T.C.
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İKTİSAT (İNGİLİZCE) BİLİM DALI

THREE ESSAYS ON MONETARY POLICY

Doktora Tezi

ZELİHA SAYAR

İSTANBUL, 2023

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Danışman: PROF.DR. HURŞİT GÜNEŞ

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ÖZET

PARA POLİTİKASI ÜZERİNE ÜÇ DENEME

Bu tez, para politikası ile ilgili üç farklı bölümden oluşmaktadır. Birinci bölüm, makroekonomik kırılganlık ve siyasi istikrarsızlık açısından birbirine benzeyen beş gelişmekte olan ülkeye (Güney Afrika, Brezilya, Türkiye, Meksika ve Arjantin) odaklanarak tüketici güveni ile siyasi değişkenler arasındaki bağlantıyı analiz etmektedir. Bu bağlamda, politik risk ve seçimlerin tüketici güveni üzerindeki etkilerini değerlendirmek için panel hata düzeltme modeli ve Wald ve Granger nedensellik testleri kullanılmıştır. Elde edilen bulgulara göre, tüketici güveninin oluşmasında finansal ve ekonomik parametrelerin yanı sıra siyasi istikrarsızlık da etkilidir.

İkinci bölümde, ilk olarak, merkez bankası şeffaflığının enflasyon üzerindeki etkilerini araştırmak amacıyla Türkiye için para politikasının yanı sıra finansal istikrar, döviz kuru ve rezerv politikasını da içeren kapsamlı bir merkez bankası şeffaflık endeksi oluşturulmuştur. Bunu takiben, enflasyon, kur, enflasyon beklentileri, CDS, işsizlik ve merkez bankası şeffaflığı arasında uzun dönemli bir ilişki olup olmadığını araştırmak için ARDL modeli kullanılarak tahminde bulunulmuştur. Bulgular döviz, beklentiler, CDS, işsizlik açığı ve şeffaflığın enflasyonun (TÜFE) uzun vadeli belirleyicileri olduğunu göstermektedir.

Üçüncü bölüm, dijital para birimi (CBDC) ile fiziksel nakit arasındaki olası bağlantıyı açığa çıkarmak için çeşitli ödeme türlerinin ve COVID-19 kısıtlamalarının dolaşımdaki para talebine olan etkisine odaklanmaktadır. OLS tahmin sonuçları, COVID-19 kısıtlamaları ile dolaşımdaki reel para birimi arasında pozitif bir bağlantı olduğunu göstermektedir. Ayrıca, kredi kartlarının dolaşımdaki reel para birimi üzerinde olumlu bir etkiye sahip iken, internet ve temassız ödemelerin etkisine dair anlamlı bir sonuca ulaşılamamıştır.

Anahtar kelimeler: Politik Riskler; Merkez Bankası Şeffaflığı, E-Ödeme.

ABSTRACT

THREE ESSAYS ON MONETARY POLICY

This dissertation includes three different chapters related to monetary policy. The first chapter concentrates on the linkage between consumer confidence and political variables by focusing on five emerging countries that resemble each other in the sense of macroeconomic fragility and political instability: South Africa, Brazil, Turkey, Mexico, and Argentina. In this regard, the Johansen cointegration test, panel-error correction model, and Wald and Granger causality tests were employed to assess the effects of political risk and elections on consumer confidence. According to the findings, political instability is significantly imperative in the formation of consumer confidence, alongside financial and economic parameters.

In the second chapter, firstly, a comprehensive central bank transparency index, which includes financial stability, foreign exchange rate, and reserve policy, as well as monetary policy, was constructed for Turkey to investigate the effects of central bank transparency on inflation between 2002:1 and 2021:2. Following that, two ARDL models are adopted to investigate whether there is a long-run relationship between inflation, exchange rate, inflation expectations, CDS, unemployment, and central bank transparency. The findings illustrate that exchange, expectations, CDS, the unemployment gap, and transparency are long-run determinants of inflation (CPI).

The third chapter concentrates on the influence of various kinds of payments and the COVID-19 restrictions on cash demand to demystify the possible linkage between digital currency (CBDC) and physical cash. This paper demystifies the impact of e-payment and COVID-19 restrictions on cash demand in Turkey using OLS models. I found a positive linkage between COVID-19 restrictions and real currency in circulation. The paper concluded that credit cards have a positive effect on real currency in circulation but did not provide any significant outcomes for the influence of the internet and contactless payments.

Keywords: Political risks; Central Bank Transparency, E-payment.

PREFACE

Firstly, I would like to express my heartfelt gratitude and utmost appreciation to my academic mentor, Prof. Hurşit Güneş, for his unwavering support and invaluable guidance over the duration of this endeavor. I am indebted to his invaluable assistance, since it played a pivotal role in the successful completion of my thesis.

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ABBREVIATIONS

AR: Auto-Regressive

ARCH: Autoregressive Conditional Heteroskedasticity

ARDL: Autoregressive Distributed Lag

ARIMA: Auto-Regressive Integrated Moving Average

ATM: Automated Teller Machine

CB: Central Bank

CBDC: Central Bank Digital Currency

CBRT: Central Bank of the Republic of Turkey

CBT: Central Bank Transparency

CDS: Credit Default Swap

DIBS: Government Debt Securities

ECM: Error Correction Model

EU-15: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

GMM: Generalized Method of Moments

ICRG: The International Country Risk Guide

IMF: International Monetary Fund

OLS: Ordinary Least Square

PRS Group: Political Risk Services

QR: Quick Response Code

VAR: Vector Autoregression

VECM: Vector Error Correction Model

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CHAPTER 1

POLITICAL RISKS AND CONSUMER CONFIDENCE:A CROSS-COUNTRY STUDY FOR DEVELOPING ECONOMIES

1) INTRODUCTION

Events and structures raising risks that are harmful to maintaining stability or cause uncertainty are considered concepts that affect economic performance in the literature. These events result in suboptimal short-term macroeconomic policies since these events shorten the policymaker's horizons. The monetary policy authorities monitor a broad array of leading indicators and collect unprecedented amounts of relevant information for forecasting the likelihood of events and factors affecting economic variables. Monetary authorities endeavour to comprehend economic patterns with the aim of mitigating risk and uncertainty. In this regard, the effectiveness of policymakers' tools for guiding the market hinges on their ability to manage expectations besides eliminating risks. Therefore, the power of monetary policy tools is hinged on managing expectations and the confidence of economic agents.

One important factor that helps predict macroeconomic shifts is consumer confidence. In particular, monetary authorities look at consumer expectations as a key sign of how consumers will react to changes in monetary instruments. The anticipation of inflationary expectations, a reduction in currency exchange rates, a stock market crash, or an amalgamation of these factors is projected to lead to a decrease in consumer confidence, so conveying unfavourable expectations.

Furthermore, claiming that the monetary policy authority is simply concerned about consumer confidence to achieve inflation targets and maintain price stability would be an understatement. There are principally two explanations. The first is that consumer confidence indices have a double-edged quality, providing information on current and future consumer behaviour along with the result of gathering economic and market information. Second, the monetary policy authority should ensure both price and financial stability. Consumers' responses to economic policy can play a role in avoiding or recovering from domestic and international debt crises, particularly in countries with weak economies and high political risk. To put it another way, losing consumer confidence can create a credibility issue for the government or monetary

authority, and governments cannot be willing to take measures to avoid economic and financial crises. Considering the high possibility of any economic and financial crisis, consumers will reduce their spending by decreasing their demand, and cause a decrease in supply by postponing or cancelling new investment decisions. Under this case, governments abandon the strict fiscal policy to enhance demand or finance investment and implement non-optimal monetary policies. This circumstance conduces to a deviation in the monetary authority's goal of attaining both price and financial stability and also may have a negative influence on the likelihood of the prevention or recovery of domestic and foreign debt crises in fragile economies. However, a large portion of existing research in the academic discipline highlights the expectations, assurance, and behaviours of investors in managing economic and financial crises. Therefore, the chief goal of this research is to provide insight into the factors that bear consumer behaviour, a crucial pillar of monetary policy, by centring on the repercussions of political risks on consumer confidence.

Most empirical studies attribute an important role to narrowly defined political factors rather than as indicators of economic policy uncertainty since consumer confidence appears to be linked to such economic and financial parameters. The influence of political uncertainty has been the subject of numerous studies, but the majority of them focus on the contribution of elections as the only factor determining political uncertainty, rendering those assessments not only insufficient but also event-based and discrete. This research is distinctive in that it uses a continuous index that encompasses a variety of political risk indicators and compares the impact of those factors to financial concerns.

We additionally delve into the variables that contribute to these risk indicators. The analysis is hinged on data that has been collected from five developing countries: Argentina, Brazil, Mexico, Turkey, and South Africa. These countries have similarities compared to one other concerning political instability and macroeconomic vulnerability.

The initial section delivers a concise overview of the current literature on the association between political factors and consumer confidence. We shall describe the model and empirical approach in the second section. In this section, cointegration tests are conducted to see whether there are unit roots between financial and political risks. The course of the causal interactions can be determined by applying Wald and Granger causality tests to all the parameters. The panel error-correction model (ECM) is maintained when data from different countries are introduced, and the impact of structural effects is discovered via dummy variables. The key empirical findings will be summarized in the concluding part.

2) THE LITERATURE REVIEW

The examination of the correlation between political institutions or events and economic variables may be traced back to the 1940s when the notion of political business cycles was first formulated. Kalecki (1943) posits that governments employ economic stimulus measures prior to elections with the aim of garnering support from their constituents, but capitalists subsequently counteract this boost following the electoral process. To begin with, Nordhaus (1975) extended Kalecki's ideas and added the Philips curve to describe the economy as differences in political party behaviour between inflation and unemployment before and after the election. In contrast to the traditional partisan theory, Alesina (1987) improved the rational political business cycle, in which voters choose the party that achieves the best results while having a variety of voting options and viewpoints regarding unemployment and inflation. The phenomenon of the political business cycle has prompted scholars to conduct research on the interconnections between political variables and economic variables; specifically focusing on factors such as economic growth (Olson, 1991; Bienen et al., 1993; Astereu and Price, 2001; Feng, 1997; Acemoglu and Robinson, 2000, 2003), exchange rates (Klein and Marion, 1994; Eichengreen et al., 1995), and financial variables such as stock markets and returns (Bailey and Chung, 1995; Diamonte et al., 1996; Lobo, 1999; Perotti and Van Oijen, 2001).

Kydland and Prescott (1977) reinterpreted the political business cycles by developing the concept of time inconsistency in monetary theory and approached it from a new angle. Political pressure has traditionally been regarded as an effect that causes a deviation from the central bank's announced policy. Economic agents do not change their decisions since they do not expect the central bank to move, assuming they have a rational perspective. Despite economic agents' decisions not changing, policy loses effectiveness and causes fluctuations in growth alongside deviations from the inflation target. In accordance with the monetarist perspective on inflation, the separation of the monetary authority from political influence entails the elimination of politically controlled central banks (PBCs). The current stream of extant empirical research primarily centres on assessing the efficacy of the independence or autonomy of monetary authority. The existing body of literature presents varied and inconclusive results. According to the findings of Hadri et al. (1998), Clark and Hallerberg (2000), Hallerberg et al. (2002), and Hiroi (2009), central bank independence has been found to have positive effects in terms of mitigating time inconsistency issues. However, several studies conducted in the United States (Grier (1987, 1989); Williams (1990); Carlsen (1997); Abrams and Iossifov (2006)) and Germany (Johnson and Siklos (1994); Vaubel (1997); Lohmann

(1998)) have demonstrated the occurrence of monetary political business cycles, despite the existence of central bank independence.

The interaction among financial risks, financial and currency crises, and political instability is another approach that constitutes the benchmark for empirical studies. The first pillar of this approach focuses on financial parameters such as stock returns, foreign currency regime rate or foreign currency volatility. In their study, Bailey, and Chung (1995) conduct a thorough examination of the influence that political risk and foreign exchange volatility have on the risk premiums associated with Mexican stocks. According to the authors, political risks and currency rate volatility influenced the stock market, notably in emerging countries. The study conducted by Diamonte et al. (1996) aimed to examine the relevance of political risk in determining stock returns, with a particular focus on the differential impact between emerging and developed economies. In their study, Erb et al. (1996) construct a composite variable by integrating four distinct country risk indicators. Their objective is to comprehend the implications between political risk and the ability to forecast future stock returns. The study posits that there exists a correlation between future stock returns and country risk parameters. In their study, Klein, and Marion (1994) analysed the termination of currency rate pegs in 16 Latin American nations spanning the timeframe 1957 to 1991. The outcomes of their examination provided empirical evidence in favour of the prevailing notion that regular electoral processes and irregular transfers of power, such as coups, are significant markers of the termination of a fixed foreign currency regime. In their seminal work, Eichengreen et al. (1995) examine the bearing of political factors on the selection of foreign currency regimes a dataset consisting of 20 OECD nations spanning the time frame 1959 to 1993. It was found that the foreign currency rate was shaped by the previous government's setbacks, while no evidence was obtained on other political variables. In summary, these studies have reached the conclusion that political factors exert influence over the choice of foreign currency system.

The subsequent set of research extended the scope of political factors and concentrated on clarifying their connection to financial stability alongside their effects on financial parameters. Particularly the economic and financial crises encountered in emerging economies demonstrated the need for investigating the political factors' relevance to economic and financial crises alongside economic and financial variables. Contributing to the formation and management of crises has prompted researchers to inquire into how political events and institutions relate to economic and financial instability. Studies have included responses to the crises (related to instability, indecision, inappropriate political practices, the lack of power,) as a reflection of

political instability. These studies have shown that crises in developing countries cannot be handled and explained only within the based on economic and financial problems.

MacIntyre (1998) underlines that China and Vietnam have not experienced a crisis like Thailand and Indonesia, despite China and Vietnam having deep problems in the banking sector. The author emphasizes the crucial role of political entities in the implementation of macroeconomic policy in these countries. These two cases examined here are instances of institutional extremes. A weak parliamentary government had to deal with numerous veto points due to the divided structure of the political system in Thailand. The indecision created by these political institutions was effective in the loss of investor confidence, the outbreak of the crisis and the delay of stabilization and recovery afterwards. The massive centralization structure of power of government and the death of veto power in Indonesia led to unpredictable policy. In other words, the government had deep problems with credibility and a loss of investor confidence resulting from unreliable policy commitments. Consequently, these two distinct political institutions provided different policy issues and generated financial and political instability.

During the years of the crisis (1994 and 1997), Bussiere and Mulder (2000) studied the implications that political instability had on the country's economic precariousness. The authors reached the conclusion that there is a substantial linkage between political strife and economic fragility, particularly for nations that have low reserves and poor economic fundamentals. They underlined the fact that by adding political variables to economic models, not only can these models better predict economic and financial crises, but they also have a greater capacity to explain the evolution of crises.

While analysing the Argentine crisis in his article "Bad Luck, Bad Economics, Bad Politics, Bad Advice", Powell (2002) shows that political risks lead to multiple equilibria. Powell (2002) examines the effect of the conflict between political parties and the government's failure to take the necessary steps to make the required financial adjustments in time to overcome the crisis. Economic problems starting with bad luck result in worsened fiscal balance, that is, a deep crisis, as the interaction of financial instability, current account instability and political risk variables. According to Powell, there are two reasons for the lack of necessary financial regulations. The first reason is that it was not feasible politically, and the second is the interactions with the real economy.

In addition, the unsustainability of the balance of the current account, which is another pillar of the crisis, is insufficient to explain the causes of the crisis. This situation is due to uprising risks rather than a sudden cessation of high capital inflows, that is, a lack of current account sustainability. The crisis becomes inevitable as a result of two vicious circles, economically and politically, that the country is going through.

According to Powell, the economic cycle is characterized by a correlation between subpar economic performance, resulting in diminished fiscal revenues, and subsequently leading to an elevated fiscal deficit. The ongoing process entails a progression from an elevated budget deficit to increased risk spreads, which lead to higher interest rates, ultimately culminating in diminished economic performance. Conversely, subpar economic outcomes and an elevated fiscal imbalance give rise to the need for fiscal regulation, heightened political discord, increased risk premiums, and diminished economic performance. The initial findings of this study indicate that Argentina is currently in a suboptimal equilibrium due to political risk and a low level of necessary fiscal account adjustment. Given the circumstances, it seems as though Argentina had to default and devalue.

Because political institutions like polarization, the parliamentary system, and the presidential system can postpone stabilization or worsen the fiscal account and increase debt, Van Rijckegman and Weder (2009) concentrate on these. In other words, they emphasized the connection between political institutions and internal and external debt problems. This study delved into the possibility of safe zones or debt thresholds depending on particular political frameworks. For 72 countries between 1979 and 2002, authors utilize political parameters including veto participants, veto confidence, and political structures such as presidents, assembly-elected presidents, and parliamentary. They find that democratic and non-democratic regimes have varying effects on internal and foreign debt. When economic foundations or liquidity are strong enough, parliamentary systems or enough checks and balances frequently prevent the default on external debt in democracies. On the other hand, the longevity of tenure and high stability also contribute to domestic debt default under dictatorships. Consequently, the study demonstrates factors related to financial stability, such as debt ratio, robust growth, sufficient openness, high foreign exchange reserves and debt-export ratios, are not enough to create safe zones or countries and therefore ensure financial stability when other factors, such as a parliamentary or presidential system and democratic limits.

These studies illustrate that political risks result in political instability, political crises, and ultimately economic crises in nations with macroeconomic fragility. Moreover, this interplay between the two events creates a vicious cycle in which the economic crisis fuels political unrest in countries with shaky economic foundations. The aforementioned studies offer crucial proof that to preserve price stability and financial stability, monetary authorities should take political factors into account. Nevertheless, the expectations and responses of investors are the main subjects of this research. For macro policies to have the desired effects, consumers' and investors' confidence is required.

There are extensive articles in the academic discipline considering the bearing of political factors on consumer confidence. One of the pioneers of this subject is probably Vuchelen (1995) who investigated such a relationship empirically. In his analysis, he distinguishes the disclosure of elections and their findings i.e., the subsequent governmental alterations. The fundamental argument put up by the author is that political events have the capacity to influence consumers' expectations regarding future policy. Although voting outcomes in a two-party political system result in a new government (hence consumers have no stake in the establishment of the possible government), governments in a multiparty political structure can be formed as coalitions, meaning polls might not completely eradicate policy uncertainty. Vuchelen (1995) examines his hypothesis utilizing Belgian data, and his discoveries show that unpredictable elections and new governments have an impact on consumer confidence, although the political leaning is rather inconsequential. In summary, he addresses how political events can alter economic factors themselves.

De Boef and Kellstedt (2004) conducted a follow-up study for the years 1981 to 2002 that demonstrates the instrumental impact of US daily politics on consumer confidence (as evaluated by news coverage of economic and political issues). De Boef and Kellstedt argue that it is widely believed that monthly data on consumer confidence in a country reflect the country's objective economic situation but ignore the significant impact of politics. Hence, the researchers seek to show the direct effects of the president's economic policy performance, his affiliation with the ruling party, and certain outstanding political occurrences on consumer confidence, along with the repercussions of the press's coverage of economic happenings. People are susceptible to offering positive opinions when news coverage is upbeat, and vice versa.

Hardouvelis and Tomakos (2007) also examine the impact of elections on consumer attitude, comparable to Vuchelen's study. An event study is conducted to analyse the impact of consumer confidence during election periods. The study focuses on a sample of 84 national elections that took place between 1985 and 2005 in the EU-15 countries. The findings of this study demonstrate an analogy between the development of stock market expectations and consumer confidence, wherein the latter tends to increase in the months leading up to national elections and afterwards decline. This pattern suggests a correlation with the electoral outcome, whether the incumbent party emerges victorious or suffers defeat. Therefore, it can be observed that consumer confidence exhibits a positive correlation with the likelihood of the incumbent party's re-election, and it possesses greater predictive capability compared to many macroeconomic factors commonly employed in the field of political business cycle analysis. Hardouvelis and Tomakos (2007) employ the error correction method (ECM) to figure out the repercussions of various variables, such as the coincident

indicator index, inflation, unemployment, approval ratings of the president and his party with regard to the Gulf War (its initiation and resolution) and economic policy, on the short- and long-lasting outcomes. Their research demonstrates that the ECM method brings out the substantial influence of these different variables.

Caleiro, Dilonsio, and Ramalho (2011) analysed the elements that underlie the development of consumer confidence in Portugal. The researchers examine the time frame from 1987 to 2009, utilizing quarterly and monthly data. Their findings indicate a significant correlation between economic success and consumer confidence in Portugal. However, the impact of joining the Eurozone and electoral conditions was also highly influential.

The authors of the latest rigorous study, Marc and Reuter (2018) carried out Austrian, French, German, and Belgian scenarios. Their findings reveal substantial Austrian, French, and German results. However, it is important to acknowledge that the Belgian case diverges from the established pattern as it does not exhibit any substantial influence.

3) THE RELEVANCE OF POLITICAL RISKS AS A KEY ELEMENT IN DETERMINING CONSUMER CONFIDENCE

All the aforementioned studies examine the effect of elections on consumer confidence besides economic and financial factors. The presumption is that as elections are the main factors influencing political expectations, they are also instrumental in affecting general expectations through the probability of policy changes and thus economic expectations. As a whole, all of these studies are based on the relationship between expectations concerning elections and consumer confidence. Yet, the adverse expectations or uncertainty concerning the election results are not the same cognitions as risks. First of all, uncertainty related to the election results terminates once the results are announced. Yet political risks may continue even after the elections if there is political instability or uncertainty about the destiny of the government. It must be remembered that many other political factors might change the political risk cognitions of society alongside elections. Therefore, a complete political analysis of consumer confidence should be extended beyond elections. Besides, during interim periods (between elections), instability may escalate, and those higher risks may influence consumer sentiment adversely. Thus, our study aims to assess the relevance of political risks on consumer confidence beyond certain intervals or occasions and include many other factors as stated below.

Political instability cannot be straightaway observed and assessed; rather, it is considered a latent construct. In academic research, the utilization of diverse methodologies and indicators proves advantageous in assessing political instability. Barro (1991) generated a proxy variable by utilizing the count of assassinations, a total of political revolutions, and coups d'état. Similarly, Aisen and Veiga (2005) forecast political instability by considering certain political events, including the count of government crises and the count of cabinet changes. Hence, it is commonly acknowledged that the election date, the effective number of parties, coalition fragility, and the volatility index (which measures the fluctuation in the proportion of seats controlled by parties) serve as reliable indicators for assessing political instability. In contrast to the comprehensive coverage and statistical methodologies employed in assessing economic and financial risks, there exists a notable paucity of publicly accessible data pertaining to political risks. Nonetheless, The World Bank estimates political risks for more than 200 countries generated on an annual basis. The World Bank Political Stability Index can be derived from its estimates of the Worldwide Governance Indicators. These estimated indicators on an annual basis, which commence by 1996, are comprised of six dimensions: *"voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality,*

the control of corruption and the rule of law" (World Bank). There are also monthly assessments of political instability produced by several private research institutions. Our political rating data is extracted from The International Country Risk Guide (ICRG of the PRS group).

The political risk rating (PRR) is predicated on the following risk factors, their individual weights, and the sequence in which they are considered:

Table 1-1: The Components of Political Risk Rating

POLITICAL RISK COMPONENTS			
Sequence	**Component**	**Sub-components**	Points
I	Socioeconomic Conditions	Unemployment, Consumer Confidence[1], Poverty	12
II	Government Stability	Government Unity, Popular Support, Legislative Strength	12
III	Internal Conflict	Civil Disorder, Terrorism/Political Violence, Civil War/Coup Threat	12
IV	External Conflict	War, Foreign Pressures, Cross-border Conflict	12
V	Investment Profile	Contract Viability/Expropriation, Payment's Delay, Profit Repatriation	12
VI	Military in Politics		6
VII	Corruption		6
VIII	Law and Order		6
IX	Religious tension		6
X	Democratic Accountability		6
XI	Ethnic tensions		6
XII	Bureaucracy Quality		4
Total			100

Political risk rating is comprised of 12 components, each having more than one subcomponent. Every component or subcomponent is valued by a risk scale between 0 and 4, where 0 denotes the very high-risk position and 4 represents the very low risk. Each subcomponent has equal weights within a component group. As seen in the table, investment profile, governmental stability, socioeconomic conditions, and

[1] As seen from the table above Consumer Confidence (which is our dependent variable in this paper) is also used (in Sequence II) as one of the socioeconomic conditions of political risk components. Although this violates the independence property of the estimator (Political Risk Rating), we could not detect any significant correlation between the two variables, and thus we decided not to undertake any modification of the overall index produced by ICRG.

external and internal conflicts are the major political risk components that may influence consumer sentiment and market conditions.

The research conducted spans more than ten years of monthly observations and aims to evaluate the influence of political risks on consumer sentiment, in conjunction with economic and financial factors.

Credit default swap (CDS) data is utilized for the purpose of estimating the financial risks associated with a certain situation. The credit default swap, frequently referred to as a CDS, is a type of financial instrument that is widely recognized. This type of financial instrument stipulates that the seller of the CDS is responsible for providing compensation to the buyer in the event of a default on a debt. To clarify, the seller of the Credit Default Swap (CDS) provides a buffer of financial protection to the buyer in the event of asset default. Conversely, the purchaser of the credit default swap (CDS) remunerates the seller with a premium and, in exchange, anticipates a financial gain in the event of asset default. In our current investigation, the bench-market CDS rates were utilized.

Those countries that are selected are peer countries in the sense of macroeconomic fragility as most global financial rating institutions cluster them in the same set. They don't only suffer from current account problems but also undergo frequent political instability. All of them are represented as peer emerging countries in terms of macroeconomic vulnerability. As explained above previous empirical studies had rather employed the role of elections to assess political expectations[2] whereas our study directly applied political risk assessment indexes. This study encompasses a dataset consisting of 930 monthly observations spanning from January 2007 to June 2022, encompassing multiple countries.

[2] Adverse political expectations demonstrate the existence of political risks. Elections pose uncertainty until they are completed. Our data directly involves the risks rather than an indirect estimation through the forthcoming and the completion of the election. Besides it includes all other factors that might cause changes in political risks.

4) DATA AND METHODOLOGY OF THE STUDY

We implement panel VECM and Granger causality test by using the data Consumer Confidence Index (CCI), Credit Default Swap rates for 5-year sovereign bonds (CDS), Political Risk Rating (PRR) and the US exchange rate of each country between 2007 M01 and 2022 M06 for five countries: South Africa, Brazil, Turkey, Mexico, and Argentina. As mentioned above, the selected countries are all emerging markets with serious macroeconomic fragilities and the period which is covered coincides with the global asset market crisis, especially in its beginning period. The second reason for selecting these countries is that they experienced political unrest that interacted with economic policy in the last two decades alongside similar macroeconomic fragilities, which we can briefly explain as follows:

1) Argentina: Argentina suffered various economic turmoil as high foreign debts, high tax rates, depleted reserves, and severe inflation during the 12 years of the President's tenure under Kirschner. Macri, the new president elected in 2015, abolished capital controls; however, economic problems continued in the country. Although the pledge to enact more liberal policies helped win certain local elections, it did not spur an upswing in the economy. Pressure to cut interest rates at the monetary authority prompted alterations in the government. The drought that Argentina encountered, and the capital movement prompted by the Fed interest rate hike caused the Argentine peso to depreciate despite the monetary authority declaring the new inflation target. Investors started reducing or drawing their investments despite high-interest rates, and the IMF provided support concerned that the country would default once more, especially if a new president was elected during the approaching election period. Alberto Fernández, a former head of Cristina Kirchner's administration, won the election in 2019. With the justification that they were no longer compelled to follow IMF guidelines; the newly elected Kirchners' leadership immediately denied accepting the remaining $11 billion of the loan. The COVID-19 epidemic early in 2020 wreaked havoc on the country. Fernández swiftly reinstated and frequently expanded some of Cristina Kirchners' undesirable economic theories. This event meant keeping a close eye on all transactions involving foreign exchange.

2) Brazil: Brazil, governed by a longstanding dictatorship, is one of the countries where economic fragility and political risks are high. This situation, and the political risks, seem to have been effective during the past ten years. Political upheavals caused by corruption, protests in 2013, Dilma Rousseff leaving office in 2015, and raising the far-right leader in the recent elections led to the continuation of political instability. In light of these events, political instability, in general, is regarded as a crucial component in the decline in CCI (Global Consumer Confidence).

3) South Africa: Thousands of people gathered starting in 2004, despite South Africa a relatively stable democracy dominated by a political party. The political risk indices assign South Africa high marks for Participation, Transparency and Corruption, the Rule of Law, and Human Rights but relatively low points for security. Another potential reason for the rise in political risk is the growth in immigration from other African nations. Nelson Mandela has gained international acclaim and has been the symbol of human rights advocacy since the termination of apartheid in 1994. However, the African National Congress (ANC), currently in power, has come under fire for allegedly eroding governmental institutions in order to shield corrupt individuals and maintain their position. The debate over President Zuma's impeachment and rising political threats, particularly in 2015, contributed to the depreciation of the national currency. The Anti-Bribery Commission heard testimony in 2018 involving allegations of high-level corruption. Expectations are also impacted by political risk, unemployment, and unequal income distribution. The consumer confidence index increased in 2010, but between 2011 and 2018, it fell to extremely low levels. The consumer confidence index rose throughout 2018, although it showed a downward movement in the final quarter. However, the index rose slightly in the second quarter of 2019.

4) Mexico: Mexico, which is one of the most densely populated nations in all of Latin America, was the subject of numerous studies on the impact of political risks on the economy, especially before 2000. Particularly in the 2000s, the country drew attention in terms of the democratic structure issue as well as the increasing doubts about the outcomes of the elections. There have been protests and objections against the outcome of Mexico's 2006 and 2012 presidential elections. In 2018, the opposition leader who claimed to have won the following elections this time won. Nevertheless, between 2006 and 2018, Mexican confidence in the democratic system declined. According to Latinobarómetro, a nonprofit organization that measures confidence in democracy in Latin America, faith in the Mexican democratic process fell by 20 critical points between 2006 and 2018. Prior to the 2018 elections, 47 per cent of Mexicans believed that the INE would not carry out a non-partisan role in this year's presidential process.

5) Turkey: A variety of studies have focused on how coalitions, political risk, instability, or military coups affected economic factors in Turkey prior to 2002. Between 2002 and 2013, Turkey's ruling one-party government enacted new laws to speed up the EU accession process. 2013 was a turning moment away from democratization for the nation as the political environment changed. For the country, the year 2013 marked a turning point away from democratization as the political climate altered. Events like the stalled membership process, local political issues, accusations of corruption, the Syrian civil war, and a military coup attempt have heightened political risks for Turkey since 2013. Political instability grew because of the

passing of new legislation restricting rights and liberties, the proclamation of an emergency, and a transition to a presidential administration. Furthermore, since 2002, Turkey has had several elections and referendums. Turkey has had 14 elections since 2002 (including three referendums, 11 generals, snap, and local elections). Every election process has a considerable bearing on fiscal and monetary policy as well as rising political risks, even though these elections did not lead to the creation of a coalition or a new ruling party.

We obtained the monthly CCI data for South Africa, Mexico, and Brazil from the OECD data website. The CCI index in Argentina was produced by the Torcuato Di Tella University in Argentina, and the CCI index in Turkey was released by Bloomberg HT. The dates of elections for each country were collected by consulting the websites of the parliaments and ministries of each nation, as well as local and international newspapers. The start date of election campaigns has also been determined by examining the news in newspapers nationwide, regionally, and internationally. We generated a dummy variable hinged on the start dates of local, parliament and presidential election campaigns. All variables are expressed in the logarithmic form, as most of them exhibit a non-stationary nature (or continuous progress) over time.

As explained above the model is rather straightforward where consumer sentiment is expected to be affected by political and financial risks and the currency value of the country against the US dollar depicting its price inertia and foreign balances. The use of this variable separately is due to an earlier study (2010) where we have shown that the most influential financial variable on consumer confidence in the context of Turkey is the foreign currency rate.

