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Araştırma Makalesi/ Research Article

Do Geopolitical Risks Affect Monetary Policies? Evidence from Türkiye with the TVP-VAR Method

Jeopolitik Riskler Para Politikalarını Etkiler Mi? TVP-VAR Yöntemi ile Türkiye'den Kanıtlar

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ABSTRACT

This study aims to fill gap in the literature by focusing on the interaction between Türkiye's geopolitical risks and monetary policy. For this purpose, the study examines how the impact of geopolitical risks on economic indicators such as the credit market, money supply, and exchange rates has changed over time, using monthly data from February 2012 to August 2024. The variables included in the model were analyzed using the Time-Varying Parameter Vector Autoregression (TVP-VAR) approach. The findings reveal that credit volume is the main center of interaction within the system. The M1 money supply and the real effective exchange rate, on the other hand, are positioned more as volatility receivers, with limited volatility transmission. Geopolitical risk, however, is largely influenced by its own internal volatility and exerts limited impact on other variables, indicating that the direct effect of geopolitical risk on economic indicators remains limited. Overall, the study results provide valuable insights into the influence of economic policies by examining the links among credit volume, money supply, and exchange rates, while also highlighting the relatively limited impact of geopolitical risk.

ÖZ

Bu çalışma, Türkiye'nin jeopolitik riskleri ile para politikası arasındaki etkileşime odaklanarak literatürdeki boşluğu doldurmayı amaçlamaktadır. Bu amaçla çalışmada, Şubat 2012-Ağustos 2024 dönemine ait aylık veriler kullanılarak jeopolitik risklerin kredi piyasası, para arzı ve döviz kuru gibi ekonomik göstergeler üzerindeki etkisinin zaman içinde nasıl değiştiği incelenmiştir. Modelde yer alan değişkenler Zamanla Değişen Parametreli Vektör Otoregresyon (TVP-VAR) yaklaşımı kullanılarak analiz edilmiştir. Bulgular, kredi hacminin sistem içindeki etkileşimin ana merkezi olduğunu ortaya koymaktadır. M1 para arzı ve reel efektif döviz kuru ise daha çok oynaklık alıcıları olarak konumlanmakta ve oynaklık aktarımı sınırlı kalmaktadır. Jeopolitik riskin ise büyük ölçüde kendi iç oynaklığından etkilenmesi ve diğer değişkenler üzerinde sınırlı etki göstermesi, jeopolitik riskin ekonomik göstergeler üzerindeki doğrudan etkisinin sınırlı kaldığını göstermektedir. Genel olarak, çalışmanın sonuçları kredi hacmi, para arzı ve döviz kurları arasındaki bağlantıları inceleyerek ekonomi politikalarının etkisine ilişkin değerli bilgiler sunarken, jeopolitik riskin nispeten sınırlı etkisinin de altını çizmektedir.
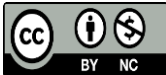
Introduction

In finance theory, Markowitz's (1952) work laid the foundation for portfolio theory, where the concept of risk is categorized into systematic and unsystematic risk. This classification is generally used in finance and economics literature and provides an important framework for understanding the nature of investment risks. Systematic risk is a type of risk that has an impact on the entire market or economy and therefore affects all investment instruments. Such risks are often triggered by macroeconomic factors (e.g. inflation, interest rates, economic recessions, political uncertainties) and therefore cannot be eliminated through diversification. The classic example of systematic risk is a global economic crisis. Unsystematic risk is defined as a type of risk that is specific to a particular company, industry or sector (Markowitz, 1952; Sharpe, 1964; Elton & Gruber, 1977).

With the increase in globalization, markets have become more fragile and more susceptible to systematic risks. Therefore, market participants have begun to measure market risks and develop strategies against adverse situations through risk assessment. In this context, various types of risks are considered when developing hedging strategies. One of these is geopolitical risk (Bezgin, 2019). Geopolitical risk refers to the risks arising when a country's policies or situations are unable to support or negatively affect the profitability of businesses within that country (Currie, Michell & Abanishe, 2008). Such risks can arise from events like wars, terrorist attacks, political crises, trade wars, and international disputes, and they can have widespread effects on markets (Pástor & Veronesi, 2013; Gülcan & Ceyhan, 2022). Geopolitical risks that develop based on a state's geographical location, economic conditions, and demographic structure, which influence its policies, are seen as fundamental determinants of investment decisions and market dynamics for entrepreneurs, market participants, and central banks. Moreover, these risk factors are associated with a wide range of causes and consequences, from Brexit to the Global Financial Crisis, terrorist attacks and wars to climate change (Caldara & Iacoviello, 2018; Akçayır, 2023). Considering the importance of these geopolitical risk factors, Caldara and Iacoviello identified the lack of a real-time indicator measuring the geopolitical risk perceived by the press, the public, global investors, and policymakers. They established the Geopolitical Risk Index (GPR) in 2018 by examining newspaper records. The geopolitical risk index, reported by Caldara and Iacoviello (2022) refers to an index of the number of articles on unfavourable geopolitical events as a share of the total number of news articles for each month, reflecting the results of an automated text search of the electronic archives of the 10 most influential international newspapers. Based on news articles from three international newspapers since the 1900s and from ten international newspapers since 1985, the index consists of eight search categories. These situations include terror threats and acts, nuclear threats, military buildups, threats of war and peace, escalation of war, and the beginning of war.

