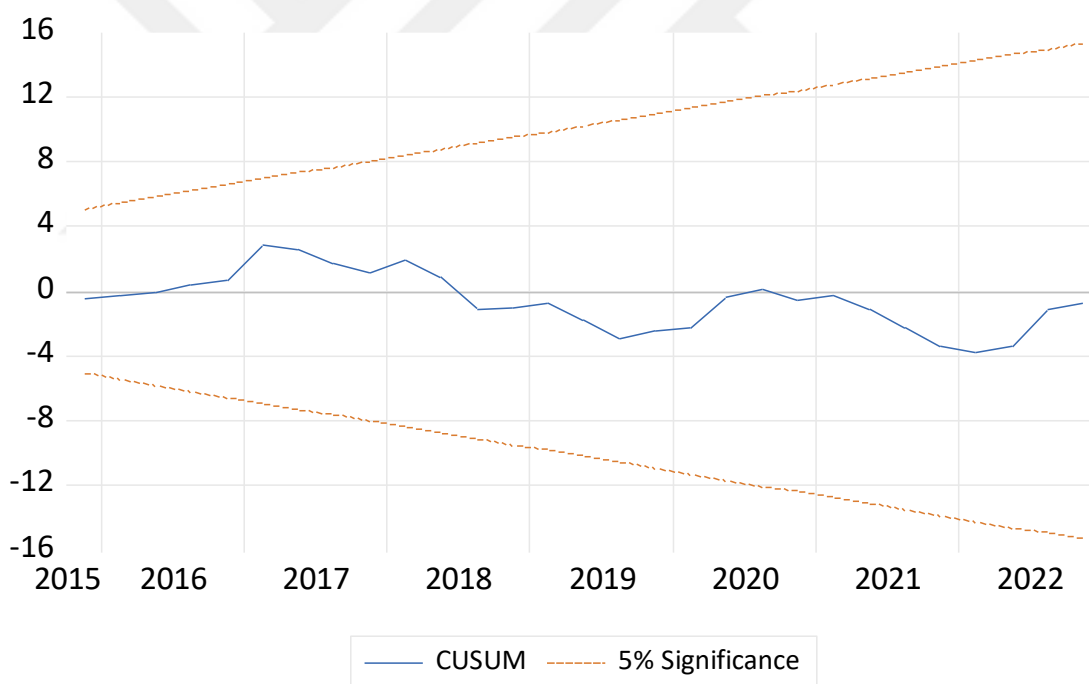
**Table 16. Diagnostic Test Results**

| Diagnostic tests. | Kind of statistics                | Lags | Test scores        |
|-------------------|-----------------------------------|------|--------------------|
| B.G. LM test      | Obs. R-squared (Prob. Chi-Square) | 2    | 3.125157 (0.2096)  |
| B.P.G. test       | Obs. R-squared (Prob. Chi-Square) |      | 11.87504 (0.6885)  |
| J.B. test         | Jarque-Bera score (Probability)   |      | 5.618108 (0.06026) |
| Ramsey RESET      | F-statistics (Prob. F-statistics) | 1    | 0.110626 (0.7419)  |

Notes: Values within parenthesis denote p-values.

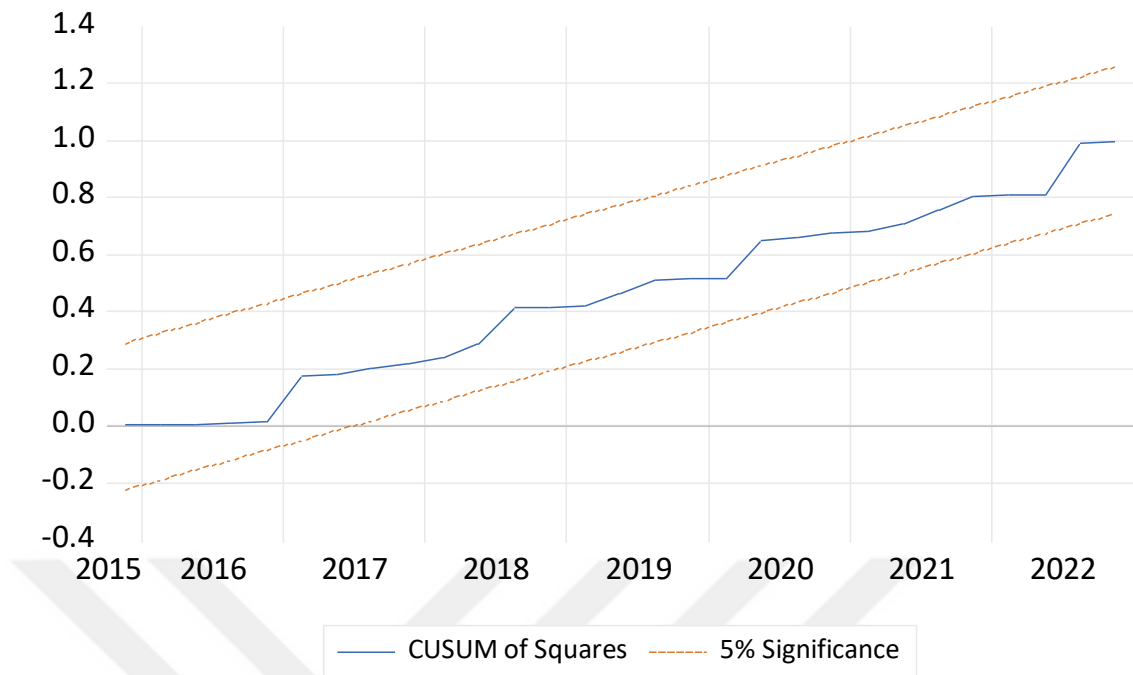
The stability diagnostics of the model are depicted in Figure 12 and Figure 13. The graphs reveal that the model has no structural breaks when we look at general trends that remain between the 5% significance level.

**Figure 12. CUSUM Graph**



Source: The figure generated by EViews 12 program.

**Figure 13. CUSUM of Squares Graph**



*Source: The figure generated by EViews 12 program.*

## **5.6 Chapter Conclusion**

The study analyzed the relationship between the credit amount granted to small and medium-sized enterprises (SMEs) and the real interest rate and other deterministic factors in Türkiye. The results revealed that the high cost of borrowing for SMEs in Türkiye is mainly due to the country's macroeconomic environment, characterized by high inflation and a volatile exchange rate. These factors have resulted in highly negative real interest rates, which make it challenging for SMEs to access affordable financing. Additionally, the traditional banking sector in Türkiye has been reluctant to lend to SMEs, preferring instead to focus on larger, more established firms.

The study used the autoregressive distributed lag (ARDL) bounds testing approach and analyzed quarterly data from 2011 to 2022 to provide insights into how changes in real interest rates and other determinants impact the availability of credit for SMEs in Türkiye. The findings have significant implications for policymakers, lending institutions, and SMEs themselves. By identifying the key drivers of SME lending rates, policymakers can implement measures to reduce borrowing costs and increase access to finance for these businesses. Lending institutions can also use these

findings to develop targeted lending strategies for SMEs, while SMEs can use the insights gained from this study to better understand the financing landscape and make informed decisions about their borrowing options.

The results showed that the real credit usage of small and medium-sized enterprises (RTC<sub>sme</sub>) influences the following periods of itself. A 1% increase in the first lag of total commercial credits of SMEs causes a 0.3956% increase and a 1% increase in its second lag causes a 0.14204% decrease in its contemporary value. These results can be attributed to the lending behavior of the banks might encourage the SMEs to demand more in the following periods even if the banks are reluctant to lend.

The net number of SMEs is found very effective to create more credit use in real terms. The analyses show a 1% increase in the net number of SMEs causes a 0.502% increase in their real credit supply of them. This is a very expected result as a rise in the number of SMEs ends up with a higher credit demand in the short run.

The credit spread of SMEs (CR<sub>sme</sub>) concerning all credit lent by the banks also has a positive effect in the short run on the real credit supply. The result tells us a basepoint increase in CR<sub>sme</sub> leads to a 2.8728% increase in RTC<sub>sme</sub>. We can conclude that the share of the credits is very deterministic for SMEs' credit access. The increasing trend of CR<sub>sme</sub> is a great return of supply programs for SMEs by several institutions.

However, the previous term of CR<sub>sme</sub> has a significant negative effect on RTC<sub>sme</sub>, when it increases by 1% the credit amount of the construction sector declines by 1.3948%. This may suggest that there might be some regulation in Banks that issue the credits to SMEs to make equilibrium of the spread of credits in the short run.

The contemporary value of real commercial credit interest rate (RCCIR) has a positive influence that if it increases by 1%, RTC<sub>sme</sub> will increase by 0.1956% in the short run. This result is very crucial to understand the dynamics of the sector's behavior because we found a direct relationship that if the real commercial credit rate goes down, SMEs credit use also goes down. In fact, it is very advantageous to get credit in a market with a high-inflation structure. This result can be considered as the banks seek profitability in the short run. But we can observe if the previous periods of RCCIR increased by 1%, the total real credit amount of SMEs decreases by

0.3015%. So, relatively lower past values of real credit rates can still increase credit access for SMEs which is connected with the credit channel's initial stages.

The real turnover of all sectors in the economy had no effects in the short run as a measure of demand for SMEs as producers. But in the long run, it has a very significant effect on RTCsme that a 1% increase leads to a 1.6176% increase in RTCsme. We can say that the aggregate demand causes SMEs' credit use in the long run because of the increase in their supply.

In the long run, the real commercial credit interest rate (RCCIR) has a positive effect, suggesting that if RCCIR increases by 0.01, the total real credit amount of SMEs increases by 0.696%. CRsme was found statistically significant, indicating that when the credit share of SMEs increases by 1% with respect to all credits of banks, the commercial credit amount of SMEs will increase by 2.963%. The NNsme and the structural breaks (Dummy2) have no impact in the long run on our results.

In conclusion, the study highlights the importance of understanding the factors that influence the borrowings of SMEs in Türkiye, and its findings can help policymakers, lending institutions, and SMEs themselves make informed decisions. By identifying the key drivers of SME lending rates, policymakers can implement measures to reduce borrowing costs and increase access to finance for these businesses. Lending institutions can also use these findings to develop targeted lending strategies for SMEs, while SMEs can use the insights gained from this study to better understand the financing landscape and make informed decisions about their borrowing options.

## **6. THE DETERMINANTS OF CREDIT VOLUME OF THE CONSTRUCTION SECTOR IN TÜRKİYE**

### **6.1 Introduction**

The construction sector plays a critical role in the economy, as it is a key driver of economic growth and job creation. However, access to credit is often cited as a major challenge for the sector, particularly in times of economic uncertainty. In recent years, the construction industry has been affected by various factors such as changes in economic policies, fluctuating oil prices, and global pandemics, which have impacted the supply and demand for credit. The dependencies of the sector's growth are related to the credits lent by the banks. In this chapter we will perform the ARDL bounds test for cointegration between total credit amount in the construction sector and real commercial credit interest rates set by the banks with other effective variables.

The purpose of this chapter is to investigate the relationship between the real credit supply of the construction sector and real commercial credit interest rates and the other determinants we assumed that the sector's credit spread, real turnover of the construction sector, number of construction permits for dwellings and the total building sold in the context of the aggregate demand to the sector. This study employs the ARDL bounds test to examine the long-run relationship between these variables for the period from the first quarter of 2011 to the last quarter of 2022.

The research aims to contribute to the existing literature on the credit market in the construction sector by providing an empirical analysis of the relationship between credit usage in the construction sector, commercial credit rates, and other demand-side factors for credits. The findings of this study may have implications for policymakers, financial institutions, and the construction industry, as they seek to address the challenges faced by the sector in accessing credit.

## 6.2 An Overview of the Construction Sector in Türkiye

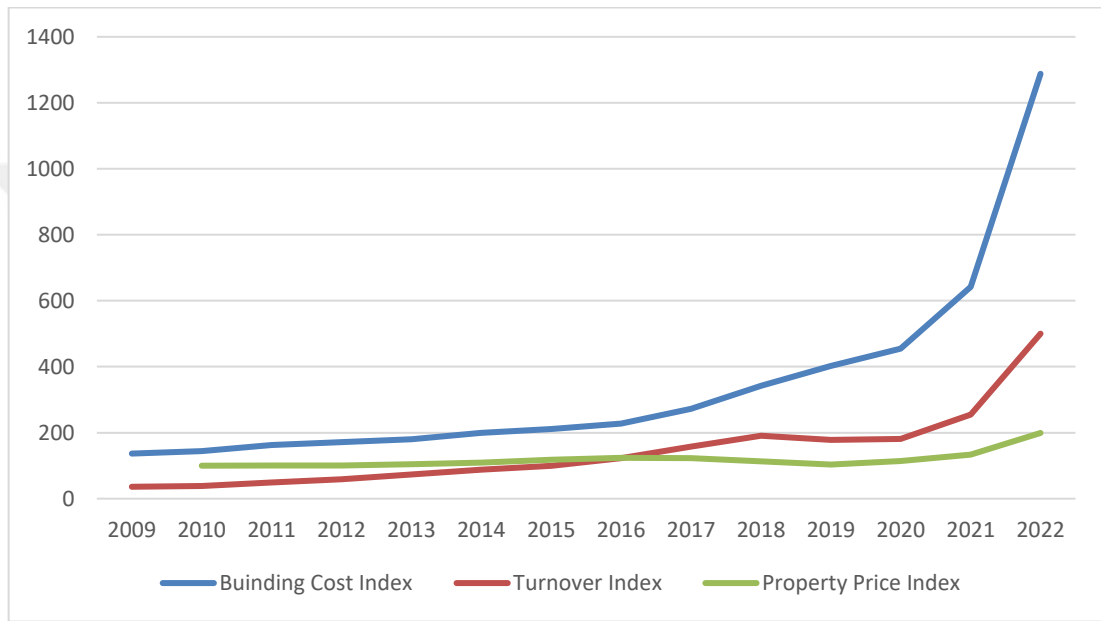
The housing and construction sectors have been important components of Türkiye's economy in recent years but have faced various challenges. It plays a crucial role in infrastructure development, with investments in roads, bridges, railways, airports, and urban facilities. The demand for residential and commercial properties has risen due to rapid urbanization, leading to increased construction activities in urban areas. Public and private investments, as well as foreign investments, have significantly contributed to the sector's expansion, attracting international construction companies and investors. The construction sector is mainly associated with demand and supply dynamics when dealing with houses and buildings. So the profitability of the sector and the credit access can determine the support side, on the other hand, the property prices and mortgage rates can form the demand side.

From 2011 to 2016 in Figure 14, property prices in Türkiye increased steadily but began to show a negative trend after that period. Despite rising mortgage interest rates of around 10% since 2014, housing sales and prices have continued to rise, except for a noticeable decline in sales in 2017, and a decrease in housing prices despite sales remaining at the same level. This behavior is mostly related to decreasing mortgage rates during the period (Yılmaz & Tanınmış-Yücememiş, 2022). The first quarter of 2019 saw a significant negative shift in the housing market due to economic contraction and tight monetary policy. After this period, house prices began to increase significantly to now because of the deterring effect of high inflation recorded officially as 64.27% at the end of 2022.