The method of empirical analysis we employ is basic and conventional. After confirming the absence of correlation amongst the independent variables by a correlation matrix and thus observing that there is no multicollinearity (although this does not remove the possibility of any spurious relationship), the unit-root tests (at the level and difference values) the series are tested whether they are non-stationary. If a time series exhibits non-stationary issues, it is possible to transform the time series into a stationary structure by applying the first differences. However, it ought to acknowledge the potential risk of losing long-term information while detrending time series data. Hence, to test the existence of such a risk, we then implemented the Johansen Fisher Panel Cointegration test to check the long-lasting cointegration among the subject parameters. Error Correction Methods (ECM) are widely used techniques for assessing both the short- and long-lasting implications of a one-time series on a different one. In cases where many cointegrating vectors are identified for an array of variables, Vector Error Correction Models (VECM) are considered the most suitable approach.

Finally, Granger Causality tests are utilized to comprehend the course of the short-run causality.

The short-run panel VECM is demonstrated below: (Equation 1)

$$\Delta LCCI_t = \beta_1\, ec_{t-1} + \beta_2\, \Delta LCCI_{t-1} - \beta_3\, \Delta LCDS_{t-1} + \beta_4\, \Delta LPRR_{t-1} - \beta_5\, \Delta LEXC_{t-1} - \beta_6\, D_1(Elections) + \beta_7 D_2(Covid19) + \varepsilon_t.$$

In the given equation, the variable LCCI represents the logarithm of the consumer confidence index, LPRR denotes the logarithm of the political risk rating of the relevant countries, LCDS signifies the logarithm of credit default swap rates, which serves as a proxy variable for the aggregation of financial risks. Additionally, LEXC represents the logarithm of the exchange rate. The variable D_1 is a binary parameter that indicates the timing of an election year, while D_2 is a second dummy variable that captures the effects of pandemic restrictions.

The long-run panel VECM is demonstrated below: (Equation 2)

$$LCCI_{t-1} = \beta_0 + \beta_1\, LCDS_{t-1} + \beta_2\, LPRR_{t-1} + \beta_3\, LEXC_{t-1} + \varepsilon_t.$$

5) EMPIRICAL FINDINGS

The fundamental overview statistics are represented below in Tables 1-2 for an initial examination and diagnosis of the characteristics of the data set.

Table 1-2-Descriptive Statistics

	LEXC	LCCI	LCDS	LPRR
Mean	1.916888	4.403039	5.739352	4.143700
Median	2.006110	4.594065	5.311135	4.166665
Maximum	4.809274	4.804078	12.48903	4.330733
Minimum	0.157409	3.468779	3.332205	3.881564
Std. Dev.	0.991008	0.338505	1.448013	0.089168
	930	930	929	930

Table 1-3 presents the linkage between endogenous and explanatory variables on a singular basis.

Table 1-3 Correlation Matrix of All Model Variables

	LEXC	LCCI	LCDS	LPRR
LEXC	1.00	-0.28	0.32	0.14
LCCI	-0.28	1.00	-0.45	0.09
LCDS	0.32	-0.45	1.00	-0.17
LPRR	0.14	0.09	-0.17	1.00

Table 1-4 Unit Roots Tests

	LLC		**ADF**		**PP**	
	LEVEL	FIRST DIFFERENCE	LEVEL	FIRST DIFFERENCE	LEVEL	FIRST DIFFERENCE
LCCI	-0.917 (0.180)	-16.134* (0.000)	7.794 (0.649)	372.442* (0.000)	10.114 (0.431)	301.094* (0.000)
LCDS	1.084 (0.861)	-28.601* (0.000)	1.8578 (0.997)	554.320* (0.000)	1.597 (0.999)	579.490* (0.000)
LPRR	1.186 (0.882)	-3.750* (0.000)	8.935 (9.538)	140.638* (0.000)	12.339 (0.263)	478.653* (0.000)
LEXC	4.441 (1.000)	-11.111* (0.000)	0.360 (1.000)	145.753* (0.000)	0.361 (1.000)	345.411* (0.000)

Notes: The abbreviation LLC refers to Levin, Lin & Chu. The acronym PP stands for the Philips-Perron-Fisher test. The abbreviation ADF refers to the Augmented Dickey-Fuller-Fisher. The numerical value included in parenthesis () represents the p-value. A significant finding at the 5% level is shown by the presence of an asterisk (*) symbol.

As seen in the outcomes of tests, the PP and ADF unit root tests illustrate varying degrees of non-stationarity in the series at different levels. This issue can be resolved by employing the method of taking the first differences. The analysis reveals that all variables demonstrate stationarity across the utilized methodologies, suggesting the absence of a unit root in the first order. This fulfils the prerequisites required for standing long-term cointegration testing.

Table 1-5 Johansen-Fisher Panel Cointegration test (CCI, CDS, PRR)

Rank	Trace Statistic	Critical value	Max-Eigen Statistic	Critical value
r=0	57.102* (0.026)	54.079	40.162* (0.011)	28.588
$r \leq 1$	16.940 (0.888)	35.193	9.209 (0.891)	22.299
$r \leq 2$	7.731 (0.846)	20.262	5.109 (0.879)	15.892

*Notes: *The asterisk denotes statistical significance at a significance level of 5%. The numbers included in parentheses are p-values, whereas "r" is the count of hypotheses pertaining to cointegration relationships. The null hypothesis assumes that there is no cointegration relationship between series.*

To assess the presence of long-term cointegration among variables, we employed the Fisher-type Johansen panel cointegration test, as depicted in Table 4. Based on the probabilities associated with the Trace statistics and the Max-Eigen tests, we may conclude that the null hypothesis, which posits the absence of cointegration equations among CCI, CDS, PRR, and EXC, can be denied. Therefore, we have obtained data that implies the occurrence of a consistent and long-lasting link among the parameters.

Table 1-6: The Short-run Estimation Outcomes

Variables	Coefficients
EC_{t-1}	-0.01 [-2.17]
$\Delta LCCI_{t-1}$	0.09 [2.46]
$\Delta LEXC_{t-1}$	-0.12 [-2.41]
$\Delta LPRR_{t-1}$	0.312 [2.09]
$\Delta LCDS_{t-1}$	-0.008 [-1.53]
Dummy (election)	-0.003 [-1.11]
COVID-19	0.001 [0.182]

Note: The statistics values shown in brackets are t values.

The estimated outcomes of Equation 1 reveal that the error correction term, symbolized by the notation (ec_t), is -0.01, that it possesses the necessary negative sign, and that it demonstrates statistically significant results. According to these outcomes, after 100 periods (1/0.01), the series converges to equilibrium, which means that approximately 1% of the divergence of the observed data from the equilibrium is eliminated within a period.

The political risk assessment and the current exchange rate are additional significant factors that we especially considered. Therefore, an improvement in political stability is concomitant with a commensurate improvement in consumer confidence and expectations in the short term. The literature corroborates the premise that the foreign currency rate has adverse effects. We could not achieve a substantial association between consumer confidence, electoral outcomes, or COVID-19 prohibitions, as observed in empirical findings.

Table 1-7: Long-run Coefficients

VARIABLES	COEFFICIENT
$\boldsymbol{LCDS_{t-1}}$	- 0.11 [-2.30]
$\boldsymbol{LPRR_{t-1}}$	1.37 [2.01]
$\boldsymbol{LEXC_{t-1}}$	-0.05 [-0.77]
Constant	10.83 [3.80]

Note: The statistics values shown in brackets are t values.

In the long-run panel, we found two factors to be statistically significant: CDS and PRR. Therefore, it may be concluded that CCI is related to these two factors in the long term. There is no statistical proof that confirms the significance of the exchange rate's coefficient. Although short-term variations (or volatility) constitute a risk for financial markets, this finding is feasible since in the long run, the effects are rather on macroeconomic factors, particularly the balance of payments. Additionally, the long-run VECM demonstrates that the major variable for political stability, political risk rating, is the foremost and potent determinant of alterations to consumer confidence in these economies.

Table 1-8: Granger Causality Test

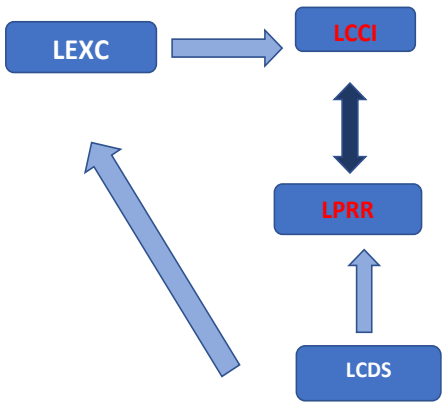
Dependent variable	Explanatory variable	Chi-square (X^2)	DF	P-value
$\Delta LCCI$	$\Delta LCDS$	2.345	1	0.126
	$\Delta LPRR$	4.367**	1	0.037**
	$\Delta LEXC$	5.820**	1	0.016**
$\Delta LPRR$	$\Delta LCCI$	3.069*	1	0.08*
	$\Delta LCDS$	6.958***	1	0.008***
	$\Delta LEXC$	0.258	1	0.612
$\Delta LCDS$	$\Delta LCCI$	0.101	1	0.751
	$\Delta LPRR$	0.0004	1	0.983
	$\Delta LEXC$	0.0015	1	0.969
$\Delta LEXC$	$\Delta LCCI$	0.0042	1	0.949
	$\Delta LCDS$	20.304***	1	0.000***
	$\Delta LPRR$	0.161	1	0.688

*Note: The symbols "***, **, and *" denote 1%, 5% and 10 % significance levels, correspondingly.*

Granger causality studies reveal that the foreign currency rate has a unidirectional bearing on the CCI, whereas the rating of political risk has a bidirectional effect.

Credit default swap premiums, on the other hand, have a unidirectional influence on ratings for political risk. Variations in the premiums (or prices) for credit default swaps also act as a unidirectional driver of the foreign exchange markets.

Figure 1-1: Granger Causality



The above flowchart illustrates the connections between the variables employed in our econometric research. A bolder arrow represents the bilateral nature of the connection.

6)CONCLUDING REMARKS

Monetary authority considers numerous predictable, unpredictable, quantifiable, and immeasurable parameters, variables, events, or potential developments while making choices. Consumption or consumer behaviors is a crucial pillar of this complex process of decision-making. The importance of assessing consumer confidence is evident for policymakers, especially for the appropriate adjustment of policy and increase in the efficacy of monetary policy. Researchers have concentrated on identifying the economic and financial variables that affect consumer confidence and assessing the degree of that effect. All types of choices, risks, fluctuations, and changes—including economic, financial, and political ones—have an impact on consumer behaviors. Public policy preferences are an essential factor that can influence consumer confidence since they stand for political changes, events, and developments. Hence, extant academic publications abound that examine the influence of public policy preferences on the formation of consumer confidence. However, the overwhelming majority of these studies consistently designate elections as the determining factor, based on the premise that elections are the primary political events that have the potential to generate political uncertainty and thus impact consumer expectations. The outcomes of these investigations have been controversial, however. Vuchelen (1995), for example, discovered that unexpected (snap or early) elections or political changes had a negative influence on consumer confidence in Belgium. Boef and Kelstedt (2004) and Caleiro et. al. (2011) in their study on Portugal concluded that elections have a positive link with consumer confidence. Similarly, in their extensive study of EC Countries, Marc, and Reuter (2018) have also confirmed the existence of a significant influence of elections on consumer sentiment, except for Belgium, confirming the results of Vuchelen some 23 years ago. These various results indicate that each election may be interpreted as a unique event in its impact on consumer confidence.

The way used in this study stands apart from previous approaches in that we assess risks—both political and financial—while evaluating shifts in consumer confidence. We tested the relevance of elections and found that the general political risk assessment of the country was significantly more prominent while being identical to the earlier studies. Interestingly, we found that exchange rates had a considerably greater impact on consumer confidence than CDS rates, despite the fact that CDS rates also influenced exchange rates. In a nutshell, it might be concluded that financial risks appear to indirectly affect consumer confidence through fluctuations in exchange rates.

This research is also distinct in the sense that it encompasses developing or emerging economies with macroeconomic fragilities, especially with current account deficits or high foreign debt. At the same time,

the democratic regimes of these countries are prone to frequent political alterations and instabilities. Thus, it is more congruent to employ the political risk rating variable rather than elections. Besides, as the frequency of our data is continuous (rather than discrete as event-based-elections) it serves more reliable results.

Moreover, our research takes into account the ramifications of the COVID-19 restrictions, which are anticipated to undermine consumer sentiment through the introduction of ambiguity and incite a surge in inflation. However, our analysis did not offer any statistically significant interactions between the restrictions imposed because of the COVID-19 pandemic and consumer confidence.

We want to point out three prominent results of this analysis. Firstly, it is the changes in the exchange rate that directly influence consumer confidence rather than CDS, although financial market risks (CDS) cause exchange rate changes in the short run. Secondly, the political risk rating is much more influential on consumer confidence in a country when compared with elections. Thirdly, of higher significance, we can emphasize that the influence of political rating on consumer confidence is higher when compared with exchange rate changes.

These results confer the fact that policymakers should also address those indicators or factors that cause political risks to rise, whilst determining the setting of the macroeconomic policy. In sum, it can be stated that political instability is significantly imperative in the formation of consumer confidence, alongside financial parameters.

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APPENDIX

Figure 1-2: The Relation Between CDS Rates and CCI

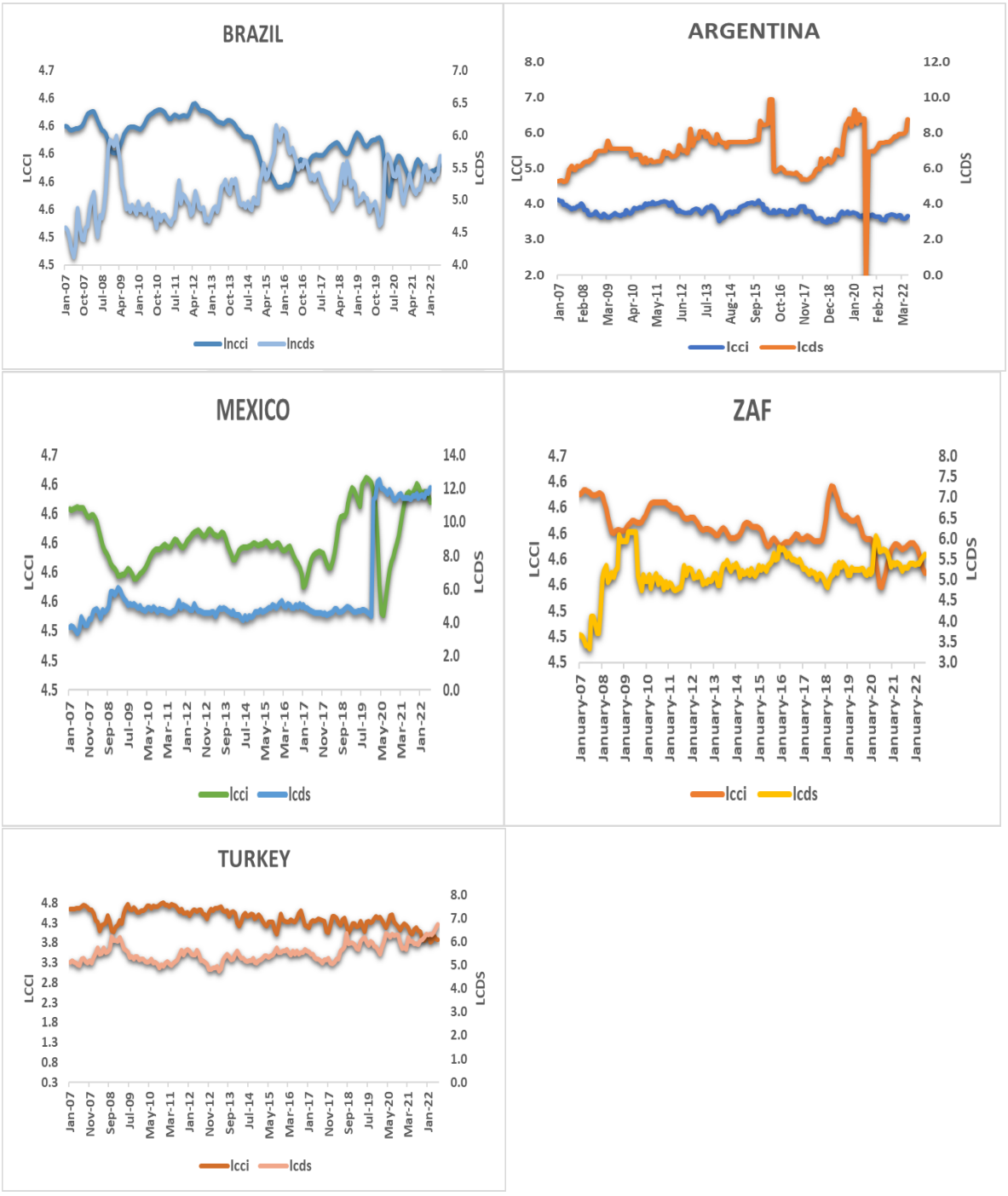


Figure 1-3: The Relation of Exchange Rates Against USD and Consumer Confidence Indexes

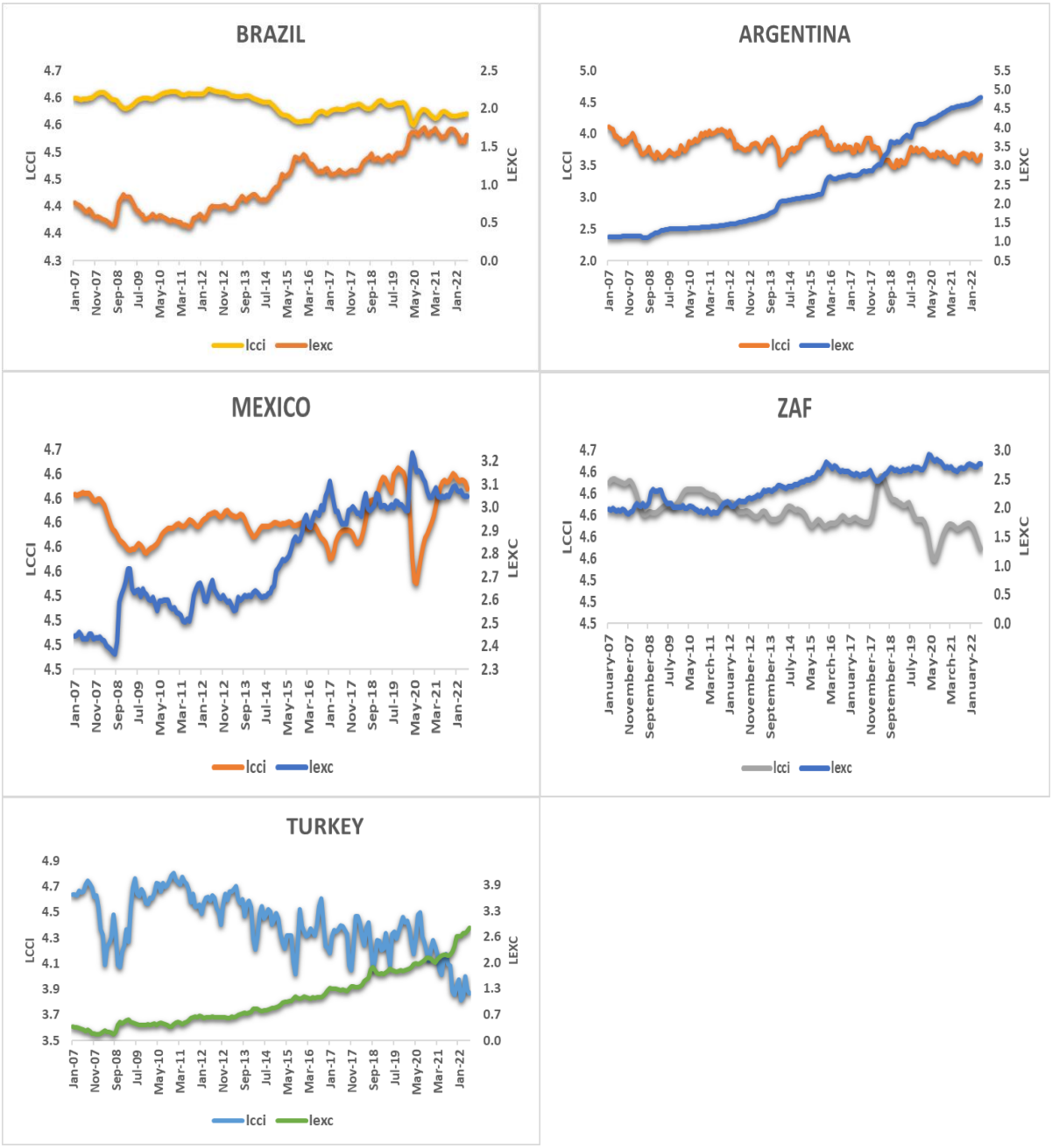


Figure 1-4: The Relation Between PRR and CCI

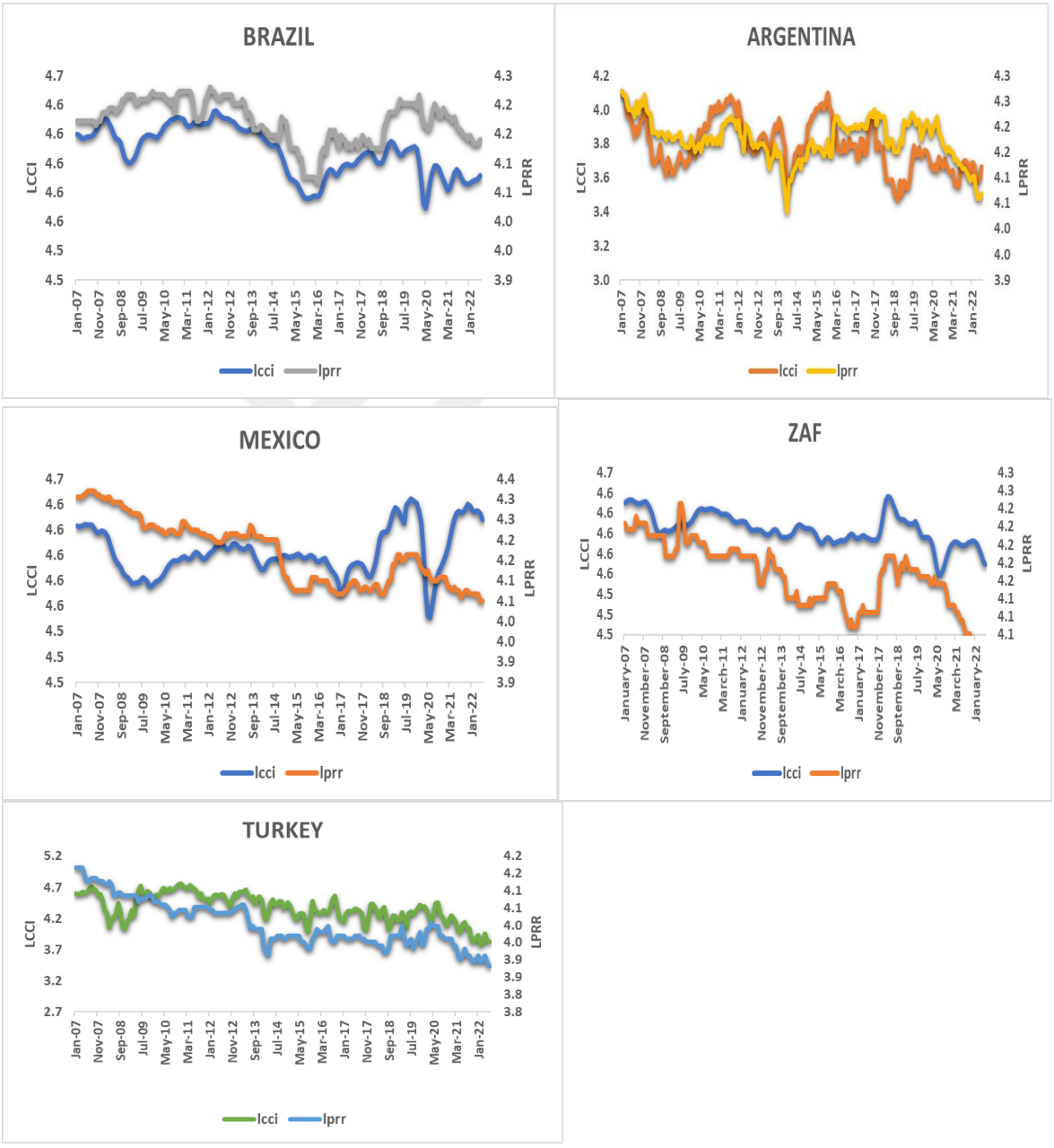
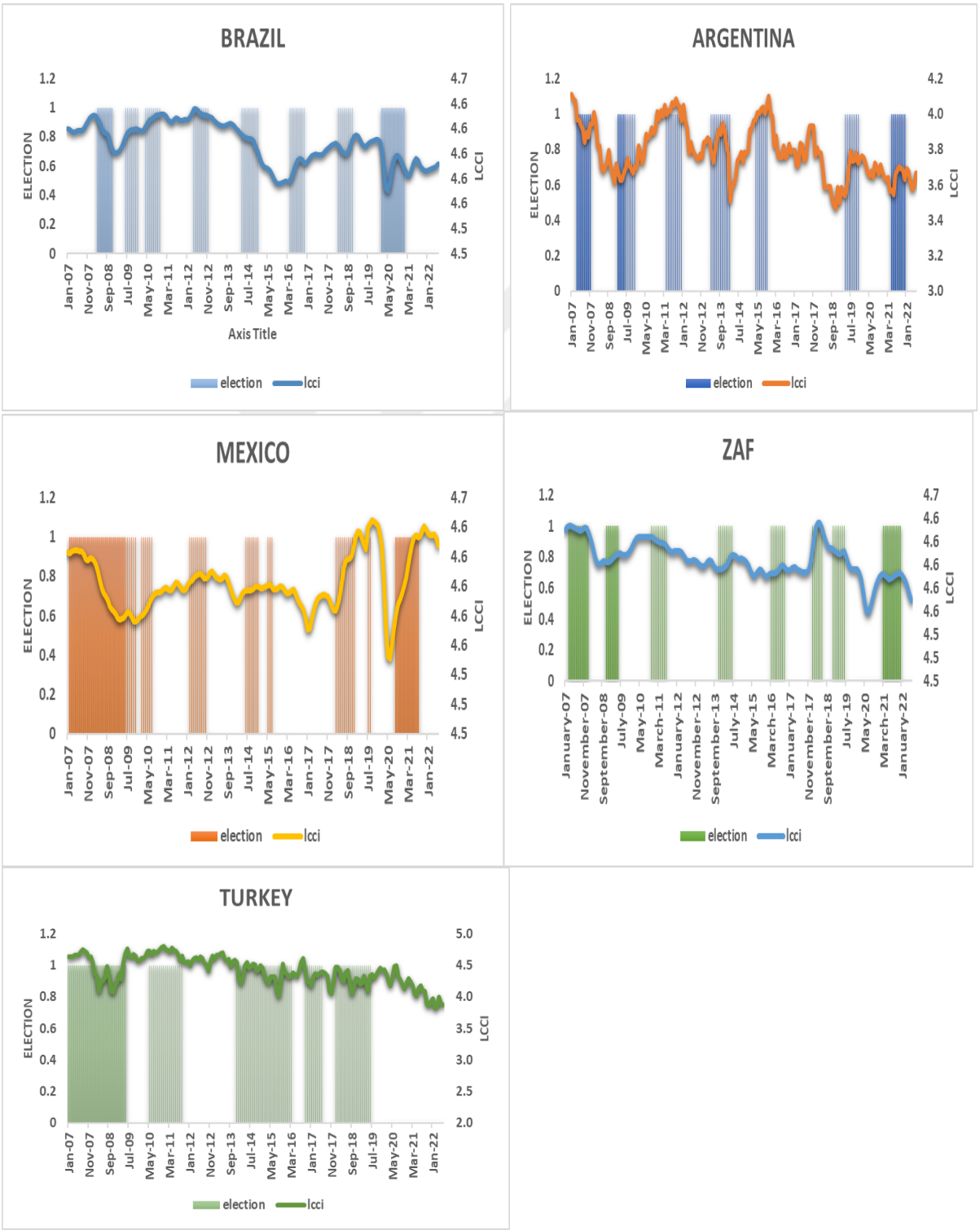


Figure 1-5: The Relation Between Elections (Dummy Variables) and the CCI



CHAPTER 2

INFLATION AND CENTRAL BANK TRANSPARENCY

1) INTRODUCTION

The salient developments in central bank transparency have led many researchers to focus on the effects of transparency over the past decades. Since its inception, the approach to transparency has changed to react to new developments in the roles and goals of the central bank.

In his work, Goodhart (2010) provided a comprehensive overview of the changes in the priorities and purposes of central banking, categorizing them into three distinct periods.

1) The period from 1914 to 1940 was marked by a notable degree of price and financial stability, mostly due to the use of gold as a form of currency.

2) The period from the 1940s to the 1970s was marked by the presence of a central bank that prioritized economic growth only within the boundaries of government oversight. This approach resulted in significant levels of economic volatility across several sectors.

3) From the 1980s until 2007, there was a notable distinction between financial security and price stability. During this period, the monetary authority focused on ensuring price stability through the implementation of inflation-targeting regulations. Additionally, financial markets experienced increased exposure to risk.

While the traditional central bank approach defends discretion, especially in the wake of an independent monetary authority or autonomy, accountability and credibility problems have strengthened the approach that the monetary authority should be transparent. Therefore, in the first studies, transparency was defined within the framework of the independence or credibility approach. These researchers investigated how monetary policy and expectations are affected by the credibility and reputation of an autonomous (independent) monetary authority. Transparency is defined in terms of predicting monetary policy, namely a CB exposes details pertaining to its policy formulation and implementation. It is often presented as a tool that keeps central banks accountable for their policies. The inflation targeting regime has become a milestone in varying the definition and implementation of transparency. Transparency in monetary policy is

identified by Poole (2003) as *"accurately providing accurate information, containing all of the information market participants require to form as complete an opinion on monetary policy as possible."*

Monetary policy openness is the revealing of all knowledge that will provide market participants with a profound comprehension of monetary policy.

The inflation target strategy has empowered monetary authorities across the world to emphasize openness by enhancing their networking efforts and disseminating further details. Additionally, the majority of monetary authorities have started releasing inflation and GDP projections that support their stance on monetary policy. Furthermore, many central banks publish projection models and the findings of other studies for demonstrating the estimation process for monetary policies. Consequently, with the widespread use of communication channels such as announcing the target, press releases, and briefings, the information generated as a byproduct of policy has reduced the uncertainty created by the monetary authority and also heightened its scope of influence. In other words, more sophisticated information has come to light. The capacity of the monetary authority to manage expectations is a crucial tool to mitigate asymmetric information issues. The asymmetry of information is a market imperfection that can lead to ineffectiveness and fluctuations that frustrate the achieving inflation objective. Enhancing the level of transparency in the communication practices of monetary authorities possesses the potential to diminish knowledge asymmetry among economic participants and alleviate the negative consequences arising from market failure.

Monetary authority independence, implementing inflation targets, and developments in financial markets have led to a rising study about the efficacy of central bank openness. Therefore, the present study seeks to foresee the repercussions of openness on the inflation rate in Turkey. Following the 2001 crisis, the inflation-targeting strategy in Turkey was implemented by applying several legal regulations regarding the independence of the monetary authority.

The body of scholarship on the issue is extremely scarce, as the majority of studies have put an emphasis on the autonomy of the central bank rather than its openness. In these studies, the index hinged on the IMF's definition in 1999 was used. The evolution of transparency requires revising its definition and calculation. This research intends to examine the linkage between inflation and the transparency index, which is based on a broader definition of transparency.

The study proceeds as outlined below:

The second section describes how the theoretical framework and empirical analyses in the literature evaluate transparency. Section 3 scrutinizes various approaches to the measurement of transparency. Section

4 represents the model and data. Section 5 examines whether transparency has an impact on inflation. Section 6 outlines our key findings.

2) THE RELEVANT LITERATURE REVIEW OF THE MONETARY AUTHORITY'S OPENNESS

2.1) Theoretical Literature Review

As mentioned above, one of the most noteworthy leaps in central banking during the past two decades has been a spike in central bank transparency. Nevertheless, there is still disagreement regarding how transparent a central bank should be, both in monetary theory and in practical terms. Too much information being released to the public may have undesirable consequences, according to Blinder et al. (2001). Imperfect knowledge has been viewed from the perspective of classical economics as a cause of market imbalances that lead to inadequate public welfare and distorted resource allocation. Even if expectations shift quickly following rational expectations, surprise or unexpected monetary policies may have a grip on the real economy. Regarding that, the monetary authority's desire to manage or modify expectations will not be advantageous to the overall economy (Lucas, 1972; Sargent, 1973; Sargent& Wallace, 1975; Barro, 1977; Cukierman & Meltzer, 1986).