Wars, political unrest, and terrorist attacks have become a routine part of today's world. Events such as elections of key officials, changes in governments, political uprisings, civil strife, and terrorist attacks that affect economic performance and asset markets can be cited as examples of more violent occurrences. In this context, the 2001 attack on the World Trade Center in New York, the November 2015 Paris attacks, the June 2016 Brexit decision by the United Kingdom, Donald Trump's election as President of the United State (U.S.) in November 2016, and the tensions between North Korea and the U.S. from 2017 to the first half of 2018 have played a role in the increase of geopolitical instability worldwide. These political developments have led to geopolitical risks and negatively impacted countries along with financial, macroeconomic, and economic policy uncertainties (Buzdağlı & Özdemir, 2021).

Türkiye is significantly affected by geopolitical risks around the world due to its geographical location and historical ties. Situated at the intersection of strategic regions such as the Middle East, the Balkans, and the Caucasia, Türkiye finds itself at the center of events like wars, political unrest, and economic uncertainties. Political uncertainties in the Middle East, economic instability, and wars are among the factors that directly threaten Türkiye's economic structure and financial markets. For instance, the influx of refugees resulting from the civil war in Syria has strained Türkiye's social and economic resources, putting pressure on employment, public spending, and infrastructure investments. Additionally, Türkiye's dependencies in international trade have amplified the effects of geopolitical risks, leading to issues such as trade deficits and currency instability. Figure 1 presents Türkiye's GPR index data developed by Caldara and Iacoviello after 1985.

Figure 1. Türkiye GPR Index (Percent of Articles)
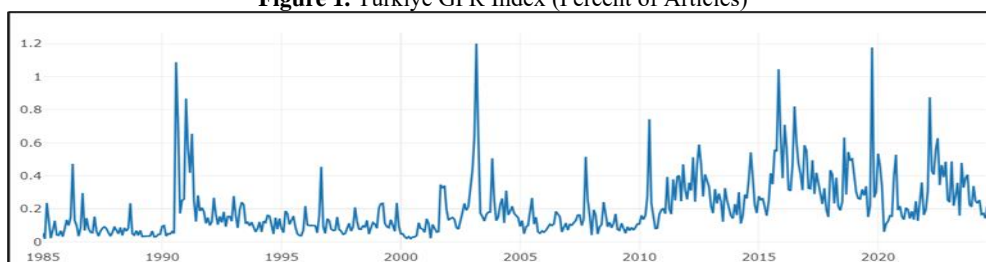
Source: (Iacoviello, n.d.)

An analysis of Türkiye's GPR index reveals that the collapse of the Soviet Union in the early 1990s significantly affected the regional dynamics around Türkiye. Likewise, the chain of events that led to the outbreak of the Gulf War with Iraq's invasion of Kuwait had a significant impact on Türkiye's security and this situation caused abnormal increases in the GPR index in the relevant period. Again, the terrorism problem that the country has been experiencing since the mid-1980s is one of the most important geopolitical risks threatening internal security. The conflicts in this period negatively affected both civilian life and the economy. One of the important developments in the 1990s was the ethnic conflicts and war in Bosnia-Herzegovina, which affected Türkiye's policies in the Balkans. Türkiye experienced various difficulties in its international relations due to its efforts to support the Muslim people in Bosnia and this situation was reflected in the index. By 2001, the terrorist attacks on the U.S. on September 11 shocked the world. This event accelerated the U.S.'s efforts in the fight against terrorism and led to major military operations, such as the intervention in Afghanistan. These attacks, while revealing the international dimension and effects of terrorism, caused a surge in GPR indices all over the world. By 2003, the Iraq War, which broke out near the country, constituted one of the major geopolitical risks. In this process, the index reached historic high levels. In 2008, the Global Financial Crisis affected Türkiye's geopolitical risk. The crisis slowed economic growth, increased unemployment rates and created financial instability. During these years, Russia's invasions in neighbouring countries increased regional geopolitical risk in the Caucasus. The Arab Spring, which started in Tunisia in 2010 and spread across the Middle East due to the food crisis, inflation, unemployment, political corruption and poor living conditions that emerged in the region afterwards, affected Türkiye's geography, and the outbreak of civil war in Syria in 2011 posed a serious security threat to Türkiye on its southern border. The influx of refugees and the activities of terrorist groups affected Türkiye, which had a negative impact on the index. The Gezi Park protests in 2013 and the 6-7 October 2014 Kobani protests were recorded as the periods when the index jumped. In 2015, the plane crisis between Türkiye and Russia seriously strained relations between the two countries. On 15 July 2016, the index reached its highest level with the failed coup attempt. Between 2018-2020, some tensions with the US and European countries caused some economic and political turmoil in the country. During this period, the Covid-19 pandemic, the Azerbaijan-Armenia war, the ongoing Syrian civil war, and the Eastern Mediterranean tension were recorded as important geopolitical risk factors. In 2022, the Russian-Ukrainian war broke out near Türkiye as an important geopolitical risk factor, which had a negative impact on Türkiye's local GPR index. In late 2023, Israel's accelerated occupation of Gaza created instability in the region and affected Türkiye's security strategies and border policies. When the general trend of the index is analyzed, it is seen that Türkiye is affected by the events that develop within the framework of its geopolitical position and this situation is reflected in the index in the form of increases.