The nominal turnover index of the construction sector has a close relationship with the nominal building cost index in Figure 14. From 2009 to 2018, they exhibit a slightly positive trend. During this period, the inflation rates were relatively low around 10% and this increase can be interpreted as the construction sector making a profit in real terms. Between 2018 and 2020, the turnover of the construction sector slightly fall but the building costs were pretty higher. This is because the pandemic COVID-19 hit economic transactions negatively and inflation got higher by 20% resulting from the tightening monetary policy stance of CBRT which finally affected construction prices. At this time, real estate investments became very advantageous among households and it affected house sales positively which hit the pick in 2020

Q3 roughly 54.000 in total. After the pandemic ended, many incentives and foreign demand for houses revived the construction sector's sales. So after 2020, even if the cost of construction prices hit its pick because of very high real inflation rates, the nominal turnover of the construction sector began to rise. Because of the higher inflation, property prices also began to rise in this period, and the increase in turnover of the construction sector reflects this change as a nominal increase in their revenue.

**Figure 14. Construction Sector Indicators**

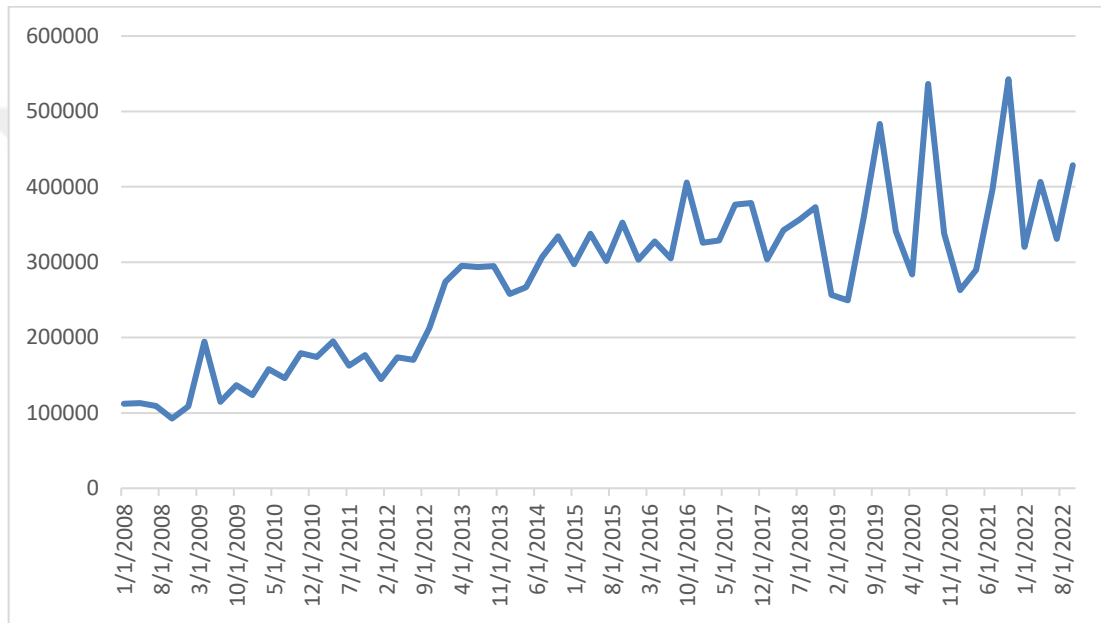


*Source: The graph was generated by the author himself (BIS, 2023; TUIK, 2018, 2023e, 2023c).*

In Figure 15, the total first and second-hand housing sales steadily rise with high volatility, especially after 2019. The global financial crisis of 2008 prompted the CBRT to lower policy rates to around 18% leading to the mortgage rates decrease in Türkiye to around 15% resulting in increasing house sales. It starts at around 110,000 sales in 2008 Q1 and in 2009 Q2 it suddenly hit 200,000 sales. Instead of decreasing the profitability of the construction sector after 2017, the total house sales kept rising trend but huge rises and falls occurred between the periods. This volatility is strongly associated with exchange rates, high inflation, and the global pandemic. The unpredictability of economic conditions considering high inflation in Türkiye and the increasing demand from abroad with decreasing value of the Turkish Lira led households and firms to invest in properties. Between 2019 and 2022, the total house

sales hit its pick with over 500.000 sales in some periods. After the beginning of 2022, the volatility cools down with the effects of the pandemic slowing down and sales kept rising. In housing sales, the proportion of mortgage sales in total sales varied between 33% and 40% from 2013 to 2017, but this proportion dropped to 20% in 2018 and 25% in 2019. After a significant reduction in mortgage interest rates, this ratio reached 41% again in 2020. However, Türkiye faced economic challenges between 2018 and 2020, but total housing sales did not significantly decline, and real housing prices continued to rise (Yılmaz & Tanınmış-Yücememiş, 2022).

**Figure 15. Total First and Second-Hand House Sales**

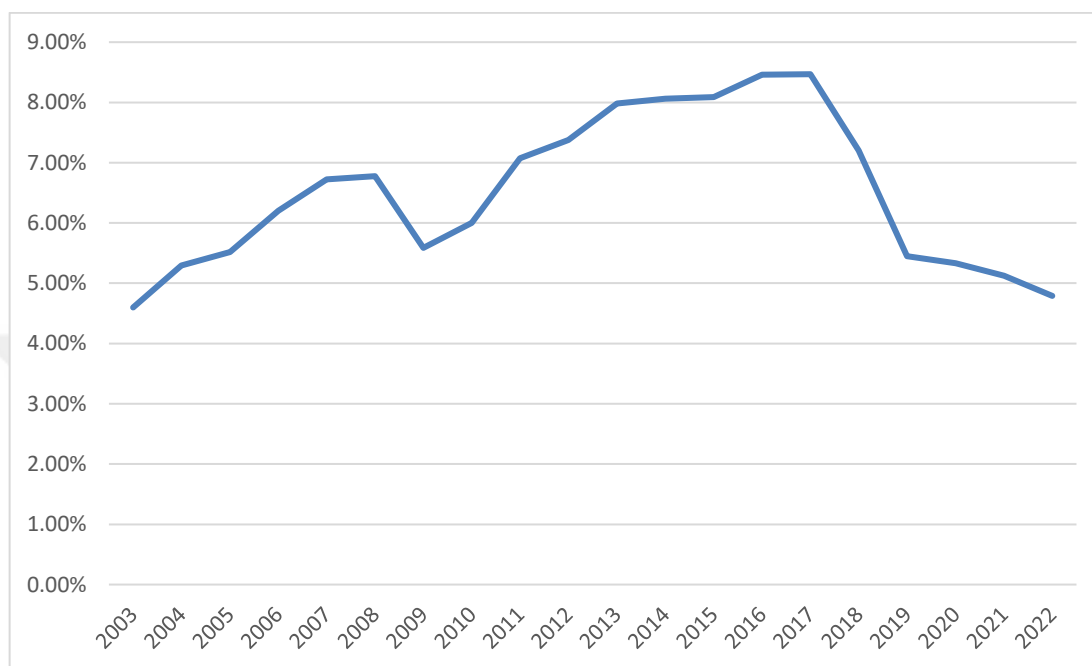


*Source: The graph was generated by the author himself from the dataset.*

In Figure 16, the construction sector's share in Türkiye's GDP increased from 4.6% to 6.8% between 2003 and 2008 and it sharply decreased to 5.6% in 2009 because of the global financial crisis head the CBRT to lower policy rates up to 8% (CBRT, 2009). After this period, the sector began to rise in the share of GDP by around 8% between 2013 and 2017 which is associated with the lower mortgage credit interest rates by the sustained tightening monetary policy caused the house sales to rise to 40.00 sales in 2016 Q4. The sector's share in GDP remained at 5.3% at the end of 2020, well below the 8.5% it reached in 2017, and continued at 5.1% in 2021 and finally fall to 4.8% in 2022 due to a decrease in the number of construction tenders and a slowdown in investment in the country. The recent high guaranteed payments by the government for Public-Private Partnership projects are affecting the

construction sector, but the sector's financial structure has been deteriorating due to the recent exchange rate increase, and it couldn't sustain the momentum gained in the middle of 2020 in the long term with oncoming tight monetary policies (Ölmez, 2021).

**Figure 16. Share of the Construction Sector in GDP**



*Source: The graph generated by the author himself (TUIK, 2023b).*

The construction industry in Türkiye has faced financial challenges in recent years, with fluctuations in the country's economy impacting funding availability. The industry's total credit balance dropped from 245 billion TL to 230 billion TL in 2019 due to a reduced appetite for funding in the financial markets. In 2020, favorable conditional loan programs implemented to mitigate the negative impact of the COVID-19 pandemic on the economy and sectors resulted in a rise in the industry's domestic commercial credit volume. In 2021, the industry's domestic bank loans increased by 39.9% to reach 449.1 billion TL, but access to financing remains a concern for the industry in 2022, with interest rates remaining high and banks reportedly reluctant to lend (Kahveci, 2022).

In conclusion, while the housing and construction sectors remain crucial components of Türkiye's economy, they have faced several challenges in recent years, including fluctuations in housing prices, the declining share of the housing sector in GDP, and decreased number of construction permits issued. Despite various support measures

and loan programs, the industries still face financial challenges, particularly access to financing, and the future remains uncertain with the country's economic and political risks, inflation-interest rate effect, and fluctuations in foreign exchange rates.

### **6.3 Empirical Literature**

The construction sector is an important sector of the economy, contributing to growth, employment, and social development. Nonetheless, the sector faces various challenges, including the availability and cost of credit. Several studies have examined the determinants of credit supply to the construction sector, including monetary policy, loan supply shocks, macroeconomic conditions, and financial regulations.

However, the relationship between the real credit supply of the construction sector and real commercial credit rates has received limited attention in the literature. This study aims to fill this gap by examining the long-run and short-run dynamics between these variables using the ARDL bounds testing approach. The empirical analysis will provide insights into the factors that affect the real credit supply of the construction sector and the commercial credit rates, contributing to the understanding of the dynamics of credit markets and the potential impact of policy measures on the construction sector.

Vuong (2016) explored the determinants of access to credit for Small and Medium-sized Enterprises (SMEs) in the industrial and construction sectors of Can Tho City, Vietnam. The study uses primary data collected through direct interviews with 200 enterprises, 148 of which had access to credit and 52 did not. The logistic regression model is employed to analyze the data, and the results show that the numbers of operational years in business, business scales, and net revenue growth of the enterprises significantly affect access to credit at the 1% and 10% levels. Based on the findings, the paper proposes three groups of solutions to help SMEs increase business scale and revenue, improve credit accessibility, secure enough capital investment, and enhance competitiveness.

Another study that investigated credit availability in the construction sector is by Balogun et al. (2016). They worked in the construction sector while taking South African small and medium-sized enterprises into consideration. To assess the

characteristics of SMEs in the construction sector and their credit availability they conducted a survey including 179 of them. They employed binary logistic regression including demographic variables from the survey. The outcomes of the study show that the characteristics of the firms such as their size, credit payoff, tax number, project value, etc. play a crucial role in accessing credits from banks of the construction sector's SMEs in South Africa.

There exist further studies that examine other types of credit use and its determinants in other sectors. We mentioned studies that are mostly related to our topic. For example, as stated by Atasoy & Tanrıvermiş (2021) the relationship between housing loans and housing prices in Türkiye, proper development of housing finance, and long-term borrowing can facilitate access to housing and increase investment in the housing sector. The study examined the relationship between the volume of housing loans, the housing price index, mortgage interest rates, cost of construction index, gross domestic product, and industrial production index. The study found a cointegrated relationship between these variables and Granger causality between the volume of housing loans, interest rates, and housing price index.

Koç et al. (2021) analyzed the relationship between the volume of housing loans and interest rate volatility in the Turkish banking sector using econometric methods. The three-stage least squares method was used to estimate the simultaneous equation model. Non-stationary time series of housing loans, income, inflation, and interest rate volatility were utilized for the long-term co-integration approach in the model. The analysis indicates that market volatility has a significant impact on the volume of housing loans, and this may be due to savers seeking higher returns in periods of generally negative interest rate trends.

B. Becker & Ivashina (2014) investigated how enterprises' flexibility to switch between various forms of financing influences the actual effects of a reduction in the supply of bank credit. Although the study primarily focuses on companies that use the bond market, other companies can also use this measure. The findings demonstrate that the loan-to-bond substitution impact is a powerful predictor of the overall contraction in lending for small and unrated enterprises. The study does caution against using some companies' capacity to issue bonds as proof that bank credit restrictions have no influence on these companies.

According to Gilchrist & Zakrajšek (2011), the New Keynesian model augmented with the financial accelerator mechanism can closely match the observed decline in economic activity and account for the effects of the 2007-09 financial crisis. The study also suggests that a monetary policy rule that allows the short-term nominal rate to respond to changes in credit spreads can effectively mitigate the negative consequences of financial disruptions on real economic activity with only a modest increase in inflation.

In order to study the effects of loan supply shocks in the euro area, Altavilla et al. (2019) developed a new credit supply indicator from bank-specific data. According to the analysis, demand, the level of market uncertainty, and corporate bond spreads all have an impact on loan supply. According to the report, bank loan contractions also result in a decline in actual activity, a rise in credit volumes, and a widening of lending spreads. Additionally, businesses commonly replace bank loans with debt instruments that are issued as a result of credit tightening, with nations with more developed corporate bond markets being more robust to shocks related to a decline in the availability of loans.

#### **6.4 Dataset**

The dataset for this study includes quarterly data from 2011 Q1 to 2022 Q4. To eliminate the harmful effects of inflation, we convert the indicators into real terms. So, we can way better understand the changes in the sector's indicators.

The dependent variable is the real credit usage of the construction sector landed by the banks, denoted as RTCC. To generate RTCC, the total nominal credits of the construction sector (total of cash, non-performing and non-cash credits for domestic and foreign currencies in terms of Turkish Lira issued by the banks operating in Türkiye) were collected from the BDDK as monthly data, and then converted into quarterly data by taking the end of the period method (Banking Regulation and Supervision Agency, 2023b). Türkiye's GDP deflator indexed for 2015 was used to convert nominal total credits of the construction sector to real terms by dividing all data with the deflator and then multiplying by 100 (OECD, 2023b).

The main independent variable is the real commercial credit interest rate, denoted as RCCIR, generated in the second study. PPI was used instead of the consumer price index (CPI) for more accurate results.

The ratio of the construction credit volume and total credits volume of banks denoted as CCR was created by dividing the total nominal credits of the construction sector and the total credits issued in the economy by banks, both obtained as monthly data from BDDK (Banking Regulation and Supervision Agency, 2023a) and then converted to quarterly data by taking the end of the period method. With this variable, we try to demonstrate the effects of government support programs over bank credits.

The real turnover index of the construction sector denoted as RCTI was obtained as monthly data from the TÜİK (TUIK, 2023d), and was converted into real terms using the PPI we used before (TUIK, 2023f). Because of the unavailability of the real amount of data, we will use the change in the index. Both data are indexed for 2015 so being 100 index of turnover index was not deteriorated by converting into real terms by using PPI. We will use this variable as aggregate demand for the construction sector.