The demand for higher transparency has appeared with the advent of democratic regimes and the tenet of central bank autonomy. According to Blinder et al. (2001), transparency in monetary policy is a form of public policy that represents democratic accountability. In other words, the effectiveness of monetary policy will only become better if the monetary authority's goals and procedures are clear to the public. Consistent and constant communication from a central bank is essential to clarifying its monetary policy stance, whether during times of prosperity or adversity. This upholds democratic accountability principles.

On the other hand, the transparency of the policy structure (objectives, benchmarks, and model) may not be as evident in a central bank that lacks a significant level of autonomy. Although certain central banks may disclose information about their monetary operations, it is still unclear how these operations are linked to the preferred and prioritized policy goals. According to Milton Friedman, as cited by Nelson (2020:p 323), the unwillingness of central banks to share monetary policy creates a dilemma: continuing to gain public prestige and avoiding accountability. This situation is expressed as a credibility problem in the academic discipline. The issue of monetary authority credibility is related to time inconsistency (Kydland & Prescott, 1977). Policy inconsistency can be released when monetary authority concentrates on output (job opportunities) regardless of ensuring price stability (Barro and Gordon, 1983). An instance of policy

inconsistency is when political pressure is exerted to fund government expenditures by creating money or implementing a lower interest rate. This often results in a higher inflation bias and can be seen as inflation tax or seigniorage. To overcome this, there are two commonly suggested solutions for this issue: (1) autonomy, and (2) monetary policy rules (Kyland and Prescott, 1977; Calvo, 1978)

In order to guarantee stability and prosperous economic development, it is essential for central banks, especially in developing countries, to have independence. A crucial aspect of this is building a solid reputation for credible policy, as explained by Barro & Gordon (1983). This is achieved by implementing consistent policy over a long period of time. By doing so, the monetary authority is able to anchor public inflation expectations to the inflation target, ultimately avoiding any inflation bias that may arise from policy inconsistency.

The fundamentals of previous studies within the Barro-Gordon framework such as Canzoneri (1985), Cukierman and Meltzer (1986), Faust and Svensson (2001), Jensen (2002), Hellwig (2002), and Gersbach (2003), aimed to explore whether extensively sharing knowledge can mitigate the inflation bias, address time inconsistency concerns, and enhance the central bank's credibility. The Barro-Gordon argument has been debunked in numerous studies. According to later studies (Tarkka& Mayer, 1999; Cukierman, 2000; Jensen, 2002; Amato & Shin, 2003; Hellwig, 2005; Walsh, 2007; Lorenzoni, 2009), the monetary authority's primary goal is to maintain output at its optimal level while also struggling with inflation. The monetary authority is no longer faced with a credibility issue due to time inconsistencies. One reason for this alteration in perception is the view that equilibrium is equal to the natural level of production but above the optimal level of inflation. In conclusion, they cannot constantly keep production above the potential level, and such an attempt will have inflationary consequences. Central banks should also stop pursuing discretionary policies.

These studies examine the impact of transparency under the different knowledge challenges. To put it another way, they employed models that acknowledged the possibility of heterogeneous information between policymakers and economic individuals rather than homogenous information. Economic actors have distinct sets of information about economic shocks. This situation creates a high degree of uncertainty and leaves economic actors unsure about each other's expectations. As a result, some rigidities and delays in strategic decisions may occur, and a temporary shock may have permanent impacts on the macroeconomic parameters.

Following Woodford (2001), various publications studied the impacts of transparency by employing models that suppose economic agents and market structure under heterogeneous information instead of homogeneous, as the difficulties in predicting caused by differential knowledge are solved.

Morris and Shin (2002) and other academic articles have discussed the concept of transparency as a double-edged sword, highlighting its potential advantages and disadvantages in the context of strategic alliances and the dissemination of information among various actors. In addition to aiding coordination, sharing information with the public may result in an excessive response to it. Private actors may tend to excessively emphasize public knowledge and overlook its true value. Consequently, transparency may rather be a burden than a benefit, particularly when public information is clamorous and detrimental to welfare.

Demertzis and Hoeberichts (2007) obtained a similar result as Morris & Shin (2002), and James &Lawler (2011). The authors reached that when the private sector takes public knowledge into account and subordinates its own knowledge in its decisions, public knowledge can reduce social welfare.

Sibert (2007) defined the bank's goal function as private knowledge of the monetary authority, that is, the details not released to the public. The author compares central banks with this specific information to the most transparent central banks and demonstrates that they have lower inflationary tendencies and can respond more effectively to shocks. According to the author, increased transparency reduces planned inflation and its variance in the absence of transparency and private information at the starting point. Furthermore, the public's predictions relied on the monetary authority's objective function are adversely affected. Therefore, the monetary authority which struggles with inflation abstains from transparency.

Contrary to the traditional approach, the studies supporting transparency focus on the positive effects of predictable information on market prices. According to (Goodfriend, 1985), transparency lowers the cost of obtaining knowledge, data and details about the central bank's policies, which has two major advantages. First, if stock prices contain all available information, more realistic prices may occur. More realistic prices benefit the economic actors who trade in the market. The second is that central bank resources and information are now available to some segments of the public who were previously unable to access them due to cost. Furthermore, the author emphasizes that the central bank's knowledge disclosure ensures that the market's response is no longer based on estimates but on real information. Thus, market reactions are getting closer to the monetary authority's policy. Monetary authority's policy effects are more predictable as a result of this situation. For these reasons, the author is sceptical of the notion that secrecy policies improve social welfare.

Garfinkel and Oh (1995) suggest that boisterous announcements by the monetary authority have the potential to decrease the cost of the sacrifice between the monetary authority's credibility and flexibility issues. In addition, the authors claim that if central banks follow a rule-driven monetary policy such as a fixed monetary growth rate, making noisy announcements containing their predictions may affect the expectations of wage setters, reducing the variance of prediction errors and ultimately output volatility. Drew and Karagedikli (2008) also state that transparency reduces the rate of the sacrifice of anti-inflationary policies and enables a more flexible monetary policy. The authors furthermore mention that transparency plays an important role in reducing instabilities in macroeconomic variables and uncertainties in the private sector.

2.2) Empirical Literature Review

On account of the monetary authority's independence or autonomy, the embracing of inflation-targeting strategies by numerous countries, and the growing power of monetary authorities in the economy following the financial crisis, studies on how monetary authority openness correlated with the efficiency of monetary policy and macro variables have intensified in the last two decades. This section will only provide a brief overview of empirical studies that investigate the interaction between transparency and inflation.

Chortareas, Stasavage, and Sterne (2002) used data from 87 countries to examine the implications of transparency in monetary policy on output and inflation. The authors concentrated on the monetary authority's publications (inflation reports and economic estimations) and their impact on inflation and output volatility. The study revealed two significant findings. First, while publishing central bank forecasts improves inflation performance, it reduces the likelihood of implementing the inflationary policy by raising the susceptibility of the monetary authority's prestige to its actions. Second, publishing central bank forecasts reduced output variability owing to restricting its ability to use unexpected policies to combat demand-side shocks. They employed the questionnaire created by (Maxwell Fry et al., 2000) for 94 countries. The survey questions incorporate a wide range of transparency topics, including the publication of economic estimation and expectations, sharing the policy formulation process, the number of analyses, research activity, and central bank officer speeches. The correlation between each transparency question and inflation and output variability was examined. Various factors were used to measure the effect of transparency, including democracy indicators, central bank independence, the quality of monetary

authority's analysis skills and GDP per capita. They concluded that inflation is adversely related to openness indicators. This empirical evidence suggests that implementing greater transparency could help to reduce inflation. Furthermore, countries with a flexible foreign currency policy have a greater impact. The monetary authority's decision to release inflation forecasts in these economies, where inflation started to reach double digits at about 12% annually, led to disinflation that ranged from 18% to 7% annually. In contrast, the effect of transparency on disinflation was shown to be negligible in economies under fixed exchange rates, where inflation slightly decreased from 12% to 11.8% per year.

Demertzis and Hallett (2002), developed a model based on the central bank objective function and Lucas-type supply function to carry out the repercussions of the openness of the monetary authority on output and inflation. They estimated an equation hinged on the central bank index of Eijffinger and Geraats. The paper examines the Eurozone and eight OECD member countries New Zealand, the United Kingdom, Japan, the USA, Sweden, Switzerland, Australia, and Canada). The authors concluded that transparency has no effect on inflation or average output levels, but it does make the economy more stable by reducing inflation and output volatility. Transparency has a greater influence on production variability.

Fatas et al. (2004) conducted a panel OLS study in 42 countries between 1960 and 2000 to investigate the effects of declaring a numerical target in inflation, exchange rate, and monetary targeting regimes. Countries with formal numerical goals for monetary policy experienced lower inflation rates and less volatility in output, according to the findings.

Using data from 24 countries from 1991Q1 to 1998Q4, Cecchetti and Krause (2002) investigated whether there is a relationship between macroeconomic performance and the monetary authority's independence, accountability, openness, and credibility. The authors argue that the foremost factor in explaining the variations in macroeconomic outcomes among countries is credibility. They discovered that countries with higher central bank credibility and transparency demonstrated better macroeconomic performance and more effective policies namely, an adverse interaction between average inflation and transparency.

Chortareas et al. (2002a) argue how the foreign currency regime shapes the interactions between transparency and inflation by utilizing the survey data of Maxwell Fry et al. (2000). The primary proposition of this research is that the sharing of inflation forecast has no impact on average under the assumptions of a small and open country that holds full convertibility and a fixed foreign currency regime. They put this presumption to the test by cross-section analysis of 87 countries and reached an adverse linkage between transparency and average inflation in economies that use a floating foreign currency regime. Transparency,

on the other hand, did not seem to have a significant relationship with average inflation in countries with a fixed foreign currency regime.

Crowe and Meade (2009) inquired how increased public information as a result of transparency affected private sector inflation predictions. The ratio of the variance (VAR) of the private sector's forecast of next year's inflation to the mean square error of the estimates (MSE) was calculated to measure the proportion of private information used against the released public information. According to the authors, enhanced central bank transparency spreads more accurate public signals, lowering the VAR / MSE ratio. To put it more simply, as a result of increased monetary authority openness, the private sector began to evaluate more public knowledge rather than private information in its inflation forecast.

Dinçer and Eichengreen (2009) asserted that the transparency index of the monetary authority and the previous inflation are the most important determinants of inflation variability. The transparency index is leading to an adverse consequence on inflation variability. This is in accordance with methods that imply that more openness will enable the public to react to policy changes more swiftly and prevent manipulation of inflation in achieving other aims.

Under the adaptive expectations, Levin et al. (2004) investigated the relationship between expectations about actual inflation and the function of the inflation targeting policy. They believe that alterations in the monetary regime will weaken the link between actual and expected inflation. Hence, in longer periods the value will approach zero. Within the scope of these explanations, the countries that apply and do not apply inflation targeting were tested for the period 1994-2003. As a matter of fact, over longer periods, the value will approach zero. Within the scope of these explanations, the economies that apply and do not apply inflation targeting for the period 1994-2003 were tested. According to the findings, countries that implement inflation targeting have lower susceptibility of long-term inflation expectations to actual inflation than those that do not. Cruijsen and Demertzis (2007), following (Levin et al., 2004), examined whether monetary authority openness affects the sensitivity between actual and expected inflation. For this purpose, dummy variables are used for institutional changes that cause a change in a country's central bank transparency. Besides that, the outcomes revealed a positive linkage between expected and actual inflation in countries with lower openness, but not in countries with higher transparency.

Similarly, Siklos (2003) researched the effect of inflation expectations and inflation forecast error with panel data analysis for 6 countries that implemented inflation-targeting policies (Australia, England, Spain, Sweden, Canada, and New Zealand) and 5 countries that do not (the USA, Germany, Austria, the Netherlands, and Switzerland. The study accepted the publication of inflation reports as a measure of

transparency and utilized the inflation forecast error for obtaining information on inflation resistance. According to the findings of the study, the disclosure of inflation reports in countries implementing inflation targeting reduces the inflation forecasts in the post-1995 period. In addition, inflation targets have an adverse and significant effect on inflation forecasts. The average inflation forecast error is lower in countries that apply inflation targeting. This situation shows that inflation has become a predictable variable in countries implementing inflation targeting.

Helder and Jose (2008) investigated the effect of announcements and publications on expectations. The analysis points to the inflation-targeting framework implemented in Brazil from January 2002 to March 2006. The 1-month and 3-month interbank interest rates, short and long-term interest rates, the rate of inflation, the public debt / GDP ratio, the exchange rate, and the Bovespa stock market index were used to assess the exchange's reaction to the Central Bank of Brazil publications. The kurtosis values of the series also decline during election periods. The authors argue that published inflation reports can guide public expectations, but periods of political uncertainty restrain the monetary authority's ability to fix long-term inflation expectations and eliminate the advantages of economic transparency.

Aron and Muellbauer (2007) examined the repercussions of increased openness on inflation and interest rate expectations in South Africa which has implemented the inflation target regime since 2000. The authors revealed that inflation expectations converge with the goal rate of the monetary authority and the repo interest rate has been better predicted since 2000. This situation generates a downward trend in the miscalculation of the repo interest rate.

Ehrmann et al. (2012) investigated the implications of evolving monetary authority communication and openness on the expectations of the private sector regarding inflation, interest rate, and other macroeconomic variables. The study covered 12 countries (These countries USA, Germany, France, Netherlands, England, Spain, Sweden, Switzerland, Italy, Japan, Canada, and Norway) for the period January 1990-November 2008 (starting date for the Netherlands, Spain, and Sweden) was analyzed via standard OLS. Central bank transparency described as declaring the numerical inflation target, publishing inflation and production forecast reports, and/or using other communication policies, has a statistically negative effect on the estimation distribution. Expectations are updated more frequently and the estimation distribution decreases in cases of greater transparency and more explicit policies.

Başkaya et al. (2008) probe the behavioural aspects of inflation expectations in Turkey, along with the implications for policy formulation and communication strategy by using data from a panel of survey respondents. According to this study, survey respondents form their expectations based on inflation

forecasts of the CBRT. Inflation expectations were firmly attached to the announced targets from 2002 to 2005. In contrast to the financial sector, the real sector places a higher value on past inflation. Furthermore, the financial markets are prone to be more vulnerable to changes in risk premiums, foreign currency volatility, and unexpected inflation rates in the short term. They suggested that CBRT should maintain to highlight the importance of the medium-term policy for building an effective network with financial markets.

Akyaz and Ekinci (2009) assessed the macroeconomic performance of Turkey's monetary policy strategies from January 2000 to July 2007. Interpreting the findings, the average rate of inflation and inflation volatility is gradually declining. As a matter of fact, while the inflation resistance value, calculated by the AR (1) process, was 0.964 for the period 1995M1-1999M12, it was 0.787 for the period 2004M1-2007M7. The study also found that output fluctuation diminished during the inflation-targeting timeframe. These results are also corroborative of the theoretical literature that predicts the reduction of inflation and production variability as a result of a more forward-looking structure of economic decision-makers and increased reliability.

Elvanlı (2009) researched the outcomes of monetary policy openness on the transaction volumes and interest rates of Government Domestic Debt Securities (DİBS) by dividing it into two sub-periods, namely January 2002-December 2004 and January 2005-January 2009. In this study, the reaction of discounted Government Domestic Debt Securities with a maturity of 6 months and 12 months to the unexpected policy surprises defined the interest rates of discounted Government Domestic Borrowing Notes with a maturity of 1 month by utilizing an event study using daily data. Moreover, the study comprises the effects of inflation data disclosures and higher monetary policy transparency on secondary market transaction volume. The author concluded that the alterations in reaction quality to the announcement of inflation data are associated with the openness of monetary policy.

Direkçi and Ozçiçek (2011) calculated the inflation resistance coefficient as the sum of the autoregressive coefficients in order to predict how greater openness modifies it. The average of the resistance coefficients calculated from 2002 to 2008 through various sub-items of the Consumer Price Index (CPI) and the Producer Price Index (PPI) is greater than the average calculated between 1994 and 2001. Consequently, the author has not obtained any evidence that the inflation resistance value has decreased since 2001.

Al (2013) searched for a correlation between the CBRT's openness and interest rate,inflation expectations, inflation volatility and expectation errors by OLS between 1998 and 2009. According to the findings, central bank transparency reduces inflation persistence and increases the foreseeable nature of monetary policy by

dwindling the volatility of interest and inflation rates. Financial and economic risk indicators are also effective for nearly all research variables. The author discussed whether monetary authority may need to adopt a secondary goal such as financial stability.

Yurdabakan and Öneş (2017) developed a model to gain insight into the interaction between policy performance and monetary authority credibility. They analyzed the CBRT's reliability over the last two decades using the transparency index generated by Cukierman et al. (1993) and the more comprehensive index of Dinçer & Eigenberg (2013). They adopted a multi-equation model for examining the bearing of transparency and institutional independence on the monetary policy performance (change in derivation from the inflation target) under the assumption of managing other macroeconomic variables that influence inflation. The authors concluded that the perception of a monetary authority with a higher degree of transparency positively improves inflation-targeting performance. Furthermore, alterations in transparency policy can be a beneficial proxy to represent the wide variety of institutional changes that transpired in the Turkish economy during the past two decades.

3) THE VARIOUS METHODS OF MEASURING MONETARY AUTHORITY'S OPENNESS

The broader scope of recognition and application of transparency has contributed to the development of different approaches on how to measure transparency. Although various aspects have been conducted to gauge the power of the transparency of monetary policy, its measurement, in general, can be divided into five major groups:

1. The descriptive explanation of transparency: This type of transparency measurement concentrates on the communication strategies of monetary authorities to the public and generally includes actions taken and not taken by them. The drawback of this measurement is that it does not allow for the generation of an index.

2. Central bank research: A ray of questionnaires is sent to central banks to conduct research. The project by Maxwell Fry et al. (2000) is an exemplification of this type. The limitation of this type of measurement is that central bankers who fill out the questionnaire are likely to misunderstand the questions and/or answer them incorrectly in order to receive an appropriate score.

3. Official documents and information: More transparency, according to this viewpoint, leads to more sophisticated information. Transparency refers to whether or not monetary authority releases its policy, procedures, assumptions, and models. The goal of this approach is to produce an index. Researchers create an index by investigating the behaviour of central bankers, and the frequency and type of information that central banks share with the public. The studies by Eijffinger & Geraats (2002); and Crowe & Mead (2008) are examples of this method. Geraats (2001) outlined the five different categories of transparency that are interrelated: (1) political openness (the disclosure of an ultimate policy target, especially the explicit inflation target) 2) economic openness (sharing the forecasts, data and models); (3) procedural openness (publishing the minutes and voting records); (4) policy openness (sharing the details about the modification of the policy rate and the articulation of future policy trajectory); and (5) operational/market openness (the exposure of market interventions and control failures).

Despite the fact that the score is subjective and varies depending on the researcher, the index is useful for describing the degree of transparency.

One other benefit of this approach is that subcomponents of transparency can be incorporated into the analysis. For instance, political transparency, (Faust & Svensson, 2001; Nolan & Schaling, 1996), which

regarded the monetary authority's policy preferences and targets as helping minimize inflation bias and fluctuations in job opportunities.

Political transparency reduces the gap between the monetary authority's desired rate of inflation and inflation expectations. Nonetheless, until the early 2000s, only a few monetary authorities released minutes and voting records of their meetings.

The theoretical framework developed by Faust and Svensson (2000, 2001) for differentiating between the lack of control over monetary policy and operational openness. They also showed that openness can have beneficial repercussions for the public's welfare.

The concept of economic openness has also involved examining the methods used by central banks to publish inflation rates and economic forecasts. According to (Gersbach, 1997; Cukierman, 2001; Geraats, 2001), publishing the projections of the monetary authority eliminates asymmetric information about economic shocks. Different perspectives on how monetary policy exerts influence on the economy and the preferences of the monetary authority have culminated in contradictory findings. Openness, according to Gersbach (1998) and Cukierman (2001), has a negative impact on public welfare, although Geraats (2001) argues that transparency leads to increases in public welfare. Tarkka and Mayes (1999) claimed that the public is unaware of the monetary authority's preferences and is also not privy to the monetary authority's evaluation of inflation expectations. They suggested that by releasing its predictions, the monetary authority could remove this uncertainty and enhance the efficiency of monetary policy.

4. Market-based indicators: These indices are based on what the market perceives from central bank actions, signals, and monetary policy implementation (Howells & Mariscal, 2002). The primary contention underpinning this viewpoint is that policy is most successful when markets correctly predict it. According to (Blinder et al., 2001), monetary policy commonly operates through parameters that are influenced by market-participants expectations. The expectations that are formed in markets play a role in the linkage between policy rates (short-term interest rates) and various financial variables. With less fluctuation in expectations, the relationships between policy and its impact on the economy become more stable and predictable.

5- Dummy variables: This view focuses on the degree of openness, therefore, pinpointing transparency as lower or higher. The virtue of this estimation is that it allows for comparing the countries that implemented inflation targeting.

4) THE MODEL

First, in this section, we will revise the CBT index developed for Turkey. Following that, the model will be analysed.

4.1) Central Bank Transparency Index

As mentioned in the preceding section, various methods are conducted to calculate the central bank's transparency degree. In this research, following Eijffinger and Geraats (2002), Crowe and Mead (2008), and Dinçer and Eichengreen (2009, 2014), the index is generated by exploiting official documents and information. This index hinges on the recently authorized Central Bank Transparency Code (CBT) by the Executive Board of the International Monetary Fund (IMF).

The CBT was created in response to the Board's policy in April 2019 to revise the "Monetary and Financial Policies Transparency Code (1999)". Other indexes stand for the 1999 CBT code. Salient developments over the past two decades required revising the CBT's pillar framework. The requirements of amending the MFPT are: *"(i) progress in the development of international standards for financial policies since 1999; (ii) monetary policy practices of many central banks since the 2008 financial crisis; (iii) the recent expansion of central banks' mandates, functions, and powers—both de jure and de facto; and (iv) the 2017 IMF "Review of the Standards and Codes Initiative" recommendation to gear the Fund's transparency guidance toward facilitation " (IMF:5)* and (v) "*the Fund's enhanced approach to good governance issues* "(IMF:6).

The emphasis of the CBT is not just on revealing operational processes, but also on aiding policy objectives, promoting policy efficacy, and overcoming macroeconomic concerns. The CBT recognizes that monetary authority operates in a variety of environments and phases of economic and financial development (IMF:6-7).

Another advantage of the new perspective is that it concerns the impact of the legal structure and the autonomous monetary authority. The legal framework of a central bank determines its level of transparency. Certain monetary authorities might confront constraints imposed by domestic regulatory frameworks that limit their capacity to reveal private information, such as personal data associated with business or trade secrecy rules. In addition, certain domestic legislation and regulations, including those regarding "freedom of information", may mandate that the central bank operates in a transparent manner.

Finally, the revised CBT codes also focus on the foreign currency rate policy, the foreign exchange reserve management, and the key elements of achieving the inflation target, especially in emerging countries, along with monetary policy and financial stability.

Table 2-1: The Five Pillars of Central Bank Transparency

PILLAR I (OPENNESS IN GOVERNANCE)	***PILLAR II (OPENNESS IN POLICIES)***	***PILLAR III (OPENNESS IN OPERATIONS)***	***PILLAR IV (OPENNESS IN OUTCOMES)***	***PILLAR V (OPENNESS IN LEGAL RELATIONS)***
1)LEGAL STRUCTURE ➢ ***Legal Framework*** ➢ ***Legal Nature*** ➢ ***Legal Protection*** ***2)MANDATE*** ➢ ***Objectives*** ➢ ***Functions*** ➢ ***Powers*** ***3)AUTONOMY*** ➢ ***Institutional*** ➢ ***Functional*** ➢ ***Personal*** ➢ ***Financial*** ***4)DECISION MAKING ARRANGEMENTS*** ***5)RISK MANAGEMENT*** ➢ ***Risk Exposure*** ➢ ***Risk Framework*** ***6)INTERNAL ACCOUNTABILITY*** ➢ ***Arrangements*** ➢ ***Tools*** ➢ ***Code Of Conduct*** ***7)COMMUNICATION*** ➢ ***Arrangement*** ➢ ***Strategy/Tools*** ***8) CONFIDENTIALITY***	➢ *Policy Frameworks* ➢ *Policy Decisions* ➢ *Supporting Analysis*	➢ *Instruments* ➢ *Coverage* ➢ *Access*	***Ex-Post Reports On:*** ➢ *Governance Actions* ➢ *Policies* ➢ *Operations*	***1)GOVERNMENT*** ➢ *Agencies* ➢ *Services* ➢ *Consultation Arrangement* ***2)OTHER AGENCIES*** ➢ *Cooperation* ➢ *Commitments* ***3)INTERNATIONAL*** ➢ *Cooperation* ➢ *Commitments*

Source: IMF Staff

Consequently, The new CBT's 5 pillar framework, demonstrated in Table 1, can be described as:

1) Pillar I: (Transparency in Governance): To maintain confidentiality, central banks need to establish a concise policy that outlines their decisions regarding sensitive information disclosure, taking into account legal and other obligations. The legal framework can help reveal the strengths and weaknesses of the monetary authority's openness practices and their significance within the country's circumstances.

2) Pillar II (Transparency in Policies): This pillar deals with the frameworks, choices, and analyses that support policies.

3) Pillar III (Transparency in Operations): This step involves making the monetary authority's operations transparent by outlining the mechanisms through which policy choices are executed. It takes into account the tools used, the extent of coverage, and the level of access provided.

4) Pillar IV (Transparency in the Outcome,): This involves communicating the outcomes to stakeholders through ex-post reports, which can help promote accountability for government actions, policies, and operations.

5) Pillar V (Transparency in Official Relations): This includes the CB's collaboration with the administration and other domestic entities, as well as its foreign relations and obligations (IMF, 2020, p.4-5).

Table 2-2: The Central Bank Transparency Index

PILLAR 1 (OPENNESS IN GOVERNANCE)	**PILLAR 2** (OPENNESS IN POLICY)	**PILLAR 3** (OPENNESS IN OPERATIONS)	**PILLAR 4** (OPENNESS IN OUTCOMES)	**PILLAR 5** (OPENNESS IN THE LEGAL RELATIONS)
1)Autonomy **a) Institutional** **b) Functional** **c)personal** **d)Financial** **2)Decision-making** **3)Accountability** **4)Communication**	**1)Monetary Policy** a) Objectives and frameworks b) Policy decisions c)Supporting Analysis **2)Exchange Rate Policy** a) Objectives and Frameworks b) Policy decisions c) Supporting Analysis **3)Exchange Rate Reserve Management** a) Objectives and Frameworks b) Policy decisions c) Supporting Analysis **4)Financial Stability**	**1)Monetary Policy** a) Instrument b) coverage c)access **2) Exchange Rate Management/Policy** a) Instrument b) coverage c)access **3)Exchange Rate Reserve Management** a) Instruments b) coverage c)Assessment **4)Financial Stability**	**1)Monetary Policy** a) Governance actions b) policies c)operations **2)Exchange Management/Policy** a) Governance actions b) Policies c)Operations **3)Exchange Rate Reserve Management** a) Governance actions b) Reporting on implementations c)Financial results **4)Financial Stability**	**1)Government** **2)Other/Domestic** **3)International**

Regarding this framework, the CBT monthly index, covering the period between January 2001 and February 2021, was created for Turkey to comprehend the current challenges of CBRT. The CBT will assist in clarifying the functions of the CB (what the CB does), its process (how it does it), and the outcomes. In this context, the index obtained consists of 70 questions and five components.

Pillar I, transparency in governance, consists of four subcomponents related to institutional issues and the legal framework: autonomy, decision-making, accountability and communication. Institutional issues and legal frameworks represent the embracing degree of openness practices hinged on country-specific conditions. Certain monetary authorities may be bound by domestic law and oversight procedures that limit their ability to be transparent. Since it demonstrates the central bank's openness constraints, transparency's applicability must clarify whether it is independent or autonomous, what kinds of autonomy it has, and under what circumstances. Autonomy comprises institutional, functional, personal, and functional.

Revealing the structure of an organization and how responsibilities are assigned to decision-making bodies is essential for monetary authority to be perceived as trustworthy and transparent.

The accountability part focuses on its framework for accountability, which offers transparency and reporting mechanisms to the public and political institutions.

With the implementation of the inflation-targeting policy, communication has come to the fore as an indicator of the transparency of the monetary authority. Over the past decade, monetary authorities have heightened their openness strategy via communication strategies that ensure more information. Clear and understandable communication, which is crucial for managing expectations, has improved the efficacy of the decisions. An effective monetary policy requires openness and communication at all stages.

Policy transparency, which is Pillar II, entails the policy, objectives, and reinforcement of monetary policy, foreign currency policy, and reserve policy separately and analyzing the function of the monetary authority in financial stability.

The index questions in Pillar III are concerned with the instrument, coverage, and accessibility of monetary policy, foreign currency rate policy and reserve policy procedures, as well as financial stability procedures.

Pillar IV demonstrates the consequences of the governance, policy, and operations of the monetary, exchange rate, and foreign reserve policies along with financial stability.

The monetary authority's relations with the government, domestic and international institutions are the focal points of Pillar V. The table below summarizes the CBT sub-components used in this study, and the comprehensive list of index questions is shown in Appendix I.

Table 2-3: The Fluctuations in CBT

CBT TOTAL	2002m1-2003m1	43	
	2003m1-2003m7	43.5	Pillar 4 (Outcomes) ↑
	2003m7-2005m8	44	Pillar 3 (Operations)↑
	2005m8-2005m9	45.5	(Pillar 2 and Pillar 3) (Policy and Operations) ↑
	2005m9—2006m1	46.75	Pillar 4 (Outcomes)↑
	2006m1-2009m1	49.25	Pillar 2 (Policy)↑
	2009m1-2010m5	49.75	Pillar 3 (Operations)↑
	2010m5-2011m7	**49.25**	**Pillar 3 (Operations) ↓**
	2011m7-2011m9	49.75	Pillar 3 (Operations)↑
	2011m9-2012m1	51.25	Pillar 2 (Policy)↑
	2012m1-2013m1	51.75	Pillar 3 (Operations)↑
	2013m1-2014m08	**51**	**(Pillar 3 and Pillar 4) (Operations &Outcomes) ↓**
	2014m08-2015m2	51.25	Pillar 3 (Operations)↑
	2015m2-2017m1	51.75	Pillar 3 (Operations) ↑
	2017m1	**51.25**	**Pillar 3 (Operations↓**
	2017m02-2018m7	**49.25**	**Pillar 3 (Operations)↓**
	2018m7-2018m8	**43.5**	**(Pillar 1 Pillar 3 Pillar 4 Pillar 5) (Governance, Operations, Outcomes and Legal Relations) ↓**
	2018m8-2018m9	**43**	**Pillar 5 (Legal Relations) ↓**
	2018m9-2018m12	**41.75**	**Pillar 2 (Policy)↓**
	2018m12-2020m11	**41.25**	**Pillar 4 (Outcomes)↓**
	2020m11	42.25	(Pillar 3 and Pillar 4) (Operations & Outcomes) ↑
	2020m12	42.75	Pillar 1 (Governance)↑
	2021m1-2021m3	43.25	Pillar 3 (Operations)↑

The table depicts each pillar's contribution to the fluctuations in the CBT index. Between 2002 and 2006, the augmentations in Pillars 4, 3, and 2 - transparency in outcomes, transparency in operations, and policy - were decisive factors under the implicit inflation target, whereas, after 2006, the changes in operational transparency with explicit inflation targeting were effective. In July 2018, because of new regulations in central bank law, almost all pillars, excluding Pillar 3, were affected adversely and there was a drastic decline in CBT. The decline in transparency continued until 2021.

Table 2-4: The Variations in Pillar I (Transparency in Governance)

2002-2016m05	2016m10-2018m7	2018m7-2020m12	2020m12-2021m3
11.75	11.25 Communication ↓	7.25 Autonomy ↓	7.75 Communication ↑

The table indicates the alterations of transparency in governance. As a consequence of the new central bank law that was implemented in 2001, Pillar I initially had a high score. Following a slight reduction in communication between October 2016 and July 2018, the governor of the Central Bank did not hold any press meeting until 2020 December, and thus, the score reached 7.25, due to a sharp decline in the subcomponents of autonomy after July 2018. With a legal change, the duration of the central bank governor's tenure became ambiguous and the appointment criteria for the board members of the central bank was suspended. This implied a reduction in the functional and personnel autonomy of the monetary authority. Besides, since 2018, as the autonomy of the principle of the monetary authority (i.e., not taking instructions from any political institution such as the government) has been violated, the central bank has lost its transparency in this regard. As of December 2020, the governor of the CBRT launched press conferences to explain the decisions made, thereby increasing transparency through the communication channel.