The U.S. Federal Reserve Bank, in its Financial Stability Report dated October 2023, stated that increases in geopolitical tensions could reduce countries' economic activities and raise inflation globally, especially in the event of prolonged disruptions in supply chains and interruptions in production. Additionally, it emphasized that a pullback in risk appetite within the global financial system could lead to declines in asset prices and material losses worldwide, including for companies and investors in the U.S. This concern is also supported by Iacoviello, Caldara, Penn and Conlisk (2024), who provide evidence that such events lead to a decline in economic activities and an increase in inflation. The reason for this is that these events are characterized by supply-side disruptions dominated by deflationary pressures stemming from low aggregate demand. Consequently, rising geopolitical tensions may lead to upward price pressures, prompting central banks to implement further interest rate hikes to prevent the anchoring of inflation expectations from deteriorating (Franconi, 2024). Geopolitical risks can impact an economy through various channels. Some of these, such as the commodity price channel, especially oil prices, and the currency channel, create an inflationary effect. On the other hand, certain channels, like the consumer sentiment channel and the financial conditions channel, tend to have a deflationary effect. While it is challenging to determine whether geopolitical risk shocks are inflationary or deflationary, recent research suggests that historically, geopolitical shocks have tended to be mostly inflationary (Iacoviello et al., 2024; Ginn & Saadaoui, 2024).

Geopolitical risks can influence central banks' monetary policies in several important ways. First, geopolitical uncertainties and risks may pressure economic activity and investment decisions, negatively affecting growth expectations. This can lead to lower interest rates or the implementation of supportive monetary policies (Azzimonti & Talbert, 2014; Baker, Bloom & Davis, 2016). Second, geopolitical events can affect inflation expectations, complicating central banks' goals of maintaining price stability (Iacoviello et al., 2024). Lastly, geopolitical risks can increase uncertainty in financial markets, causing fluctuations in exchange rates and asset prices. This creates an additional layer of complexity that central banks must consider when making monetary policy decisions (Kamin, 2010; Powell, 2019).

In this context, Türkiye's situation of facing geopolitical risks and the responses of the Central Bank of the Republic of Türkiye (CBRT) to these risks may share similarities with other economies while also exhibiting

different characteristics. In the current scenario, where geopolitical tensions pose a real risk, an important question naturally arises for central banks; do central banks have the necessary tools to implement monetary policies when geopolitical risks are high? This article analyses whether the effectiveness of conventional monetary policy actions depends on the level of geopolitical risk. This study aims to fill the gap in the literature by focusing on the relationship between Türkiye's geopolitical risks and the monetary policies implemented by the Central Bank. In this context, the main motivation of the study is to better understand the macroeconomic consequences of geopolitical risks in countries with high geopolitical risks such as Türkiye and to contribute to policymakers to manage these risks more effectively. For this purpose, monthly data for the period 2012:02 - 2024:08 was used. The analysis examines how the impact of geopolitical risks on economic indicators such as the credit market, money supply, and exchange rates have changed over time. The variables in the model were analyzed using the Time-Varying Parameter Vector Autoregression (TVP-VAR) approach. We believe this model, which allows parameters to change over time, offers a robust tool for assessing the effectiveness of monetary policies in volatile geopolitical risk environments like Türkiye's.

The article is organized as follows: After the introduction, a literature review on the subject is presented. Next, the materials and methods section are detailed, and research findings are provided. In the final part, a general evaluation is conducted, followed by policy implications and recommendations, concluding the study.

1. Literature Review

There are several studies in the literature, such as examining how geopolitical risks affect stock markets, stock market index returns and volatilities, time series of returns and volatilities of commodities and similar assets, and several macroeconomic and financial variables (Cheng & Chiu, 2018; Plakandaras, Gogas & Papadimitriou, 2019; Bouras, Christou, Gupta & Suleman, 2019; Mansour-Ichrakieh & Zeaiter, 2019; Mamun, Uddin, Suleman & Kang, 2020; Cunado, Gupta, Lau & Sheng, 2020; Le & Tran, 2021; Salisu, Lasisi & Tchankam, 2021; Agoraki, Kouretas & Laopodis, 2022; Köstekçi, 2024; Jalkh & Bouri, 2024).