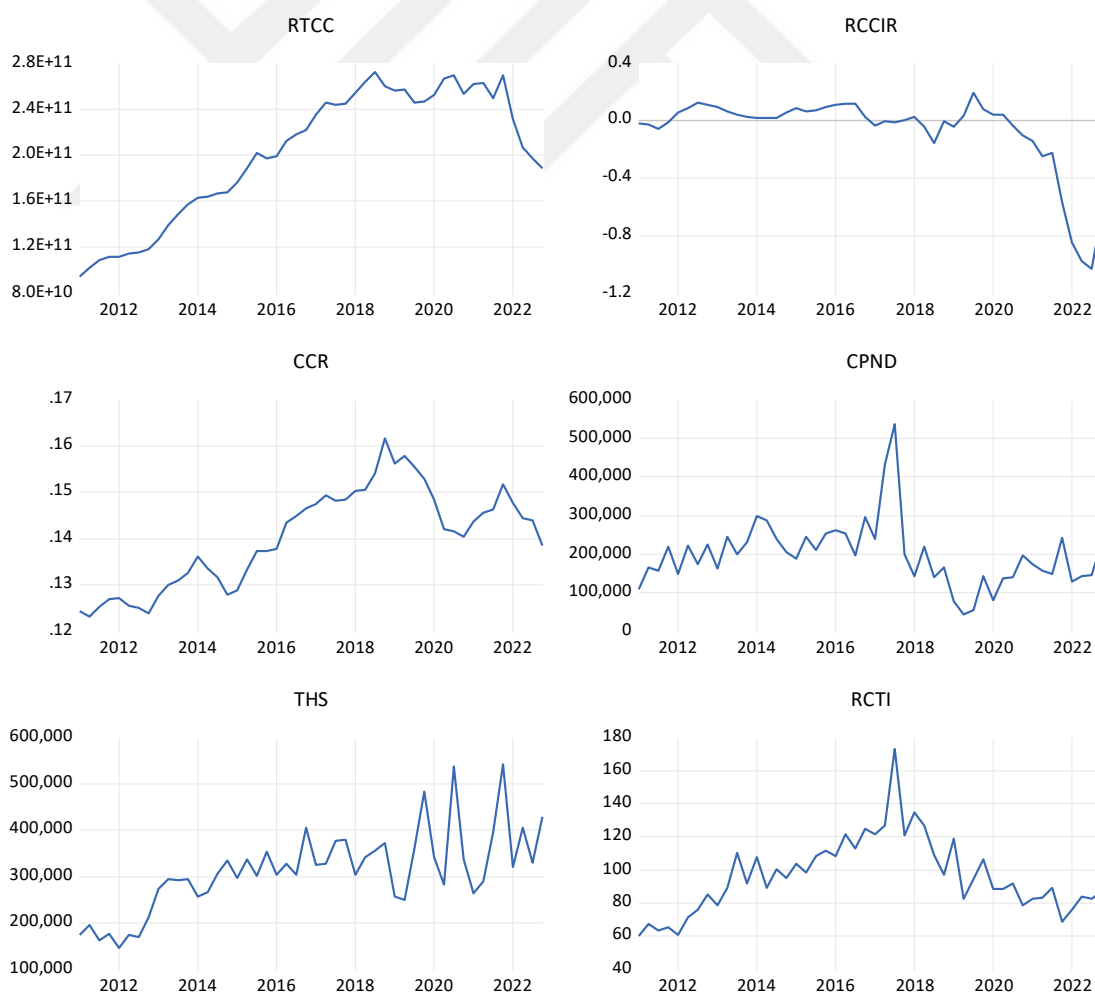
The number of construction permits of buildings for dwellings denoted as CPND was obtained as quarterly data from TÜİK (TUIK, 2023a). We will consider this variable as a factor of demand for credits by the construction sector.

The total house sold (THS) was obtained from TÜİK. The data is given in 2 different databases, so we put them together in terms of total houses sold (total of first-hand, second-hand, mortgaged, and other specs). One of the data was converted to quarterly data by summation method and other data is already quarterly so remained. Thereafter we put them together to create a series (General Directorate of Land Registry and Cadastre, 2022, 2023). We consider this variable as another demand factor for the construction sector.

In Figure 17 we can observe that the real total credit amount of the construction sector (RTCC) has an increasing trend starting from roughly 95 billion TL to around 260 billion TL until 2018s, thereafter it begins to fluctuate till the end of 2021 when it starts to sharply fall to around 189 billion TL toward 2022. Until the 2020s, the real commercial credit interest rate (RCCIR) fluctuates around 0 then it begins to

deeply fall by the end of 2022. We can detect the credit spread of the construction sector significantly rises by 2019s which exceeds 16%. But after, it dramatically decreases to 14% by the end of 2020. Thereafter, we can observe the government interventions for around 1 year, yet it starts to decrease in the middle of 2021. The construction permit for dwellings (CPND) exhibits an unstable trend over the periods, especially for 2017 it exceeds 500,000 permits. But after 2018, we can see it goes under 100,000 permits noticeably and it gathers again around 200,000s after 2020. The total house sales (THS) have a slightly increasing trend with fluctuations. Between 2019 and 2022 it reaches around 500,000 three times and after alleviates to 400,000s. Lastly, the real turnover index of the construction sector (RCTI) illustrates a different observation. It begins with a rising trend and picks top in the third quarter of 2017 which is relatively high 173. Subsequently, it dramatically falls until now where hits nearly the starting point 80s.

**Figure 17. Time Series Graphs of the Variables**



*Source: The graph generated by the author himself*

Table 17 presents information on six variables: logRTCC, RCCIR, CCR, logCPND, logRCTI, and logTHS. The average values (means) range from 25.9817 for logRTCC to 12.6092 for logTHS. The medians closely align with the means, such as 26.0668 for logRTCC and 12.6306 for logTHS, indicating symmetric distributions. The maximum values include 26.3305 for logRTCC and 13.2044 for logTHS, while the minimum values range from 25.2764 for logRTCC to -1.02879 for RCCIR. The standard deviations vary, with logCPND having a larger value of 0.44871, indicating greater variability. Skewness values range from -0.75807 for logRTCC to 0.10545 for logRCTI, indicating departures from symmetry. Kurtosis values, ranging from 2.25709 for logRTCC to 7.82264 for RCCIR, suggest heavier tails compared to a normal distribution. The Jarque-Bera test yields low p-values, particularly for RCCIR (0.00000) and logCPND (0.00272), indicating departures from normality. These summary statistics provide valuable insights into the dataset, capturing central tendency, dispersion, skewness, kurtosis, and deviations from normality for each variable.

**Table 17. Properties of the Dataset**

| Summary            | Variables |          |          |          |         |          |
|--------------------|-----------|----------|----------|----------|---------|----------|
|                    | logRTCC   | RCCIR    | CCR      | logCPND  | logRCTI | logTHS   |
| <b>N</b>           | 48        | 48       | 48       | 48       | 48      | 48       |
| <b>Mean</b>        | 25.9817   | -0.07139 | 0.14017  | 12.1078  | 4.54031 | 12.6092  |
| <b>Median</b>      | 26.0668   | 0.01887  | 0.14182  | 12.1885  | 4.51992 | 12.6306  |
| <b>Max</b>         | 26.3305   | 0.19102  | 0.16159  | 13.1947  | 5.15363 | 13.2044  |
| <b>Min</b>         | 25.2764   | -1.02879 | 0.12316  | 10.7108  | 4.10185 | 11.8834  |
| <b>Std. Dev.</b>   | 0.31869   | 0.274197 | 0.01059  | 0.44871  | 0.22764 | 0.29853  |
| <b>Skewness</b>    | -0.75807  | -2.38191 | -0.01254 | -0.77756 | 0.10545 | -0.55224 |
| <b>Kurtosis</b>    | 2.25709   | 7.82264  | 1.88872  | 4.86835  | 2.82417 | 3.18844  |
| <b>Jarque-Bera</b> | 5.70115   | 91.9037  | 2.47113  | 11.8182  | 0.15079 | 2.51073  |
| <b>Probability</b> | 0.05781   | 0.00000  | 0.29067  | 0.00272  | 0.92738 | 0.28497  |

Notes: The descriptive statistics were generated by EViews 12 program.

## 6.5 Methodology and Empirical Analysis

This study employs the autoregressive distributed lag (ARDL) bounds testing approach to examine the relationship between the real credit supply of the construction sector and real commercial credit rates. The ARDL approach is a useful econometric method for analyzing the long-run and short-run dynamics between variables when the data is stationary or non-stationary. The choice of the ARDL approach is based on the fact that the variables under investigation, real credit supply

of the construction sector and real commercial credit rates, are likely to be integrated into different orders.

### 6.5.1. Unit Root Test Results

Before conducting the ARDL bounds test, we will use the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests to find the stationarity of the variables.

Based on the tables provided, we can interpret the results of the unit root tests for each variable at a 5% significance level. Table 18 shows the results of the augmented Dickey-Fuller (ADF) test, while Table 19 shows the results of the Philips-Perron (PP) test.

**Table 18. Augmented Dickey-Fuller Test Results**

| Variables  | Trend + Constant |                 |            | Constant |                 |            |
|------------|------------------|-----------------|------------|----------|-----------------|------------|
|            | P value          | Test statistics | Lag length | P value  | Test statistics | Lag length |
| logRTCC(0) | 0.9999           | 1.158177        | 0          | 0.0299   | -3.145958       | 0          |
| RCCIR(0)   | 0.9310           | -1.015866       | 4          | 0.3001   | -1.966683       | 1          |
| CCR(0)     | 0.9751           | -0.588901       | 0          | 0.4922   | -1.565131       | 0          |
| logCPND(0) | 0.0467           | -3.538877       | 0          | 0.0206   | -3.298585       | 0          |
| logTHS(0)  | 0.0046           | -4.454883       | 0          | 0.2512   | -2.085672       | 3          |
| logRCTI(0) | 0.8159           | -1.497337       | 2          | 0.3488   | -1.857835       | 1          |
| logRTCC(1) | 0.0001           | -5.931135       | 0          | 0.0006   | -4.538552       | 0          |
| RCCIR(1)   | 0.0011           | -4.998859       | 3          | 0.0002   | -4.969936       | 3          |
| CCR(1)     | 0.0002           | -5.464046       | 0          | 0.0001   | -5.222781       | 0          |
| logCPND(1) | 0.0000           | -9.062291       | 0          | 0.0000   | -9.186395       | 0          |
| logTHS(1)  | 0.0000           | -7.506652       | 2          | 0.0000   | -7.412268       | 2          |
| logRCTI(1) | 0.0000           | -7.561882       | 1          | 0.0000   | -11.76599       | 0          |

Notes: All lags are automatically selected by the Schwarz information criteria at 5 maximum lag selection via EViews 12 program. The (0) and (1) represent the level and first differences of the variables, respectively. The “log” prefix means the neutral logarithm of the variable.

**Table 19. Philips-Perron Unit Root Test Results**

| Variables  | Trend + Constant |                 |           | Constant |                 |           |
|------------|------------------|-----------------|-----------|----------|-----------------|-----------|
|            | P value          | Test statistics | Bandwidth | P value  | Test statistics | Bandwidth |
| logRTCC(0) | 1.000            | 1.66779         | 4         | 0.0785   | -2.71837        | 3         |
| RCCIR(0)   | 0.7399           | -1.69037        | 1         | 0.7929   | -0.85762        | 2         |
| CCR(0)     | 0.9435           | -0.93137        | 2         | 0.4498   | -1.64954        | 3         |
| logCPND(0) | 0.0467           | -3.53888        | 0         | 0.0260   | -3.20406        | 1         |
| logTHS(0)  | 0.0053           | -4.40304        | 2         | 0.0622   | -2.82716        | 7         |
| logRCTI(0) | 0.4233           | -2.30461        | 4         | 0.1078   | -2.56318        | 4         |
| logRTCC(1) | 0.0001           | -5.93539        | 1         | 0.0005   | -4.61302        | 4         |
| RCCIR(1)   | 0.0203           | -3.89236        | 1         | 0.0034   | -3.97058        | 0         |
| CCR(1)     | 0.0002           | -5.48904        | 2         | 0.0001   | -5.25859        | 2         |
| logCPND(1) | 0.0000           | -10.0392        | 8         | 0.0000   | -10.1988        | 8         |
| logTHS(1)  | 0.0000           | -17.7794        | 18        | 0.0000   | -16.2639        | 19        |
| logRCTI(1) | 0.0000           | -12.9845        | 3         | 0.0000   | -11.7187        | 4         |

Notes: All bandwidths are automatically selected by the Newey-West information using Bartlett kernel via EViews 12 program. The (0) and (1) represent levels and first differences of the variables, respectively. The “log” prefix means the neutral logarithm of the variable.

**Table 20. Breakpoint Unit Root Test**

| Variables  | Trend + Constant |                 |             |            |
|------------|------------------|-----------------|-------------|------------|
|            | P value          | Test statistics | Time Breaks | Lag length |
| logRTCC(0) | 0.99             | -0.520718       | 2022 Q1     | 2          |
| RCCIR(0)   | 0.01             | -9.209604       | 2021 Q3     | 3          |
| CCR(0)     | 0.8021           | -3.300923       | 2019 Q4     | 4          |
| logCPND(0) | 0.01             | -5.680910       | 2017 Q3     | 0          |
| logTHS(0)  | 0.01             | -6.597349       | 2013 Q1     | 1          |
| logRCTI(0) | 0.7830           | -3.339196       | 2012 Q3     | 0          |
| logRTCC(1) | 0.01             | -6.490320       | 2021 Q4     | 5          |
| RCCIR(1)   | 0.01             | -6.538248       | 2020 Q3     | 3          |
| CCR(1)     | 0.01             | -5.967786       | 2021 Q4     | 0          |
| logCPND(1) | 0.01             | -10.78276       | 2019 Q4     | 0          |
| logTHS(1)  | 0.01             | -8.955670       | 2012 Q1     | 0          |
| logRCTI(1) | 0.01             | -12.01708       | 2012 Q1     | 0          |

Notes: All lags are automatically selected based on F-statistics selection at 5 maximum lags via EViews 12 program. Break specification is based on the intercept selected by minimize Dickey-Fuller t-statistics. The (0) and (1) represent the level and first differences of the variables, respectively. The “log” prefix means the neutral logarithm of the variable.

Starting with logRTCC, both ADF and PP tests show that the variable is non-stationary at level, but stationary at first difference. For RCCIR, both tests indicate that the variable is non-stationary at the level, but stationary at first difference. CCR,

on the other hand, is non-stationary at the level for both tests, but stationary at first difference. While logCPND is stationary at the level and the first difference according to both tests, likely logTHS is stationary at the first difference and the levels according to the ADF and PP tests. Finally, logRCTI is non-stationary at level but stationary at the first difference for both tests.

Looking at the specific results, for all variables except logTHS and logRCTI, the p-values for the ADF and PP tests at the level are greater than 0.05, indicating that we fail to reject the null hypothesis of non-stationarity. However, at the first difference, the p-values for all variables are less than 0.05, indicating that we can reject the null hypothesis of non-stationarity and conclude that the variables are stationary.