Table 2-5: The Variations in Pillar II (Transparency in Policies)

2002-2005M8	2005m8-2006m1	2006m1-2011m9	2011m9-2017m3	2017m3-2021m3
8.75	9.75	12.25	13.75	12.5
	Financial Stability ↑	Monetary Policy ↑	(Reserve Management and Financial Stability) ↑	(Reserve Management and Exchange Rate) ↓

Pillar II assesses policy transparency through the aspects of monetary policy, foreign currency rate policy, reserve management policy, and financial stability. Under the implicit inflation target, the score is initially 8.75, and since August 2005, when the CB introduced regular financial stability assessments and clarified its responsibility, the score has risen to 9.75. As of January 2006, the monetary authority has released press statements in English and Turkish following policy decisions, along with comprehensive minutes regularly. In September 2011, the central bank redefined its policy as an explicit inflation target coordinated with financial stability and deployed a reserve option mechanism. The Reserve Option Mechanism (ROM) application has enhanced transparency in financial stability and reserve management policy. After 2017, CBRT refrained from making regular statements on foreign exchange policy and took an ambiguous stance on reserve policy instruments, models to be used, and risks.

Table 2-6: The Variations in Pillar III (Transparency in Operations)

2002m1-2003m7	**7.5**	
2003m7-2005m8	8	**Reserve Management ↑**
2005m8-2009m1	8.5	**Reserve Management ↑**
2009m1-2010m5	9	**Financial Stability ↑**
2010m5-2011m7	8.5	**Monetary Policy ↓**
2011m7-2012m1	9	**Reserve Management↑**
2012m1-2013m1	9.5	**Financial Stability↑**
2013m1-2014m8	9	**Foreign Currency ↓**
2014m8-2015m2	9.25	**Financial Stability ↑**
2015m2-2016m6	9.75	**Exchange Rate↑**
2016m6-2017m1	10.25	**Monetary Policy ↑**
2017m1-2017m2	9.75	**Monetary Policy ↓**
2017m2-2018m7	8	**(Reserve Management and Foreign Currency Rate) ↓**
2018m7-2020m11	7.75	**Financial Stability ↓**
2020m11-2021m1	8.25	**Monetary Policy ↑**
2021m1-2021m3	8.75	**Foreign Currency↑**

Transparency in operations, firstly, rose gradually from 7.5 (during 2002m1-2003m7) to 8.5 (on average in the aftermath) as the monetary authority started sharing more details and knowledge about the selection criteria for the composition of instruments, investment horizon and the criteria for selecting suitable vendors and appropriate markets to carry out its actions. The banking supervisory and regulatory agency has improved its stress testing for banks, even though the transition to Basel II has been postponed until 2012 owing to the 2008 financial crisis. The decision to deploy the asymmetric interest rate corridor, the MPC meeting on 18 May 2010, created ambiguity in the monetary policy instruments. Publishing the reserve-eligible assets data and sharing the outcomes and methods of the stress test after passing Basel II in January 2012 contributed to the upward trend. During 2013 and 2014 monetary and exchange rate reports highlighted uncertainties, namely, lessening the clarity of operations. The publication of the 2014 Stress Test Guide in August 2014, alongside greater transparency in the disclosure of the foreign currency policy intervention strategy in 2015, and the effects of the decision to simplify monetary policy instruments in June 2016, rendered the index to rise from 9 to 10.25. On the other hand, the CBRT overturned its decision to simplify monetary policy instruments and implemented an implicit policy regarding the intervention exchange rate policy after 2017. Furthermore, the central bank refrained from disclosing the composition of instruments and appropriate markets used to carry out its reserve management policy operations. The new Central Bank Governor, Naci Agbal, tried to implement a clear policy on exchange rate policy and intervention strategy tools.

Table 2-7: The Variations in Pillar IV (Transparency in Outcomes)

2002m1-2003m1	**9.25**	
2003m1-2005m9	9.75	**Exchange Rate↑**
2005m9-2013m1	11	**Financial Stability ↑**
2013m1-2018m7	10.75	**Reserve Management ↓**
2018m7-2018m12	9.75	**(Monetary Policy and Reserve Management) ↓**
2018m12-2020m11	9.25	**Reserve Management↓**
2020m11-2021m3	9.75	**Monetary Policy↑**

The above table demonstrates that the CBRT initially applied an explicit policy about financial stability and foreign currency policy. However, the adverse effects of the new accounts standards in 2013 caused a decline in Pillar IV. The Bank avoided disclosing the results of its reserve policy by using its new accounting approach instead of international standards. Besides this, the central bank endorsed a superficial approach to disclosing the results of monetary policy operations.

Table 2-8: The Variations in Pillar V (Transparency in Official Relations)

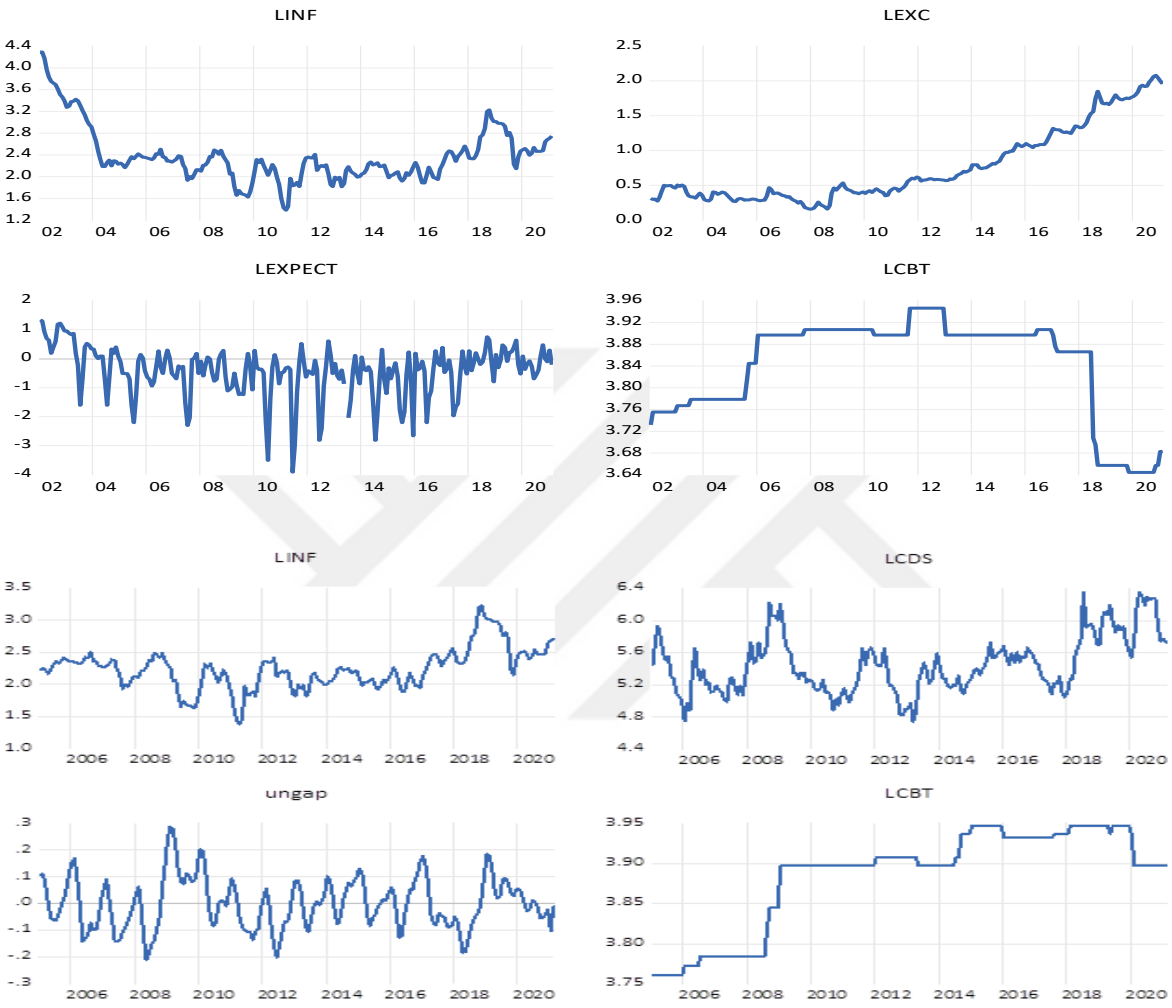
2002-2017m2	**2017m2-2018m7**	**2018m7**	**2018m8-2021m2**
5.75	5.5 **Domestic Institutions ↓**	5 **Government ↓**	4.5 **International Institutions ↓**

As a consequence of the implementation of the presidential political system and the alterations in the CBRT law, it is witnessed that the central bank refrained from sharing knowledge about the relations, regulations, and protocols of the central bank with domestic institutions, government, and international institutions, respectively. This became conspicuous by the protocol between the Treasury and the CBRT in 2017, and the protocol or swap arrangements between the Central Bank of Qatar and the CBRT.

In our research, the data of CDS, nominal exchange rate, the inflation expectations survey of CBRT, inflation rate (CPI), unemployment, and central bank transparency index are used to scrutinize the linkage between inflation and transparency. The foreign currency (USD $) and the inflation expectations are obtained from the CBRT's official website, whereas the CPI, and the unemployment from the TURKSTAT website.

Figure 1 represents the data utilized in the research. We benefit from monthly time series data on transparency (CBT), exchange rate, inflation, and inflation expectations from January 2002 to February 2021, CDS from January 2004 to February 2021, and unemployment from January 2005 to February 2021. All variables, except the unemployment gap, are in logarithmic forms.

Figure 2-1: The Data



Notes: To obtain the unemployment gap, the most common approach, the Hodrick-Prescott filter, is used in this study.

4.2) Model

In this paper, the Autoregressive distributed lag model (ARDL) is employed to shed light on the role of transparency. For many years, ARDL models have been utilized as a useful tool for checking long-run interactions amongst economic time series. We employed the ARDL bound test created by Pesaran and Shin (2001). The aforementioned cointegration forecasting tools created by Engle and Granger (1987) and Johansen and Juselius (1990) exhibit several benefits, but this particular test offers three notable gains in comparison.

* We can employ ARDL even if all parameters are not incorporated in the same order. In contrast, Johansen's co-integration methods necessitate all variables in the model to be incorporated in the same order. To put it differently, the ARDL technique can be employed for parameters of different orders, including those that are integrated with orders of one, zero, or fractional integrated.

* Regarding small and limited data sample sizes, the ARDL test is more convenient, while the Johansen co-integration procedures demand large sample data sizes for validity.

* A simplified error correction (ECM) model offers long-lasting equilibrium and short-run coefficients without discarding the long-run coefficients.

Finally, the asymptotic pattern of the statistic value is unaffected by whether the ARDL model has various orders or the same number of lag lengths for all parameters (Pesaran et al., 2001).

The specifics of the generalized ARDL (p, q) model are:

$$Y_t = \gamma_{oi} + \sum_{i=1}^{p} \delta_i Y_{t-i} + \sum_{i=0}^{q} \beta_i' X_{t-i} + \varepsilon_{it}.$$

Vectorized by Y_t' , where $(X_t')'$ may be either strictly level or first difference cointegrated, and where $\beta \; and \; \delta$ are coefficients: The only constant is γ. The symbols p, q are the number of optimal; ε_{it} is a vector of the error terms (independent or serially uncorrelated); and i=1,….., k represents the number of iterations.

The endogenous parameter hinges on its lagged values along with the present and previous configurations of the independent parameters in the model. The lags represented by p and q need not be the same length; p stands for lags in the endogenous variables while q stands for lags in the endogenous ones. Since the model is specified with its own lagged values, it is autoregressive. In addition, there is a distributed lag part made up of latencies in exogenous parameters. The OLS estimation method can be used to make predictions in the ARDL (p, q) model.

The following steps compose this article's methodology:

A common way to appraise the stationarity of parameters is through the utilization of a unit root test. The literature presents a variety of strategies for doing unit root tests. The Dickey-Fuller (ADF) test, introduced by Dickey and Fuller in 1979 and 1981 respectively, and the Phillips-Perron (PP) test, proposed by Phillips and Perron in 1988, are two widely used statistical tests in econometrics. The null hypothesis posited in these tests postulates that the parameter being examined exhibits a unit root, hence indicating its non-stationarity. In the context of these tests, the ideal lags for the unit root test are determined by selecting lag lengths that effectively mitigate any remaining serial correlation. Based on the underlying premise of the

ARDL limits test, it is posited that the variables under consideration may exhibit integration at either the order of I (0) or I (1). However, it is crucial to mention that if any series demonstrates integration at an order of I (2) or beyond, the estimated F-statistic loses its validity (Ouattara, 2004). Consequently, it is necessary to employ these two tests (unit root) to decide the level of integration of all parameters prior to conducting the test.

According to Pesaran et al., the second step is to formulate a specific type of ARDL model (Models 1 and 2), known as an "unrestricted error correction" or "conditional error correction" model (2001). The suitable lag length must be selected prior to the model being predicted.

The LM test is carried out in the third step for contrasting the serially independent error terms, the null hypothesis, to the second (alternative) possibility according to which the errors could be AR(m) or MA(m). In a nutshell, the estimated model's errors should be serially independent. This necessity may have an impact on how we choose the appropriate lags for the parameters utilized in the model, as Pesaran et al. (2001) point out.

The conditional ARDL $(\mathrm{p}, q_1, q_2, q_3)$ the model with 4 variables model (1) and (2) used here is expressed as follows:

EQUATION 1 FOR MODEL 1:

$$\Delta LCPI_t = \beta_0 + \sum_{i=1}^{m_1} \beta_{it} \Delta LCPI_{t-i} + \sum_{i=1}^{m_2} \beta_{it} \Delta LCBT_{i,t-i} + \sum_{i=1}^{m_3} \beta_{it} \Delta LEXC_{i,t-i} + \sum_{i=1}^{m_4} \beta_{it} \Delta LExpect_{i,t-i} + b_{1i} LCPI_{t-1} + b_{2i} LCBT_{t-1} + b_{3i} LEXC_{t-1} + b_{4i} LEXPECT_{t-1} + \varepsilon_{it}.$$

EQUATION 2 FOR MODEL 2:

$$\Delta LCPI_t = \beta_0 + \sum_{i=1}^{m_1} \beta_{it} \Delta LCPI_{t-i} + \sum_{i=1}^{m_2} \beta_{it} \Delta LCBT_{i,t-i} + \sum_{i=1}^{m_3} \beta_{it} \Delta LCDS_{i,t-i} + \sum_{i=1}^{m_4} \beta_{it} \Delta UNGAP_{i,t-i} + b_{1i} LCPI_{t-1} + b_{2i} LCBT_{t-1} + b_{3i} LCDS_{t-1} + b_{4i} UNGAP_{t-1} + \varepsilon_{it}.$$

The fourth step is to perform the Bound testing. The F test is applied to assess whether there is a level linkage (long-term) amongst the parameters in the model. This scenario corresponds to zero coefficients for the lag level of parameters.

The null hypothesis positing the absence of cointegration amongst parameters is:

$H_0: d_{1i} = d_{2i} = d_{3i} = d_{4i} = 0$, against the second hypothesis

$H_1: d_{1i} \neq d_{2i} \neq d_{3i} \neq d_{4i} \neq 0$, where i=1,2,3,4.

The distribution of the F-test is influenced by several factors, including the number of regressors, the condition of the model's parameters (I (0) or I (1)), and the inclusion of a constant term (intercept) and/or a trend. These factors all contribute to the non-standard distribution of the F-test. The test incorporates asymptotic critical value constraints, which are contingent upon the values of the parameters I (0) and I (1). In all situations, the lower limit is predicated on the presumption that all parameters possess a zeroth order, whereas the upper bound is contingent upon the premise that all parameters possess a first order. When the obtained F-statistic gets a value less than the lower threshold, the researcher concludes that the parameters are incorporated of order zero (I (0)), indicating that there is no possibility of cointegration. Once the F-statistic exceeds the upper limit, it demonstrates the existence of cointegration among parameters. However, if the F-statistic lies inside the range defined, the test results are ambiguous.

In the next phase, supposing that the bounds test revealed the long-run (level) correlations among variables, the below equations will be applied to gauge the level interactions among the variables:

MODEL 1:

$$\Delta LCPI_t = \beta_0 + \sum_{j=1}^{m_1} \beta_{jt} \Delta LCPI_{t-j} + \sum_{j=1}^{m_2} \beta_{it} \Delta LCBT_{j,t-j} + \sum_{j=1}^{m_3} \beta_{jt} \Delta LEXC_{j,t-j} + \sum_{j=1}^{m_4} \beta_{jt} \Delta LExpect_{j,t-j} + \varepsilon_{jt}$$

MODEL 2:

$$\Delta LCPI_t = \beta_0 + \sum_{j=1}^{m_1} \beta_{jt} \Delta LCPI_{t-j} + \sum_{j=1}^{m_2} \beta_{jt} \Delta LCBT_{j,t-j} + \sum_{j=1}^{m_3} \beta_{jt} \Delta LCDS_{j,t-j} + \sum_{j=1}^{m_4} \beta_{jt} \Delta UNGAP_{j,t-j} + \varepsilon_{jt}$$

Furthermore, the ARDL bounds test can be used to generate a dynamic ECM using a basic linear modification. By predicting an unrestricted or conditional ECM connected with the level predictions, the following short-run dynamic parameters are obtained:

ECM MODEL 1:

$$\Delta LCPI_t = \beta_0 + \sum_{i=1}^{m_1} \beta_{it} \Delta LCPI_{t-i} + \sum_{i=1}^{m_2} \beta_{it} \Delta LCBT_{i,t-i} + \sum_{i=1}^{m_3} \beta_{it} \Delta LEXC_{i,t-i} + \sum_{i=1}^{m_4} \beta_{it} \Delta LExpect_{i,t-i} + b_{1i} LCPI_{t-1} + b_{2i} LCBT_{t-1} + b_{3i} LEXC_{t-1} + b_{4i} LEXPECT_{t-1} + \lambda ECT_{t-1} + \varepsilon_{it}.$$

ECM MODEL 2:

$$\Delta LCPI_t = \beta_0 + \sum_{i=1}^{m_1} \beta_{it} \Delta LCPI_{t-i} + \sum_{i=1}^{m_2} \beta_{it} \Delta LCBT_{i,t-i} + \sum_{i=1}^{m_3} \beta_{it} \Delta LCDS_{i,t-i} + \sum_{i=1}^{m_4} \beta_{it} \Delta UNGAP_{i,t-i} + b_{1i} LCPI_{t-1} + b_{2i} LCBT_{t-1} + b_{3i} LCDS_{t-1} + b_{4i} UNGAP_{t-1} + \lambda ECT_{t-1} + \varepsilon_{it}.$$

λ refers to the acceleration of the correction coefficient and has a negative sign.

5) RESULTS

Table 2-9: Descriptive Statistics

	LINF	LEXC	LEXP	LCBT	LCDS	UNGAP
Median	2.28	0.55	-0.32	3.90	5.40	0.17
Mean	2.38	0.76	-0.40	3.84	5.45	0.16
Minimum	1.38	0.16	-3.91	3.64	4.74	-5.36
Maximum	4.29	2.08	1.34	3.95	6.36	10.40
Std. Dev.	0.50	0.53	0.84	0.09	0.36	2.27
Obs.	230	230	229	230	194	194

The fundamental statistics for all parameters used in Model 1 and Model 2 are illustrated in Table 2- 9.

Table 2-10: The Estimation Outcomes of ADF and PP Unit Root Tests

	LEVEL				FIRST DIFFERENCE			
	ADF		PP		ADF		PP	
Variable	Constant	Constant& Trend	Constant	Constant& Trend	Constant	Constant& Trend	Constant	Constant& Trend
LINF	-3.45**	-3.21*	-3.82***	-3.36*	-4.90***	-4.97***	-11.20***	-11.18***
	(0.01)	(0.08)	(0.00)	(0.06)	(0.00)	(0.00)	(0.00)	(0.00)
LEXC	1.35	-1.21	1.23	-1.212	-7.67***	-8.04***	-9.72***	-9.69***
	(0.10)	(0.91)	(1.00)	(0.91)	(0.000)	(0.00)	(0.00)	(0.00)
LEXP	-3.17**	-2.92	-7.64***	-7.66***	-6.53***	-6.83***	-27.05***	-29.46***
	(0.02)	(0.16)	(0.000)	(0.00)	(0.00)	(0.00)	0.00	(0.00)
LCBT	-1.04	-1.35	-1.0064	-1.32	-8.55 ***	-8.74***	-13.83 ***	-13.99***
	(0.74)	(0.87)	(0.751)	(0.81)	(0.000)	(0.0000)	(0.000)	(0.00)
UNGAP	-3.41**	-3.33*	-4.03***	-4.01**	-11.81***	-11.79***	-10.07***	-10.05***
	(0.01)	(0.07)	(0.000)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
LCDS	-3.06	-3.52**	-3.10**	-3.57**	-14.06***	-14.03***	-14.09***	-14.08***
	(0.00)	(0.04)	(0.03)	(0.04)	(0.000)	(0.000)	(0.00)	(0.00)

Notes: PP refers Philips-Perron-Fisher, ADF represents Augmented Dickey-Fuller-Fisher. The value shown in parentheses () is p-value.

Table 2-10 presents the outcomes of conducting the unit root tests, PP and ADF, on the time-series data for various variables, namely LINF (log of consumer price index), LEXC (log of the nominal foreign currency), LEXP (log of inflation expectations), LCBT (log of central bank transparency index), UNGAP (unemployment gap), and LCDS (log of Credit Default Swap rates for 5-year sovereign bonds). The LEXC and LCBT exhibit nonstationary at the level, but demonstrate stationarity at the first difference, as indicated

by unit root tests such as the Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF) tests. The unit root findings gave a mixture of the I (1) and I (0) series. As previously stated, ARDL can be utilized even in cases where the parameters are not incorporated in the same sequence.

MODEL 1:

Table 2-11: Unrestricted Constant and No Trend ARDL (3,1,4,3)

DEPENDENT VARIABLE LCPI		
Variable	Coefficient	t-Statistic
LCPI1(-1)	1.15	17.98***
		(0.06)
LCPI1(-2)	-0.34	-3.55***
		(0.1)
LCPI1(-3)	0.17	2.77***
		(0.01)
LEXC	0.04	3.43***
		(0.01)
LEXC (-1)	-0.03	-2.03***
		(0.01)
LEXPECT	0.007	10.06***
		(0.001)
LEXPECT (-1)	-0.003	-2.74***
		(0.001)
LEXPECT (-2)	0.001	1.05
		(0.001)
LEXPECT (-3)	-0.0002	-0.19
		(0.001)
LEXPECT (-4)	-0.002	-2.67***
		(0.001)
LTRANS	0.04	1.10
		(0.03)
LTRANS (-1)	-0.05	-0.97
		(0.05)
LTRANS (-2)	-0.13	-2.72***
		(0.05)
LTRANS (-3)	0.16	4.97***
		(0.03)
D1	0.001	1.23
		(0.22)
C	-0.022	-0.83
		(0.03)
$\mathcal{R}^2$	0.999	
Adj. $\mathcal{R}^2$	0.999	
F-statistic	95997.50	
Durbin-Watson	1.9092	

Notes: The standard deviations of the values presented in the table are indicated within parentheses. The symbols "***", "**", and "*" denote significant levels of 1 percent, 5 percent, and 10 percent, correspondingly.

Table 2-11 provides the ARDL estimation result for Model 1.

Table 2-12: The outcomes of ARDL Bound Test

F-statistic	N			F-statistic (Critical values)			
10.874	3	**Significant level (10%)**		**Significant level (5%)**		**Significant level (1%)**	
		I (1) Upper Bound	I (0) Lower Bound	I (1) Upper Bound	I (0) Lower Bound	**I (1) Upper Bound**	I (0) Lower Bound
		3.77	2.72	4.35	3.23	**5.61**	4.29
T-statistic	N			**T-statistic (Critical values)**			
-6.6433	3	**Significant level (10%)**		**Significant level (5%)**		**Significant level (1%)**	
		I (1) Upper Bound	I (0) Lower Bound	I (1) Upper Bound	I (0) Lower Bound	**I (1) Upper Bound**	I (0) Lower Bound
		3.46	-2.57	-3.78	-2.86	**-4.37**	-3.43

Notes:" N" denotes the number of exogenous variables. The null hypothesis postulates that there is no level linkage among the variables.

The F-statistic model's bounds testing results are compared to the critical values of 10 per cent, 5 per cent, and 1 per cent. The findings demonstrate that the F-statistic (10.874) exceeds the upper bounds of critical values at all significance levels, correspondingly, which obviously indicates that the validity of the level link among the parameters. Furthermore, at all levels, t-bound testing provides substantial backing for rejecting the presumption of no level linkage among variables.

Table 2-13: ARDL (3,1,4,3) Level Prediction Outcomes

Variable	Coefficient	t-statistic
LEXC	**1.06*** **	14.06
		(0.075)
LEXPECT	**0.25** **	2.106
		(0.117)
LCBT	**-1.76*** **	-3.52
		(0.500)
	DIAGNOSTIC TESTS	
R-SQ	ADJ. R-SQ.	F-STATISTICS
0.75	0.74	63.36
LM TEST	ARCH	JARQUE-BERA
0.13	0.15	0.367
CUSUM	CUSUM SQ	
YES	YES	

Notes: The "***", "**", and "*" show 1 percent, 5 percent, and 10 percent significance levels, correspondingly. The values demonstrated in parentheses are standard deviations.

Table 2-13 outlines the outcomes of the level model estimations. As seen in the table, the models adhere to the necessary presumptions of autoregressive conditional heteroscedasticity (ARCH), normal distribution, serial correlation, and parameter stability.

According to estimation results, the exchange rate and inflation have a statistically significant and favorable relationship with CPI in the long term. The conclusion reached aligns with the literature. The rise in the foreign currency rate conduces to an upward movement in inflation via import goods prices. In other words, variations in exchange rates create cost-push inflation, especially in emerging countries. Inflation expectations influence the behavior of economic agents, such as changes in aggregate demand, price, and wage. Consumers are prone to purchase goods at the lowest possible price. Consumers advance their demand if they expect higher prices in the future. If businesses anticipate lower inflation, they may raise prices at a slower pace as they would not prefer their prices to appear out of line with those of their competitors. When workers anticipate lower inflation, they may request lower wage increases. In a nutshell, inflationary expectations cause inflation.

Our results show that there is an adverse linkage between transparency and inflation. Within the confines of inflation targeting, the greater transparency of the monetary authority is the key point of achieving the inflation target or reducing the bias from the inflation target. In the long term, the CPI will decline by 1.76% for every 1 unit that transparency rises. This result supports the view that there are beneficial impacts of openness on inflation (Chortareas et al (2002), Dinçer and Eichengreen (2009)). Consequently, the results of long-run coefficients in Model 1 are compatible with the literature. In other words, the inflation rate has an adverse interaction with central bank transparency but a positive interaction with the exchange rate and expectations.

Table 2-14 ARDL (3,1,4,3) Short-Run Estimation Results

Variable	Coefficient	t-value
D(LCBT)	0.04	**1.14**
		(0.032)
D (LCBT (-1))	-0.03	**-1.04**
		(0.03)
D (LCBT (-2))	**-0.16*****	-5.08
		(0.03)
D (LCPI (-1)	**0.16****	2.61
		(0.06)
D (LCPI (-2)	**0.17****	-2.83
		(0.01)
D(LEXP)	**0.007*****	**11.3**
		(0.001)
D (LEXP (-1))	0.0009	**1.31**
		(0.007)
D (LEXP (-2))	**0.002****	**3.16**
		(0.001)
D (LEXP (-3)	**0.002****	**2.97**
		(0.001)
D(LEXC)	**0.04*****	**3.48**
		(0.01)
INTERCEPT	**-0.03*****	-5.27
		(0.004)
EC	**-0.14*****	-6.64*
		(0.02)

Notes: The numbers placed in parentheses denote standard deviations. The asterisk characters *"***, **, and *"* signify significance for the levels of 1%, 5%, and 10%, correspondingly.

To comprehend the short-term adaptation process, it is indispensable to evaluate the magnitude and sign of the error correction terms coefficient (EC (-1)). The coefficient, denoted as -0.14, has statistical significance at a confidence level of 1%. This suggests that divergence to the long-term equilibrium between parameters is rectified by around 14% in the subsequent period.

Past fluctuations in inflation are characterized by the uplifting repercussions of the consumer price index coefficients, specifically the first and second lag, on the current level of inflation.

At the 1% level, the exchange rate coefficient is statistically significant. The positive relation with exchange continues in the short term, albeit being lower than the long-run coefficient. The relevance of the foreign currency rate pass-through to inflation continues to remain. The positive effect of expectation and its lagged value (the second and third lagged) in the short run is lower.

Whilst the coefficient of CBT and the first lag of CBT are statistically not significant, the second lag of transparency is statistically significant at a 1% level. In the short term, an adverse association between CPI and transparency supports the argument that transparency is a helpful tool for reducing inflation bias and achieving inflation targets.

MODEL 2:

Table 2-15: Unrestricted Constant and Unrestricted Trend ARDL (4,3,3,0)

Variable	Coefficient	t-Statistic
CPI (-1)	0.31	4.54***
		(0.07)
CPI (-2)	-0.32	-4.446**
		(0.07)
CPI (-3)	0.18	2.52**
		(0.07)
CPI (-4)	-0.25	-3.61***
		(0.07)
CDS	-0.002	-1.20
		(0.001)
CDS (-1)	0.001	0.69
		(0.001)
CDS (-2)	0.005	3.10***
		(0.002)
CDS (-3)	-0.004	-3.32***
		(0.001)
UN	-0.29	-1.97**
		(0.15)
UN (-1)	0.38	1.36
		(0.28)
UN (-2)	0.24	0.83
		(0.29)
UN (-3)	-0.37	-2.46***
		(0.15)
CBT	-0.07	-1.93**
		(0.04)
C	4.14	2.37***
		(1.75)
@TREND	0.006	2.77***
		(0.002)
$\mathcal{R}^2$	0.33	
Adj. $\mathcal{R}^2$	0.27	
F-statistic	6.0847	
Durbin-Watson	2.061	

Notes: The asterisk symbols "***, **, and *" indicate 1%, 5% and 10% significance levels, respectfully. Standard deviations are shown in parentheses.

Table 2-16: The outcomes of ARDL Bound Test

F-statistic	**N**	**F-statistic (Critical values)**					
11.06972	3	**Significant level (10%)**		**Significant level (5%)**		Significant level (1%)	
		I (1) Upper Bound	I (0) Lower Bound	I (1) Upper Bound	I (0) Lower Bound	I (1) Upper Bound	I (0) Lower Bound
		3.1	2.01	3.63	2.45	4.84	3.42
t-statistic	N	**t-statistic (Critical values)**					
-6.21918	3	**Significant level (10%)**		**Significant level (5%)**		Significant level (1%)	
		I (1) Upper Bound	I (0) Lower Bound	I (1) Upper Bound	I (0) Lower Bound	I (1) Upper Bound	I (0) Lower Bound
		-3	-1.62	-3.33	-1.95	-3.97	-2.58

Notes: The "N" symbol denotes the number of exogenous parameters. The null hypothesis postulates that there is no level linkage among the variables.

Based on the bound test outcomes, the F-statistic (11.0697) is significantly higher than the upper bounds (4.8, 3.63, and 3.1) at 1%, 5%, and 10% significance levels. This strongly implies that all parameters possess level or long-run linkages. Moreover, the null hypothesis, which posits the absence of a level linkage, is invalidated at all levels of significance pursuant to t-bound testing.