Central banks' exchange rate policy implementations are determined within the framework of monetary policy objectives, and exchange rate policy may also be changed in case of a change in monetary policy. Within this framework, although the exchange rate policies shaped around monetary policy are likely to be affected by geopolitical risks, the empirical literature on the impact of geopolitical risks on exchange rates is quite limited. Among the studies which tested the impact of geopolitical risk on the exchange rate, Plakandaras et al. (2019), in their study trying to determine the predictive power of geopolitical risks of 14 developing countries on oil prices, exchange rates, national stock indices, and the price of gold with support vector regression, claimed that geopolitical events occurring in developing countries have a minor impact on the world economy. This is because their effects on the assets analyzed were temporary and only important for the region. Şahin and Arslan (2021) applied the nonparametric causality-quantiles approach, which considered the impact of geopolitical risk on stock market index and USD/national currency in 18 emerging economies. These results indicate that geopolitical risk affects the returns of the exchange rate and stock market index in roughly half of the countries under consideration and, thus, significantly influences all stock market and exchange rate fluctuations in all countries of the sample. Gkillas, Gupta, Konstantatos and Vortelinos (2021) investigated the causal relationship of geopolitical risks on jumps in the exchange prices of seven major currencies within the period 2003-2015. The result shows that there is a statistically significant and significant relationship between geopolitical risk and jumps in the foreign exchange market. Duan, Khurshid, Rauf, Khan and Calin (2021) investigated the relationship between geopolitical risk, oil prices, and exchange rates. The sample was for Venezuela between 2008 and 2019, with Wavelet analysis. The results obtained are analyzed, and accordingly, it can be found out that there was a medium-term co-movement between geopolitical risk and exchange rates within the period 2015-2019. Kisswani and Elian (2021) use the nonlinear autoregressive distributed lag model with country samples from Canada, China, Japan, the Republic of Korea, and the United Kingdom to find asymmetric impacts of exchange rate volatility among measures of oil price and uncertainty proxied by the Economic Policy Uncertainty Index and the Global Geopolitical Risk Index. Hui (2022) examined the long-run relationship between geopolitical risk and exchange rates for four ASEAN countries using the ARDL cointegration approach. The study's results reflect a long-run relationship established for models with exchange rates as dependent variables. While geopolitical risk is a long-run driver of these exchange rates, higher geopolitical risk in all countries makes the local currency depreciate. In their study examining the sensitivity of BRICS exchange rates to geopolitical risks, Salisu, Cuñado and Gupta (2022) found that, in the long run, exchange rates are less sensitive to geopolitical risks, while the opposite is observed in the short run. Additionally, it has been determined that BRICS exchange rates are more sensitive to global risks compared to local geopolitical risks. Bossman, Gubareva and Teplova (2023) examined the asymmetric effects of Russia-Ukraine geopolitical risk on seven major currencies using non-parametric quantile regression analysis. The research findings revealed that the impact of geopolitical risk on exchange rates is asymmetric, and that the Euro and Swiss franc are attractive as hedges for foreign exchange portfolios against geopolitical risks. In their study addressing the impact of the Russia-Ukraine conflict on the interaction between

geopolitical risks and foreign exchange markets, Hossain, Masum and Saadi (2024) found that the conflict had a negative effect on exchange rates due to increased geopolitical risks.

In the traditional monetary policy transmission mechanism, interest rates play an essential role in the economy's response to monetary policies (Sellon, 2007). The inability to explain the real sector's reactions to monetary policy solely through the interest rate channel has necessitated the consideration of the credit channel, which has come to be seen as a complementary component of the monetary transmission channel (Bernanke & Blinder, 1988; Bernanke & Gertler, 1995). While exchange rate volatility, risk premiums, stock returns, market interest rates, and portfolio flows are affected by movements in global risk appetite and developments related to geopolitical risks, it is also likely that the credit channel, a complementary component of the monetary transmission mechanism, could be impacted as well. Increasing geopolitical risks can lead domestic firms to cancel or postpone their investments. This situation is likely to increase consumer fears and reduce consumer confidence, which can decrease the demand for durable consumer goods, real estate, automobiles, and other purchases, mostly financed by consumer loans and mortgages. As a result, domestic credit supply may also decrease due to a reduction in capital inflows. Lu, Gozgor, Huang and Lau (2020) examined the impact of geopolitical risks on credit volume in their study, which focused on a sample of 18 emerging economies using data from the 1985-2018 period. The findings indicate that an increase in geopolitical risks leads to a decrease in the volume of domestic credit provided to the private sector. Demir and Ozturk Danisman (2021) examined the effects of geopolitical risks on bank credit growth in their study, which analyzed data from 2,439 banks across 19 countries during the period 2010-2019. The findings indicated that geopolitical risks had no documented impact on overall bank credit growth. However, additional analyses on credit types revealed that geopolitical risks reduced consumer and mortgage loans. Nguyen and Thuy (2023) investigated the interaction between geopolitical risk and bank loan costs in their study, which examined 31,004 loan transactions in the U.S. during the period 1991-2019. They found that geopolitical risk was associated with higher credit prices and stricter non-price credit terms. Moreover, an increase in the geopolitical risk index is found to lead to an increase in the cost of bank loans.