Additionally, we performed a breakpoint unit root test to check structural breaks with a better unit root result. The results are listed in Table 20. We can see RCCIR, logCPND, and logTHS are stationary in level with a break date that 20221 Q3, 2017 Q3, and 2013 Q1, respectively. In their first difference, logRTCC, CCR, and logRCTI become stationary with a break date of 2021 Q4, 2021 Q4, and 2012 Q1, respectively. For more accurate results, we created a dummy variable (Dummy3) and selected the breakpoints as dummies. With this method, we aimed to prevent recursive estimation problems in our ARDL bounds model.

### 6.5.2. Traditional ARDL Test

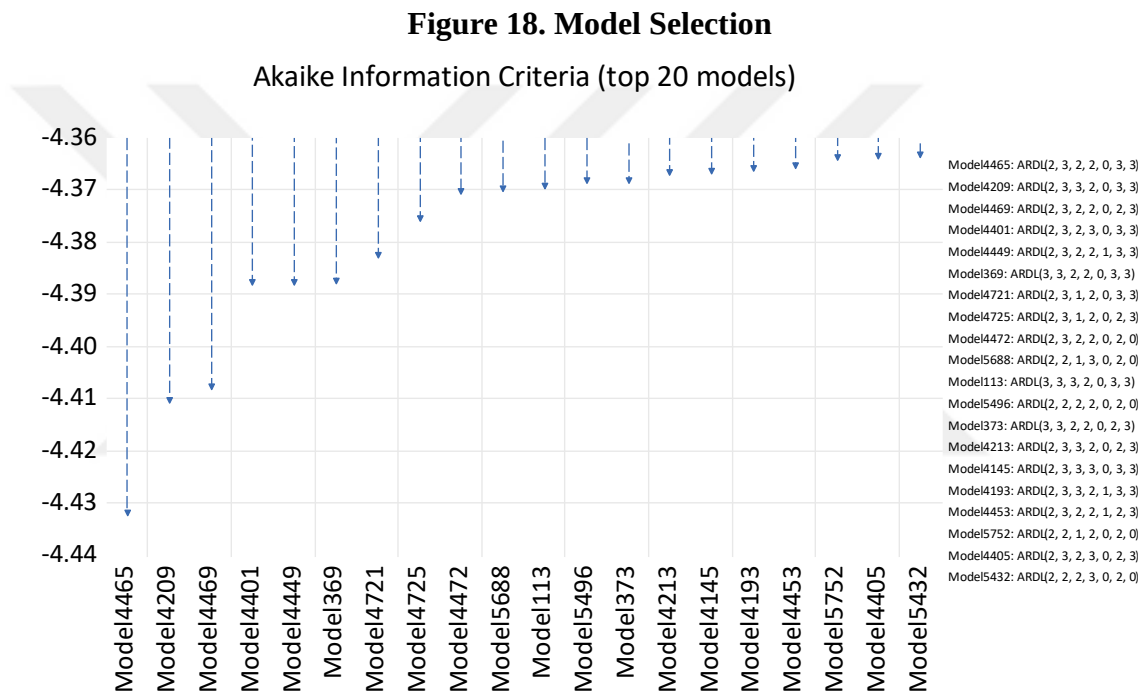
The traditional ARDL model can be written as:

$$\begin{aligned} \log RTCC_t = & c_0 + c_1 t + \sum_{i=1}^p b_{\log RTCC,i} \log RTCC_{t-i} + \sum_{j=0}^q b_{RCCIR,j} RCCIR_{t-j} \\ & + \sum_{l=0}^r b_{CCR,l} CCR_{t-l} + \sum_{d=0}^z b_{\log THS,d} \log THS_{t-d} \\ & + \sum_{k=0}^g b_{\log CPND,k} \log CPND_{t-k} + \sum_{b=0}^c b_{\log RCTI,b} \log RCTI_{t-b} \\ & + \sum_{f=0}^u b_{Dummy3,f} Dummy3_{t-f} + \varepsilon_t \end{aligned}$$

Where:

- $p, q, r, z, g, c,$  and  $u$  are the optimal lag length determined by the Akaike Information Criterion (AIK).
- $c_0$  is the constant term and  $c_1 t$  is the trend term.
- $b$  is the coefficient of the lagged variables.
- $\varepsilon_t$  is the error term.

To set the traditional ARDL model lag selection was performed by using Akaike selection criteria automatically via EViews 12 program at maximum for dependent and independent variables as 3 and results are depicted in Figure 18. For logRTCC 2, RCCIR 3, CCR 2, logTHS 2, logCPND 0, logRCTI 3, and Dummy3 3 lags were selected. The model was performed with a linear trend and constant term.



Source: The figure generated by EViews 12 program.

### 6.5.3. Unrestricted Error Correction Model (UECM)

The long-run form of the ARDL bounds test can be written as:

$$\begin{aligned}
\Delta \log RTCC_t = & c_0 + c_1 t + \pi_{\log RTCC} \log RTCC_{t-1} + RCCIR_{t-j} + CCR_{t-l} + \log THS_{t-d} \\
& + \log CPND_{t-k} + \log RCTI_{t-b} + Dummy3_{t-f} \\
& + \sum_{i=1}^{p-1} \psi_{\log RTCC,i} \Delta \log RTCC_{t-i} + \sum_{j=1}^{q-1} \psi_{RCCIR,j} \Delta RCCIR_{t-j} \\
& + \sum_{l=1}^{r-1} \psi_{CCR,l} \Delta CCR_{t-l} + \sum_{d=1}^{z-1} \psi_{\log THS,d} \Delta \log THS_{t-d} \\
& + \sum_{k=1}^{g-1} \psi_{\log CPND,k} \Delta \log CPND_{t-k} + \sum_{b=1}^{c-1} \psi_{\log RCTI,b} \Delta \log RCTI_{t-b} \\
& + \sum_{f=1}^{u-1} \psi_{Dummy3,f} \Delta Dummy3_{t-f} + \omega_{RCCIR} \Delta RCCIR_t + \omega_{CCR} \Delta CCR_t \\
& + \omega_{CRsme} \Delta CRsme_t + \omega_{\log THS} \Delta \log THS_t + \omega_{\log CPND} \Delta \log CPND_t \\
& + \omega_{\log RCTI} \Delta \log RCTI_t + \omega_{Dummy3} \Delta Dummy3_t + \varepsilon_t
\end{aligned}$$

Where:

- $\omega$  is the long-run coefficients of the lagged variables.
- $\psi$  is the short-run coefficients of the lagged variables.
- $c_0$  is the constant term and  $c_1 t$  is the trend term.
- $\varepsilon_t$  is the error term. The error term ( $\varepsilon_t$ ) is assumed to be white noise.
- $\Delta$  represents the first difference.

**Table 21. The UECM Test Results**

| <b>ARDL (2,3,2,2,0,3,3) Case 3: Unrestricted constant and trend</b>                                                  |                    |                  |                     |                    |
|----------------------------------------------------------------------------------------------------------------------|--------------------|------------------|---------------------|--------------------|
| <b>Long-Run terms</b>                                                                                                |                    |                  |                     |                    |
| <b>Variable</b>                                                                                                      | <b>Coefficient</b> | <b>St. error</b> | <b>t-statistics</b> | <b>Probability</b> |
| RCCIR                                                                                                                | 0.315041           | 0.060257         | 5.228329            | 0.0000             |
| CCR                                                                                                                  | 1.598373           | 1.860399         | 0.859156            | 0.3995             |
| logTHS                                                                                                               | 0.061123           | 0.077260         | 0.791124            | 0.4373             |
| logCPND                                                                                                              | -0.016042          | 0.023025         | -0.696744           | 0.4933             |
| logRCTI                                                                                                              | 0.456454           | 0.082417         | 5.538356            | 0.0000             |
| Dummy3                                                                                                               | -0.082026          | 0.056213         | -1.459193           | 0.1586             |
| EC = LOG(RTCC) - (0.3150*RCCIR + 1.5984*CCR + 0.0611*LOG(THS) - 0.0160*LOG(CPND) + 0.4565*LOG(RCTI) - 0.0820*DUMMY3) |                    |                  |                     |                    |

Notes: EC refers to the error correction term.

Table 21 shows the long-run terms of the ARDL bounds test. The coefficients, standard errors, t-statistics, and probabilities for each variable are presented. The results indicate that the RCCIR variable has a statistically significant coefficient of 0.315041 with a p-value of 0.0000, suggesting a positive long-run relationship when it rises by 1% the construction sector's credit volume will increase by 0.315%. The

CCR variable has a coefficient of 1.598373, but the probability value of 0.3995 indicates that it is not statistically significant in the long run.

The logTHS variable has a coefficient of 0.061123 with a probability value of 0.4373, which has no effects statistically. The logCPND variable has a coefficient of -0.016042 with a probability value of 0.4933, indicating that it is not statistically significant in the long run. For logRCTI, it has a statistically significant coefficient of 0.456454 with a p-value of 0.0000, suggesting a positive long-run relationship that a 1% increase in real turnover of all sectors causes a 0.456% increase in the dependent variable. This can be considered as the aggregate demand of the construction sector is a crucial factor in determining the credit application of the construction sector. Finally, the dummy variable has a p-value of 0.1586 which is higher than 5% means that it's not significant in the long run. So, we can say structural breaks do not affect the real credit supply of the construction sector.

#### **6.5.4. ARDL Bounds Test F Statistics Result**

We will now proceed to the ARDL bounds test. The null hypothesis states that there is no long-term connection between the variables, while the alternative hypothesis suggests the existence of such a relationship. According to Table 22, the F-statistic of our model (5.9468) exceeds all the upper bound critical values, indicating that the variables in our model are cointegrated, and the long-term coefficients are statistically significant.

**Table 22. Bounds F Test Results**

| <b>Significance</b> | <b>I(0) Lower bound</b> | <b>I(1) Upper bound</b> | <b>F statistics</b> | <b>K</b> |
|---------------------|-------------------------|-------------------------|---------------------|----------|
| Level %10           | 2.53                    | 3.59                    | 5.946831            | 6        |
| Level %5            | 2.87                    | 4                       |                     |          |
| Level %1            | 3.6                     | 4.9                     |                     |          |

Notes: "K" denotes the number of variables.

#### **6.5.5. Restricted Error Correction Model (RECM)**

The RECM model is used to test the short-run dynamics and the speed of adjustment of the variables toward their long-run equilibrium. The RECM model can be represented as follows:

$$\begin{aligned}
\Delta \log RTCC_t = & c_0 + c_1 t + \sum_{i=1}^{p-1} \psi_{\log RTCC,i} \Delta \log RTCC_{t-i} + \sum_{j=1}^{q-1} \psi_{RCCIR,j} \Delta RCCIR_{t-j} \\
& + \sum_{l=1}^{r-1} \psi_{CCR,l} \Delta CCR_{t-l} + \sum_{d=1}^{z-1} \psi_{\log THS,d} \Delta \log THS_{t-d} \\
& + \sum_{k=1}^{g-1} \psi_{\log CPND,k} \Delta \log CPND_{t-k} + \sum_{b=1}^{c-1} \psi_{\log RCTI,b} \Delta \log RCTI_{t-b} \\
& + \sum_{f=1}^{u-1} \psi_{Dummy3,f} \Delta Dummy3_{t-f} + \omega_{RCCIR} \Delta RCCIR_t + \omega_{CCR} \Delta CCR_t \\
& + \omega_{CRsme} \Delta CRsme_t + \omega_{\log THS} \Delta \log THS_t + \omega_{\log CPND} \Delta \log CPND_t \\
& + \omega_{\log RCTI} \Delta \log RCTI_t + \omega_{Dummy3} \Delta Dummy3_t + \pi_{\log RTCC} ECT_t + \varepsilon_t
\end{aligned}$$

Where:

- $\Delta$  represents the first difference.
- $\pi$  is the coefficient of the error correction term (ECT).
- $ECT_t$  represents the error correction term.

**Table 23. Restricted Error Correction Model (RECM)**

**ARDL (2,3,2,2,0,3,3) Case 3: Unrestricted constant and Trend**

| Variable       | Coefficient | St. error | t-statistics | Probability |
|----------------|-------------|-----------|--------------|-------------|
| D(logRTCC(-1)) | 0.342673    | 0.099009  | 3.461039     | 0.0022      |
| D(RCCIR)       | -0.114338   | 0.033921  | -3.370730    | 0.0028      |
| D(RCCIR(-1))   | 0.085131    | 0.059335  | 1.434754     | 0.1654      |
| D(RCCIR(-2))   | -0.136979   | 0.055426  | -2.471360    | 0.0217      |
| D(CCR)         | 6.032156    | 1.189348  | 5.071815     | 0.0000      |
| D(CCR(-1))     | -2.716144   | 1.451490  | -1.871280    | 0.0747      |
| D(logTHS)      | -0.037385   | 0.017464  | -2.140749    | 0.0436      |
| D(logTHS(-1))  | -0.065073   | 0.016841  | -3.864027    | 0.0008      |
| D(logRCTI)     | 0.039501    | 0.032440  | 1.217689     | 0.2362      |
| D(logRCTI(-1)) | -0.129656   | 0.046465  | -2.790424    | 0.0107      |
| D(logRCTI(-2)) | -0.055633   | 0.036042  | -1.543555    | 0.1370      |
| D(Dummy3)      | 0.003123    | 0.008839  | 0.353326     | 0.7272      |
| D(Dummy3(-1))  | 0.053028    | 0.011933  | 4.443680     | 0.0002      |
| D(Dummy3(-2))  | 0.028899    | 0.009829  | 2.940238     | 0.0076      |
| CointEq(-1)    | -0.608840   | 0.083646  | -7.278795    | 0.0000      |
| Constant       | 13.83634    | 1.897985  | 7.290014     | 0.0000      |
| Trend          | 0.010763    | 0.001563  | 6.886799     | 0.0000      |

Notes: “D” denotes the first difference operator.

Table 23 presents the short-run coefficients, standard errors, t-statistics, and probabilities for the ARDL model Case 3, which is an unrestricted constant and trend model. The first lag of logRTCC has a coefficient of 0.342673, which is statistically

significant at the 5% level, indicating that a 1% increase in the total credits of the construction sector in the previous period leads to a 0.34% increase in its contemporary value. RCCIR has a negative coefficient of -0.114338, which is statistically significant at the 5% level, indicating that a 1% increase in RCCIR leads to a 0.1143 % decrease in the dependent variable. But the first lag of RCCIR has a positive p-value of 0.1654 which means statistically not significant. The second lag of RCCIR has a negative coefficient (-0.136979) which is statistically significant at the 5% level, indicating that a 1% increase leads to a 0.137 % decrease in the dependent variable.

CCR has a large positive coefficient of 6.032156, which is statistically significant at the 5% level, indicating that a 1% increase in the credit spread leads to a 6.032% increase in the dependent variable. Its previous period has a negative coefficient of -2.716144, which is not statistically significant at the 5% level.

logTHS has a negative coefficient of -0.037385, which is statistically significant at the 5% level means that an increase in the total house sales ends up with a 0.374% decrease in the dependent variable. For its first lag, logTHS(-1), has a larger negative coefficient of -0.065073, which is statistically significant at the 5% level, indicating that a 1% increase in the first lag of logTHS leads to a 0.0651% decrease in the real credit supply.