Table 2-17: ARDL (3,1,3,1) Level Predictions Outcomes

Variable	**Coefficient**	**t-statistic**
LCDS	**0.75*** **	2.35 (0.32)
LCBT	**-1.11*** **	-2.52 (0.44)
UNGAP	**-3.92*** **	-2.63 (1.49)
	DIAGNOSTIC TESTS	
R-SQ	ADJ. R-SQ	F-STATISTICS
0.57	0.53	62.35
LM TEST	ARCH	JARQUE-BERA
0.42	0.91	0.22
CUSUM	CUSUM SQ	
YES	YES	

Notes: Standard deviations are represented by the numbers in parentheses. The characters *"***, **, and *"* indicate significant levels of 1%, 5% and 10%, respectively.

According to the outcomes of the diagnostic test, there are not any issues with the assumptions of normality, correlation, the stability of parameters and heteroscedasticity. The negative sign of the error correction coefficient (-0.9) provides the required conditional and the coefficient exhibits statistical significance at a confidence level of 1%. This implies that any previous shock would be gradually mitigated in the long term equilibrium at a rate of 90%. In other words, only 10% of disequilibrium is transmitted from one month to the next.

At the 1 per cent level, the LCBT, LCDS, and unemployment gap coefficient are all statistically significant. The results for long run demonstrate a positive linkage with CDS (as expected) and a negative relationship between transparency (compatible with literature) and the unemployment gap. The coefficient of the unemployment gap is greater than the CBT and CDS rates. It can be concluded that a trade-off exists between inflation and unemployment in the long run.

Nonetheless, in the short term, the repercussion of past inflation on current inflation still continues, and the effects of the first and second-lagged values of the CPI are positive as in Model 1. Furthermore, the short-run coefficients of CBT (central bank transparency) and CDS are statistically insignificant.

Table 2-18 ARDL (3,1,3,1) Short-Run Estimation Results

Variable	Coefficient	t-value
D (LINF (-1))	0.21***	2.91
		(0.07)
D (LINF (-2))	**0.24*** **	3.41
		(0.07)
D(LCDS)	**-0.22**	-0.41
		(0.70)
D(UNGAP)	**-5.51** **	-2.73
		(0.01)
D (UNGAP (-1))	2.58	0.99
		(0.32)
D (UNGAP (-2))	**4.98** **	1.99
		(0.05)
D(LCBT)	-19.90	-1.33
		(0.19)
CointEq (-1) *	**-0.90*** **	-6.75
		(0.00))

Notes: Standard deviations are shown in parentheses. The icons "***, **, and *" indicate 1%, 5% and 10% significance levels, correspondingly.

This model indicates that the linkage between transparency and inflation exists only in the long term. The credibility of the monetary authority, which is one of the prerequisites for effective transparency, is possible in the medium to long term instead of the short term. The short-run coefficient of the unemployment gap

implies a negative impact, a trade-off between inflation and unemployment, whereas the coefficient of the second-lag unemployment gap represents a positive linkage with CPI.

This result indicates that the trade-off between unemployment and inflation does not continue after two months due to the positive contribution of the second-lagged value of the unemployment gap.

6) CONCLUSION

This paper aims to build a comprehensive CBT index that includes salient developments as well as examine the linkage between inflation and central bank transparency in Turkey from 2002 January to 2021 February. This period coincides with the years of inflation targeting, implicitly between 2002 and 2005 and explicitly between 2006 and 2011 and after the 2010 policy of price stability with financial stability coordination. Study timeframes include Turkey's economic and political changes and the global crisis, which led many nations to alter their monetary policies. The monetary authority implemented different monetary policy strategies (inflation targeting) because of the changing circumstances and institutional/structural transformations. Furthermore, although the monetary authority's principal responsibility is to maintain price stability, its responsibility to uphold financial stability has become gradually prominent after the global financial crises. There was no consideration of these developments in previous studies in order to fill this gap in the academic discipline by creating a comprehensive transparency index based on five different pillars. We shall briefly discuss the distinctions between this study and previous researches.

First, any actions taken by the monetary authority to ensure financial and price stability should be considered when constructing a comprehensive transparency, the central bank transparency index created in the study stands apart from other studies as it covers the linkage between financial stability and transparency index.

Second, the foreign exchange reserve policy, which is crucial because it affects inflation in emerging economies like Turkey, along with transparency-related elements that impact foreign exchange policy's implementation phases, are also mentioned.

In addition, the central bank's openness is influenced by the laws that guide the pillar of transparency in governance besides its policies, activities, and results. As a result, the index's scope of the pillar of transparency in governance has extended.

Since the central bank's legal status has just been taken into account in the context of autonomy, the impact of the monetary authority's legal status and level of independence on openness has been neglected in previous studies. Hence, the Central bank laws that included transparency-affecting variables were incorporated into the transparency index.

Additionally, because of the pressure put on them by governments in emerging economies, several central banks have begun to pursue procedures that could result in the loss of the independence of the monetary authorities. Because of weakened democratic institutionalization, the CBRT has turned away from the accountability premise. As an outcome, the central bank's interactions with the administration and international organizations become less transparent. The main focal point of this study is to create a comprehensive transparency index encompassing all of these applications to gauge the central bank's level of transparency.

Fundamental conditions for an effective monetary policy are instrument independence and high credibility. One of the components that makes tool independence powerful is transparency. Transparency ensures instruments are used effectively, building confidence in the adopted policy. A central bank with high credibility moulds the decisions of economic agents (consumers and investors) and ensures that they are compatible with monetary policy. A central bank with greater transparency eliminates monetary policy ambiguity and builds confidence in the policy. However, monetary authority, where transparency is low, damages the reliability of the policy it implements, and it has a devastating effect not merely on price stability but additionally on financial stability, along with on several macroeconomic variables from liquidity problems to foreign exchange rates, domestic and foreign debt ratios. For this reason, the study went beyond merely producing a more comprehensive index and included an empirical part to examine its impact on inflation.

A comprehensive central bank transparency method is designed that hinges on the Central bank announcements, the press, legislative changes, the speeches of the central bank governor, and formal presentations. Then, two ARDL models are adopted to scrutinize the validity of a long-run linkage between inflation, foreign currency rate, inflation expectations, CDS, unemployment, and central bank transparency. The findings illustrate that exchange, expectations, CDS, the unemployment gap, and transparency are long-run determinants of inflation (CPI). The empirical findings highlight the significance of the transparency index for Turkey, a country with a high inflation rate, to successfully combat inflation and provide price stability.

Nevertheless, this essay has a few potential limitations. The research solely considers the relationship between inflation and transparency. The scope of the study can be extended to analyzing how transparency influences macroeconomic variables such as the foreign currency and interest rates variables. Consequently, the Central bank is required to assess and improve transparency and communication strategies.

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APPENDIX

Pillar I: Governance

1.1) Autonomy

1.1.a) Institutional

1) Is it clear whether the CB is forbidden from receiving instructions from any private/public entity?

a) Yes (1)

b) No (0)

2) Is clearly disclosed to what extent the central bank's autonomy differs for the various elements of its mandate?

a) Yes =1

b) No= 0

3) Does explicitly central bank have the operational autonomy to implement monetary policy instruments?

a) No =0

b) Yes= 1

b) Functional

1) Does CB carry out its duties without the government?

a) Yes = 1

b) No=0

c) Personal

1) Are the appointment criteria of central bank members clear? Do the appointment criteria encompass being qualified and experienced as well as the duration?

A) No=0

b) Yes only duration= 0,25

c) Yes duration and qualified= 0,5

d) Yes all =1

2) Is the tenure of office of the central bank's governor clearly stated?

a) No= 0.00

b) Yes 4 years=0.25

c) Yes 5 years =0,5

d) Yes 6 to 8 years== 0.75

e) Yes over 8 years 1

3) Does the government dismiss the governor of the central bank?

a) Yes =0

b) No =1

d) Financial

1) Are the financial resources available to the central bank to fulfill its mandate and is the structure of these resources explicitly revealed? (capital, the rules of recapitalization, budget, profit distribution)

a) No= 0

b) Yes two resources= 0.5

c) Yes more than two =1

2) Decision-making

1) Is there clarity on the organizational structure and the delegation of jurisdiction to its decision-making bodies? (day-to-day management, policy-making and internal audit committee)

a) No=0

b) Yes only organization structure= 0.25

c) Yes all process and organization structure =0.5

d) Yes all processes, allocation of responsibility and organization structure =1

3) Accountability

1) Does central bank's law explicitly state internal and external audits?

a) Yes 1

b) No=0

2) Does it report to an audit committee?

a) No =0

b) Only parliament/congress or government= 0.5

c) Parliament/congress and government =1

3) Does cb press audited financial statements and annual reports?

a) No= 0

b) Yes =1

4) Communication

1) Is there clarity on the objectives and tools of communication policy?

a)No=0

b)Yes, only objectives= 0.5

c)Yes, objectives and tools =1

Pillar II: Policy

1) Monetary Policy:

a) Objectives and frameworks:

1) Is there a clear statement of monetary policy's objective(s), including explicit prioritization in the context of several objectives?

a) There are no formal objective(s) = 0.

b) One primary goal or several goals with explicit priority = 1.

c) Multiple goals lacking prioritizing = 1/2.

2) Does the central bank possess explicit policy rules or strategies in place to clarify its monetary policy framework?

a) Yes, explicit inflation target/price stability= 1

b) Yes, implicit inflation target/price stability= 0.5

c) No = 0.

b) Policy Decisions:

1) Is a statement to the public issued by the central bank promptly after policy decisions?

a) CB does not issue any press releases promptly after the meeting or not often. =0.0
b) CB issues press releases in the native language only. = 0.5
c) CB issues press releases in English. =1.0

2) Does the CB provide an in-depth account of policy deliberations within a plausible time frame?

a) Yes, comprehensive minutes (whether they are verbatim or accredited) or clarifications (in the situation of just one central banker), comprising a debate of backward- and forward-looking reasoning = 1.

b) No or after a significant delay (greater than eight weeks) = 0.

3) Is it apparent what role staff and policymakers perform in the fundamental forecasting process?

a) Yes=1.0
b) No. It is not clear how the projection is formulated and applied in the decision-making process. (Not votes) =0.0

4) Is the estimation performance of the central bank assessed in the monetary policy reports (at least once a year) or in a distinct report?

a) Yes, monetary policy and separate document =1
b) Yes, in monetary policy/annual reports or separate reports= 0.5
c) No.= 0.0

c) Supporting Analysis :

1) Is basic economic data relevant to the carry-out of monetary policy publicly available? (The focus is on the following five variables: money supply, inflation, GDP, unemployment rate, inflation expectations, output gap and capacity utilization.)

a) For at most two of the seven specified variables (quarterly time series) = 0.

b) For three or four of the seven specified variables (quarterly time series) = 0.5.

c) For at least five of the seven specified variables (quarterly time series) = 1.

2) Exchange rate Management/Policy

a) Objectives and frameworks: :

1) Is there an official declaration about the foreign exchange policy objective(s)?

a) Yes= 1.

b) No= 0

b) Policy decisions:

1)Does the central bank state the decision-making process of exchange management policy? (The methods of reaching a decision)

a) No (0)

b) Yes (1)

2) Is there an immediate formal statement following the policy decisions?

a) No (0)

b) Yes, not regularly native, or English (0.5)

c) Yes, regularly native and English (1)

3) Is it apparent what role staff and policymakers undertake in the baseline forecasting process?

a) No. (0)

b) Yes. (1)

4) Is the forecasting performance of the central bank assessed at least once a year in the monetary policy reports or in a distinct report?

a) No. (0)

b) Yes, only annual reports (0.5)

c) Yes, separate documents (1.0)

c) Supporting Analysis:

1) Does the CB explain its presumptions, transmission channels and evaluations that support intervention policy decisions?

a) No (0)

b) Yes, only one of them (0.25)

c) Yes, two (0.5)

d) Yes, all (1)

3) Exchange rate Reserve Management

a) Objectives and Frameworks:

1) Does the central bank explicitly state the investment objectives and operative models of exchange reserve management policy?

a) No (0)

b) Yes, only investment obj (0.5)

c) Yes, investment objectives and operative models but superficially (0.75)

d) Yes, investment objectives and operative models (1)

b) Policy Decisions:

1) Is there an explicit statement of the key elements of policy decisions?

a) No (0)

b) Yes, briefly without instruments and risk exposure (0.25)

c) Yes, only instruments or risk exposure (0.5)

d) Yes, risk exposures and instruments but superficially (0.75)

e) Yes, risk exposures and instruments (1)

2) Does the CB clarify how it allocates responsibility and the role of other institutions (treasury, government, banks etc.)

a) No (0)

b) Yes, only its role (0.5)

c) Yes, CB and other institutions (1)

c) Supporting Analysis:

1) Does the central bank explain the essential presumptions and evaluation process underlying its policy decisions and potential impact?

a) No (0)

b) Yes, only assumptions (0.25)

c) Yes, assumptions and assessment process (0.5)

d) Yes, all (1)

4) Financial Stability

1) Is there an explicitly formal statement of financial stability assessment?

a) No= 0

b) Yes not press regulary= 0.5

c) Yes press regularly 1

2) Is CB resposible for financial stability

a) No=0

b) Yes, partly implicitly responsible =0.5

c) Yes, explicitly responsible =0.75

d) Yes, only cb responsible =1

3) Are the objectives and tools of the financial stability framework clear?

a) The line that separates between monetary policy and financial stability tools is ambiguous. This raises questions regarding the primary goal of price stability.= 0.0

b) The CB possesses both monetary policy and macroprudential instruments, and it is apparent how the central bank incorporates these tools to fulfil its monetary policy and financial stability goals.= 1.0

Pillar III: Operations

1) Monetary Policy :

a) Instruments:

1) Does the CB explicitly describe and disclose its (main) monetary policy instrument?

a) No=0

b) Yes, superficial =0.5

c) Yes, explicitly = 1

2) Is there a quantification of the primary objective(s)?

a) Yes = 1.

b) No = 0.

b) Coverage:

1) Does the monetary authority explicitly explain the coverage of monetary policy operations?

a) Yes, interest rate and others (open market operations, reserve requirements, credit ceiling) =1

b) Yes, two variables (interest rate and one more) =0.5

c) Yes, only the interest rate= 0.25

d) No=0

2) Does the central bank declare its collateral framework (such as exchange deposit)?

a) Yes= 1

b) No =0

c) Access

1)Does central bank disclosure how counterparties access lending facilities?

a) Yes =1

b) No= 0

2) Exchange rate Management/Policy

a) Instruments :

1) Does the central bank deliver an explicit set of instruments and strategic framework that express its intervention policy?

a) Yes, both instruments and size= 1

b) Yes, only instruments 0.5

c) No = 0.

2) Is there a quantification of the exchange rate policy?

a) No = 0.

b) Yes = 1.

b) Coverage:

1) Does the CB disclose the economic agents and the market that the foreign currency management policy is aimed at?

a) No=0

b) Yes not all=0,5

c) Yes domestic, foreign and international =1.00

3) Exchange rate Reserve Management

a) Instruments

1) Does the CB disclose the selection criteria for the composition of instruments, eligible assets, investment horizon and constraints?

a) No or only composition of instruments= 0

b) Yes, only (two) variables or superficially= 0,5

c) Yes, all not ignoring any compositions =1

b) Coverage

1) Does the central bank disclose the criteria for selecting suitable vendors of services and market counterparties and appropriate markets to carry out its operations?

a) No (0)

b) Yes, only market counterparties or appropriate markets (0.5)

c) Yes, all (1)

c) Assessment:

1) Does the cb assess the adequacy and liquidity parameters regularly?

a) No (0)

b) Yes, not regularly or superficially (0.5)

c) Yes, regular and extended assessments (1)

4) Financial Stability

1) Does the CB or banking authority/banking regulation agency conduct stress tests to evaluate the banks' ability to withstand financial and economic disturbances?

a) No=0

b) Yes, only the banking authority or other institution, cb =0,5

c) Yes cb=1

2) Is there clarity about the techniques and main presumptions of the stress testing framework?

a) Yes, with all scenarios 1

b) Yes, explain extended methods or assumptions and scnerio= 0.75

c) Yes, briefly or report only result= 0.5

d)No =0

3) Is there clarity about how the central bank utilizes the stress test outcomes?

a) Yes= 1

b) No =0

Pillar IV: Outcome

1) Monetary Policy:

a) Governance Actions.

1) Is the CB's accountability regarding monetary policy clear?

a) No (0)

b) Yes, CB is accountable to the government (0.5)

c) Yes, CB is accountable to parliament and government (1)

b) Policies

1) Does the central bank routinely assess the effectiveness of the policy in light of its macroeconomic goals?

a) Yes, with a clear explanation of how monetary policy assisted in accomplishing the goals = 1.

b) Yes, the central bank does but superficially = 1/2.

c) No or not very often (at less than annual frequency) = 0.

c) Operations:

1) Does the central bank provide information regarding the volume of operations as well as the interest rates?

a) No (0)

b) Yes, only quantity 0,5

c)Yes, all (quantity, volume and interest rate)=1

2) Does the central bank periodically assess to what extent, if any, its primary policy operational aims have been met?

a) No or not very often (at less than annual frequency) = 0.

b) Yes, without ensuring justifications for substantial deviations = 1/2.

c) Yes, accounting for considerable departures from the goal (if any); or, (nearly) perfect

oversight of primary operating instrument/target = 1.

3) Does the central bank routinely share information on (unexpected) macroeconomic turmoil that has an impact on the transmission of policy?

a) No or rarely = 0.

b) Yes, but only through short-term forecasts or assessments of current macroeconomic developments (at least quarterly) = 1/2.

c) Yes, covering an acknowledged of past forecast errors (at least annually) = 1.

4) Does the central bank reveal how each decision regarding the level of its main operating instrument or goal was determined?

a) No publication or only after a substantial lag (more than eight weeks) = 0.

b) Yes, publish concise minutes (which may not be verbatim or attributed) or justifications =0.75

c) Yes, publish comprehensive minutes (which may not be verbatim or attributed) or justifications (in the case of a single central banker) = covering a discussion of forward- and backwards-looking views= 1.

2) Exchange Rate Management/Policy:

a) Governance Actions

1) Does the CB disclose how it is responsible for foreign currency policy management and its decision-making structure?

a) No, not clearly accountable and its decision-making structure (0)

b) Yes, it is clear how the cb is accountable for it but not disclose its decision-making structure (0.5)

c) Yes, both (1)

b) Policies: :

1) Does the central bank routinely assess the effectiveness of its policies in relation to its monetary policy goals?

a) No or rarely (at less than annual frequency) = 0.

b) Yes, but superficially annually = 1/2.

c) Yes, with an explicit description of the role performed for monetary policy in achieving its goals (monthly) = 1.

c) Operations:

1) Does the cb regularly share the outcomes of its market operations, the course of interventions and the volume of operations on its website at an interval of time?

a) No or rarely (0)

b) Yes, but superficially (0.5)

c) Yes, regularly with a detailed description of the effects/impacts on monetary policy or macroeconomic outcomes (1)

3) Exchange Rate Reserve Management

a) Governance Actions:

1)Does the cb disclose the general principles of internal governance and share any changes to the internal governance process publicly?

a) No (0)

b) Yes, superficially (0.5)

c) Yes, regularly and detailed (1)

b) Reporting on Implementation:

1)Does the CB regularly disclose the data relating to foreign exchange reserve management?

a) No (0)

b) Yes, only the level and composition of reserve assets (0.25)

c) Yes, short-term liabilities, and the level and composition of reserve assets (0.5)

d) Yes, short-term liabilities, the level and composition of reserve assets, and foreign currency drains (swap)=1

c) Financial Results:

1) Are the size, composition, profit/loss, and risks associated with foreign exchange reserves clearly stated in audited financial reports?

a) No (0)

b) Yes, superficially (0,5)

c) Yes, extended but not all (0.75)

d) Yes, all (1)

4) Financial Stability

a) governance actions:

1) Is the accountability of the CB on financial stability policy clear?

a) No (0)

b) Yes (1)

b) policies:

1) Does the central bank routinely assess the effectiveness of its policies with respect to its macroeconomic and monetary policy goals?

a) No or rarely (at less than annual frequency) = 0.

b) Yes, but superficially annually = 0.5.

c) Yes, taking into account the role of monetary policy in achieving the goals (not on a monthly basis) = 0.75.

d) With a clear explanation of the role performed by monetary policy in achieving the goals (monthly)= 1

Pillar V: Relations

1) Government:

1) Do the monetary authority and the government have any formal interactions or analogous institutional arrangements?

a) No, central bank contracts or other institutional arrangements = 0.

b) Yes, implicitly contracts=0.25

c) Yes, a central bank without a contract or explicit instrument independence = 1/2.

d) Yes, a central bank with instrument independence (partially instrument independence) = 0.75.

e) Yes, a central bank with explicit instrument independence or a central bank contract although possibly subject to an explicit override procedure = 1.

2)Does the CB disclose regularly its policies, rules and guidelines that apply to financial transactions with the government?

a) No (0)
b) Yes, but superficial and not regularly (0,5)
c) Yes (The management of the current account, fiscal agent role, deposit taking, loans, guarantees and credit arrangements to the public sector) = 1

3) Does the central bank routinely make the results of its interactions, consisting of its operations, with the government and its agencies public?

a) No (0)
b) Yes, but superficially (0.5)
c) Yes, regularly, and elaborately (1)

2) Other

1) Is the interaction between the central bank and pertinent domestic financial institutions clearly laid out and publicly released, covering the procedures for cooperation and (joint) decision-making, and the sharing of informal/formal knowledge?

a) No, central bank explicitly contracts or other institutional arrangements = 0.

b) Yes, but superficially= 0.5

c) Yes, treasury, financial agencies (investment banks, commercial banks, insurance entities) = 1

2) Does the CB disclose its policies, instruments, and the outcome of the interaction with the domestic institutions?

a) No (0)
b) Yes, superficially (0.25)
c) Yes, without the outcomes (0,5)
d) Yes, with the outcomes (1)

3) International

1) Is there clarity in the information exchange and coordination of actions and policies between the central bank, international entities, other monetary authorities, and other relevant foreign organizations?

a) No (0)

b) Yes, but superficially (0.5)

c) Yes, extended detailed (1)

2)Does the CB disclose its policies and conditions governing financial transactions with international and foreign institutions?

a) No (0)

b) Yes, but superficially (0.5)

c) Yes (1)

3) Does the CB disclose the instruments utilized in the linkage between international organizations and the CB?

a) No (0)
b) Yes (1)

4) Does the central bank routinely release publicly the repercussions of its interaction (including operations) with international/foreign entities?

a) No (0)

b) Yes, but not often (0.5)

c) Yes, regularly (1)

CHAPTER 3

CURRENCY CIRCULATION, PAYMENTS AND COVID-19 RESTRICTIONS: THE CASE OF TURKEY

1) INTRODUCTION

Following the 2008 financial crisis, cryptocurrencies emerged as a concept for a new and alternative form of money. This new type of currency sparked a reappraisal of the evolution of money, the function of monetary authority, and monetary policy. Initially, it was not envisioned that this new type of money would hasten the reshaping of money and payment systems. The global rise in internet shopping and digital payment platforms, particularly in China and Asian countries, and the volatility of cryptocurrencies revealed the notion of central bank digital money. At first, central banks and academicians focused on the definition of Central Bank Digital Currency (CBDC) definition and its conceptual framework. Following the instability of the cryptocurrency market, many central banks hastened the shift to digital money or CBDC in response to the growing need for central banks to play an oversight position following the instability of the cryptocurrency market.

The speculative nature of cryptocurrencies, as well as the growing need for digitalization in the economy as an outcome of pandemic shackles, prompted many countries to begin technological infrastructure preparations while conceptual discussions continued. In literature, studies are divided into two pillars, with one pillar concentrating on technological issues and the other on conceptual considerations. Whereas a common approach to technological problems emerges, conceptual discussions shift to different points of view, such as Hayek money[3], interest-based digital money, or the potential political ramifications of digital

[3] Hayek (1977), in his denationalization of money, objected to the monopoly of money by the government and suggested that, like law and morals, it can emerge spontaneously. The four defects defined as "*inflation, instability, undisciplined state expenditure, and economic nationalism—have a common origin and a common cure: the replacement of the government monopoly of money by competition in currency supplied by private issuers, who, to preserve public confidence, will limit the quantity of their paper issue and thus maintain its value*" (Hayek:112). In addition, Hayek states that the implementation of a gold standard is the sole secure system; nonetheless, it is preferable to make money fully independent of political control. Briefly, private money is what Hayek refers to, as opposed to legal cash or the government's sole authorization to issue money. The monetary system should be based on the gold standard, even if the government continues its monopoly on money. Numerous economists (including Ametrano (2016), Fantacci (2019), and Sanz Bas (2020)) reconsidered the denationalization of money after the advent of cryptocurrencies and

money definitions (moral hazard issues in credit allocation or crony capitalism). Aside from all these conceptual deliberations, it is possible to become confused about the definition of CBDC, especially at a time when debit and credit cards and internet banking have advanced to the point where the majority of money is now stored and processed in digital form. Rochemont (2019) claims that it is simpler to describe a CBDC by concentrating on what it is not. Essentially, a CBDC is digital central bank cash that differs from deposits in settlement accounts and standard reserves. On the other hand, central banks refer to digital money as "digital yuan, digital krona, or digital lira" and classify it as a substitute for or supplement to cash.

Regardless of the similarity in definition and name, the motivation for CBDC differs between developed and developing countries. Developing countries prioritize financial inclusion, increasing access to financial services, preventing illegal activities, avoiding sanctions, and developing their payment systems. In developed countries, on the other hand, the essential motivation for digital money is the fear of missing out on significant advancements, as well as the creation of new tools to maintain the policy of negative real interest rates and counter the risk of cryptocurrency.

Despite these differences, central banks appear to be focusing on retail CBDC and technological issues, namely, digital cash/money, rather than the initial discussions, which focused on its debut and the implications of digital cash on monetary policy and whether digital money could be a new instrument to sustain negative real interest policy. This approach assumes that the reduced usage of cash is due to technological innovations and pandemic restraints. It also suggests that the groundwork for a shift towards a cashless society has been established. Consumer payment behaviour has been drastically altered as a byproduct of the pandemic. People were increasingly turning to online shopping and contactless payment as a result of the temporary closure of stores and restaurants, as well as quarantine rules. According to King (2020), cash transactions have decreased. During the UK lockdown, ATM cash withdrawals fell by around 60%. Moreover, the Monetary Authority of Singapore encouraged members of the public to use electronic payments.

Conversely, throughout the pandemic, the quantity of cash circulating increased dramatically in many countries, including Australia, Brazil, and Russia, as well as in the eurozone. The United States experienced a coin shortage. However, unlike typical panic-driven increments in cash demand, currency-to-deposit ratios may not have risen and may have even fallen. This suggests that people are hoarding money rather than

examined the parallels between Hayek's philosophy and the use of cryptocurrencies. As Hayek's money, they characterize cryptocurrency, notably Bitcoin.

spending it or depositing it. By the end of March 2021, the Indian rupee had risen by more than 16 per cent. People's growing reliance on cash is one of the multiple variables attributed to the system's heightened currency circulation. People were withdrawing more cash as a result of the second wave's increased uncertainty, fear of stricter lockdowns, and medical emergencies, among several other factors. The majority of the increase in cash demand has occurred in semi-urban and rural areas.

On the one hand, COVID-19 restrictions led to rising contactless, mobile, and internet payments; on the other hand, they changed people's expectations and confidence in government policy and their belief in the system because of the uncertainty of the present and future. Physical cash is perceived as the main toolkit for individuals to protect themselves against unexpected situations and policies. This attitude, cash hoarding, culminates in breaking the link between cash, deposit, and credit; therefore, it may morph into a threat to the banking system and financial stability. Furthermore, it provides beneficial insights into the situation of physical money and the problems that may arise during the transition to digital money and abnormal times, just like the technological problems that may arise during the transition to digital money.

Although there is an increasing amount of studies on the repercussions of changing payment systems and COVID-19 shackles on cash demand for physical money, the effect appears to vary by country. By examining the potential effects of various kinds of payments and COVID-19 prohibitions on cash demand in a developing country, this study hopes to add to the ongoing discourse on the potential of digital money or Central Bank Digital Currency (CBDC) to aid as a viable alternative to or complement physical currency. This paper demystifies the outcomes of e-payment and pandemic restraints on cash demand using OLS models. The subsequent sections of the study are laid out as follows: The empirical literature is examined in Section 2. Section 3 expresses the model and data utilized in our study and the estimation result. The main findings are summarized in Section 4. Finally, the main outcomes and contributions of this study are displayed as a conclusion.

2) LITERATURE

In the literature, the preliminary studies delved into the concept of "e-money", basically defined as any form of payment made using electronic devices, and its implications. To put it differently, the elevated use of e-payment prompted a re-evaluation of the impact on cash demand and money velocity as well as the efficacy of monetary policy. E-money products are “prepaid" or "stored-value” commodities where the retention of the cash or "value" supplied to a consumer is saved on an electronic gadget, as described by Craig et al. (1996) in a seminal study devoted to the concept of e-money products. Additionally, they emphasized the potential for an escalation in the utilization of electronic money as a replacement for physical currency to induce a modification in the speed at which money circulates, resulting in a diminished efficacy of monetary policy in nations that employ monetary aggregates as their policy objective. Woodford (2000), on the other hand, argued that unless e-money can influence policy rates, it will not alter the efficacy of monetary policy.

According to Palley (2001), the upsurge in e-money adoption is associated with a downward trend in currency demand, which might also result in a change in money velocity. He also concentrated on the potential channels through which e-money could influence the demand for monetary authority liabilities and the policy effectiveness of open market operations. The need for settlement balances is the foremost monetary transmission channel, as it tends to affect the monetary authority's capacity to carry out open market operations, thereby influencing short-term interest rates. According to the study, even though electronic money could be utilized for interbank markets, which is unlikely under current circumstances, the control of central banks over policy rates would not affect the financial and real sectors.

Nsouli and Fullenkamp (2004) made a significant contribution by emphasizing the adverse impact of e-money. They created a model to assess the potential repercussions of electronic money on policy efficacy via the interest rate mechanism. In contrast to Palley's viewpoint, they put forward the proposition that the debut of e-money could reduce the efficacy of policy. When electronic money is issued, e-money issuers receive government funds. Some of the funds raised will be invested in their portfolio. As an outcome, under the scenario of a higher interest rate, they will desire to provide more e-money as the return on their initial investment will be greater. The tightening in monetary policy will be partially offset by enhancing the supply of money as a side effect of the greater issuance of e-money.

Empirical research has also examined the pros and cons of e-money and its potential effects on monetary variables, in addition to theoretical studies. Greenwood-Nimmo (2009) utilized various time-series analysis models to predict the growth of electronic money. In the author's view, the medium-term growth rate of

electronic money should be moderate. Mishkin (2012), on the other hand, expanded the discussion, stating that the quantity theory of money stands valid in the long term, and indeed, variations in money velocity are bound to cause inflation or a shift in the price level in the long term. According to Oyelami and Yinusa (2013), the demand for money had a short-term negative linkage with the innovation of electronic payments and internet payments, but a long-term positive relationship in Indonesia.

Rui Qin (2017) used OLS to investigate the repercussions of digital money on the supply of money along with the authority of central banks. The researcher discovers compelling evidence indicating that electronic currency has a detrimental bearing on M0 while yielding a beneficial effect on M1 based on an analysis of data obtained from the Chinese Central Bank from 1990 to 2010. In addition, the extensive adoption of electronic currency has the potential to erode the central bank's capacity to regulate the money supply. According to the author, these outcomes could serve as a guide for monetary authorities and financial entities in predicting the economic landscape and executing appropriate measures to mitigate these factors while restoring the buoyancy of the money market.

In their study, Saraswati and Mukhlis (2018) made the observation that e-money transactions in Indonesia have a positive impact on the demand for currency, which remains valid irrespective of the time frame. That means it can be concluded that an increase in electronic money transactions will contribute to an elevation in currency demand over both the immediate and extended periods.

Khatat (2018) concentrates on two kinds of currency in circulation models to demonstrate the pros and cons of these models: (1) a first-generation model assessment based on money demand theory and (2) a second-generation model designed to generate daily currency in circulation forecasts. He converted the currency demand function into a VAR in this paper to express the dynamic interplay involving interest rates and cash demand. He also forecasted daily currency in circulation in Kazakhstan, Sudan, Morocco, Brazil, and New Zealand, adopting ARIMA modelling. According to the author, the econometric analysis revealed that some of the inferences of the economic literature on the bearing of interest rates and on the currency demand are not always correct and that central banks would benefit from both generations of currency in circulation models. Alternatively, the fundamental longer-run determinants of cash demand differ from the short-run determinants.