Examples of research on the effectiveness of central banks' monetary policy tools in environments of geopolitical risk and uncertainty include Andreasen, Caggiano, Castelnuovo and Pellegrino (2023), who demonstrated in their study using an interactive VAR model that a more proactive monetary policy is more effective during expansions than during recessions in stabilizing output growth following an uncertainty shock. Franconi (2024), analyzing how the response of the U.S. economy to monetary policy shocks depends on the level of geopolitical risk, using a non-linear Proxy-SVAR and the Caldara and Iacoviello (2022) index and found that the effects of monetary policy are weaker when geopolitical risk is high. Ginn and Saadaoui (2024) analyzed the impact of geopolitical risks on monetary policy using linear and nonlinear regression models based on panel data for a sample of 20 economies from 1999 to 2022. The empirical findings of the study indicate that, for the linear model, there is a statistically insignificant negative relationship between monetary policy response and geopolitical risk shocks. On the other hand, the findings from the nonlinear model show that geopolitical risk shocks lead to a weak interest rate policy response during expansionary periods. However, outside of expansionary periods, geopolitical risks can amplify the policy response.

Yalçınkaya (2019) examined the effects of Türkiye's global economic, political, and geopolitical risks on macroeconomic indicators. The study, conducted with quarterly data from the period 1992Q1-2018Q2, was analyzed using the SVAR (Structural Vector Autoregression) method. The findings showed that global risk uncertainty had an increasing effect on nominal effective exchange rates during the first five quarters, but this effect weakened after the fifth quarter. Özkan (2020) investigated the impact of geopolitical risk on the foreign exchange market in BRICS-T countries using monthly data from 2005M7-2020M2. The analysis, employing a non-parametric quantile causality test, revealed that geopolitical risk had significant effects on exchange rate returns and volatility. Tuna and Çalışkan Terzioğlu (2022) analyzed the effects of geopolitical risks on macroeconomic variables in Türkiye using monthly data from January 1994 to April 2022. The global geopolitical risk index developed by Caldara and Iacoviello (2022) was used, examining the industrial production index, inflation rate, and real effective exchange rate. Through frequency domain causality tests, it was concluded that the inflation rate and real effective exchange rate were influenced by geopolitical risks in the medium and long term. Kyriazis and Economou (2022), examine the volatility of the Turkish lira against other currencies on account of geopolitical risk in Türkiye between 2003 and 2020. From these variables, results have revealed that geopolitical risk significantly reduces the value of the Turkish lira with respect to the US dollar, Swiss franc, and Swedish krona-but not in a meaningful way. Akçayır (2023) analyzed the impact of risk and uncertainty on the value of the Turkish Lira using the VAR model, covering the period from March 2010 to August 2021. The analysis employed CDS premiums, geopolitical risk indices, and uncertainty indices. The results indicated that CDS had the strongest impact on the Turkish Lira, while the effect of geopolitical risks was found to be weaker. These studies provide valuable insights into the impact of geopolitical risks on monetary policy instruments,

especially exchange rates, through analyses conducted with different periods and methodologies, particularly in the case of Türkiye.

When the studies in the literature mentioned above are evaluated, it is observed that local and global geopolitical risks and uncertainties predominantly have negative effects on macroeconomic indicators and monetary policy tools. This study aims to analyze the interactions between geopolitical risk, M1 money supply, credit volume, and the real effective exchange rate. While the impact of geopolitical risks on financial markets and macroeconomic variables continues to be explored in the literature, the relationship between Türkiye's geopolitical risk and key monetary policy instruments such as money supply, credit volume, and exchange rates has been the subject of very limited research. In fact, it has been found that a TVP-VAR model, like the model constructed in this study and addressing dynamic connections, has not been used in the literature. In this context, the lack of research in this framework using the Turkish case has served as a primary motivation. This research seeks to develop a more comprehensive understanding of how geopolitical risks influence monetary policy variables and to assess the potential impacts of these risks on economic stability.

2. Materials and Methods

The study examines the impact of Türkiye's evolving geopolitical risks over time on monetary policy. In the research, credit volume, money supply, and the real effective exchange rate are used to represent monetary policy. To achieve this objective, the study was conducted with monthly data from February 2012 to August 2024. February 2012, the earliest accessible date for the variables used, was chosen as the starting period of the research. Table 1 below presents summary information on the research variables.