Likely, logRCTI has a positive coefficient of 0.039501, which is not statistically significant at the 5% level, but the previous period of logRCTI has a negative coefficient of -0.129656, which is statistically significant at the 5% level, indicating that a 1% increase in the first lag of the construction sector turnover in the previous period leads to a 0.13 % decrease in the total real credit amount of construction sector. Also, It's the second lag has a statistically significant coefficient (-0.055633) at a 5% significance level means that a 1% increase in the second lag of the real turnover of the construction sector leads to a 0.0556% decrease in the real total credits of the construction sector.

The dummy variable has no statistically significant coefficient in the initial period, but its first and second lag becomes significant with p-values of 0.0002 and 0.0076 respectively indicating that when the structural breaks occur the real credit supply increases by 0.053 and 0.0289 amounts, respectively.

The lagged error correction term (CointEq(-1)) has a negative coefficient of -0.608840, which is statistically significant at the 5% level, indicating that there is a tendency to converge towards the long-run equilibrium relationship.

The constant term has a large positive coefficient of 13.83634, which is statistically significant at the 1% level, indicating that the intercept of the regression line is quite high. The trend term has a positive coefficient of 0.010763, which is statistically significant at the 1% level, indicating that there is a trend in the data.

#### 6.5.6. Diagnostic Tests Results

Table 24 provides the results of diagnostic tests conducted to assess the goodness-of-fit of the model. The first test, the B.G. LM test, assesses the overall goodness-of-fit of the model and tests for any signs of autocorrelation. The test produced a test score of 1.808704 and a p-value of 0.1897, indicating that there is no significant evidence of autocorrelation in the model.

The second test, the B.P.G. test, evaluates whether there is any heteroskedasticity in the residuals. The test produced an observation R-squared value of 14.06085 and a p-value of 0.8993, indicating that there is no significant evidence of heteroskedasticity.

The third test, the J.B. test, assesses whether the residuals of the model are normally distributed. The test produced a Jarque-Bera score of 2.916427 and a p-value of 0.232652, indicating that there is no significant evidence to reject the null hypothesis of normality.

Finally, the Ramsey RESET test evaluates whether there is any evidence of omitted variables in the model. The test produced an F-statistic of 0.044134 and a p-value of 0.8356, indicating that there is no significant evidence of omitted variables in the model. Overall, these diagnostic tests suggest that the model fits the data well and there are no significant issues with the model assumptions.

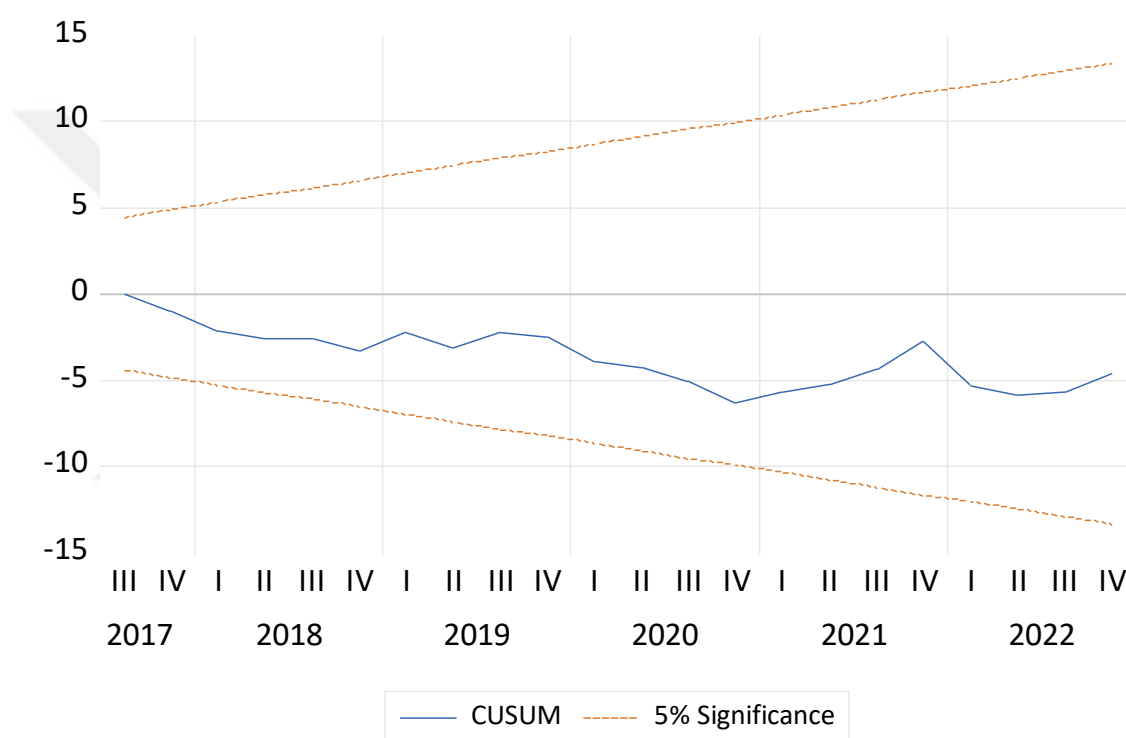
**Table 24. Diagnostic Test Results**

| Diagnostic tests. | Kind of statistics                | Lags | Test scores         |
|-------------------|-----------------------------------|------|---------------------|
| B.G. LM test      | F-statistics (Prob. F-statistics) | 2    | 1.808704 (0.1897)   |
| B.P.G. test       | Obs. R-squared (Prob. Chi-Square) |      | 14.06085 (0.8993)   |
| J.B. test         | Jarque-Bera score (Probability)   |      | 2.916427 (0.232652) |
| Ramsey RESET      | F-statistics (Prob. F-statistics) | 1    | 0.044134 (0.8356)   |

Values within parenthesis denote p-values.

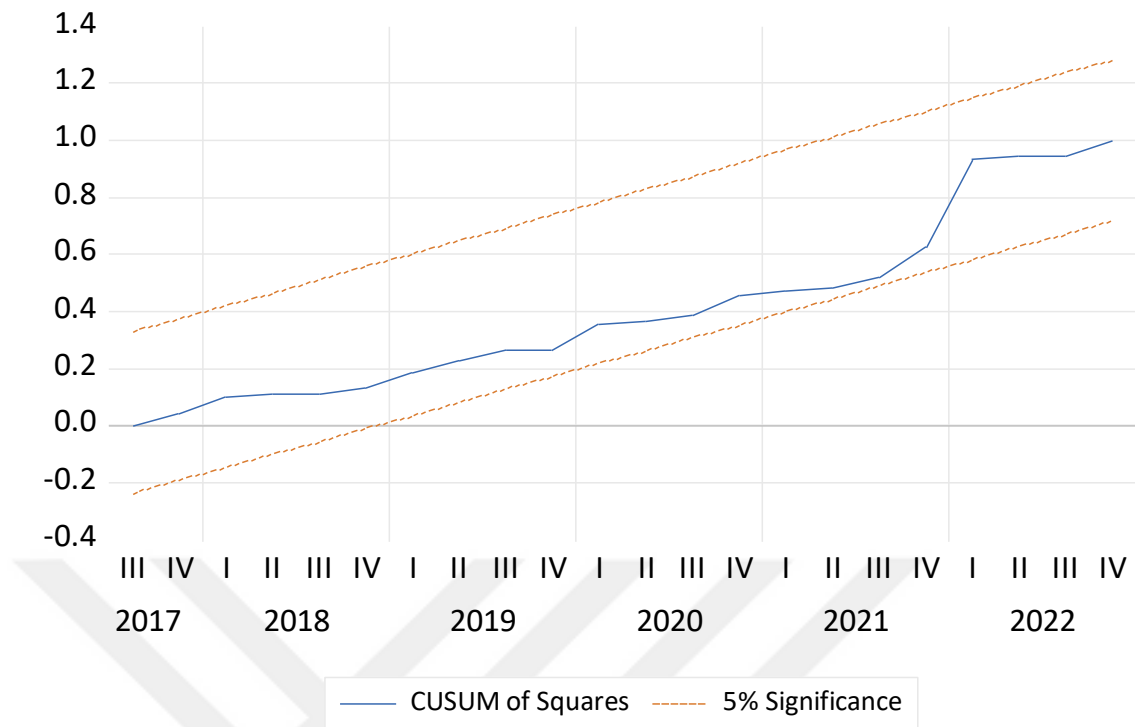
The stability diagnostics of any statistical model is an important aspect of its analysis. In the case of our model, we have presented the results of the stability diagnostics in Figure 19 and Figure 20. These figures offer insights into the behavior of our model over time, which is a crucial aspect in determining its reliability and effectiveness. Upon examining the figures, it becomes evident that there are no significant structural breaks in our model. The overall trends remain within the 5% significance level, which suggests that the model is stable and does not experience any significant shifts or changes in its behavior over time.

**Figure 19. CUSUM Graph**



*Source: The figure generated by EViews 12 program.*

**Figure 20. CUSUM of Squares Graph**



*Source: The figure generated by EViews 12 program.*

## 6.6 Chapter Conclusion

The construction sector plays a critical role in the economy as it is a key driver of economic growth and job creation. However, access to credit is often cited as a major challenge for the sector, particularly in times of economic uncertainty. The purpose of this thesis was to investigate the relationship between the real credit usage of the construction sector and real commercial credit interest rates, as well as other determinants such as the sector's credit spread, real endorsement of the construction sector, number of construction permits for dwellings, and the total building sold in the context of the aggregate demand to the sector. The study contributes to the literature on the credit market in the construction sector by providing empirical evidence of the relationship between credit supply and commercial credit rates. The findings may have significant implications for policymakers, financial institutions, and the construction industry in addressing the challenges faced by the sector in accessing credit.

The results indicate that real commercial credit interest rates have a positive and statistically significant long-run relationship with the construction sector's credit volume. This is a crucial result in line with our aim to research. A 1 base point increase in real commercial credit interest rates leads to a 0.315% increase in the construction sector's credit volume. We can interpret that the decreasing real interest rate is not eligible in the long-run in Türkiye while the firms can make more profits from it. This is most likely the behavior of the lenders (banks) that are reluctant to lend because of the high cost of lending.

The results also suggest that the aggregate demand for the construction sector is a crucial factor in determining the credit applications of the sector. The real turnover of the construction sector (RCTI) has a positive long-run relationship with the RTCC, and a 1% increase in real turnover leads to a 0.4565% increase in the construction sector's credit volume.

On the other hand, credit spread, total house sales, and the number of construction permits for dwellings have no statistically significant relationship with the construction sector's credit volume in the long run.

In the short run, a 1% increase in the real total credits of the construction sector in the previous period leads to a 0.3427% increase in its contemporary value. This autoregressive behavior can be interpreted as the expectations about the increasing demand for credits from the construction sector can lead to credit supply in banks' balance sheets.

The real commercial credit interest rates (RCCIR) were found to cause a significant negative effect on RTCC in the short run. So, we can interpret from the results as a 1 base point decrease in the contemporary and the previous period lead to a 0.1143% and 0.137% increase in the RTCC respectively. These results are very expected for the initial stages of the credit channel of the monetary transmission mechanism that decreasing real interest rate creates more demand, because firms demand more credits where they are way too much profitable in real terms as they positively yield to maturity.

The credit spread has a large positive effect, indicating that a 1 base point increase in the credit spread leads to a 6.032% increase in the RTCC. Based on this result, we

can conclude that support by the government and institutions can increase the credit volume of the construction sector via bank lending.

On the other hand, total house sales (THS) has a negative significant impact on the construction sector's credit volume in the short run. A 1% increase in the current and previous periods in THS leads to a 0.037% and 0.065% decrease in the RTCC. We can infer that the revenue of the construction sector depends on the house sales and when they increase their sales, their dependency on credit goes to fall.

The real construction turnover also reflects the revenue of the construction sector. The results suggest that if the first and second past periods increase, RTCC decreases by 0.13% and 0.056% respectively. We can infer from the result; the construction sector tends to lower its credit demand as it can fund itself.

Lastly, the structural breaks found to be inclusive in the short run when there exists a structural break in pre-periods of the variables, the real commercial credit use of the sector increases slightly.

The lagged error correction term has a negative coefficient, indicating that there is a tendency to revert toward the long-run equilibrium relationship. Therefore, policymakers and financial institutions should consider the long-term effects of real commercial credit interest rates and the aggregate demand of the construction sector when making decisions regarding credit supply to the construction industry.

Overall, the results suggest that access to credit is a significant challenge for the construction industry, particularly in times of economic uncertainty. Policymakers and financial institutions should work together to address the challenges faced by the construction sector in accessing credit, as the sector plays a critical role in the economy and is a key driver of economic growth and job creation. These findings have implications for policymakers, financial institutions, and the construction industry. Policymakers need to consider the impact of real commercial credit interest rates on the real credit supply of the construction sector when setting economic policies. Financial institutions should take into account the aggregate demand of the construction sector when evaluating loan applications. The construction industry should also consider the aggregate demand of the construction sector and the real commercial credit interest rates when planning for future projects and investments.

## 7. CONCLUSION

This thesis comprises three empirical studies that examine the interconnection between credit dynamics and interest rates in Türkiye. The study aimed to show the crucial role played by interest rates and behaviors of credit markets, encompassing the cost of borrowing, lending practices, and the availability of credit within various sectors of the economy. Gaining a comprehensive understanding of the intricate relationship between interest rates and credit dynamics is crucial for policymakers, investors, and practitioners who strive to foster sustainable economic growth and development in Türkiye.

The first study, Chapter 4, examines the relationship between policy interest rates set by the Central Bank of the Republic of Türkiye and commercial credit rates offered by banks in the country. By employing the ARDL bounds model, this study aims to provide valuable insights for policymakers seeking to manage interest rates in a way that supports economic growth and stability in Türkiye. Additionally, this research contributes to the existing literature by conducting a specific analysis of the relationship between policy interest rates and commercial credit rates, which has not been extensively studied before.

The study reveals a statistically significant positive association between changes in policy interest rates and changes in commercial credit interest rates in the short run while controlling for other factors. This suggests that adjustments in the policy rate are rapidly transmitted to the banking sector, resulting in corresponding changes in lending rates for consumers and businesses. The study also finds a negative effect of previous periods' policy interest rates, indicating that changes in policy rates may exhibit diminishing effects over time. As market expectations about future interest rates become more firmly established, the impact of policy rate changes diminishes.

The study demonstrates that changes in policy interest rates also have a significant positive relationship with commercial credit interest rates in the long run. This shows us the monetary transmission mechanism for the interest rate channel exists in Türkiye. Policymakers must seek the potential effects of past values and consider

both short-term and long-term effects to manage interest rates. Policymakers aiming to stimulate economic activity through interest rate reductions must ensure that such changes effectively reach consumers and businesses through lending rates.

Briefly, this study demonstrates a significant positive association between policy interest rates and commercial credit rates in Türkiye, both in the short run and long run. The ARDL bounds model employed in this research provides a reliable tool for analyzing this relationship. The results highlight the need for policymakers to consider the rapid transmission of changes in policy rates to lending rates and the potential diminishing effects over time. By ensuring that interest rate adjustments are effectively transmitted to consumers and businesses, policymakers can support economic growth and stability in Türkiye.