Bech et al. (2018) evaluate the association involving financial innovation and the main dimensions of money demand: transactional, precautionary, and speculative, in advanced and emerging economies between 2007 and 2016. According to panel regression results, financial breakthroughs have culminated in a decline in transaction demand for money.

In the research, Sukmonkongsamoe (2019) examined the potential effects of modifications in e-money on the efficacy of monetary policy. Initially, the author conducted an examination of electronic money generation within the Eurozone to ascertain its potential to impede the efficacy of policy. The scope of the research is expanded to encompass multiple nations in order to ascertain the factors influencing the emergence of electronic money (e-money) and examine its interactions and dynamics with conventional payment methods. Following this, the author made an effort to ascertain the correlation between electronic money and conventional payment systems. The results suggest that the implementation of e-money does not diminish the efficacy of monetary policy, but rather enhances it. Additionally, the development of a robust e-money infrastructure performs a pivotal role in promoting the expansion of e-money. Lastly, the introduction of e-money does not significantly disrupt established conventional payment methods.

Another crucial query is whether variations in the e-payment system can account for discrepancies in the use of cash in various countries. Engert et al. (2019) compared two countries, Canada, where cash demand has been stable for decades, and Sweden, where cash demand has been steadily declining, to decipher the reason for the difference in cash demand. The study examined the disparities between the two nations by separately analyzing the demand for cash for transactions and currency as a store of value. They propose that there exists a downward trajectory in the proportion of small-denomination banknotes in relation to the growth (GDP) in Sweden and Canada. The authors assert that this phenomenon is a parallel trend observed in the gradual decline of cash usage for transactions, which can be ascribed to the introduction of innovative payment methods. Put simply, the insufficiency of payment innovations and dissemination as explanatory factors is evident in the divergent trends of aggregate cash demand between Sweden and Canada. The divergence in cash demand patterns between Sweden and Canada can be attributed to the characteristics and usage patterns of higher denomination banknotes, which are primarily regarded as a means of preserving value.

The COVID-19 limitations spurred discussion about how the global pandemic influenced the usage of cash, and whether it would survive. Guttmann et al. (2021) reported a substantial surge in the demand for cash in Australia amidst the COVID-19 outbreak.

Since mid-March 2020, there has been a notable 17% increase in the quantity of banknotes circulating in Australia, primarily attributed to the emergence of pandemic-related uncertainties. The implementation of security protocols and various limitations, coupled with a transition towards online transactions and apprehensions regarding the potential transmission of viruses through physical currency, have collectively contributed to a reduction in the demand for cash transactions. Given the reduced utilization of cash in

routine transactions, the high demand for banknotes can be attributed solely to precautionary or store-of-wealth considerations. Precautionary impulses tend to manifest prominently during periods of economic and financial strain, as seen by historical records. Australia was not the sole nation to experience a substantial upsurging in the demand for banknotes; numerous other economies encountered comparable patterns in cash demand.

Numerous studies regarding the determinants of money demand have been accomplished in Turkey (M1, M2, and M3). However, there have been few studies in the academic discipline on the interplay between cash demand and retail payment methods such as cards, the internet, and mobile. Ari (2008) investigated the bearing of cards (debit and credit) payments on cash in circulation between 2002 M01 and 2007 M12 by OLS. The study posits that there exists a negative implication between debit card expenditures and the amount of physical currency circulating, while a positive association is shown between credit card usage and the quantity of physical currency circulating.

Yilmazkuday and Yazgan (2009) applied the generalized method of moments (GMM), an estimating tool for examining the bearing of debit and credit cards on the cash in circulation. Instead of utilizing the survey data, the researchers opted to utilize monthly data obtained from an interbank organization. This institution provided comprehensive statistics on the utilization of cards (debit and credit) in Turkey from January 2002 to October 2006. It has been found that the heightened utilization of cards (debit and credit) is associated with a reduction in the need for physical currency. Moreover, it seems that the utilization of debit cards exerts a more pronounced repercussion on the demand for money compared to the utilization of credit cards.

3) MODEL AND DATA

We follow the traditional money demand function (Goldfeld and Sichel (1990), Cassino et al. (1997), Akinlo (2006), and Hossain (2010). Money demand is an expression of both scale and opportunity variables in this case.

$M/P = F(SV, OV)$.

The scale variables (SV) are commonly referred to as income and expenditure, while the opportunity variables (OV) are referred to as inflation, interest rates, exchange rates or stock prices. Although the money demand function can be defined in an assortment of multiple manners, the log-linear version is the most commonly used form as it outperforms other forms and enables the interpretation of logarithmic coefficients as elasticities.

In our research, we have used the consumer tendency indices and industrial production index as scale variables, and the exchange and interest rates are referred to as opportunity costs. In addition, variables such as credit cards, internet, and mobile, and contactless payments are covered in the model to probe the repercussions of different payment methods on money in circulation, which is the main focus of this study. Furthermore, a binary parameter is also employed to estimate the repercussions of COVID-19 restrictions.

We used the monthly data between 2012 M01 and 2022 M08 for Turkey. The data on currency in circulation, 3-month deposit interest rate, and foreign currency rate is obtained from CBRT's website. Credit card payments, internet payments, mobile payments, contactless, and QR payments are obtained from the website of the interbank card center. The consumer tendency index is obtained from Bloomberg HT. 2-year bond rates are obtained from matrixdata.com and investing.com. Due to the absence of digital or mobile money in Turkey, only data on cards, the internet, and contactless payments are used. For detrending the industrial production index, the most common approach is the Hodrick-Prescott filter, which is also used in this study. The appendix contains all the figures for the data that are utilized to predict the model.

In the present study, we employed the dynamic regression method, which additionally takes the lagged values of the dependent and exogenous parameters into account.

The below-mentioned expression is simply dynamic regression:

$y_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 y_{t-2} \ldots + \beta_k y_{t-k} + \delta_1 X_t + \delta_2 X_{t-2} + \cdots \delta_n X_{t-n} + \varepsilon_t$. *(1)*

Where y_t is the endogenous variable, and X_t represents the vector of exogenous parameters.

The two main factors that favors dynamic regression are theoretical and technical. Firstly, the theoretical reason is the lag of the exogenous and endogenous parameters added in the model also affects holding cash. Due to the necessity of cash for precautionary and speculative objectives alongside transaction motives, past values of both dependent and independent variables might also be a critical part of the determinants of holding cash. Cash is a simple device for monitoring liquidity and controlling budgets; to put it differently, it has memory. Therefore, past transactions of cash bear implications for current cash value.

Likewise, the past values of the explanatory parameters that are incorporated into the model may have non-negligible implications on the cash demand for a multitude of reasons. For instance, retaining cash depends on previous expectations because the consumer consumption tendency utilized in this paper reflects expectations about future income and consumption. Additionally, since Turkish investors typically deal in short-term time deposits, the interest rates of the previous period also influence the demand for cash. Although exchange rate volatility instantly affects cash demand, the lagged values of exchange rates in the wealth effect or substitution effect become more significantly relevant to expectations of a rise or reduction in exchange rates. Moreover, the primary explanatory variables in this study (credit cards, contactless payments, and online payments) have a lagged effect on the quantity of cash required in some situations.

These methods provide a chance to temporarily overcome financial constraints and create an illusion of liquidity by offering consumers instalments, postponements, and other campaigns. Users, especially credit card users, tend to forget past transactions; therefore, the lagged values of these payment instruments need consideration.

Eliminating the issue of autocorrelation between the variables is the second justification.

In a nutshell, the model will estimate to follow the below process:

Firstly, we concentrate on the implication of foreign currency rates (nominal and real exchange rates) as opportunity cost variables and various payment instruments (credit, online, and contactless) on real cash alongside other explanatory variables (CTI, IPI, and COVID). The real currency in circulation is assumed to be an expression of the present and lagged values of all independent and dependent variables. Consequently, three equations are estimated to scrutinize the linkage between the real currency in circulation and three distinct payment methods.

$$\ln\text{rcash}_t = \alpha_0 + \beta_1 \ln\text{rcash}_{t-1} + \ldots + \beta_k \ln\text{rcash}_{t-k} + \delta_1 \ln\text{rcredit}_t + \ldots + \delta_m \ln\text{rcredit}_{t-m} + \gamma_1 \text{CTI}_t + \ldots + \gamma_n \text{CTI}_{t-n} + \rho_t \text{IPI}_t \ldots + \rho_p \text{IPI}_{t-p} + \psi_t \ln\text{rexc}_t + \ldots \psi_r \ln\text{rexc}_{t-r} + \theta_t \text{dummy(COVID)} + \varepsilon_t. \quad (2)$$

$$\ln\text{rcash}_t = \alpha_0 + \beta_1 \ln\text{rcash}_{t-1} + \ldots + \beta_k \ln\text{rcash}_{t-k} + \delta_1 \ln\text{rcredit}_t + \ldots + \delta_m \ln\text{rcredit}_{t-m} + \gamma_1 \text{CTI}_t + \ldots + \gamma_n \text{CTI}_{t-n} + \rho_t \text{IPI}_t \ldots + \rho_p \text{IPI}_{t-p} + \psi_t \ln\text{exc}_t + \ldots \psi_r \ln\text{exc}_{t-r} + \theta_t \text{dummy(COVID)} + \varepsilon_t. \quad (3)$$

$$\ln\text{rcash}_t = \alpha_0 + \beta_1 \ln\text{rcash}_{t-1} + \ldots + \beta_k \ln\text{rcash}_{t-k} + \delta_1 \ln\text{rinternet}_t + \ldots + \delta_m \ln\text{rinternet}_{t-m} + \gamma_1 \text{CTI}_t + \cdots + \gamma_n \text{CTI}_{t-n} + \rho_t \text{IPI}_t \ldots + \rho_p \text{IPI}_{t-p} + \psi_t \ln\text{rexc}_t + \ldots \psi_r \ln\text{rexc}_{t-r} + \theta_t \text{dummy(COVID)} + \varepsilon_t. \quad (4)$$

$$\ln\text{rcash}_t = \alpha_0 + \beta_1 \ln\text{rcash}_{t-1} + \ldots + \beta_k \ln\text{rcash}_{t-k} + \delta_1 \ln\text{rinternet}_t + \ldots + \delta_m \ln\text{rinternet}_{t-m} + \gamma_1 \text{CTI}_t + \cdots + \gamma_n \text{CTI}_{t-n} + \rho_t \text{IPI}_t \ldots + \rho_p \text{IPI}_{t-p} + \psi_t \ln\text{exc}_t + \ldots \psi_r \ln\text{exc}_{t-r} + \theta_t \text{dummy(COVID)} + \varepsilon_t. \quad (5)$$

$$lnrcash_t = \alpha_0 + \beta_1 lnrcash_{t-1} + \ldots + \beta_k lnrcash_{t-k} \delta_1 lnrcontactless_t + \ldots + \delta_m lnrcontactless_{t-m} + \gamma_1 CTI_t + \cdots + \gamma_n CTI_{t-n} + \rho_t IPI_t \ldots + \rho_p IPI_{t-p} + \psi_t lnrexc_t + \ldots \psi_r lnrexc_{t-r} + \theta_t dummy(COVID) + \varepsilon_t \quad (6)$$

$$lnrcash_t = \alpha_0 + \beta_1 lnrcash_{t-1} + \ldots + \beta_k lnrcash_{t-k} + \delta_1 lnrcontactless_t + \ldots + \delta_m lnrcontactless_{t-m} + \gamma_1 CTI_t + \cdots + \gamma_n CTI_{t-n} + \rho_t IPI_t \ldots + \rho_p IPI_{t-p} + \psi_t lnexc_t + \ldots \psi_r lnexc_{t-r} + \theta_t dummy(COVID) + \varepsilon_t. \quad (7)$$

Secondly, we used nominal and real interest rates separately (2-year bond and 3-deposit interest rates as opportunity costs instead of the exchange rate) and predicted three equations to examine the influence of payments (credit cards, internet, and contactless payments).

$$\ln\text{rcash}_t = \alpha_0 + \beta_1 \ln\text{rcash}_{t-1} + \ldots + \beta_k \ln\text{rcash}_{t-k} + \delta_1 \ln\text{rcredit}_t + \ldots + \delta_m \ln\text{rcredit}_{t-m} + \gamma_1 \text{CTI}_t + \ldots + \gamma_n \text{CTI}_{t-n} + \rho_t \text{IPI}_t \ldots + \rho_p \text{IPI}_{t-p} + \psi_t \text{interest(deposit)}_t + \ldots \psi_r \text{interest(deposit)}_{t-r} + \theta_t \text{dummy(COVID)} + \varepsilon_t. \quad (8)$$

$$\ln\text{rcash}_t = \alpha_0 + \beta_1 \ln\text{rcash}_{t-1} + \cdots + \beta_k \ln\text{rcash}_{t-k} + \delta_1 \ln\text{rcredit}_t + \cdots + \delta_m \ln\text{rcredit}_{t-m} + \gamma_1 \text{CTI}_t + \cdots + \gamma_n \text{CTI}_{t-n} + \rho_t \text{IPI}_t \ldots + \rho_p \text{IPI}_{t-p} + \psi_t \text{rinterest(deposit)}_t + \ldots \psi_r \text{rinterest(deposit)}_{t-r} + \theta_t \text{dummy(COVID)} + \varepsilon_t. \quad (9)$$

$$\ln\text{rcash}_t = \alpha_0 + \beta_1 \ln\text{rcash}_{t-1} + \ldots + \beta_k \ln\text{rcash}_{t-k} + \delta_1 \ln\text{rcredit}_t + \ldots + \delta_m \ln\text{rcredit}_{t-m} + \gamma_1 \text{CTI}_t + \ldots + \gamma_n \text{CTI}_{t-n} + \rho_t \text{IPI}_t \ldots + \rho_p \text{IPI}_{t-p} + \psi_t \text{interest(bond)}_t + \ldots \psi_r \text{interest(bond)}_{t-r} + \theta_t \text{dummy(COVID)} + \varepsilon_t . \quad (10)$$

$$\ln\text{rcash}_t = \alpha_0 + \beta_1 \ln\text{rcash}_{t-1} + \ldots + \beta_k \ln\text{rcash}_{t-k} + \delta_1 \ln\text{rcredit}_t + \ldots + \delta_m \ln\text{rcredit}_{t-m} + \gamma_1 \text{CTI}_t + \ldots + \gamma_n \text{CTI}_{t-n} + \rho_t \text{IPI}_t \ldots + \rho_p \text{IPI}_{t-p} + \psi_t \text{rinterest(bond)}_t + \ldots \psi_r \text{rinterest(bond)}_{t-r} + \theta_t \text{dummy(COVID)} + \varepsilon_t. \quad (11)$$

$$\ln\text{rcash}_t = \alpha_0 + \beta_1 \ln\text{rcash}_{t-1} + \ldots + \beta_k \ln\text{rcash}_{t-k} + \delta_1 \ln\text{rinternet}_t + \ldots + \delta_m \ln\text{rinternet}_{t-m} + \gamma_1 \text{CTI}_t + \cdots + \gamma_n \text{CTI}_{t-n} + \rho_t \text{IPI}_t \ldots + \rho_p \text{IPI}_{t-p} + \psi_t \text{interest(deposit)}_t + \ldots \psi_r \text{interest(deposit)}_{t-r} + \theta_t \text{dummy(COVID)} + \varepsilon_t. \quad (12)$$

$$\ln\text{rcash}_t = \alpha_0 + \beta_1 \ln\text{rcash}_{t-1} + \cdots + \beta_k \ln\text{rcash}_{t-k} + \delta_1 \ln\text{rinternet}_t + \cdots + \delta_m \ln\text{rinternet}_{t-m} + \gamma_1 \text{CTI}_t + \cdots + \gamma_n \text{CTI}_{t-n} + \rho_t \text{IPI}_t \ldots + \rho_p \text{IPI}_{t-p} + \psi_t \text{rinterest(deposit)}_t + \ldots \psi_r \text{rinterest(deposit)}_{t-r} + \theta_t \text{dummy(COVID)} + \varepsilon_t. \quad (13)$$

$$\ln\text{rcash}_t = \alpha_0 + \beta_1 \ln\text{rcash}_{t-1} + \ldots + \beta_k \ln\text{rcash}_{t-k} + \delta_1 \ln\text{rinternet}_t + \ldots + \delta_m \ln\text{rinternet}_{t-m} + \gamma_1 \text{CTI}_t + \cdots + \gamma_n \text{CTI}_{t-n} + \rho_t \text{IPI}_t \ldots + \rho_p \text{IPI}_{t-p} + \psi_t \text{interest(bond)}_t + \ldots \psi_r \text{interest(bond)}_{t-r} + \theta_t \text{dummy(COVID)} + \varepsilon_t. \quad (14)$$

$$\ln rcash_t = \alpha_0 + \beta_1 \ln rcash_{t-1} + \ldots + \beta_k \ln rcash_{t-k} + \delta_1 \ln rinternet_t + \ldots + \delta_m \ln rinternet_{t-m} + \gamma_1 CTI_t + \cdots + \gamma_n CTI_{t-n} + \rho_t IPI_t \ldots + \rho_p IPI_{t-p} + \psi_t rinterest(bond)_t + \ldots \psi_r rinterest(bond)_{t-r} + \theta_t dummy(COVID) + \varepsilon_t. \quad (15)$$

$$\ln rcash_t = \alpha_0 + \beta_1 \ln rcash_{t-1} + \ldots + \beta_k \ln rcash_{t-k} + \delta_1 \ln rcontactless_t + \ldots + \delta_m \ln rcontactless_{t-m} + \gamma_1 CTI_t + \cdots + \gamma_n CTI_{t-n} + \rho_t IPI_t \ldots + \rho_p IPI_{t-p} + \psi_t interest(deposit)_t + \ldots \psi_r interest(deposit)_{t-r} + \theta_t dummy(COVID) + \varepsilon_t. \quad (16)$$

$$\ln rcash_t = \alpha_0 + \beta_1 \ln rcash_{t-1} + \cdots + \beta_k \ln rcash_{t-k} + \delta_1 \ln rcontactless_t + \cdots + \delta_m \ln rcontactless_{t-m} + \gamma_1 CTI_t + \cdots + \gamma_n CTI_{t-n} + \rho_t IPI_t \ldots + \rho_p IPI_{t-p} + \psi_t rinterest(deposit)_t + \ldots \psi_r rinterest(deposit)_{t-r} + \theta_t dummy(COVID) + \varepsilon_t. \quad (17)$$

$$\ln rcash_t = \alpha_0 + \beta_1 \ln rcash_{t-1} + \ldots + \beta_k \ln rcash_{t-k} + \delta_1 \ln rcontactless_t + \ldots + \delta_m \ln rcontactless_{t-m} + \gamma_1 CTI_t + \cdots + \gamma_n CTI_{t-n} + \rho_t IPI_t \ldots + \rho_p IPI_{t-p} + \psi_t interest(bond)_t + \ldots \psi_r interest(bond)_{t-r} + \theta_t dummy(COVID) + \varepsilon_t . \quad (18)$$

$$\ln rcash_t = \alpha_0 + \beta_1 \ln rcash_{t-1} + \ldots + \beta_k \ln rcash_{t-k} + \delta_1 \ln rcontactless_t + \ldots + \delta_m \ln rcontactless_{t-m} + \gamma_1 CTI_t + \cdots + \gamma_n CTI_{t-n} + \rho_t IPI_t \ldots + \rho_p IPI_{t-p} + \psi_t rinterest(bond)_t + \ldots \psi_r rinterest(bond)_{t-r} + \theta_t dummy(COVID) + \varepsilon_t. \quad (19)$$

Thirdly, we assumed the nominal interest rate (deposit and bond) and the real foreign currency rate as opportunity costs and predicted three equations to analyze the effect of different payment methods.

$$\ln rcash_t = \alpha_0 + \beta_1 \ln rcash_{t-1} + \ldots + \beta_k \ln rcash_{t-k} + \delta_1 \ln rcredit_t + \ldots + \delta_m \ln rcredit_{t-m} + \gamma_1 CTI_t + \ldots + \gamma_n CTI_{t-n} + \rho_t IPI_t \ldots + \rho_p IPI_{t-p} + \psi_t interest(deposit)_t + \ldots \psi_r interest(deposit)_{t-r} + \sigma_t \ln rexc_t + \ldots \ldots + \sigma_s \ln rexc_{t-s} + \theta_t dummy(COVID) + \varepsilon_t. \quad (20)$$

$$\ln\text{rcash}_t = \alpha_0 + \beta_1 \ln\text{rcash}_{t-1} + \ldots + \beta_k \ln\text{rcash}_{t-k} + \delta_1 \ln\text{rcredit}_t + \ldots + \delta_m \ln\text{rcredit}_{t-m} + \gamma_1 \text{CTI}_t + \ldots + \gamma_n \text{CTI}_{t-n} + \rho_t \text{IPI}_t \ldots + \rho_p \text{IPI}_{t-p} + \psi_t \text{interest(bond)}_t + \ldots \psi_r \text{interest(bond)}_{t-r} + \sigma_t \ln\text{rexc}_t + \ldots\ldots + \sigma_s \ln\text{rexc}_{t-s} + \theta_t \text{dummy(COVID)} + \varepsilon_t. \quad (21)$$

$$\ln\text{rcash}_t = \alpha_0 + \beta_1 \ln\text{rcash}_{t-1} + \ldots + \beta_k \ln\text{rcash}_{t-k} + \delta_1 \ln\text{rinternet}_t + \ldots + \delta_m \ln\text{rinternet}_{t-m} + \gamma_1 \text{CTI}_t + \cdots + \gamma_n \text{CTI}_{t-n} + \rho_t \text{IPI}_t \ldots + \rho_p \text{IPI}_{t-p} + \psi_t \text{interest(deposit)}_t + \ldots \psi_r \text{interest(deposit)}_{t-r} + \sigma_t \ln\text{rexc}_t + \ldots\ldots + \sigma_s \ln\text{rexc}_{t-s} + \theta_t \text{dummy(COVID)} + \varepsilon_t. \quad (22)$$

$$\ln\text{rcash}_t = \alpha_0 + \beta_1 \ln\text{rcash}_{t-1} + \ldots + \beta_k \ln\text{rcash}_{t-k} + \delta_1 \ln\text{rinternet}_t + \ldots + \delta_m \ln\text{rinternet}_{t-m} + \gamma_1 \text{CTI}_t + \cdots + \gamma_n \text{CTI}_{t-n} + \rho_t \text{IPI}_t \ldots + \rho_p \text{IPI}_{t-p} + \psi_t \text{interest(bond)}_t + \ldots \psi_r \text{interest(bond)}_{t-r} + \sigma_t \ln\text{rexc}_t + \ldots\ldots + \sigma_s \ln\text{rexc}_{t-s} + \theta_t \text{dummy(COVID)} + \varepsilon_t. \quad (23)$$

$$\ln\text{rcash}_t = \alpha_0 + \beta_1 \ln\text{rcash}_{t-1} + \ldots + \beta_k \ln\text{rcash}_{t-k} + \delta_1 \ln\text{rcontactless}_t + \ldots + \delta_m \ln\text{rcontactless}_{t-m} + \gamma_1 \text{CTI}_t + \cdots + \gamma_n \text{CTI}_{t-n} + \rho_t \text{IPI}_t \ldots + \rho_p \text{IPI}_{t-p} + \psi_t \text{interest(deposit)}_t + \ldots \psi_r \text{interest(deposit)}_{t-r} + \sigma_t \ln\text{rexc}_t + \ldots\ldots + \sigma_s \ln\text{rexc}_{t-s} + \theta_t \text{dummy(COVID)} + \varepsilon_t. \quad (24)$$

$$\ln\text{rcash}_t = \alpha_0 + \beta_1 \ln\text{rcash}_{t-1} + \ldots + \beta_k \ln\text{rcash}_{t-k} + \delta_1 \ln\text{rcontactless}_t + \ldots + \delta_m \ln\text{rcontactless}_{t-m} + \gamma_1 \text{CTI}_t + \cdots + \gamma_n \text{CTI}_{t-n} + \rho_t \text{IPI}_t \ldots + \rho_p \text{IPI}_{t-p} + \psi_t \text{interest(bond)}_t + \ldots \psi_r \text{interest(bond)}_{t-r} + \sigma_t \ln\text{rexc}_t + \ldots\ldots + \sigma_s \ln\text{rexc}_{t-s} + \theta_t \text{dummy(COVID)} + \varepsilon_t. \quad (25)$$

Finally, we will predict the equations mentioned below that include the real interest (deposit and bond) and the real foreign currency rate as the costs of opportunity to investigate the repercussions of payment techniques on real currency in circulation.

$$\ln rcash_t = \alpha_0 + \beta_1 \ln rcash_{t-1} + \ldots + \beta_k \ln rcash_{t-k} + \delta_1 \ln rcredit_t + \ldots + \delta_m \ln rcredit_{t-m} + \gamma_1 CTI_t + \ldots + \gamma_n CTI_{t-n} + \rho_t IPI_t \ldots + \rho_p IPI_{t-p} + \psi_t rinterest(deposit)_t + \ldots \psi_r rinterest(deposit)_{t-r} + \sigma_t \ln rexc_t + \ldots\ldots + \sigma_s \ln rexc_{t-s} + \theta_t dummy(COVID) + \varepsilon_t. \quad (26)$$

$$\ln rcash_t = \alpha_0 + \beta_1 \ln rcash_{t-1} + \ldots + \beta_k \ln rcash_{t-k} + \delta_1 \ln rcredit_t + \ldots + \delta_m \ln rcredit_{t-m} + \gamma_1 CTI_t + \ldots + \gamma_n CTI_{t-n} + \rho_t IPI_t \ldots + \rho_p IPI_{t-p} + \psi_t rinterest(bond)_t + \ldots \psi_r rinterest(bond)_{t-r} + \sigma_t \ln rexc_t + \ldots\ldots + \sigma_s \ln rexc_{t-s} + \theta_t dummy(COVID) + \varepsilon_t. \quad (27)$$

$$\ln rcash_t = \alpha_0 + \beta_1 \ln rcash_{t-1} + \ldots + \beta_k \ln rcash_{t-k} + \delta_1 \ln rinternet_t + \ldots + \delta_m \ln rinternet_{t-m} + \gamma_1 CTI_t + \cdots + \gamma_n CTI_{t-n} + \rho_t IPI_t \ldots + \rho_p IPI_{t-p} + \psi_t rinterest(deposit)_t + \ldots \psi_r rinterest(deposit)_{t-r} + \sigma_t \ln rexc_t + \ldots\ldots + \sigma_s \ln rexc_{t-s} + \theta_t dummy(COVID) + \varepsilon_t. \quad (28)$$

$$\ln rcash_t = \alpha_0 + \beta_1 \ln rcash_{t-1} + \ldots + \beta_k \ln rcash_{t-k} + \delta_1 \ln rinternet_t + \ldots + \delta_m \ln rinternet_{t-m} + \gamma_1 CTI_t + \cdots + \gamma_n CTI_{t-n} + \rho_t IPI_t \ldots + \rho_p IPI_{t-p} + \psi_t rinterest(bond)_t + \ldots \psi_r rinterest(bond)_{t-r} + \sigma_t \ln rexc_t + \ldots\ldots + \sigma_s \ln rexc_{t-s} + \theta_t dummy(COVID) + \varepsilon_t. \quad (29)$$

$$\ln rcash_t = \alpha_0 + \beta_1 \ln rcash_{t-1} + \ldots + \beta_k \ln rcash_{t-k} + \delta_1 \ln rcontactless_t + \ldots + \delta_m \ln rcontactless_{t-m} + \gamma_1 CTI_t + \cdots + \gamma_n CTI_{t-n} + \rho_t IPI_t \ldots + \rho_p IPI_{t-p} + \psi_t rinterest(deposit)_t + \ldots \psi_r rinterest(deposit)_{t-r} + \sigma_t \ln rexc_t + \ldots\ldots + \sigma_s \ln rexc_{t-s} + \theta_t dummy(COVID) + \varepsilon_t. \quad (30)$$

$$\ln rcash_t = \alpha_0 + \beta_1 \ln rcash_{t-1} + \ldots + \beta_k \ln rcash_{t-k} + \delta_1 \ln rcontactless_t + \ldots + \delta_m \ln rcontactless_{t-m} + \gamma_1 CTI_t + \cdots + \gamma_n CTI_{t-n} + \rho_t IPI_t \ldots + \rho_p IPI_{t-p} + \psi_t rinterest(bond)_t + \ldots \psi_r rinterest(bond)_{t-r} + \sigma_t \ln rexc_t + \ldots\ldots + \sigma_s \ln rexc_{t-s} + \theta_t dummy(COVİD) + \varepsilon_t. \quad (31)$$

4) EMPIRICAL FINDINGS

Table 3-1: The Summary of Descriptive Statistics

VARIABLES	MEDIAN	MEAN	MAX	MIN	STD. DEV	OBS
LRCASH	10.41	10.40	10.81	10.06	0.16	128
LRCREDIT	9.70	9.73	10.30	9.34	0.17	128
LRINTERNET	6.71	6.65	7.76	5.66	0.66	128
LRCONTACTLESS	9.64	6.45	10.30	1.37	3.73	128
INTEREST	16.00	18.12	32.50	10.00	5.03	128
RINTEREST	6.09	3.64	11.66	-30.46	8.25	128
LREXC	4.51	4.44	4.73	3.87	0.24	128
LEXC	1.27	1.37	2.89	0.56	0.63	128
RBOUND	0.08	-1.31	4.44	-36.69	7.19	128
BOUND	10.93	12.56	24.48	5.14	4.95	128
LCTI	4.05	4.05	4.79	3.28	0.35	128
IPI	1.35	-3.01E-11	28.92	-40.54	9.85	128

Table 3-1 contains descriptive statistics of all variables, while correlation matrix is demonstrated in table 3-2.

Table 3-2: Correlation Matrix

	Lrcash	**Lrcredit**	**Lrinternet**	**Lrcontactless**	**Interest**	**Rinterest**	**Lrexc**	**Lexc**	**Rbond**	**Bond**	**Lcti**	**Ipi**
Lrcash	1.00	0.40	-0.40	0.55	-0.19	-0.09	-0.42	0.47	0.24	0.22	-0.41	-0.06
Lrcredit	0.40	1.00	-0.29	0.61	0.29	-0.58	-0.76	0.78	-0.41	0.67	-0.54	0.37
Lrinternet	-0.40	-0.29	1.00	-0.89	-0.32	0.13	0.57	-0.57	-0.03	-0.53	0.16	-0.05
Lrcontactless	0.55	0.61	-0.89	1.00	0.38	-0.40	-0.83	0.86	-0.19	0.73	-0.41	0.05
Interest	-0.19	0.29	-0.32	0.38	1.00	-0.04	-0.48	0.43	-0.20	0.77	-0.32	0.09
Rinterest	-0.09	-0.58	0.13	-0.40	-0.04	1.00	0.59	-0.64	0.90	-0.47	0.41	0.01
Lrexc	-0.42	-0.76	0.57	-0.83	-0.48	0.59	1.00	-0.98	0.42	-0.84	0.60	-0.05
Lexc	0.47	0.78	-0.57	0.86	0.43	-0.64	-0.98	1.00	-0.46	0.81	-0.60	0.02
Rbond	0.24	-0.41	-0.03	-0.19	-0.20	0.90	0.42	-0.46	1.00	-0.37	0.26	0.04
Bond	0.22	0.67	-0.53	0.73	0.77	-0.47	-0.84	0.81	-0.37	1.00	-0.61	0.12
Lcti	-0.41	-0.54	0.16	-0.41	-0.32	0.41	0.60	-0.60	0.26	-0.61	1.00	-0.09
IPI	-0.06	0.37	-0.05	0.05	0.09	0.01	-0.05	0.02	0.04	0.12	-0.09	1.00

All variables are stationary after the application of the first differences, as shown in the table. Then, using dynamic OLS, the models specified above can be estimated.