Table 1. Summary Information of Variables

Variable	Short Code	Source
Türkiye's Geopolitical Risk Index	GPR	(Iacoviello, n.d.)
Credit Volume	CRD	
M1 Money Supply	M1	Central Bank of the Republic of Türkiye Electronic Data Delivery Platform
Real Effective Exchange Rate	REER	

In the study, the Time-Varying Parameter Vector Autoregressive (TVP-VAR) method was used to examine the relationship between the geopolitical risk index and credit volume, M1 money supply, and the real effective exchange rate. Antonakakis and Gabauer (2017) and Diebold and Yılmaz (2009, 2012, 2014) developed connectedness measures based on the constant-parameter rolling-window VAR approach. Similarly, these authors proposed dynamic connectedness measures based on the TVP-VAR approach with a time-varying covariance structure. The TVP-VAR model is preferred because, by using the Kalman filter, it demonstrates sensitivity to outliers, eliminates the issue of arbitrarily choosing the moving window length, and avoids data loss issues, thus allowing for analysis with smaller datasets (Akyıldırım, Güneş & Çelik, 2022; Erdoğan & Doğan, 2024). The implementation steps of the TVP-VAR model can be outlined as follows (Antonakakis & Gabauer, 2017):

$$Y_t = \beta_t Y_{t-1} + \epsilon_t, \qquad \epsilon_t | F_{t-1} \sim N(0, S_t) \tag{1}$$

$$\beta_t = \beta_{t-1} + v_t, \qquad v_t | F_{t-1} \sim N(0, R_t) \tag{2}$$

Time-varying coefficients and error covariances are used to estimate the generalized connectedness procedure based on the generalized impulse response functions of Diebold and Yilmaz (2014) and the generalized forecast error variance decompositions developed by Koop, Pesaran, and Potter (1996) and Pesaran and Shin (1998). The total connectedness index is calculated as follows (Antonakakis & Gabauer, 2017):

$$C_t^g(J) = \frac{\Sigma_{i,j=1,i\neq j}^N \tilde{\phi}_{ij,t}^g(J)}{\Sigma_{i,j=1}^N \tilde{\phi}_{ij,t}^g(J)} * 100 \tag{3}$$

$$= \frac{\Sigma_{i,j=1,i\neq j}^N \tilde{\phi}_{ij,t}^g(J)}{N} * 100 \tag{4}$$

The case in which a shock to variable i is transmitted to all other j variables, referred to as "total directional connectedness to others," is expressed as follows:

$$C_{i\to j,t}^g(J) = \frac{\Sigma_{j=1,i\neq j}^N \tilde{\phi}_{ji,t}^g(J)}{\Sigma_{j=1}^N \tilde{\phi}_{ji,t}^g(J)} * 100 \tag{5}$$

The case in which variable i receives from all other j variables, referred to as "total directional connectedness from others," is as follows:

$$C_{i \leftarrow j,t}^{g}(J) = \frac{\Sigma_{j=1,i \neq j}^{N} \tilde{\phi}_{ij,t}^{g}(J)}{\Sigma_{i=1}^{N} \tilde{\phi}_{ij,t}^{g}(J)} * 100 \tag{6}$$

The "net total directional connectedness" of variable i, which can be interpreted as the "strength" or impact over the entire network of variables, is obtained as follows by subtracting total directional connectedness to others from total directional connectedness from others:

$$C_{i,t}^{g} = C_{i \rightarrow j,t}^{g}(J) - C_{i \leftarrow j,t}^{g}(J) \tag{7}$$

3. Findings

The table presents the fundamental statistical properties and stationarity tests of the variables GPR, CRD, M1, and REER. Skewness and Excess Kurtosis values indicate positive skewness and leptokurtic features in GPR and M1, suggesting that these variables exhibit non-normal distributions with a tendency toward extreme values. According to the results of the Jarque-Bera (JB) test, it confirms that all variables are not normally distributed, indicating the presence of skewness and kurtosis, thus exhibiting a non-normal distribution.

The Elliott-Rothenberg-Stock (ERS) test was employed to assess the stationarity of each series. According to the results, only the GPR variable was found to be stationary (p < 0.01), while CRD, M1, and REER failed to reject the null hypothesis of a unit root, indicating non-stationarity. This non-stationarity suggests that these series may contain trends and do not fluctuate around a stable mean over time.

To address this issue, the first differences of the non-stationary series were taken, rendering the data stationery and suitable for analysis. Differencing removed the trend component, allowing the transformed series to exhibit stability around a constant mean. Analyses were subsequently conducted on these different, stationary series, providing more reliable results due to the elimination of trends and unit root concerns.