The second study, Chapter 5, analyses the relationship between credit access for small and medium-sized enterprises (SMEs) in Türkiye and various determinants, including the real interest rate and macroeconomic factors. The findings have important implications for policymakers, lending institutions, and SMEs themselves. By understanding the drivers of SME lending rates, policymakers can implement measures to enhance access to affordable financing. Lending institutions can utilize these insights to develop targeted lending strategies, while SMEs can make informed decisions about their borrowing options.

The study employed the autoregressive distributed lag (ARDL) bounds testing approach and analyzed quarterly data from 2011 to 2022. The aim was to provide insights into how changes in real interest rates and other determinants impact the availability of credit for SMEs in Türkiye.

The results revealed that the high cost of borrowing for SMEs in Türkiye is primarily attributed to the country's macroeconomic environment, characterized by high negative real interest rates, posing challenges for SMEs to access affordable financing. Moreover, traditional banks in Türkiye have shown reluctance in lending to SMEs, focusing instead on larger, established firms.

The study found that the real credit usage of SMEs influences its subsequent periods. An increase in the previous value of total commercial credits of SMEs causes a corresponding increase in its contemporary value, while an increase in the past

period leads to a decrease. This suggests that despite banks' reluctance to lend, their lending behavior can encourage SMEs to demand more credit in subsequent periods.

The net number of SMEs was found to have a significant positive effect on their real credit supply. An increase in the net number of SMEs results in a corresponding increase in their real credit supply. This relationship indicates that a rise in the number of SMEs leads to higher credit demand in the short run.

The credit spread of SMEs concerning all credit lent by banks also has a positive effect on the real credit supply in the short run. An increase in the credit spread leads to a corresponding increase in the real credit supply for SMEs. This finding highlights the importance of credit availability and the role of supply programs by various institutions in supporting SMEs.

However, the previous term of the credit spread has a significant negative effect on the real credit supply. An increase in the credit spread leads to a decline in the credit amount for the construction sector. This suggests the presence of regulations by banks to maintain an equilibrium in credit spread distribution in the short run.

The contemporary value of the real commercial credit interest rate (RCCIR) was found to have a positive influence on the real credit usage of SMEs in both the short and long run. An increase in the RCCIR leads to an increase in SMEs' real credit usage. Conversely, if the previous periods of RCCIR increase, the total real credit amount for SMEs decreases in the short-run. This implies that SMEs' credit usage is directly affected by changes in real commercial credit rates.

The real turnover of all sectors in the economy showed no significant effects in the short run but had a substantial impact in the long run. An increase in the real turnover of all sectors leads to a corresponding increase in SMEs' real credit supply. This highlights the role of aggregate demand in driving credit utilization by SMEs in the long run.

In the long run, the RCCIR and credit spread (CRsme) were found to have positive effects on the real credit supply for SMEs. An increase in RCCIR and CRsme leads to a respective increase in SMEs' real credit usage. The net number of SMEs (NNsme) and structural breaks (Dummy2) showed no impact on the long-term results.

This study underscores the significance of understanding the factors that influence SME borrowings in Türkiye. Policymakers can utilize these findings to implement measures aimed at reducing borrowing costs and increasing access to finance for SMEs. Lending institutions can develop targeted lending strategies based on these insights. SMEs, on the other hand, can use the study's findings to gain a better understanding of the financing landscape and make informed decisions regarding their borrowing options. By addressing the challenges faced by SMEs in accessing affordable credit, Türkiye can advance the growth and development of these crucial economic players.

The last study, Chapter 6, contributes to the existing literature on the credit market in the construction sector by providing empirical evidence of the relationship between the real credit supply in the construction sector and real commercial credit interest rates, along with other determining factors such as credit spread, endorsement of the sector, number of construction permits, and total building sales. The findings have significant implications for policymakers, financial institutions, and the construction industry, offering insights into addressing the sector's credit accessibility challenges.

The results of this study demonstrate a positive and statistically significant long-run relationship between real commercial credit interest rates and the real credit volume in the construction sector. This finding aligns with the research objective of the study. Remarkably, this suggests that lower real interest rates are not conducive to long-term credit growth in Türkiye, as lenders (banks) appear to be cautious to lend due to higher associated costs.

The study also highlights the significant influence of aggregate demand on credit applications within the construction sector. Real turnover of the construction sector (RCTI) exhibits a positive long-run relationship with real commercial credit interest rates (RTCC).

Contrary to expectations, credit spread, total house sales, and the number of construction permits for dwellings show no statistically significant relationship with the construction sector's credit volume in the long run. While these factors may have other important implications for the industry, they do not directly impact credit accessibility.

In the short run, the study reveals that the previous periods of the real total credit volume of the construction sector have a positive effect on its contemporary value. This autoregressive behavior indicates that expectations of future credit supply for the construction sector considering the past values prompt banks to create credit supply within their balance sheets.

Furthermore, the real commercial credit interest rates (RCCIR) exhibit a significant negative effect on the real total credit volume of the construction sector in the short run. This observation can be attributed to the initial stages of the credit channel of the monetary transmission mechanism is still hold in Türkiye where firms seek more credit to capitalize on profitable real terms.

The credit spread demonstrates a substantial positive effect. This suggests that government and institutional support can foster increased credit volumes in the construction sector through bank lending.

Interestingly, total house sales (THS) exhibit a negative and significant impact on the construction sector's credit volume in the short run. This implies that the construction sector's revenue is closely tied to house sales, and an increase in sales reduces its reliance on credit.

Similarly, the real construction turnover also reflects the revenue of the construction sector. This suggests that the construction sector tends to decrease its credit demand when it can self-fund its projects.

Concisely, the construction industry faces significant challenges in accessing credit, particularly during times of economic uncertainty. Policymakers, financial institutions, and the industry itself must collaborate to address these challenges, considering the sector's critical role in driving economic growth and job creation. The study's findings offer insights into the relationship between credit supply, interest rates, and other determining factors, providing valuable implications for stakeholders involved in the construction industry. By addressing the credit accessibility issues, policymakers and financial institutions can foster a conducive environment for the construction sector to thrive, contributing to overall economic development.

In a comprehensive examination of the Turkish economy, this trilogy of research papers presents a wealth of crucial insights that shed light on its intricate dynamics

and the elaborate interplay between interest rates and credit dynamics across important sectors. The studies capture many critical factors that contribute to shaping the economic landscape of Türkiye, emphasizing the importance of considering both short-term and longer-term effects of policy interest rate changes and the broader macroeconomic environment.

By delving deep into the relationship between interest rates and credit access, these papers offer a nuanced understanding of the implications for different sectors of the economy. They highlight the intricate mechanisms by which changes in policy interest rates can transmit throughout the financial system, influencing credit availability and affecting the borrowing capacity of businesses, households, and individuals. By exposing these dynamics, the research underscores the significance of adopting a comprehensive perspective when formulating monetary policy and financial regulations.

The findings of this trilogy have substantial implications for policymakers in Türkiye who are tasked with the responsibility of promoting financial stability and driving sustainable economic growth. With a nuanced understanding of the interconnections between interest rates, credit dynamics, and sectoral performance, policymakers are better equipped to make informed decisions that optimize the allocation of credit and facilitate the growth of key industries. By taking into account both the short-term effects and the longer-term consequences of policy interest rate changes, policymakers can design more effective measures to stimulate economic activity while safeguarding financial stability.

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## APPENDIX

### A1. Empirical Results of Chapter 4

**Table 25. Traditional ARDL Test Result**

Dependent Variable: CCIR

Method: ARDL

Date: 04/23/23 Time: 19:44

Sample (adjusted): 2012Q1 2022Q4

Included observations: 44 after adjustments

Maximum dependent lags: 4 (Automatic selection)

Model selection method: Hannan-Quinn criterion (HQ)

Dynamic regressors (4 lags, automatic): PIR DUMMY1

Fixed regressors: C

Number of models evaluated: 100

Selected Model: ARDL(1, 4, 0)

| Variable           | Coefficient | Std. Error            | t-Statistic | Prob.*    |
|--------------------|-------------|-----------------------|-------------|-----------|
| CCIR(-1)           | 0.353653    | 0.115972              | 3.049460    | 0.0043    |
| PIR                | 0.591260    | 0.107083              | 5.521509    | 0.0000    |
| PIR(-1)            | 0.379775    | 0.195129              | 1.946276    | 0.0595    |
| PIR(-2)            | -0.508067   | 0.202822              | -2.504992   | 0.0169    |
| PIR(-3)            | 0.094439    | 0.186118              | 0.507415    | 0.6150    |
| PIR(-4)            | 0.226798    | 0.116210              | 1.951614    | 0.0588    |
| DUMMY1             | -0.041750   | 0.008308              | -5.025080   | 0.0000    |
| C                  | 0.023730    | 0.009372              | 2.532003    | 0.0158    |
| R-squared          | 0.934109    | Mean dependent var    |             | 0.167254  |
| Adjusted R-squared | 0.921297    | S.D. dependent var    |             | 0.049996  |
| S.E. of regression | 0.014026    | Akaike info criterion |             | -5.532870 |
| Sum squared resid  | 0.007082    | Schwarz criterion     |             | -5.208472 |
| Log likelihood     | 129.7231    | Hannan-Quinn criter.  |             | -5.412567 |
| F-statistic        | 72.90825    | Durbin-Watson stat    |             | 1.973830  |
| Prob(F-statistic)  | 0.000000    |                       |             |           |

\*Note: p-values and any subsequent tests do not account for model selection.

**Table 26. Long Run Form of ARDL Bounds Test Result**

ARDL Long Run Form and Bounds Test  
 Dependent Variable: D(CCIR)  
 Selected Model: ARDL(1, 4, 0)  
 Case 3: Unrestricted Constant and No Trend  
 Date: 04/23/23 Time: 19:48  
 Sample: 2011Q1 2022Q4  
 Included observations: 44

| Conditional Error Correction Regression |             |            |             |        |
|-----------------------------------------|-------------|------------|-------------|--------|
| Variable                                | Coefficient | Std. Error | t-Statistic | Prob.  |
| C                                       | 0.023730    | 0.009372   | 2.532003    | 0.0158 |
| CCIR(-1)*                               | -0.646347   | 0.115972   | -5.573288   | 0.0000 |
| PIR(-1)                                 | 0.784204    | 0.134301   | 5.839164    | 0.0000 |
| DUMMY1**                                | -0.041750   | 0.008308   | -5.025080   | 0.0000 |
| D(PIR)                                  | 0.591260    | 0.107083   | 5.521509    | 0.0000 |
| D(PIR(-1))                              | 0.186830    | 0.131064   | 1.425492    | 0.1626 |
| D(PIR(-2))                              | -0.321237   | 0.115883   | -2.772086   | 0.0088 |
| D(PIR(-3))                              | -0.226798   | 0.116210   | -1.951614   | 0.0588 |

\* p-value incompatible with t-Bounds distribution.  
 \*\* Variable interpreted as  $Z = Z(-1) + D(Z)$ .

| Levels Equation<br>Case 3: Unrestricted Constant and No Trend |             |            |             |        |
|---------------------------------------------------------------|-------------|------------|-------------|--------|
| Variable                                                      | Coefficient | Std. Error | t-Statistic | Prob.  |
| PIR                                                           | 1.213286    | 0.105794   | 11.46840    | 0.0000 |
| DUMMY1                                                        | -0.064594   | 0.011924   | -5.417232   | 0.0000 |

EC = CCIR - (1.2133\*PIR - 0.0646\*DUMMY1)

| F-Bounds Test       |          | Null Hypothesis: No levels relationship |       |       |
|---------------------|----------|-----------------------------------------|-------|-------|
| Test Statistic      | Value    | Signif.                                 | I(0)  | I(1)  |
| Asymptotic: n=1000  |          |                                         |       |       |
| F-statistic         | 12.44956 | 10%                                     | 3.17  | 4.14  |
| k                   | 2        | 5%                                      | 3.79  | 4.85  |
|                     |          | 2.5%                                    | 4.41  | 5.52  |
|                     |          | 1%                                      | 5.15  | 6.36  |
| Finite Sample: n=45 |          |                                         |       |       |
| Actual Sample Size  | 44       | 10%                                     | 3.33  | 4.347 |
|                     |          | 5%                                      | 4.083 | 5.207 |
|                     |          | 1%                                      | 5.92  | 7.197 |
| Finite Sample: n=40 |          |                                         |       |       |
|                     |          | 10%                                     | 3.373 | 4.377 |
|                     |          | 5%                                      | 4.133 | 5.26  |
|                     |          | 1%                                      | 5.893 | 7.337 |

| t-Bounds Test  |           | Null Hypothesis: No levels relationship |       |       |
|----------------|-----------|-----------------------------------------|-------|-------|
| Test Statistic | Value     | Signif.                                 | I(0)  | I(1)  |
| t-statistic    | -5.573288 | 10%                                     | -2.57 | -3.21 |
|                |           | 5%                                      | -2.86 | -3.53 |
|                |           | 2.5%                                    | -3.13 | -3.8  |
|                |           | 1%                                      | -3.43 | -4.1  |

**Table 27. Error Correction Form of ARDL Bounds Test Result**

ARDL Error Correction Regression

Dependent Variable: D(CCIR)

Selected Model: ARDL(1, 4, 0)

Case 3: Unrestricted Constant and No Trend

Date: 04/23/23 Time: 19:50

Sample: 2011Q1 2022Q4

Included observations: 44

| ECM Regression                             |             |                       |             |        |
|--------------------------------------------|-------------|-----------------------|-------------|--------|
| Case 3: Unrestricted Constant and No Trend |             |                       |             |        |
| Variable                                   | Coefficient | Std. Error            | t-Statistic | Prob.  |
| C                                          | 0.023730    | 0.004267              | 5.560704    | 0.0000 |
| D(PIR)                                     | 0.591260    | 0.096786              | 6.108947    | 0.0000 |
| D(PIR(-1))                                 | 0.186830    | 0.125570              | 1.487853    | 0.1455 |
| D(PIR(-2))                                 | -0.321237   | 0.106977              | -3.002873   | 0.0048 |
| D(PIR(-3))                                 | -0.226798   | 0.107336              | -2.112968   | 0.0416 |
| CointEq(-1)*                               | -0.646347   | 0.102941              | -6.278821   | 0.0000 |
| R-squared                                  | 0.814932    | Mean dependent var    | 0.000673    |        |
| Adjusted R-squared                         | 0.790581    | S.D. dependent var    | 0.029832    |        |
| S.E. of regression                         | 0.013652    | Akaike info criterion | -5.623779   |        |
| Sum squared resid                          | 0.007082    | Schwarz criterion     | -5.380480   |        |
| Log likelihood                             | 129.7231    | Hannan-Quinn criter.  | -5.533552   |        |
| F-statistic                                | 33.46597    | Durbin-Watson stat    | 1.973830    |        |
| Prob(F-statistic)                          | 0.000000    |                       |             |        |

\* p-value incompatible with t-Bounds distribution.