Table 3-3: The Result of PP and ADF Unit Root Tests for All Parameters

	LEVEL		FIRST DIFFERENCE	
VARIABLES	**ADF**	**PP**	**ADF**	**PP**
LRCASH	**-1.893**	**-2.142**	**-10.479***	**-10.517***
LRCREDIT	**0.337**	**-4.204**	**-3.826***	**-14.893***
LRINTERNET	**-1.803**	**-1.712**	**-12.872***	**-12.856***
LRCONTACTLESS	**-1.735**	**-1.777**	**-11.114***	**-11.150***
LREXC	**-2.919**	**-2.799**	**-9.288***	**-10.193***
LEXC	**-0.822**	**-0.874**	**-8.361***	**-7.376***
LCTI	**-4.659**	**-3.766**	**-9.077***	**-16.185***
RBOND	**2.520**	**2.240**	**-8.784***	**-8.791***
RINT	**0.349**	**0.053**	**-9.754***	**-9.765***
IPI	**-2.475**	**-9.795**	**-5.318***	**-71.739***
INTEREST	**-2.684**	**-2.644**	**-11.358***	**-11.408***
BOND	**-3.002**	**-2.563**	**-8.292***	**-8.123***

Notes: The abbreviation PP stands for Philips-Perron-Fisher., while ADF refers to Augmented Dickey-Fuller-Fisher. (*) denotes that the values above indicate significance at a 5 percent level.

4.1) Real Cash, Payments, and Exchange Rate:

4.1.1) Credit Cards:

According to the results, the coefficients associated with credit card payments are deemed statistically significant at a 5% significance level in both models., while the first lag coefficients of credit card payments in the two models are not statistically significant. The elasticities of credit cards (0.16 and 0.18) demonstrate a positive effect on cash in models 1 and 2.

Table 3-4: Real Cash, Credit Cards, and Exchange rate

DEPENDENT VARIABLE REAL CURRENCY IN CIRCULATION			
Model1		Model2	
VARIABLE	COEFFICIENT	VARIABLE	COEFFICIENT
C	-0.0009 (0.004)	C	0.004 (0.005)
D(LNRCREDIT)	0.16** (0.08)	D(LNRCREDIT)	0.18** (0.08)
D (LNRCREDIT (-1))	0.04 (0.08)	D (LNRCREDIT (-1))	0.06 (0.08)
D(LNCTI)	-0.02 (0.03)	D(LNCTI)	-0.023 (0.025)
D (LNCTI (-1))	-0.08*** (0.03)	D (LNCTI (-1))	-0.08*** (0.03)
D(IPI)	-0.002*** (0.0005)	D(IPI)	-0.002*** (0.0005)
D (IPI (-1))	-0.001* (0.0006)	D (IPI (-1))	-0.0013** (0.0006)
D (IPI (-2))	-0.001** (0.0005)	D (IPI (-2))	-0.001** (0.0005)
D (IPI (-3))	-0.0008* (0.0004)	D (IPI (-3))	-0.0007 (0.0004)
D (LNRCASH (-1))	-0.16 (0.1)	D (LNRCASH (-1))	-0.16 (0.1)
D (LNRCASH (-2))	0.28** (0.09)	D (LNRCASH (-2))	0.23*** (0.09)
D(LNREXC)	**-0.33** (0.14)**	**D(LNEXC)**	**0.16 (0.11)**
D (LNREXC (-1))	**0.30** (0.15)**	**D (LNEXC (-1))**	**-0.32** (0.13)**
D (LNREXC (-2))	**0.37*** (0.14)**	**D (LNEXC (-2))**	**-0.25** (0.11)**
DUMMY	0.06** (0.02)	DUMMY	0.06*** (0.023)
DIAGNOSTIC		**DIAGNOSTIC**	
R-SQUARE	0.38	R-SQUARE	0.37
NORMALITY	JARQUE-BERA: 3.25 PROB:0.197	NORMALITY	JARQUE-BERA: 2.095 PROB:0.35
LM	F (3,103): 0.596 Chi-Sq (3):0.535	LM	F (3,103): 0.74 Chi-Sq (3):0.69
ARCH	F (3,114):0.46 Chi-Sq (3):0.45	ARCH	F (3,114):0.30 Chi-Sq (3):0.298
CUSUM/CUSUM SQ	NO/YES	CUSUM/CUSUM SQ	NO/YES

Notes: The asterisk symbols "***, **, and *" indicate 1 percent, 5 percent, and 10 percent significance levels, correspondingly. The statistical values demonstrated in parentheses () represent standard errors.

The coefficients of first-lagged CTI are statistically significant and indicate an adverse repercussion on currency in circulation. This result is contrary to our expectation since an increase in consumer tendencies spawns rising currency in circulation.

The current and lags of the industrial production index (outgap) coefficients are statistically significant and have small values. They show a negative relationship with real cash in the two models.

The second-lagged real cash demonstrates a positive effect on real currency in circulation.

The COVID-19 restrictions have a positive effect on currency in circulation; this outcome supports the view that COVID-19 restrictions create uncertainty and lead to cash hoarding.

The current real foreign currency coefficient exhibits an adverse trend (substitution factor), while the first and second lags of the real coefficients have a positive sign (wealth factor). In essence, an upward movement in real exchange induces the holding foreign exchange rate, namely the substitution effect. The effects of wealth is when an investor prefers to convert foreign currency to domestic currency because she anticipates that it won't increase further.

The current nominal exchange rate coefficient has a positive sign (wealth effect), while the first and second lag coefficients of nominal exchange rates have a negative effect (substitution effect).

4.1.2) Internet Payments:

A review of the outcomes demonstrates that internet payment coefficients are not statistically significant in both models.

Like previous models, we obtained the same signs for the coefficients of IPI, lag of real cash, CTI, and real and nominal exchange rates.

Despite of statistically significant, the first lag coefficients of the CTI indicate a negative impact on currency in circulation.

The current and lag coefficients of the IPI (output gap) are statistically significant and have small values. They show a negative relationship with real cash in two models.

The second lag of real cash demonstrates a positive effect on real cash. The COVID-19 restrictions pose a positive effect on currency in circulation (cash hoarding). The current real exchange rate coefficient has an adverse trend (substitution effect), while the first and second lag coefficients of real foreign currency rates have a positive sign (wealth factor). The current nominal exchange rate coefficient has a positive sign (wealth effect), while the first and second lags of the nominal exchange rate coefficients have a negative effect (substitution effect).

Table 3-5: Real Cash, Internet Payments, and Exchange Rates

DEPENDENT VARIABLE REAL CURRENCY IN CIRCULATION			
MODEL1		MODEL2	
VARIABLE	COEFFICIENT	VARIABLE	COEFFICIENT
C	0.0004 (0.004)	C	0.006 (0.005)
D(LNRINTERNET)	0.019 (0.02)	D(LNRINTERNET)	0.017 (0.02)
D (LNRINTERNET (-1))	-0.010 (0.02)	D (LNRINTERNET (-1))	-0.01 (0.02)
D(LNCTI)	-0.017 (0.025)	D(LNCTI)	-0.021 (0.025)
D (LNCTI (-1))	-0.067*** (0.026)	D (LNCTI (-1))	-0.065** (0.025)
D(IPI)	-0.001*** (0.0004)	D(IPI)	-0.001*** (0.0004)
D (IPI (-1))	-0.0007 (0.0005)	D (IPI (-1))	-0.0008* (0.0005)
D (IPI (-2))	-0.001*** (0.0005)	D (IPI (-2))	-0.001*** (0.0005)
D (IPI (-3))	-0.0007 (0.0004)	D (IPI (-3))	-0.0006 (0.0004)
D (LNRCASH (-1))	-0.1 (0.1)	D (LNRCASH (-1))	-0.09 (0.09)
D (LNRCASH (-2))	0.29*** (0.09)	D (LNRCASH (-2))	0.23** (0.09)
D(LNREXC)	**-0.35**** **(0.14)**	**D(LNEXC)**	**0.17** **(0.12)**
D (LNREXC (-1))	**0.4***** **(0.15)**	**D (LNEXC (-1))**	**-0.39***** **(0.13)**
D (LNREXC (-2))	**0.34**** **(0.14)**	**D (LNEXC (-2))**	**-0.22*** **(0.11)**
DUMMY	0.06** (0.023)	DUMMY	0.06*** (0.023)
DIAGNOSTIC		**DIAGNOSTIC**	
R-SQ	0.36	R-SQUARE	0.35
NORMALITY	Jarque-Bera:6.15 Prob:0.0.046	NORMALITY	Jarque-Bera: 6.41 PROB:0.041
LM	F (3,103): 0.74 Chi-Sq (3): 0.69	LM	F (3,103): 0.815 Chi-Sq (3):0.778
ARCH	F (3,114): 0.21 Chi-Sq (3): 0.21	ARCH	F (3,114):0.17 Chi-Sq (3):0.17
CUSUM/CUSUM-SQ	NO/YES	CUSUM/CUSUM-SQ	NO/YES

Notes: The characters "***, **, and *" denote 1 percent, 5 percent, and 10 percent significance levels, correspondingly.

4.1.3) Contactless Payments:

Table 3-6: Real cash, Contactless Payments, and Exchange Rates

DEPENDENT VARIABLE REAL CURRENCY IN CIRCULATION			
	MODEL1		MODEL2
VARIABLES	COEFFICIENTS	VARIABLES	COEFFICIENTS
C	0.0005 (0.004)	C	0.005 (0.005)
D(LNRCONTACTLESS)	-0.001 (0.007)	D(LNRCONTACTLESS)	-0.0006 (0.007)
D (LNRCONTACTLESS (-1))	-0.0003 (0.007)	D (LNRCONTACTLESS (-1))	0.001 (0.007)
D(LNCTI)	-0.019 (0.025)	D(LNCTI)	-0.02 (0.03)
D (LNCTI (-1))	-0.062** (0.025)	D (LNCTI (-1))	-0.061** (0.026)
D(IPI)	-0.001*** (0.0004)	D(IPI)	-0.0012*** (0.0004)
D (IPI (-1))	-0.0007 (0.0005)	D (IPI (-1))	-0.0008 (0.0005)
D (IPI (-2))	-0.001*** (0.0005)	D (IPI (-2))	-0.001*** (0.0005)
D (IPI (-3))	-0.0007* (0.0004)	D (IPI (-3))	-0.0007 (0.0004)
D (LNRCASH (-1))	-0.1 (0.1)	D (LNRCASH (-1))	-0.093 (0.094)
D (LNRCASH (-2))	0.27*** (0.09)	D (LNRCASH (-2))	0.22** (0.09)
D(LNREXC)	-0.35** (0.14)	D(LNEXC)	0.17 (0.12)
D (LNREXC (-1))	0.38** (0.15)	D (LNEXC (-1))	-0.39*** (0.13)
D (LNREXC (-2))	0.34** (0.14)	D (LNEXC (-2))	-0.21* (0.12)
DUMMY	0.06** (0.023)	DUMMY	0.062*** (0.023)
DIAGNOSTIC		**DIAGNOSTIC**	
R-SQ	0.36	R-SQ	0.34
NORMALITY	Jarque-berra:6.001 Prob:0.049	NORMALITY	Jarque-Bera: 6.06 PROB:0.048
LM	F (3,103): 0.58 Chi-Sq (3): 0.52	LM	F (3,103): 0.74 Chi-Sq (3):0.69
ARCH	F (3,114): 0.24 Chi-Sq (3): 0.235	ARCH	F (3,114):0.182 Chi-Sq (3):0.179
CUSUM/CUSUM SQ	No/yes	CUSUM/CUSUM SQ	NO/YES

Notes: The symbols" ***, **, and * "show significance levels of 1 percent, 5 percent, and 10 percent, successively.

In the two models, contactless payment coefficients are not statistically significant.

Like previous models, we obtained the same signs for the coefficients of IPI, COVID-19 restrictions, lag of real cash, CTI, and real and nominal exchange.

4.2) Payments and Interest Rate:

4.2.1) Credit Cards

4.2.1.1) Credit Cards and Deposit Interest Rate:

Table 3-7: Real Cash, Credit Cards, and Deposit Interest Rates

DEPENDENT VARIABLE REAL CURRENCY IN CIRCULATION			
	MODEL1		MODEL2
VARIABLE	COEFFICIENT	VARIABLE	COEFFICIENT
D(LNRCREDIT)	0.22** (0.09)	D(LNRCREDIT)	0.204** (0.083)
D (LNRCREDIT (-1))	0.14 (0.09)	D (LNRCREDIT (-1))	0.148* (0.083)
D(LNCTI)	-0.024 (0.03)	D(LNCTI)	-0.03 (0.025)
D (LNCTI (-1))	-0.043 (0.03)	D (LNCTI (-1))	-0.062** (0.026)
D(IPI)	-0.002*** (0.0006)	D(IPI)	-0.002*** (0.0006)
D (IPI (-1))	-0.002** (0.0007)	D (IPI (-1))	-0.002** (0.0006)
D (IPI (-2))	-0.002*** (0.0007)	D (IPI (-2))	-0.002** (0.0006)
D (IPI (-3))	-0.001* (0.0006)	D (IPI (-3))	-0.0009 (0.0006)
D (LNRCASH (-1))	-0.164 (0.10)	D (LNRCASH (-1))	-0.2* (0.10)
D (LNRCASH (-2))	0.11 (0.1)	D (LNRCASH (-2))	0.099 (0.091)
D(RINTEREST)	0.004 (0.002)	D(INTEREST)	-0.004* (0.021)
D (RINTEREST (-1))	0.003 (0.002)	D (INTEREST (-1))	-0.004** (0.002)
D (RINTEREST (-2))	-0.002 (0.002)	D (INTEREST (-2))	-0.006** (0.002)
D (RINTEREST (-3))	-0.003 (0.002)	D (INTEREST (-3))	-0.005** (0.002)
DUMMY	0.054* (0.03)	DUMMY	0.045* (0.03)
C	-0.003 (0.005)	C	-0.0032 (0.0043)
DIAGNOSTIC		**DIAGNOSTIC**	
R-SQ	0.31	R-SQ	0.37
NORMALITY	JARQUE-BERA: 3.874 PROB:0.144	NORMALITY	JARQUE-BERA:3.452 prob:0.177
LM	F (3,99): 0.048 χ^2 (3):0.03	LM	F (3,99): 0.5048 χ^2 (3): 0.4213
ARCH	F (3,114):0.161 χ^2 (3):0.158	ARCH	F (3,114):0.2431 χ^2 (3):0.2381
CUSUM/CUSUM SQ	NO/YES	CUSUM/CUSUM SQ	NO/YES

Note: The asterisk symbols *"***, **, and *"* represent significance for the levels of 1 percent, 5 percent, and 10 percent, correspondingly.

According to the above outcomes, The statistical significance of credit card coefficients is observed at a 5 per cent level in both models. However, the first lags of credit card coefficients lack statistical significance in any of the two models.

The coefficient values differ slightly, and the estimation outcomes demonstrate a positive influence on real cash in Models 1 and 2.

As in previous models, we obtained the same signs for the coefficients of IPI, COVID-19 restrictions, lag of real cash, and CTI.

The statistical significance of the coefficient of the first lagged CTI in Model 1 is not observed, while it is statistically significant and indicates an adverse implication on currency circulating in Model 2.

The first-lagged real cash in Model 2 demonstrates an adverse repercussion on real cash.

The current and lagged real deposit interest rate coefficients in Model 1 lack statistically significant in Model 1.

The current and lagged nominal deposit interest rate coefficients have small values and negative signs (substitution effect). An elevated interest rate on deposits serves as an incentive for individuals to retain time deposits.

4.2.1.2) Credit Cards and Bond Interest Rate:

In the second model, the coefficients associated with credit card payments exhibit statistical significance at a 5% level, whereas the coefficients corresponding to first-lagged credit cards do not demonstrate statistical significance. The model exhibits a favourable impact on cash.

The current and lags of the industrial production index (output gap) coefficients are statistically significant and have a small value. The model implies the same result as previous models, or, to put it differently, a negative relationship with real cash.

The coefficients of the first- and second-lagged real cash in Model 2 are not statistically significant.

The COVID-19 restrictions have uplifting repercussions for currency in circulation (cash hoarding).

The first lagged nominal bond interest rates have a small value and negative signs (the substitution effect).

Table 3-8: Real Cash, Credit Cards, and Bond Rates

DEPENDENT VARIABLE REAL CURRENCY IN CIRCULATION			
	MODEL1		MODEL2
VARIABLE	COEFFICIENT	VARIABLE	COEFFICIENT
D(LNRCREDIT)	0.14* (0.08)	D(LNRCREDIT)	0.18** (0.08)
D (LNRCREDIT (-1))	0.11 (0.08)	D (LNRCREDIT (-1))	0.13 (0.083)
D(LNCTI)	-0.03 (0.023)	D(LNCTI)	-0.05* (0.03)
D (LNCTI (-1))	-0.038 (0.025)	D (LNCTI (-1))	-0.063** (0.03)
D(IPI)	-0.002*** (0.0005)	D(IPI)	-0.002*** (0.0006)
D (IPI (-1))	-0.001** (0.0006)	D (IPI (-1))	-0.001* (0.0006)
D (IPI (-2))	-0.002*** (0.0005)	D (IPI (-2))	-0.001** (0.0005)
D (IPI (-3))	-0.0008* (0.0004)	D (IPI (-3))	-0.0006 (0.0004)
D (LNRCASH (-1))	-0.14 (0.1)	D (LNRCASH (-1))	-0.08 (0.1)
D (LNRCASH (-2))	0.13 (0.1)	D (LNRCASH (-2))	0.15 (0.094)
D (RBOND)	0.01*** (0.003)	D(BOND)	0.003 (0.003)
D (RBOND (-1))	0.002 (0.003)	D (BOND (-1))	-0.007* (0.004)
D (RBOND (-2))	0.0008 (0.003)	D (BOND (-2))	-0.0039 (0.004)
DUMMY	0.056** (0.02)	DUMMY	0.05** (0.02)
C	6.63E-05 (0.004)	C	-0.003 (0.004)
DIAGNOSTIC		**DIAGNOSTIC**	
R-SQ	0.37	R-SQ	0.31
NORMALITY	Jarque-berra: 1.74 PROB:0.419	NORMALITY	Jarque-berra: 4.52 Prob:0.10
LM	F (3,103): 0.78 χ^2 (3):0.74	LM	F (3,103): 0.94 χ^2 (3): 0.93
ARCH	F (3,114):0.11 χ^2 (3):0.11	ARCH	F (3,114): 0.16 χ^2 (3): 0.16
CUSUM/CUSUM SQ	NO/NO	CUSUM/CUSUM SQ	NO/YES

Notes: The symbols *''***, **, and *''* demonstrate 1 percent, 5 percent, and 10 percent significance levels, correspondingly.

4.2.2) Internet Payments

4.2.2.1) Internet Payments and Deposit Interest Rate:

Table 3-9: Real Cash, Internet Payments, and Deposit Interest Rates

DEPENDENT VARIABLE REAL CURRENCY IN CIRCULATION			
MODEL 1		MODEL2	
VARIABLE	COEFFICIENT	VARIABLE	COEFFICIENT
C	-0.0003	C	-0.0004
	(0.005)		(0.004)
D(LNRINTERNET)	0.010	D(LNRINTERNET)	0.015
	(0.021)		(0.021)
D (LNRINTERNET (-1))	-0.011	D (LNRINTERNET (-1))	-0.006
	(0.022)		(0.02)
D(LNCTI)	-0.03	D(LNCTI)	-0.04
	(0.025)		(0.024)
D (LNCTI (-1))	-0.021	D (LNCTI (-1))	-0.04*
	(0.025)		(0.025)
D(IPI)	-0.001**	D(IPI)	-0.0009**
	(0.0004)		(0.0004)
D (IPI (-1))	-0.0008	D (IPI (-1))	-0.0006
	(0.0005)		(0.0005)
D (IPI (-2))	-0.002***	D (IPI (-2))	-0.0013**
	(0.0005)		(0.0005)
D (IPI (-3))	-0.0007	D (IPI (-3))	-0.0005
	(0.0005)		(0.0004)
D (LNRCASH (-1))	-0.05	D (LNRCASH (-1))	-0.08
	(0.1)		(0.094)
D (LNRCASH (-2))	0.14	D (LNRCASH (-2))	0.13
	(0.1)		(0.09)
D(RINTEREST)	0.004	**D(INTEREST)**	**-0.005****
	(0.002)		**(0.002)**
D (RINTEREST (-1))	0.002	**D (INTEREST (-1))**	**-0.004****
	(0.002)		**(0.002)**
D (RINTEREST (-2))	-0.002	**D (INTEREST (-2))**	**-0.006*****
	(0.002)		**(0.002)**
D (RPINTEREST (-3))	-0.0024	**D (INTEREST (-3))**	**-0.004***
	(0.002)		**(0.002)**
DUMMY	0.05*	DUMMY	0.04
	(0.025)		(0.024)
DIAGNOSTIC		**DIAGNOSTIC**	
R-SQUARE	0.25	R-SQ	0.32
NORMALITY	Jarque-Bera: 11.29 PROB:0.0035	NORMALITY	Jarque-Bera: 3.77 PROB:(0.15)
LM	F (3,102): 0.71	LM	F (3,102): 0.71
	χ^2 (3):0.66		χ^2 (3):0.66
ARCH	F (3,114):0.05	ARCH	F (3,114):0.035
	χ^2 (3):0.05		χ^2 (3): 0.036
CUSUM/CUSUM SQ	NO/YES	CUSUM/CUSUM SQ	NO/YES

Notes: The asterisks symbols "***, **, and *" indicate 1 percent, 5 percent, and 10 percent significance levels, correspondingly.

The statistical significance of the coefficient of the first lagged CTI in Model 1 is not observed whereas it is statistically significant and indicates an adverse repercussion on currency in circulation in Model 2.

The current and second-lagged industrial production index (output gap) coefficients are statistically significant and have a small value. They show a negative relationship with real cash in both two models.

In both models, the statistical significance of the coefficients for the first and second-lagged real cash appears to be non-existent.

The COVID-19 restrictions have uplifting repercussions for currency in circulation (cash hoarding).

The current and lagged real deposit interest rate coefficients lack statistical significance in Model 1. On the other hand, the current and lagged nominal deposit interest rate coefficients in Model 2 have small values and negative signs (substitution effect).

4.2.2.2) Internet Payments and Bond Interest Rate:

According to the outcomes, the statistical significance of internet payments, CTI, and the real cash coefficients are not observed in both models.

The current and second-lagged industrial production index (output gap) coefficients are statistically significant and have a small value. They show a negative relationship with real cash in both two models.

The COVID-19 restrictions have uplifting repercussions for currency in circulation (cash hoarding).

The current real bond interest rate coefficient is statistically significant and implies a favourable association with currency circulation in Model 1. The first lagged nominal bond interest rate coefficient has a small value and negative signs (the substitution effect).

Table 3-10: Real Cash, Internet Payments, and Bond Rates

DEPENDENT VARIABLE REAL CURRENCY IN CIRCULATION			
	MODEL1	MODEL2	
VARIABLE	COEFFICIENT	VARIABLE	COEFFICIENT
C	0.002 (0.004)	C	-0.0009 (0.005)
D(LNRINTERNET)	0.020 (0.02)	D(LNRINTERNET)	0.01 (0.02)
D (LNRINTERNET (-1))	-0.01 (0.02)	D (LNRINTERNET (-1))	-0.01 (0.02)
D(LNCTI)	-0.03 (0.02)	D(LNCTI)	-0.04 (0.03)
D (LNCTI (-1))	-0.023 (0.023)	D (LNCTI (-1))	-0.04 (0.03)
D(IPI)	-0.001*** (0.0004)	D(IPI)	-0.001** (0.0004)
D (IPI (-1))	-0.0007 (0.0005)	D (IPI (-1))	-0.0003 (0.0005)
D (IPI (-2))	-0.002*** (0.0005)	D (IPI (-2))	-0.001** (0.0005)
D (IPI (-3))	-0.0008* (0.0004)	D (IPI (-3))	-0.0007 (0.0004)
D (LNRCASH (-1))	-0.08 (0.1)	D (LNRCASH (-1))	0.001 (0.1)
D (LNRCASH (-2))	0.15 (0.1)	D (LNRCASH (-2))	0.14 (0.1)
D(RBOND)	**0.011*** **(0.003)**	**D(BOND)**	**0.004** **(0.004)**
D (RBOND (-1))	**0.0012** **(0.003)**	**D (BOND (-1))**	**-0.008*** **(0.004)**
D (RBOND (-2))	**-0.0002** **(0.003)**	**D (BOND (-2))**	**-0.004** **(0.004)**
DUMMY	0.05** (0.02)	DUMMY	0.05** (0.25)
DIAGNOSTIC		**DIAGNOSTIC**	
R-SQUARE	0.35	R-SQ	0.25
NORMALITY	Jarque-Bera: 2.63 PROB:0.27	NORMALITY	Jarque-Bera: 12.33 PROB:(0.002)
LM	F (3,103): 0.67 Chi-Sq (3):0.61	LM	F (3,103): 0.975 Chi-Sq (3):0.968
ARCH	F (3,114):0.065 Chi-Sq (3):0.065	ARCH	F (3,114):0.027 Chi-Sq (3): 0.028
CUSUM/CUSUM SQ	NO/YES	CUSUM/CUSUM SQ	NO/YES

Notes: The "***, **, and *" denote significant levels of 1 percent, 5 percent, and 10 percent, correspondingly.

4.2.3) Contactless Payment

4.2.3.1) Contactless Payments and Deposit Rates:

Table 3-11: Real Cash, Contactless Payments, and Deposit Rates

DEPENDENT VARIABLE REAL CURRENCY IN CIRCULATION			
	MODEL1		MODEL2
VARIABLE	COEFFICIENT	VARIABLE	COEFFICIENT
C	-0.0004	C	-0.0002
	(0.005)		(0.004)
D(LNRCONTACTLESS)	0.0003	D(LNRCONTACTLESS)	-0.0018
	(0.008)		(0.008)
D (LNRCONTACTLESS (-1))	0.0009	D (LNRCONTACTLESS (-1))	-0.002
	(0.008)		(0.008)
D(LNCTI)	-0.029	D(LNCTI)	-0.04
	(0.025)		(0.025)
D (LNCTI (-1))	-0.02	D (LNCTI (-1))	-0.04
	(0.03)		(0.025)
D(IPI)	-0.001**	D(IPI)	-0.0008*
	(0.0004)		(0.0004)
D (IPI (-1))	-0.0008	D (IPI (-1))	-0.0005
	(0.0005)		(0.0005)
D (IPI (-2))	-0.002***	D (IPI (-2))	-0.001**
	(0.0005)		(0.0005)
D (IPI (-3))	-0.0007	D (IPI (-3))	-0.0005
	(0.0005)		(0.0004)
D (LNRCASH (-1))	-0.05	D (LNRCASH (-1))	-0.08
	(0.1)		(0.094)
D (LNRCASH (-2))	0.13	D (LNRCASH (-2))	0.124
	(0.094)		(0.09)
D(RINTEREST)	**0.004**	D(INTEREST)	-0.005**
	(0.002)		(0.002)
D (RINTEREST (-1))	**0.002**	D (INTEREST (-1))	-0.004**
	(0.002)		(0.002)
D (RINTEREST (-2))	**-0.002**	D (INTEREST (-2))	-0.006**
	(0.002)		(0.002)
D (RINTEREST (-3))	**-0.002**	D (INTEREST (-3))	-0.004*
	(0.002)		(0.002)
DUMMY	0.05*	DUMMY	0.038
	(0.025)		(0.024)
DIAGNOSTIC		**DIAGNOSTIC**	
R-SQ	0.25	R-SQ	0.31
NORMALITY	Jarque-Bera: 10.99 PROB:0.0041	NORMALITY	Jarque-Bera: 3.83 PROB:(0.15)
LM	F (3,102): 0.44 χ^2 (3):0.37	LM	F (3,102): 0.81 χ^2 (3):0.77
ARCH	F (3,114):0.055 χ^2 (3):0.056	ARCH	F (3,114):0.0495 χ^2 (3): 0.05
CUSUM/CUSUM SQ	NO/YES	CUSUM/CUSUM SQ	NO/YES

Notes: The symbols "***, **, and *" indicate 1 %, 5 % and 10 % significance levels, successively.

The coefficients of internet payments, CTI, and real cash are not statistically significant in either model.

The current and second-lagged industrial production index (output gap) coefficients are statistically significant and have a small value. They show a negative relationship with real cash in both two models.

The COVID-19 restrictions have a positive effect on currency in circulation (cash hoarding).

Like the previous estimation findings, the real deposit interest rate coefficients lack statistical significance in Model 1. The nominal bond interest rate coefficients have small values and negative signs (the substitution effect).

4.2.3.2) Contactless Payments and Bond Rates:

In the two models, the coefficients of untouched payments, CTI, and real cash are not statistically significant.

The current, second-, and third-lagged industrial production index (output gap) coefficients in Model 1 are statistically significant, while the current and the second-lagged output gaps in the second model are statistically significant. They have small values that show a negative relationship with real cash in the two models.

The COVID-19 restrictions have uplifting repercussions for currency in circulation (cash hoarding).

The coefficients of the current real bond interest rate are statistically significant and imply a positive relationship with the currency in circulation in Model 1. In addition, the first-lagged nominal bond interest rate coefficients have small values and negative signs (substitution effect).

Table 3-12: Real Cash, Contactless Payments, and Bond Rates

DEPENDENT VARIABLE REAL CURRENCY IN CIRCULATION			
	MODEL1		MODEL2
VARIABLE	COEFFICIENT	VARIABLE	COEFFICIENT
C	0.002	C	-0.0008
	(0.004)		(0.005)
D(LNRCONTACTLESS)	-0.003	D(LNRCONTACTLESS)	-0.001
	(0.007)		(0.008)
D (LNRCONTACTLESS (-1))	0.0002	D (LNRCONTACTLESS (-1))	-0.0001
	(0.007)		(0.008)
D(LNCTI)	-0.032	D(LNCTI)	-0.04
	(0.023)		(0.03)
D (LNCTI (-1))	-0.02	D (LNCTI (-1))	-0.037
	(0.023)		(0.03)
D(IPI)	-0.001***	D(IPI)	-0.0009**
	(0.0004)		(0.0004)
D (IPI (-1))	-0.0007	D (IPI (-1))	-0.0003
	(0.0005)		(0.0005)
D (IPI (-2))	-0.002***	D (IPI (-2))	-0.001**
	(0.0005)		(0.0005)
D (IPI (-3))	-0.0008*	D (IPI (-3))	-0.0007
	(0.0004)		(0.0005)
D (LNRCASH (-1))	-0.08	D (LNRCASH (-1))	0.0009
	(0.1)		(0.1)
D (LNRCASH (-2))	0.14	D (LNRCASH (-2))	0.14
	(0.1)		(0.1)
D(RBOND)	0.011***	**D(BOND)**	**0.004**
	(0.003)		**(0.004)**
D (RBOND (-1))	0.001	**D (BOND (-1))**	**-0.007***
	(0.003)		**(0.004)**
D (RBOND (-2))	-6.99E-05	**D (BOND (-2))**	**-0.004**
	(0.003)		**(0.004)**
DUMMY	0.05**	DUMMY	0.05**
	(0.02)		(0.03)
DIAGNOSTIC		**DIAGNOSTIC**	
R-SQ	0.35	R-SQ	0.25
NORMALITY	Jarque-Bera: 2.35 PROB:0.31	NORMALITY	Jarque-Bera: 12.15 PROB:(0.002)
LM	F (3,103): 0.61 Chi-Sq (3):0.55	LM	F (3,103): 0.99 Chi-Sq (3):0.99
ARCH	Prob. F (3,114):0.074 Prob. Chi-Square (3):0.074	ARCH	F (3,114):0.03 Chi-Sq (3): 0.032
CUSUM/CUSUM SQ	NO/YES	CUSUM/CUSUM SQ	NO/YES

Notes: The characters "***, **, and *" represent 1 percent, 5 percent, and 10 percent significance levels, successively.