Table 2. Descriptive Statistics and Unit Root Test Result

	GPR	CRD	M1	REER
Mean	0.334	9.371	8.819	1.9
Variance	0.031	0.128	0.223	0.013
Skewness	1.654***	0.488**	0.569***	-0.217
	(0.000)	(0.015)	(0.005)	(0.260)
Ex.Kurtosis	4.421***	-0.629**	-0.928***	-1.432***
	(0.000)	(0.038)	(0.000)	(0.000)
JB	191.811***	8.487**	13.569***	14.098***
	(0.000)	(0.014)	(0.001)	(0.001)
ERS	-3.503***	3.037	3.357	0.366
	(0.001)	(0.003)	(0.001)	(0.715)
Q(10)	49.500***	704.041***	727.127***	745.714***
	(0.000)	(0.000)	(0.000)	(0.000)
Q2(10)	18.193***	702.430***	725.311***	746.877***
	(0.001)	(0.000)	(0.000)	(0.000)

Note: Table 2 was prepared by the authors. *** indicates significance at 99% confidence level.

The Dynamic Total Connectedness Index, explained in the methodology section of the study, measures the average effect of one variable on others. An increase in this index indicates that interactions among variables have intensified, and therefore, total risk has risen, as external shock to the system can more easily spread to other members. Similarly, a decrease in the index suggests weakened interactions among network members and,

consequently, reduced total risk. As shown in Figure 2, the dynamic connectedness of the four macroeconomic variables examined in the study fluctuated significantly between 2012 and 2024.

Looking at Figure 2, a sudden increase in interactions among variables is observed in 2013. This can be attributed to the U.S. Federal Reserve's announcement in May 2013 of its plan to reduce asset purchases, which soon shifted market expectations toward an interest rate hike (Akyıldırım et al., 2022). Consequently, due to turbulence in the markets, emerging market currencies and bonds experienced weeks of depreciation. Another factor contributing to this spike could be the Gezi Park tensions that began on May 28, 2013. The index surpassing the 65 level in 2015 may be associated with the inability to form a government within the constitutional timeframe following the June 2015 elections, which led to the decision to hold a repeat election.

Since 2016, significant fluctuations in the index have also been observed. During this period, the attempted coup in July 2016 and U.S. President Donald Trump's social media posts regarding economic sanctions on Türkiye in 2018 are considered to have had a substantial impact. As a result of these developments, there were sudden increases in exchange rates and significant losses in the stock market. The rise in the index began to decline from the end of 2018, remaining around an average level of 50 until the end of the study period.

Starting from 2020, the effects of the COVID-19 pandemic began to be felt, and subsequent extreme fluctuations in inflation, exchange rates, and other macroeconomic indicators have not had as significant an impact on the index as in previous periods. Overall, the graph shows that while high volatility diffusion was observed, particularly between 2013 and 2018, the system became more stable after 2019, and the volatility diffusion among variables has relatively decreased.

Figure 2. Dynamic Total Connectedness Index
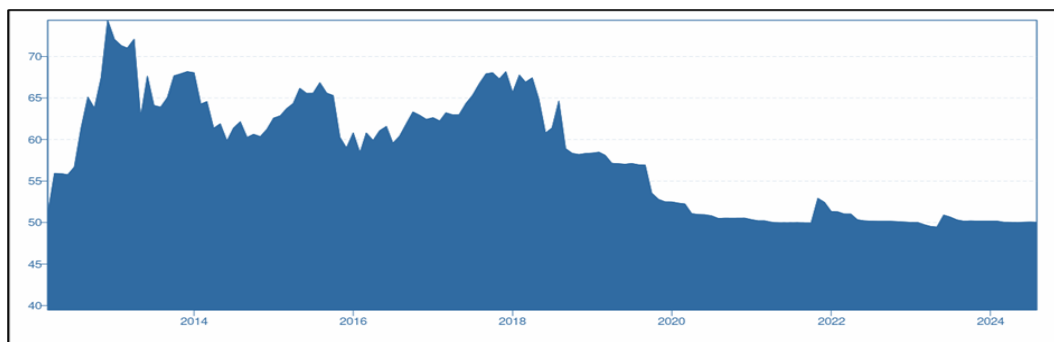
Source: Figure 2 was created by the authors.

Figure 3 presents the results of the net total connectedness index among the variables. The connections related to each variable are interpreted below.

GPR: The net connectedness of geopolitical risk reached positive values and peaked during the 2014-2016 period, indicating that geopolitical risk had a significant impact on other variables during this time. Notably, in the late stages of 2015, it was observed that the geopolitical risk index transmitted high levels of volatility to other variables. After 2016, connectedness decreased and mostly fell into negative values, meaning that the impact of other variables on geopolitical risk increased.

CRD: The dynamic connectedness of the credit variable has generally remained positive since 2015, indicating that credit has had a continuous impact on other economic variables. In the period between 2012 and 2014, both positive and negative fluctuations were observed.