**Table 28. Ramsey RESET Test Result**

Ramsey RESET Test

Equation: UNTITLED

Omitted Variables: Squares of fitted values

Specification: CCIR CCIR(-1) PIR PIR(-1) PIR(-2) PIR(-3) PIR(-4)

DUMMY1 C

|                   | Value      | df      | Probability  |
|-------------------|------------|---------|--------------|
| t-statistic       | 0.320460   | 35      | 0.7505       |
| F-statistic       | 0.102694   | (1, 35) | 0.7505       |
| Likelihood ratio  | 0.128912   | 1       | 0.7196       |
| F-test summary:   |            |         |              |
|                   | Sum of Sq. | df      | Mean Squares |
| Test SSR          | 2.07E-05   | 1       | 2.07E-05     |
| Restricted SSR    | 0.007082   | 36      | 0.000197     |
| Unrestricted SSR  | 0.007061   | 35      | 0.000202     |
| LR test summary:  |            |         |              |
|                   | Value      |         |              |
| Restricted LogL   | 129.7231   |         |              |
| Unrestricted LogL | 129.7876   |         |              |

**Table 29. Breusch - Pagan - Godfrey Test Result**

Heteroskedasticity Test: Breusch-Pagan-Godfrey

Null hypothesis: Homoskedasticity

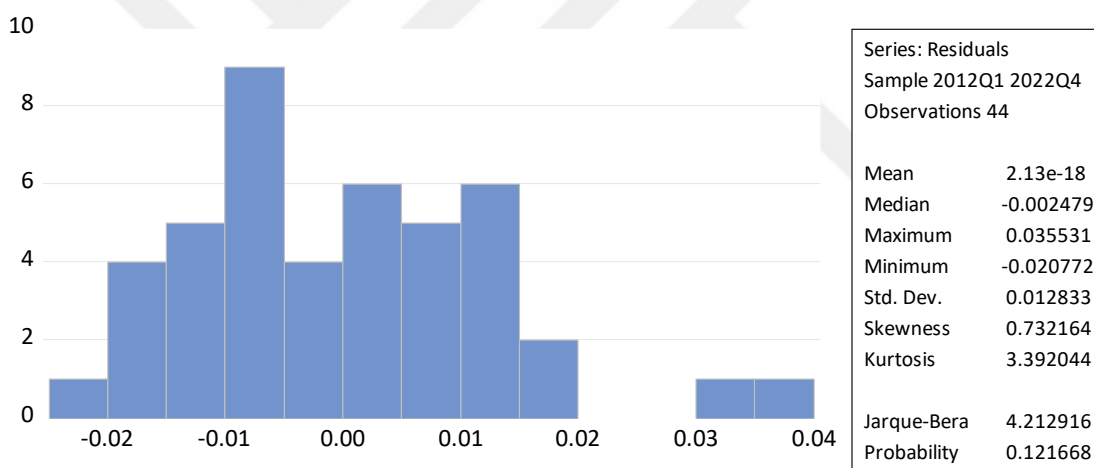
|                     |          |                     |        |
|---------------------|----------|---------------------|--------|
| F-statistic         | 0.688853 | Prob. F(7,36)       | 0.6807 |
| Obs*R-squared       | 5.197368 | Prob. Chi-Square(7) | 0.6359 |
| Scaled explained SS | 4.161235 | Prob. Chi-Square(7) | 0.7610 |

**Table 30. Breusch - Godfrey LM Test Result**

Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 2 lags

|               |          |                     |        |
|---------------|----------|---------------------|--------|
| F-statistic   | 0.016628 | Prob. F(2,34)       | 0.9835 |
| Obs*R-squared | 0.042994 | Prob. Chi-Square(2) | 0.9787 |

**Table 31. Jarque - Bera Test Result**

## A2. Empirical Results of Chapter 5

**Table 32. Traditional ARDL Test Result**

Dependent Variable: LOG(RTCSME)  
Method: ARDL  
Date: 05/31/23 Time: 16:53  
Sample (adjusted): 2011Q4 2022Q4  
Included observations: 45 after adjustments  
Maximum dependent lags: 3 (Automatic selection)  
Model selection method: Schwarz criterion (SIC)  
Dynamic regressors (3 lags, automatic): RCCIR LOG(NNSME) CRSME  
LOG(RTISME) DUMMY1  
Fixed regressors: C  
Number of models evaluated: 3072  
Selected Model: ARDL(3, 3, 1, 2, 1, 0)

| Variable           | Coefficien | Std. Error           | t-Statistic | Prob.* |
|--------------------|------------|----------------------|-------------|--------|
| LOG(RTCSME(-1))    | 1.061120   | 0.122135             | 8.688067    | 0.0000 |
| LOG(RTCSME(-2))    | -0.537674  | 0.130224             | -4.128852   | 0.0003 |
| LOG(RTCSME(-3))    | 0.142038   | 0.071634             | 1.982823    | 0.0569 |
| RCCIR              | 0.195610   | 0.036842             | 5.309395    | 0.0000 |
| RCCIR(-1)          | -0.021453  | 0.067160             | -0.319435   | 0.7517 |
| RCCIR(-2)          | -0.242685  | 0.073683             | -3.293629   | 0.0026 |
| RCCIR(-3)          | 0.301517   | 0.059486             | 5.068724    | 0.0000 |
| LOG(NNSME)         | 0.502032   | 0.120170             | 4.177687    | 0.0002 |
| LOG(NNSME(-1))     | -0.531137  | 0.137092             | -3.874305   | 0.0006 |
| CRSME              | 2.872750   | 0.298392             | 9.627448    | 0.0000 |
| CRSME(-1)          | -3.276356  | 0.499218             | -6.562975   | 0.0000 |
| CRSME(-2)          | 1.394801   | 0.449098             | 3.105787    | 0.0042 |
| LOG(RTISME)        | 0.138993   | 0.140820             | 0.987022    | 0.3318 |
| LOG(RTISME(-1))    | 0.402113   | 0.127589             | 3.151627    | 0.0038 |
| DUMMY1             | -0.028502  | 0.013707             | -2.079438   | 0.0465 |
| C                  | 6.449247   | 1.283113             | 5.026249    | 0.0000 |
| R-squared          | 0.995581   | Mean dependent var   | 26.68738    |        |
| Adjusted R-squared | 0.993295   | S.D. dependent var   | 0.234487    |        |
| S.E. of regression | 0.019201   | Akaike info criterio | -4.795992   |        |
| Sum squared resid  | 0.010691   | Schwarz criterion    | -4.153623   |        |
| Log likelihood     | 123.9098   | Hannan-Quinn criter. | -4.556523   |        |
| F-statistic        | 435.5502   | Durbin-Watson stat   | 2.246722    |        |
| Prob(F-statistic)  | 0.000000   |                      |             |        |

\*Note: p-values and any subsequent tests do not account for model selection.

**Table 33. Long Run Form of ARDL Bounds Test Result**

Dependent Variable: DLOG(RTCSME)  
 Selected Model: ARDL(3, 3, 1, 2, 1, 0)  
 Case 3: Unrestricted Constant and No Trend  
 Date: 06/03/23 Time: 14:29  
 Sample: 2011Q1 2022Q4  
 Included observations: 45

| Conditional Error Correction Regression |            |            |             |        |
|-----------------------------------------|------------|------------|-------------|--------|
| Variable                                | Coefficien | Std. Error | t-Statistic | Prob.  |
| C                                       | 6.449247   | 1.283113   | 5.026249    | 0.0000 |
| LOG(RTCSME(-1))*                        | -0.334516  | 0.078238   | -4.275634   | 0.0002 |
| RCCIR(-1)                               | 0.232989   | 0.045754   | 5.092211    | 0.0000 |
| LOG(NNSME(-1))                          | -0.029105  | 0.084449   | -0.344647   | 0.7328 |
| CRSME(-1)                               | 0.991195   | 0.313926   | 3.157414    | 0.0037 |
| LOG(RTISME(-1))                         | 0.541106   | 0.146631   | 3.690243    | 0.0009 |
| DUMMY1**                                | -0.028502  | 0.013707   | -2.079438   | 0.0465 |
| DLOG(RTCSME(-1))                        | 0.395636   | 0.107974   | 3.664173    | 0.0010 |
| DLOG(RTCSME(-2))                        | -0.142038  | 0.071634   | -1.982823   | 0.0569 |
| D(RCCIR)                                | 0.195610   | 0.036842   | 5.309395    | 0.0000 |
| D(RCCIR(-1))                            | -0.058832  | 0.062916   | -0.935092   | 0.3575 |
| D(RCCIR(-2))                            | -0.301517  | 0.059486   | -5.068724   | 0.0000 |
| DLOG(NNSME)                             | 0.502032   | 0.120170   | 4.177687    | 0.0002 |
| D(CRSME)                                | 2.872750   | 0.298392   | 9.627448    | 0.0000 |
| D(CRSME(-1))                            | -1.394801  | 0.449098   | -3.105787   | 0.0042 |
| DLOG(RTISME)                            | 0.138993   | 0.140820   | 0.987022    | 0.3318 |

\* p-value incompatible with t-Bounds distribution.

\*\* Variable interpreted as  $Z = Z(-1) + D(Z)$ .

| Levels Equation<br>Case 3: Unrestricted Constant and No Trend |            |            |             |        |
|---------------------------------------------------------------|------------|------------|-------------|--------|
| Variable                                                      | Coefficien | Std. Error | t-Statistic | Prob.  |
| RCCIR                                                         | 0.696495   | 0.094277   | 7.387732    | 0.0000 |
| LOG(NNSME)                                                    | -0.087007  | 0.263099   | -0.330700   | 0.7432 |
| CRSME                                                         | 2.963073   | 0.776476   | 3.816054    | 0.0007 |
| LOG(RTISME)                                                   | 1.617577   | 0.490181   | 3.299960    | 0.0026 |
| DUMMY1                                                        | -0.085205  | 0.043159   | -1.974185   | 0.0580 |

$$EC = LOG(RTCSME) - (0.6965 * RCCIR - 0.0870 * LOG(NNSME) + 2.9631 * CRSME + 1.6176 * LOG(RTISME) - 0.0852 * DUMMY1)$$

| F-Bounds Test       |          | Null Hypothesis: No levels relationship |       |       |
|---------------------|----------|-----------------------------------------|-------|-------|
| Test Statistic      | Value    | Signif.                                 | I(0)  | I(1)  |
| Asymptotic: n=1000  |          |                                         |       |       |
| F-statistic         | 6.677667 | 10%                                     | 2.26  | 3.35  |
| k                   | 5        | 5%                                      | 2.62  | 3.79  |
|                     |          | 2.5%                                    | 2.96  | 4.18  |
|                     |          | 1%                                      | 3.41  | 4.68  |
| Finite Sample: n=45 |          |                                         |       |       |
| Actual Sample Size  | 45       | 10%                                     | 2.458 | 3.647 |
|                     |          | 5%                                      | 2.922 | 4.268 |
|                     |          | 1%                                      | 4.03  | 5.598 |

**Table 34. Error Correction Form of ARDL Bounds Test Result**

Dependent Variable: DLOG(RTCSME)  
 Selected Model: ARDL(3, 3, 1, 2, 1, 0)  
 Case 3: Unrestricted Constant and No Trend  
 Date: 06/03/23 Time: 14:32  
 Sample: 2011Q1 2022Q4  
 Included observations: 45

| ECM Regression                             |            |                       |             |        |
|--------------------------------------------|------------|-----------------------|-------------|--------|
| Case 3: Unrestricted Constant and No Trend |            |                       |             |        |
| Variable                                   | Coefficien | Std. Error            | t-Statistic | Prob.  |
| C                                          | 6.449247   | 0.941337              | 6.851158    | 0.0000 |
| DLOG(RTCSME(-1))                           | 0.395636   | 0.089026              | 4.444044    | 0.0001 |
| DLOG(RTCSME(-2))                           | -0.142038  | 0.052682              | -2.696128   | 0.0116 |
| D(RCCIR)                                   | 0.195610   | 0.027943              | 7.000357    | 0.0000 |
| D(RCCIR(-1))                               | -0.058832  | 0.051247              | -1.148011   | 0.2603 |
| D(RCCIR(-2))                               | -0.301517  | 0.052149              | -5.781838   | 0.0000 |
| DLOG(NNSME)                                | 0.502032   | 0.105386              | 4.763746    | 0.0000 |
| D(CRSME)                                   | 2.872750   | 0.232573              | 12.35202    | 0.0000 |
| D(CRSME(-1))                               | -1.394801  | 0.345406              | -4.038150   | 0.0004 |
| DLOG(RTISME)                               | 0.138993   | 0.104338              | 1.332138    | 0.1932 |
| CointEq(-1)*                               | -0.334516  | 0.048808              | -6.853753   | 0.0000 |
| R-squared                                  | 0.923415   | Mean dependent var    | 0.016055    |        |
| Adjusted R-squared                         | 0.900891   | S.D. dependent var    | 0.056327    |        |
| S.E. of regression                         | 0.017733   | Akaike info criterion | -5.018214   |        |
| Sum squared resid                          | 0.010691   | Schwarz criterion     | -4.576585   |        |
| Log likelihood                             | 123.9098   | Hannan-Quinn criter.  | -4.853579   |        |
| F-statistic                                | 40.99540   | Durbin-Watson stat    | 2.246722    |        |
| Prob(F-statistic)                          | 0.000000   |                       |             |        |

\* p-value incompatible with t-Bounds distribution.