4.3) Payments, Real Exchange Rate and Nominal Interest Rate:

4.3.1) Credit Cards:

Table 3-13: Real Cash, Credit Cards, Real, Exchange Rate and Nominal Interest Rates

DEPENDENT VARIABLE REAL CURRENCY IN CIRCULATION			
	MODEL1		MODEL2
VARIABLE	COEFFICIENT	VARIABLE	COEFFICIENT
C	-0.002	C	-0.001
	(0.004)		(0.004)
D(LNRCREDIT)	0.16**	D(LNRCREDIT)	0.17**
	(0.08)		(0.08)
D (LNRCREDIT (-1))	0.09	D (LNRCREDIT (-1))	0.06
	(0.08)		(0.08)
D(LNREXC)	-0.44***	D(LNREXC)	-0.39**
	(0.14)		(0.17)
D (LNREXC (-1))	0.24	D (LNREXC (-1))	0.23
	(0.16)		(0.17)
D (LNREXC (-2))	0.26*	D (LNREXC (-2))	0.36**
	(0.15)		(0.16)
D(LNCTI)	-0.01	D(LNCTI)	-0.02
	(0.02)		(0.03)
D (LNCTI (-1))	-0.08***	D (LNCTI (-1))	-0.08***
	(0.03)		(0.03)
D(IPI)	-0.002***	D(IPI)	-0.002***
	(0.0005)		(0.0005)
D (IPI (-1))	-0.001**	D (IPI (-1))	-0.001*
	(0.0006)		(0.0006)
D (IPI (-2))	-0.001***	D (IPI (-2))	-0.001**
	(0.0005)		(0.0005)
D (IPI (-3))	-0.0008**	D (IPI (-3))	-0.0008*
	(0.0004)		(0.0004)
DUMMY	0.04*	DUMMY	0.05**
	(0.02)		(0.02)
D (LNRCASH (-1))	-0.23**	D (LNRCASH (-1))	-0.17
	(0.1)		(0.1)
D (LNRCASH (-2))	0.24***	D (LNRCASH (-2))	0.25**
	(0.09)		(0.1)
D(INTEREST)	-0.005**	**D(BOND)**	**-0.002**
	(0.002)		**(0.004)**
D (INTEREST (-1))	-0.001	**D (BOND (-1))**	**-0.004**
	(0.002)		**(0.004)**
D (INTEREST (-2))	-0.004	**D (BOND (-2))**	**0.002**
	(0.002)		**(0.004)**
D (INTEREST (-3))	-0.004*		
	(0.002)		
DIAGNOSTIC		**DIAGNOSTIC**	
R-SQ	0.46	R-SQ	0.39
NORMALITY	Jarque-Bera:6.01	NORMALITY	Jarque-Bera: 2.78
	Prob:0.049		Prob.:0.25
LM	F (3,99):0.69	LM	F (3,100): 0.68
	χ^2 (3): 0.62		χ^2 (3): 0.61
ARCH	F (3,114): 0.387	ARCH	F (3,114): 0.29
	χ^2 (3): 0.378		χ^2 (3): 0.286
CUSUM/ CUSUM SQ	NO/YES	CUSUM/CUSUM SQ	NO/YES

Notes: The symbols "***, **, and *" show 1 percent, 5 percent, and 10 percent significance levels, respectfully.

Based on the outcomes, the coefficients of the credit card variable exhibit statistical significance at a 5% level in both models, whereas the coefficients of the first-lagged credit card variable do not demonstrate statistical significance in either of the two models. Although there are some discrepancies in the coefficient values (0.16 and 0.17), both model 1 and model 2 exhibit a favourable impact on cash.

Like previous models, we obtained the same signs for the coefficients of IPI, COVID-19 restrictions lag of real cash and CTI.

The current real foreign currency rate coefficient has an adverse trend (substitution factor), while the second lag of real exchange rate coefficients poses an uplifting effect (wealth factor) in the two models. In the first model, we obtained an adverse interaction between the nominal deposit interest rate and the real currency in circulation, whereas the coefficients of bond interest rates in the second model are not statistically significant.

4.3.2) Internet Payments:

Reviewing estimation outcomes, it can be concluded that the Internet payment coefficients in both models lack statistical significance.

The coefficients of IPI, the lag of real cash, the COVID-19 restriction, the CTI, and real exchange rates all had the same sign as in earlier models.

While the nominal bond rate coefficients lack statistical significance, the current nominal deposit interest rate coefficient has a small value and negative signs (the substitution effect).

Table 3-14: Real Cash, Internet Payments, Real Exchange, and Nominal Interest Rates

DEPENDENT VARIABLE REAL CURRENCY IN CIRCULATION			
	MODEL1		MODEL2
VARIABLE	COEFFICIENT	VARIABLE	COEFFICIENT
C	-0.0002	C	0.0003
	(0.004)		(0.004)
D(LNRINTERNET)	0.02	D(LNRINTERNET)	0.018
	(0.02)		(0.02)
D (LNRINTERNET (-1))	-0.004	D (LNRINTERNET (-1))	-0.01
	(0.02)		(0.02)
D(LNREXC)	-0.49***	D(LNREXC)	-0.35**
	(0.15)		(0.17)
D (LNREXC (-1))	0.34**	D (LNREXC (-1))	0.34**
	(0.16)		(0.17)
D (LNREXC (-2))	0.24	D (LNREXC (-2))	0.375**
	(0.16)		(0.161)
D(LNCTI)	-0.014	D(LNCTI)	-0.019
	(0.024)		(0.03)
D (LNCTI (-1))	-0.07***	D (LNCTI (-1))	-0.06**
	(0.03)		(0.03)
D(IPI)	-0.001***	D(IPI)	-0.001***
	(0.0004)		(0.0004)
D (IPI (-1))	-0.0008*	D (IPI (-1))	-0.0007
	(0.0005)		(0.0005)
D (IPI (-2))	-0.001***	D (IPI (-2))	-0.001***
	(0.0005)		(0.0005)
D (IPI (-3))	-0.0008*	D (IPI (-3))	-0.0007*
	(0.0004)		(0.0004)
DUMMY	0.04*	DUMMY	0.056**
	(0.02)		(0.024)
D (LNRCASH (-1))	-0.16	D (LNRCASH (-1))	-0.09
	(0.1)		(0.1)
D (LNRCASH (-2))	0.26***	D (LNRCASH (-2))	0.26***
	(0.09)		(0.1)
D(INTEREST)	**-0.006*** **	**D(BOUND)**	**0.0003**
	(0.002)		**(0.004)**
D (INTEREST (-1))	**-0.001**	**D (BOUND (-1))**	**-0.003**
	(0.002)		**(0.004)**
D (INTEREST (-2))	**-0.003**	**D (BOUND (-2))**	**0.002**
	(0.002)		**(0.004)**
D (INTEREST (-3))	**-0.003**		
	(0.002)		
DIAGNOSTIC		**DIAGNOSTIC**	
R-SQ	0.44	R-SQ	0.37
NORMALITY	Jarque-Bera: 5.31	NORMALITY	Jarque-Bera: 5.71
	PROB:(0.07)		PROB:(0.057)
LM	F (3,99): 0.86	LM	F (3,100): 0.734
	χ^2 (3):0.82		χ^2 (3):0.675
ARCH	F (3,114):0.09	ARCH	F (3,114):0.163
	χ^2 (3): 0.09		χ^2 (3): 0.161
CUSUM/CUSUM SQ	NO/YES	CUSUM/CUSUM SQ	NO/YES

Notes: The "***, **, and *" indicate 1 %, 5 % and 10 % significance levels, successively.

4.3.3) Contactless Payments:

Table 3-15: Real Cash, Contactless Payments, Real Exchange, and Nominal Interest Rates

DEPENDENT VARIABLE REAL CURRENCY IN CIRCULATION			
	MODEL1		MODEL2
VARIABLE	COEFFICIENT	VARIABLE	COEFFICIENT
C	7.13E-05	C	0.0003
	(0.004)		(0.004)
D(LNRCONTACTLESS)	-0.003	D(LNRCONTACTLESS)	-0.001
	(0.007)		(0.007)
D (LNRCONTACTLESS (-1))	-0.001	D (LNRCONTACTLESS (-1))	3.81E-05
	(0.01)		(0.01)
D(LNREXC)	-0.490***	D(LNREXC)	-0.35**
	(0.15)		(0.17)
D (LNREXC (-1))	0.32**	D (LNREXC (-1))	0.32*
	(0.16)		(0.17)
D (LNREXC (-2))	0.24	D (LNREXC (-2))	0.37**
	(0.15)		(0.16)
D(LNCTI)	-0.02	D(LNCTI)	-0.02
	(0.03)		(0.03)
D (LNCTI (-1))	-0.064**	D (LNCTI (-1))	-0.06**
	(0.02)		(0.03)
D(IPI)	-0.001***	D(IPI)	-0.001***
	(0.0004)		(0.000)
D (IPI (-1))	-0.001	D (IPI (-1))	-0.001
	(0.001)		(0.001)
D (IPI (-2))	-0.001***	D (IPI (-2))	-0.0013***
	(0.001)		(0.001)
D (IPI (-3))	-0.001**	D (IPI (-3))	-0.001*
	(0.0004)		(0.0004)
DUMMY	0.04*	DUMMY	0.06**
	(0.02)		(0.02)
D (LNRCASH (-1))	-0.16	D (LNRCASH (-1))	-0.09
	(0.1)		(0.1)
D (LNRCASH (-2))	0.25***	D (LNRCASH (-2))	0.25**
	(0.09)		(0.10)
D(INTEREST)	**-0.01*** **	**D(BOND)**	**4.50E-05**
	(0.002)		**(0.004)**
D (INTEREST (-1))	**-0.001**	**D (BOND (-1))**	**-0.003**
	(0.002)		**(0.004)**
D (INTEREST (-2))	**-0.003**	**D (BOND (-2))**	**0.002**
	(0.002)		**(0.004)**
D (INTEREST (-3))	**-0.003**		
	(0.002)		
DIAGNOSTIC		**DIAGNOSTIC**	
R-SQ	0.43	R-SQ	0.36
NORMALITY	Jarque-Bera: 5.13	NORMALITY	Jarque-Bera: 5.515
	PROB:(0.077)		PROB:(0.063)
LM	F (3,99): 0.79	LM	F (3,100): 0.68
	Chi-Sq (3):0.74		Chi-Sq (3):0.62
ARCH	F (3,114):0.125	ARCH	F (3,114):0.17
	Chi-Sq (3): 0.123		Chi-Sq (3): 0.17
CUSUM/CUSUM SQ	NO/YES	CUSUM/CUSUM SQ	NO/YES

Notes: The "***, **, and *" symbolize significance levels of 1%, 5%, and 10%, respectfully.

In both models, the contactless payment coefficients are statistically insignificant.

We derived the same signs for the coefficients of IPI, first-lag real cash, nominal deposit interest rates, CTI, COVID-19 limitations, and real exchange rates as I accomplished for the previous two models. The nominal bond rate coefficients are not statistically significant.

4.4) Payments, Real Exchange and Real Interest

4.4.1) Credit Cards:

According to the results, the coefficients associated with credit cards exhibit statistical significance at a 5% level in both models, while the first-lagged credit card coefficients are not statistically significant in either model. Despite minor varying in coefficient values, they (0.17 and 0.14) demonstrate an uplifting bearing on cash in Model 1 and Model 2.

The coefficients of IPI, first-lagged real cash, CTI, and COVID-19 restrictions have the same signs as they did for the earlier models that we estimated.

The current real exchange rate coefficients in both models have a negative sign (substitution effect), while the first and second lagged rex in Model 1 and the second lagged real exchange rate coefficient in Model 2 have a positive sign (wealth effect).

The coefficient for the current real bond interest rate in Model 2 exhibits statistical significance and suggests a positive interaction with currency circulation. Moreover, the real deposit interest rate coefficients lack statistical significance.

Table 3-16: Real Cash, Credit Cards, Real Interest Rates and Real Foreign Currency Rate

DEPENDENT VARIABLE REAL CURRENCY IN CIRCULATION			
	MODEL1		MODEL2
VARIABLE	COEFFICIENT	VARIABLE	COEFFICIENT
C	-0.0008	C	0.0004
	(0.004)		(0.004)
D(LNRCREDIT)	0.17**	D(LNRCREDIT)	0.14*
	(0.08)		(0.08)
D (LNRCREDIT (-1))	0.06	D (LNRCREDIT (-1))	0.06
	(0.08)		(0.077)
D(LNREXC)	-0.32**	D(LNREXC)	-0.27*
	(0.14)		(0.14)
D (LNREXC (-1))	0.32*	D (LNREXC (-1))	0.13
	(0.16)		(0.17)
D (LNREXC (-2))	0.31**	D (LNREXC (-2))	0.36**
	(0.15)		(0.14)
D(LNCTI)	-0.02	D(LNCTI)	-0.013
	(0.03)		(0.03)
D (LNCTI (-1))	-0.08***	D (LNCTI (-1))	-0.06**
	(0.03)		(0.03)
D(IPI)	-0.002***	D(IPI)	-0.002***
	(0.0005)		(0.0005)
D (IPI (-1))	-0.001**	D (IPI (-1))	-0.001**
	(0.0006)		(0.0006)
D (IPI (-2))	-0.001**	D (IPI (-2))	-0.001***
	(0.001)		(0.001)
D (IPI (-3))	-0.001**	D (IPI (-3))	-0.001**
	(0.0004)		(0.0004)
DUMMY	0.05**	DUMMY	0.06**
	(0.02)		(0.02)
D (LNRCASH (-1))	-0.17*	D (LNRCASH (-1))	-0.18*
	(0.1)		(0.1)
D (LNRCASH (-2))	0.27***	D (LNRCASH (-2))	0.20**
	(0.10)		(0.1)
D(RINTEREST)	0.0005	D(RBOND)	0.008***
	(0.002)		(0.003)
D (RINTEREST (-1))	0.002	D (RBOND (-1))	-0.002
	(0.002)		(0.003)
D (RINTEREST (-2))	-8.38E-05	D (RBOND (-2))	0.003
	(0.002)		(0.003)
D (RINTEREST (-3))	-0.002		
	(0.002)		
DIAGNOSTIC		**DIAGNOSTIC**	
R-SQUARE	0.39	R-SQUARE	0.43
NORMALITY	Jarque-Bera: 3.57	NORMALITY	Jarque-Bera: 1.15
	PROB:0.168		PROB:0.56
LM	F (3,99): 0.59	LM	F (3,100): 0.75
	Chi-Sq (3):0.51		Chi-Sq (3):0.66
ARCH	F (3,114):0.44	ARCH	F (3,114):0.12
	Chi-Sq (3):0.43		Chi-Sq (3):0.11
CUSUM/CUSUM SQ	NO/YES	CUSUM/CUSUM SQ	NO/YES

Notes: The symbols "***, **, and *" denote significance levels of 1 percent, 5 percent, and 10 percent, successively.

4.4.2) Internet Payments:

Table 3-17: Real Cash, Internet Payments, Real Interest Rates and Real Foreign Currency Rate

DEPENDENT VARIABLE REAL CURRENCY IN CIRCULATION			
	MODEL1		MODEL2
VARIABLE	COEFFICIENT	VARIABLE	COEFFICIENT
C	0.0005	C	0.002
	(0.004)		(0.004)
D(LNRINTERNET)	0.02	D(LNRINTERNET)	0.02
	(0.02)		(0.02)
D (LNRINTERNET (-1))	-0.01	D (LNRINTERNET (-1))	-0.01
	(0.02)		(0.02)
D(LNREXC)	-0.35**	D(LNREXC)	-0.28**
	(0.15)		(0.14)
D (LNREXC (-1))	0.42***	D (LNREXC (-1))	0.18
	(0.16)		(0.17)
D (LNREXC (-2))	0.30*	D (LNREXC (-2))	0.36**
	(0.15)		(0.14)
D(LNCTI)	-0.02	D(LNCTI)	-0.01
	(0.03)		(0.02)
D (LNCTI (-1))	-0.07**	D (LNCTI (-1))	-0.05**
	(0.03)		(0.03)
D(IPI)	-0.001***	D(IPI)	-0.001***
	(0.0004)		(0.0004)
D (IPI (-1))	-0.0008	D (IPI (-1))	-0.0008*
	(0.0005)		(0.0005)
D (IPI (-2))	-0.001***	D (IPI (-2))	-0.002***
	(0.0005)		(0.0005)
D (IPI (-3))	-0.0008*	D (IPI (-3))	-0.0008**
	(0.0004)		(0.0004)
DUMMY	0.05**	DUMMY	0.06**
	(0.02)		(0.02)
D (LNRCASH (-1))	-0.10	D (LNRCASH (-1))	-0.12
	(0.1)		(0.1)
D (LNRCASH (-2))	0.28***	D (LNRCASH (-2))	0.22**
	(0.1)		(0.09)
D(RINTEREST)	-9.00E-05	D(RBOND)	0.008***
	(0.002)		(0.003)
D (RINTEREST (-1))	0.002	D (RBOND (-1))	-0.003
	(0.002)		(0.003)
D (RINTEREST (-2))	-0.0003	D (RBOND (-2))	0.003
	(0.002)		(0.003)
D (RINTEREST (-3))	-0.001		
	(0.002)		
DIAGNOSTIC		**DIAGNOSTIC**	
R-SQ	0.37	R-SQ	0.43
NORMALITY	Jarque-bera:6.95	NORMALITY	Jarque-bera:1.21
	Prob:0.0.031		Prob:0.546
LM	F (3,99): 0.73	LM	F (3,95): 0.5891
	Chi-Sq (3): 0.67		Chi-Sq (3): 0.4920
ARCH	F (3,114): 0.2	ARCH	F (3,114): 0.0726
	Chi-Sq (3): 0.2		Chi-Sq (3): 0.0726
CUSUM/CUSUM SQ	NO/YES	CUSUM/CUSUM SQ	NO/YES

Notes: The "***, **, and *" indicate 1 percent, 5 percent, and 10 percent significance levels, successively.

The statistical analysis reveals that the coefficients associated with internet payments lack statistical significance.

As in the previous two models, the same signs for the coefficients of IPI, first-lag real cash, CTI, and COVID-19 limitations are derived.

The current real exchange rate coefficients in both models have a negative sign (substitution effect), while the first and second lagged rex in Model 1 and the second lagged real exchange rate coefficient in Model 2 have a positive sign (wealth factor).

The coefficient for the current real bond interest rate in Model 2 is found to be statistically significant, indicating an uplifting effect on currency circulation. Additionally, the coefficients for the real deposit interest rate appear to have no significance in statistical terms.

4.4.3) Contactless Payments:

In either model, the statistical analysis indicates that the coefficients of contactless payments do not exhibit substantial statistical significance.

The coefficients of IPI, the lag of real cash, the COVID-19 restriction, the CTI, and real exchange rates all had the same sign as in earlier models.

The coefficient for the current real bond interest rate in Model 2 is found to be statistically significant, indicating a positive association with currency circulation. Furthermore, the coefficients of the real deposit interest rate are found to have no significance in statistical terms.

Table 3-18: Real Cash, Contactless Payments, Real Interest and Real Foreign Currency Rates

DEPENDENT VARIABLE REAL CURRENCY IN CIRCULATION			
	MODEL1		MODEL2
VARIABLE	COEFFICIENT	VARIABLE	COEFFICIENT
C	0.0006	C	0.002
	(0.004)		(0.004)
D(LNRCONTACTLESS)	-0.0016	D(LNRCONTACTLESS)	-0.003
	(0.008)		(0.007)
D (LNRCONTACTLESS (-1))	5.98E-05	D (LNRCONTACTLESS (-1))	0.0009
	(0.007)		(0.007)
D(LNREXC)	-0.35**	D(LNREXC)	-0.28**
	(0.15)		(0.14)
D (LNREXC (-1))	0.41**	D (LNREXC (-1))	0.16
	(0.16)		(0.18)
D (LNREXC (-2))	0.3*	D (LNREXC (-2))	0.36**
	(0.15)		(0.14)
D(LNCTI)	-0.02	D(LNCTI)	-0.01
	(0.03)		(0.02)
D (LNCTI (-1))	-0.06**	D (LNCTI (-1))	-0.05*
	(0.03)		(0.03)
D(IPI)	-0.001***	D(IPI)	-0.001***
	(0.0004)		(0.0004)
D (IPI (-1))	-0.0008	D (IPI (-1))	-0.0008*
	(0.0005)		(0.0005)
D (IPI (-2))	-0.001***	D (IPI (-2))	-0.002***
	(0.0005)		(0.0005)
D (IPI (-3))	-0.0008*	D (IPI (-3))	-0.0009**
	(0.0004)		(0.0004)
DUMMY	0.05**	DUMMY	0.06**
	(0.02)		(0.02)
D (LNRCASH (-1))	-0.10	D (LNRCASH (-1))	-0.12
	(0.1)		(0.1)
D (LNRCASH (-2))	0.3***	D (LNRCASH (-2))	0.21**
	(0.1)		(0.09)
D(RINTEREST)	**-0.0002**	**D(RBOND)**	**0.008*** **
	(0.002)		**(0.003)**
D (RINTEREST (-1))	**0.002**	**D (RBOND (-1))**	**-0.003**
	(0.002)		**(0.003)**
D (RINTEREST (-2))	**-0.0003**	**D (RBOND (-2))**	**0.003**
	(0.002)		**(0.003)**
D (RINTEREST (-3))	**-0.001**		
	(0.002)		
DIAGNOSTIC		**DIAGNOSTIC**	
R-SQ	0.36	R-SQ	0.42
NORMALITY	Jarque-Bera: 6.75	NORMALITY	Jarque-Bera: 0.134
	Prob:0.034		Prob:0.51
LM	F (3,99): 0.59	LM	F (3,100): 0.66
	Chi-Sq (3): 0.51		Chi-Sq (3): 0.59
ARCH	F (3,114): 0.23	ARCH	F(3,114): 0.086
	Chi-Sq (3): 0.22		Chi-Sq(3):0.086
CUSUM/CUSUM SQ	NO/YES	CUSUM/CUSUM SQ	NO/YES

Notes: "The ***, **, and *" indicate 1 percent, 5 percent, and 10 percent significance levels, correspondingly.

5) CONCLUSION

The discussions about the transition to central bank digital cash are intended to anticipate and mitigate potential issues such as technical difficulties, financial stability, monetary policy, and payment techniques security. Despite the experience of cryptocurrencies, the creation of digital cash by the government will create newly anticipated and unforeseen scenarios. Hence, many governments and central banks initially try to prepare a safe payment system and complete the phase of transition to digitization. Digital money is expected to alter monetary policy, financial structure, and monetary hierarchy (deposit, loan, and reserve money) in the future. However, because some of these changes will occur within the context of future applications and needs, central banks are more focused on digital money, which is analogous to physical money. The need for physical cash will determine the stages and timing of this transition for a variety of reasons. In other words, analyzing the change in demand for cash in circulation provides valuable information for developing a roadmap and resolving complex problems.

Based on this, this research focuses on the impact of various widely used payment methods and the COVID-19 restrictions on cash demand to clarify the potential connection between digital currency (CBDC) and actual cash. The numerous payment options (credit cards, internet payments, and untouched payments), opportunity cost variables (exchange and interest rates), the impact of COVID-19 restrictions, the output gap, and the consumer tendency index are the main parameters that we prioritize.

Our findings indicate a negative relationship with nominal deposit interest rates. Nonetheless, no significant interactions are observed with respect to real deposit interest rates. This finding aligns with the prior studies conducted by Yilmazkuday and Yazgan (2009) as well as Ari (2008), indicating that interest rates exert a substitution impression on the quantity of currency in circulation. Furthermore, the incorporation of bond rates is essential for understanding the implications of monetary policy. The findings reveal that real bond interest rates exert an upward repercussion on real cash, whereas nominal interest rates exhibit an adverse linkage. However, it is worth noting that fewer models yielded statistically significant outcomes for nominal bond interest rates.

The outcome of the exchange rate on domestic demand for money might exhibit either a favorable or adverse relationship. Currency depreciation exerts a downward bearing on money demand if the public expects further depreciation, namely, the substitution effect. An exchange rate increase would boost their wealth by

raising the value of their foreign assets. To preserve a set percentage of their wealth invested in domestic assets, they will convert a portion of their foreign investments into their country's assets. Depreciation of the currency would therefore result in more demand for domestic currency. According to the results, the current elasticity of real exchange rates has an adverse effect (substitution effect); however, the first and second-lagged coefficients of REXC have a positive repercussion (wealth factor) on the currency. On the other hand, it ought to be considered to acknowledge the current nominal foreign currency rate exhibits a positive sign, indicating the presence of a wealth factor. Conversely, the lagged nominal foreign currency rate demonstrates an adverse sign, implying the existence of a substitution influence.

The consumer tendency index is a leading indicator to evaluate as a proxy for estimating household income as well as demonstrating how optimistic or pessimistic consumers are regarding their financial situation and expectations. The first lag coefficient of CTI has an adverse effect. The negative and significant relationship with currency in circulation may be due to the greater benefits of credit card usage over cash payments. As we know, credit card use allows households to overcome short-term budget constraints by providing options such as instalments and payment postponements.

The “positive output gap” is characterized by a situation where the realized output surpasses the potential production. When demand is high factories surpass their ability to operate in order to cope with the demand. “A negative output gap” is observed when the actual output of an economy falls below its maximum potential output at full capacity, in other words, the economy has excess capacity. The output gap's current and lagged coefficients and real money have an adverse correlation. This outcome does not comply with our expectations as the literature suggests that a rise in income ought to culminate in an increase in cash. It is expected that they will move in the same direction since growth in income is expected to lead to a rise in cash.

During the global pandemic, the widespread use of the internet and contactless payments would be expected to lead to a decline in cash demand, yet they demonstrated a positive correlation with cash demand. This depicts the currency hoarding that occurred as a result of the panic that the COVID-19 restrictions engendered.

Hence, it can be concluded that credit cards positively affect real currency in circulation. The positive contribution of card payments to real cash obtained for Turkey indicates the opposite result of the previous studies (Yilmazkuday & Yazgan (2009)) that achieved an adverse linkage between credit card payments and real currency in circulation. This result we obtained does not comply with our expectations since it is commonly expected that the widespread usage of credit cards will conduce to a decline in the requirement

for cash. The result can be explained in different ways. Credit card payments enable consumers to overcome budgetary constraints; therefore, consumers can continue to pay in cash without adversely affecting the real currency in circulation. Cash privacy, the informal economy, and traditional payment habits are the other causes of this outcome. The paper did not provide any significant findings about the influence of the Internet and contactless payments.

The study stands out significantly from previous ones in that it examines the period during which e-payments, e-money, and contactless payments improved the most, as well as the bearing of the COVID-19 restrictions. The foreign currency rate is also incorporated into our model as it is a significant opportunity cost variable which influences both inflation and the demand for cash and money. The inclusion of the consumption tendency index into the model, as a leading indicator, is another significant contribution.

Nonetheless, the study may have several possible limitations. For instance, the study does not address how e-payments and e-money influence the effectiveness and transmission channels of monetary policy. Despite this limitation, our research may help central banks prepare for the transition to digital money by providing substantial insight into the future of physical cash.

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APPENDIX

Figure 3-1: Real cash, Real credit, Internet, and Contactless Payments

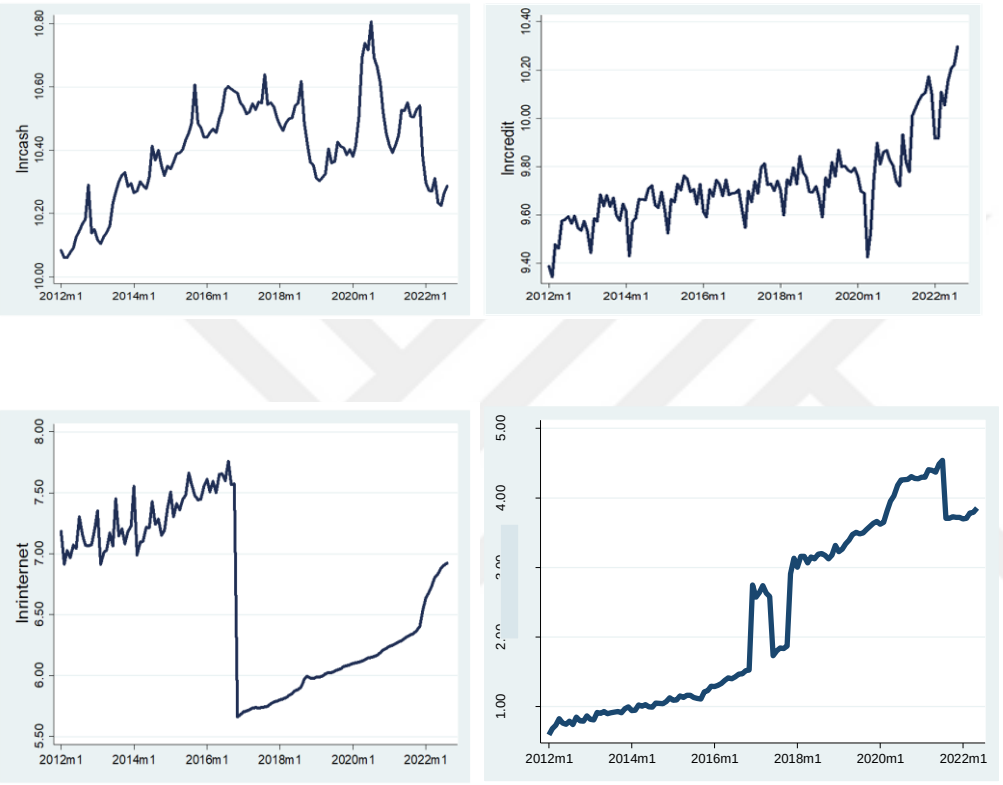

Figure 3-2: CTI and IPI (output gap)

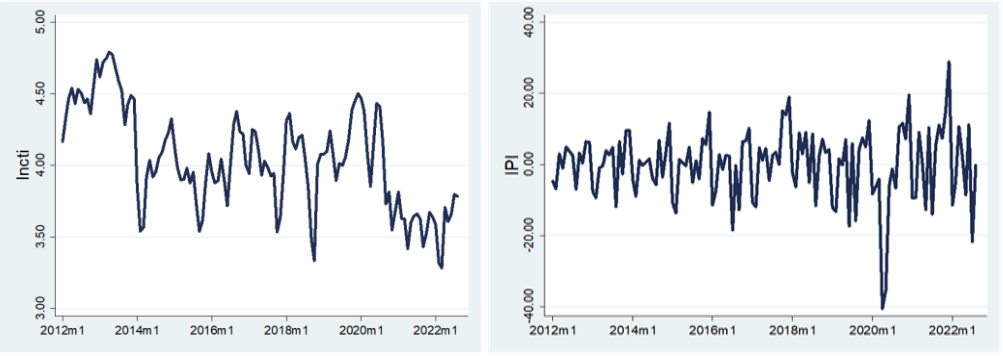

Figure 3-3: The Nominal and Real Foreign Currency Rates (USD $)

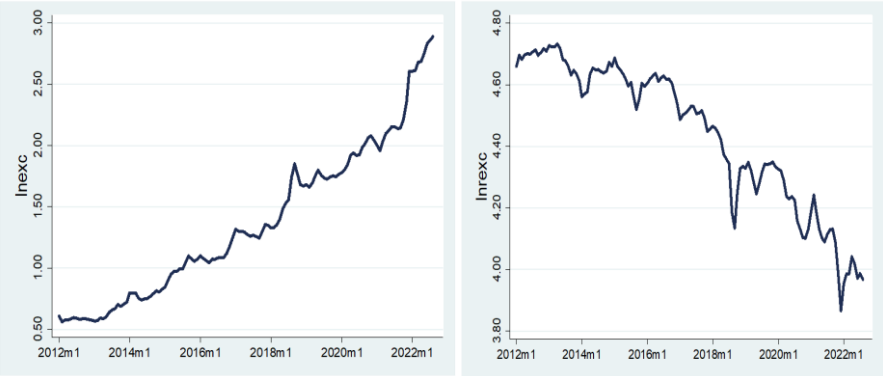

Figure 3-4: The Nominal and Real Rate of Interest (Deposit Interest Rates)

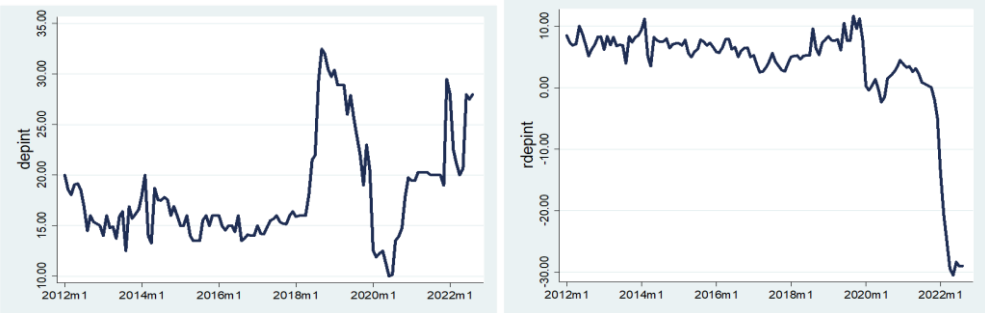

Figure 3-5: Nominal and Real Bound Rate