**Table 35. Ramsey RESET Test Result**

|                   | Value      | df      | Probability  |
|-------------------|------------|---------|--------------|
| t-statistic       | 0.332604   | 28      | 0.7419       |
| F-statistic       | 0.110626   | (1, 28) | 0.7419       |
| Likelihood ratio  | 0.177441   | 1       | 0.6736       |
| F-test summary:   |            |         |              |
|                   | Sum of Sq. | df      | Mean Squares |
| Test SSR          | 4.21E-05   | 1       | 4.21E-05     |
| Restricted SSR    | 0.010691   | 29      | 0.000369     |
| Unrestricted SSR  | 0.010649   | 28      | 0.000380     |
| LR test summary:  |            |         |              |
|                   | Value      |         |              |
| Restricted LogL   | 123.9098   |         |              |
| Unrestricted LogL | 123.9985   |         |              |

**Table 36. Breusch - Pagan - Godfrey Test Result**

Heteroskedasticity Test: Breusch-Pagan-Godfrey

Null hypothesis: Homoskedasticity

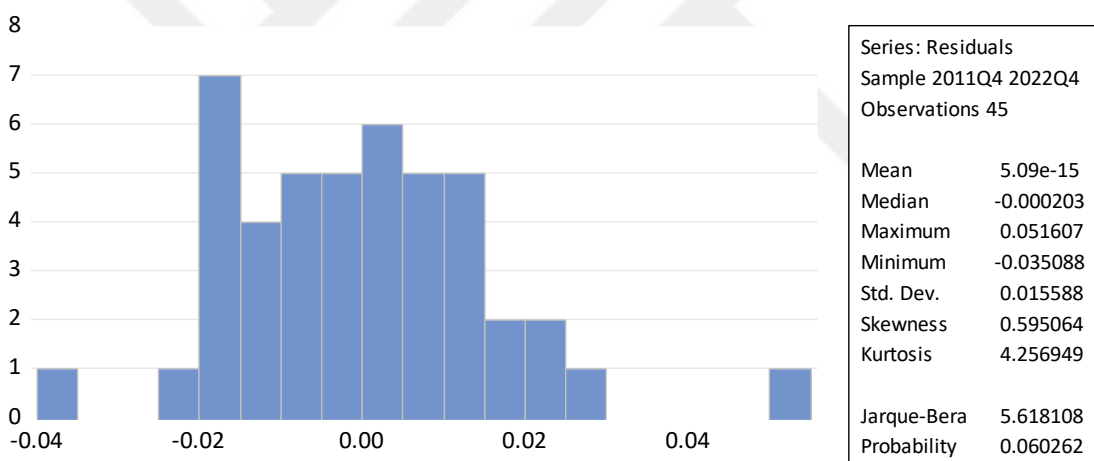
|                     |          |                      |        |
|---------------------|----------|----------------------|--------|
| F-statistic         | 0.693085 | Prob. F(15,29)       | 0.7704 |
| Obs*R-squared       | 11.87504 | Prob. Chi-Square(15) | 0.6885 |
| Scaled explained SS | 8.031321 | Prob. Chi-Square(15) | 0.9225 |

**Table 37. Breusch - Godfrey LM Test Result**

Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 2 lags

|               |          |                     |        |
|---------------|----------|---------------------|--------|
| F-statistic   | 1.007517 | Prob. F(2,27)       | 0.3784 |
| Obs*R-squared | 3.125157 | Prob. Chi-Square(2) | 0.2096 |

**Table 38. Jarque - Bera Test Result**

### A3. Empirical Results of Chapter 6

**Table 39. Traditional ARDL Test Result**

Dependent Variable: LOG(RTCC)  
Method: ARDL  
Date: 05/30/23 Time: 16:04  
Sample (adjusted): 2011Q4 2022Q4  
Included observations: 45 after adjustments  
Maximum dependent lags: 3 (Automatic selection)  
Model selection method: Akaike info criterion (AIC)  
Dynamic regressors (3 lags, automatic): RCCIR CCR LOG(THS)  
LOG(CPND) LOG(RCTI) DUMMY3  
Fixed regressors: C @TREND  
Number of models evaluated: 12288  
Selected Model: ARDL(2, 3, 2, 2, 0, 3, 3)

| Variable           | Coefficien | Std. Error           | t-Statistic | Prob.* |
|--------------------|------------|----------------------|-------------|--------|
| LOG(RTCC(-1))      | 0.733834   | 0.156589             | 4.686361    | 0.0001 |
| LOG(RTCC(-2))      | -0.342673  | 0.135678             | -2.525631   | 0.0193 |
| RCCIR              | -0.114338  | 0.055731             | -2.051595   | 0.0523 |
| RCCIR(-1)          | 0.391279   | 0.084954             | 4.605791    | 0.0001 |
| RCCIR(-2)          | -0.222110  | 0.103722             | -2.141393   | 0.0436 |
| RCCIR(-3)          | 0.136979   | 0.079106             | 1.731573    | 0.0974 |
| CCR                | 6.032156   | 1.555496             | 3.877963    | 0.0008 |
| CCR(-1)            | -7.775147  | 2.522651             | -3.082134   | 0.0054 |
| CCR(-2)            | 2.716144   | 1.846425             | 1.471028    | 0.1554 |
| LOG(THS)           | -0.037385  | 0.025220             | -1.482334   | 0.1524 |
| LOG(THS(-1))       | 0.009526   | 0.027556             | 0.345703    | 0.7328 |
| LOG(THS(-2))       | 0.065073   | 0.027074             | 2.403476    | 0.0251 |
| LOG(CPND)          | -0.009767  | 0.013947             | -0.700331   | 0.4911 |
| LOG(RCTI)          | 0.039501   | 0.043991             | 0.897936    | 0.3789 |
| LOG(RCTI(-1))      | 0.108750   | 0.042591             | 2.553371    | 0.0181 |
| LOG(RCTI(-2))      | 0.074024   | 0.041409             | 1.787615    | 0.0876 |
| LOG(RCTI(-3))      | 0.055633   | 0.044497             | 1.250272    | 0.2243 |
| DUMMY3             | 0.003123   | 0.013634             | 0.229071    | 0.8209 |
| DUMMY3(-1)         | -3.58E-05  | 0.014603             | -0.002453   | 0.9981 |
| DUMMY3(-2)         | -0.024129  | 0.014973             | -1.611569   | 0.1213 |
| DUMMY3(-3)         | -0.028899  | 0.016142             | -1.790300   | 0.0872 |
| C                  | 13.83634   | 2.513671             | 5.504433    | 0.0000 |
| @TREND             | 0.010763   | 0.002256             | 4.770479    | 0.0001 |
| R-squared          | 0.996755   | Mean dependent var   | 26.02404    |        |
| Adjusted R-squared | 0.993510   | S.D. dependent var   | 0.281009    |        |
| S.E. of regression | 0.022637   | Akaike info criterio | -4.431820   |        |
| Sum squared resid  | 0.011274   | Schwarz criterion    | -3.508415   |        |
| Log likelihood     | 122.7159   | Hannan-Quinn criter. | -4.087584   |        |
| F-statistic        | 307.1888   | Durbin-Watson stat   | 2.125110    |        |
| Prob(F-statistic)  | 0.000000   |                      |             |        |

\*Note: p-values and any subsequent tests do not account for model selection.

**Table 40. Long Run Form of ARDL Bounds Test Result**

Dependent Variable: DLOG(RTCC)  
 Selected Model: ARDL(2, 3, 2, 2, 0, 3, 3)  
 Case 5: Unrestricted Constant and Unrestricted Trend  
 Date: 06/03/23 Time: 17:44  
 Sample: 2011Q1 2022Q4  
 Included observations: 45

| Conditional Error Correction Regression |            |            |             |        |
|-----------------------------------------|------------|------------|-------------|--------|
| Variable                                | Coefficien | Std. Error | t-Statistic | Prob.  |
| C                                       | 13.83634   | 2.513671   | 5.504433    | 0.0000 |
| @TREND                                  | 0.010763   | 0.002256   | 4.770479    | 0.0001 |
| LOG(RTCC(-1))*                          | -0.608840  | 0.103248   | -5.896878   | 0.0000 |
| RCCIR(-1)                               | 0.191810   | 0.047716   | 4.019788    | 0.0006 |
| CCR(-1)                                 | 0.973153   | 1.165013   | 0.835316    | 0.4125 |
| LOG(THS(-1))                            | 0.037214   | 0.045614   | 0.815846    | 0.4233 |
| LOG(CPND)**                             | -0.009767  | 0.013947   | -0.700331   | 0.4911 |
| LOG(RCTI(-1))                           | 0.277907   | 0.069829   | 3.979804    | 0.0006 |
| DUMMY3(-1)                              | -0.049941  | 0.035406   | -1.410500   | 0.1724 |
| DLOG(RTCC(-1))                          | 0.342673   | 0.135678   | 2.525631    | 0.0193 |
| D(RCCIR)                                | -0.114338  | 0.055731   | -2.051595   | 0.0523 |
| D(RCCIR(-1))                            | 0.085131   | 0.088043   | 0.966923    | 0.3441 |
| D(RCCIR(-2))                            | -0.136979  | 0.079106   | -1.731573   | 0.0974 |
| D(CCR)                                  | 6.032156   | 1.555496   | 3.877963    | 0.0008 |
| D(CCR(-1))                              | -2.716144  | 1.846425   | -1.471028   | 0.1554 |
| DLOG(THS)                               | -0.037385  | 0.025220   | -1.482334   | 0.1524 |
| DLOG(THS(-1))                           | -0.065073  | 0.027074   | -2.403476   | 0.0251 |
| DLOG(RCTI)                              | 0.039501   | 0.043991   | 0.897936    | 0.3789 |
| DLOG(RCTI(-1))                          | -0.129656  | 0.062362   | -2.079079   | 0.0495 |
| DLOG(RCTI(-2))                          | -0.055633  | 0.044497   | -1.250272   | 0.2243 |
| D(DUMMY3)                               | 0.003123   | 0.013634   | 0.229071    | 0.8209 |
| D(DUMMY3(-1))                           | 0.053028   | 0.023749   | 2.232869    | 0.0361 |
| D(DUMMY3(-2))                           | 0.028899   | 0.016142   | 1.790300    | 0.0872 |

\* p-value incompatible with t-Bounds distribution.

\*\* Variable interpreted as  $Z = Z(-1) + D(Z)$ .

| Levels Equation                                      |            |            |             |        |
|------------------------------------------------------|------------|------------|-------------|--------|
| Case 5: Unrestricted Constant and Unrestricted Trend |            |            |             |        |
| Variable                                             | Coefficien | Std. Error | t-Statistic | Prob.  |
| RCCIR                                                | 0.315041   | 0.060257   | 5.228329    | 0.0000 |
| CCR                                                  | 1.598373   | 1.860399   | 0.859156    | 0.3995 |
| LOG(THS)                                             | 0.061123   | 0.077260   | 0.791124    | 0.4373 |
| LOG(CPND)                                            | -0.016042  | 0.023025   | -0.696744   | 0.4933 |
| LOG(RCTI)                                            | 0.456454   | 0.082417   | 5.538356    | 0.0000 |
| DUMMY3                                               | -0.082026  | 0.056213   | -1.459193   | 0.1586 |

$$EC = LOG(RTCC) - (0.3150 \cdot RCCIR + 1.5984 \cdot CCR + 0.0611 \cdot LOG(THS) - 0.0160 \cdot LOG(CPND) + 0.4565 \cdot LOG(RCTI) - 0.0820 \cdot DUMMY3)$$

| F-Bounds Test       |          | Null Hypothesis: No levels relationship |       |       |
|---------------------|----------|-----------------------------------------|-------|-------|
| Test Statistic      | Value    | Signif.                                 | I(0)  | I(1)  |
| Asymptotic: n=1000  |          |                                         |       |       |
| F-statistic         | 5.946831 | 10%                                     | 2.53  | 3.59  |
| k                   | 6        | 5%                                      | 2.87  | 4     |
|                     |          | 2.5%                                    | 3.19  | 4.38  |
|                     |          | 1%                                      | 3.6   | 4.9   |
| Finite Sample: n=45 |          |                                         |       |       |
| Actual Sample Size  | 45       | 10%                                     | 2.796 | 3.97  |
|                     |          | 5%                                      | 3.267 | 4.584 |
|                     |          | 1%                                      | 4.364 | 6.006 |

**Table 41. Error Correction Form of ARDL Bounds Test Result**

Dependent Variable: DLOG(RTCC)  
 Selected Model: ARDL(2, 3, 2, 2, 0, 3, 3)  
 Case 5: Unrestricted Constant and Unrestricted Trend  
 Date: 06/03/23 Time: 17:46  
 Sample: 2011Q1 2022Q4  
 Included observations: 45

| ECM Regression                                       |            |                      |             |        |
|------------------------------------------------------|------------|----------------------|-------------|--------|
| Case 5: Unrestricted Constant and Unrestricted Trend |            |                      |             |        |
| Variable                                             | Coefficien | Std. Error           | t-Statistic | Prob.  |
| C                                                    | 13.83634   | 1.897985             | 7.290014    | 0.0000 |
| @TREND                                               | 0.010763   | 0.001563             | 6.886799    | 0.0000 |
| DLOG(RTCC(-1))                                       | 0.342673   | 0.099009             | 3.461039    | 0.0022 |
| D(RCCIR)                                             | -0.114338  | 0.033921             | -3.370730   | 0.0028 |
| D(RCCIR(-1))                                         | 0.085131   | 0.059335             | 1.434754    | 0.1654 |
| D(RCCIR(-2))                                         | -0.136979  | 0.055426             | -2.471360   | 0.0217 |
| D(CCR)                                               | 6.032156   | 1.189348             | 5.071815    | 0.0000 |
| D(CCR(-1))                                           | -2.716144  | 1.451490             | -1.871280   | 0.0747 |
| DLOG(THS)                                            | -0.037385  | 0.017464             | -2.140749   | 0.0436 |
| DLOG(THS(-1))                                        | -0.065073  | 0.016841             | -3.864027   | 0.0008 |
| DLOG(RCTI)                                           | 0.039501   | 0.032440             | 1.217689    | 0.2362 |
| DLOG(RCTI(-1))                                       | -0.129656  | 0.046465             | -2.790424   | 0.0107 |
| DLOG(RCTI(-2))                                       | -0.055633  | 0.036042             | -1.543555   | 0.1370 |
| D(DUMMY3)                                            | 0.003123   | 0.008839             | 0.353326    | 0.7272 |
| D(DUMMY3(-1))                                        | 0.053028   | 0.011933             | 4.443680    | 0.0002 |
| D(DUMMY3(-2))                                        | 0.028899   | 0.009829             | 2.940238    | 0.0076 |
| CointEq(-1)*                                         | -0.608840  | 0.083646             | -7.278795   | 0.0000 |
| R-squared                                            | 0.892696   | Mean dependent var   | 0.012200    |        |
| Adjusted R-squared                                   | 0.831380   | S.D. dependent var   | 0.048866    |        |
| S.E. of regression                                   | 0.020066   | Akaike info criterio | -4.698487   |        |
| Sum squared resid                                    | 0.011274   | Schwarz criterion    | -4.015970   |        |
| Log likelihood                                       | 122.7159   | Hannan-Quinn criter. | -4.444051   |        |
| F-statistic                                          | 14.55881   | Durbin-Watson stat   | 2.125110    |        |
| Prob(F-statistic)                                    | 0.000000   |                      |             |        |

\* p-value incompatible with t-Bounds distribution.

**Table 42. Ramsey RESET Test Result**

|                  | Value    | df      | Probability |
|------------------|----------|---------|-------------|
| t-statistic      | 0.210081 | 21      | 0.8356      |
| F-statistic      | 0.044134 | (1, 21) | 0.8356      |
| Likelihood ratio | 0.094474 | 1       | 0.7586      |

| F-test summary:  |            |    |              |
|------------------|------------|----|--------------|
|                  | Sum of Sq. | df | Mean Squares |
| Test SSR         | 2.36E-05   | 1  | 2.36E-05     |
| Restricted SSR   | 0.011274   | 22 | 0.000512     |
| Unrestricted SSR | 0.011250   | 21 | 0.000536     |

| LR test summary:  |          |
|-------------------|----------|
|                   | Value    |
| Restricted LogL   | 122.7159 |
| Unrestricted LogL | 122.7632 |

**Table 43. Breusch - Pagan - Godfrey Test Result**

Heteroskedasticity Test: Breusch-Pagan-Godfrey

Null hypothesis: Homoskedasticity

|                     |          |                      |        |
|---------------------|----------|----------------------|--------|
| F-statistic         | 0.454468 | Prob. F(22,22)       | 0.9645 |
| Obs*R-squared       | 14.06085 | Prob. Chi-Square(22) | 0.8993 |
| Scaled explained SS | 4.258834 | Prob. Chi-Square(22) | 1.0000 |

**Table 44. Breusch - Godfrey LM Test Result**

Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 2 lags

|               |          |                     |        |
|---------------|----------|---------------------|--------|
| F-statistic   | 1.808704 | Prob. F(2,20)       | 0.1897 |
| Obs*R-squared | 6.892517 | Prob. Chi-Square(2) | 0.0319 |

Table 45. Jarque - Bera Test Result