M1: The connectedness of the M1 money supply showed more pronounced negative values between 2012 and 2016, indicating that the impact of other variables on M1 was more dominant. In the period after 2016, however, it has generally hovered near zero, suggesting that the money supply is in a more balanced interaction.

REER: The net connectedness of the real effective exchange rate variable is quite volatile, especially between 2012 and 2014, and has generally remained positive, indicating that the exchange rate variable has a stronger impact on other variables. In the period after 2016, connectedness decreased, and it has become a variable characterized by volatility.

Overall, the graphs indicate that interactions among the variables have strengthened and weakened during different periods. It can be said that geopolitical risk had a greater impact on other variables during the 2014-2016 period, that credit growth generally provided a stable effect, and that the money supply and exchange rate were subject to periodic fluctuations.

Figure 3. Net Total Connectedness Index
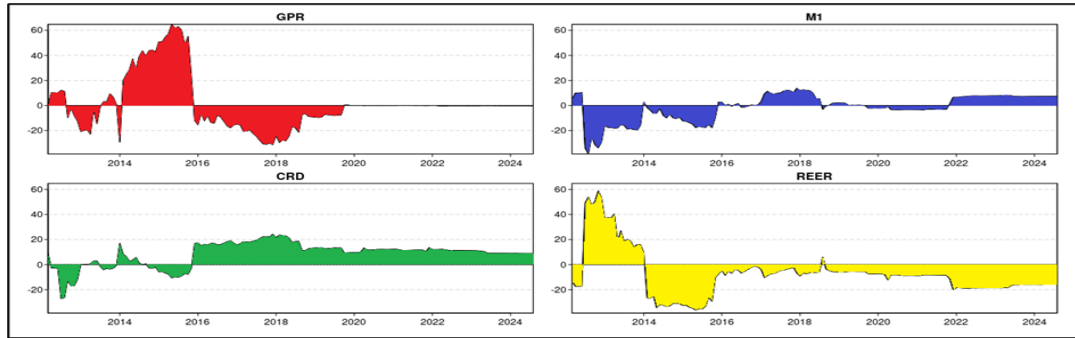
Source: Figure 3 was created by the authors.

Table 3 presents the average dynamic connectedness results for the variables. Their interpretations are provided below.

Main Diagonal (Self-Volatility): GPR: 90.43%, CRD: 43.18%, M1: 44.04%, and REER: 48.21%. These values indicate the amount of volatility generated by each variable itself. The highest value is observed in GPR, which shows that geopolitical risk is significantly influenced by its own internal volatility.

Volatility Spread to Others: GPR spreads volatility to others at a rate of 10.51%. CRD spreads 65.16%, M1 spreads 54.42%, and REER spreads 44.04% volatility. The CRD is particularly prominent in spreading the highest volatility to other variables.

Volatility Received from Others: GPR receives volatility from others at a rate of 9.57%, CRD at 56.82%, M1 at 55.96%, and REER at 51.79%. CRD and M1 are the variables that receive the most volatility from others, indicating that these variables are more affected by external factors.

Net Volatility Spread: GPR: 0.94%, Credit: 8.34%, M1: -1.54%, and REER: -7.75%. Positive values indicate that the variable is a net volatility transmitter (spreading more volatility to others), while negative values show that the variable is a net volatility receiver. In this case, CRD is a net volatility transmitter, whereas M1 and REER are net volatility receivers.

In general, CRD is the variable that spreads and receives the most volatility, positioning it at the center of the system with a significant impact on other variables. M1 and REER receive more volatility from other variables, while the volatility they transmit is relatively lower, making them more susceptible to external influences. GPR is mainly affected by its own internal volatility, with limited volatility transmitted to other variables, which may suggest that the direct impact of geopolitical risk on other economic factors is limited.

Table 3. Average Dynamic Connectivity Relationship of Variables

	GPR	CRD	M1	REER	Volatility Received from Others
GPR	90.43	2.94	2.11	4.52	9.57
CRD	3.29	43.18	31.85	21.68	56.82
M1	2.23	35.89	44.04	17.84	55.96
REER	4.99	26.33	20.46	48.21	51.79
Volatility Spread to Others	10.51	65.16	54.42	44.04	174.14
NET	0.94	8.34	-1.54	-7.75	58.05/43.53

Note: Table 3 was prepared by the authors.

Figure 4 presents a network analysis illustrating shock transmission among variables. Comments related to this network analysis are provided below.

Effect of CRD on M1 and REER

CRD → M1: There is volatility directed from the CRD variable to the M1 variable, indicating that changes in credit volume affect the M1 money supply. The thickness of the connection arrow in the network analysis represents a relatively strong interaction, meaning that credit expansion or contraction can lead to a significant change in the money supply.

CRD → REER: The presence of an arrow from the credit variable to the real effective exchange rate indicates that movements in credit have an impact on the exchange rate. The thickness of the connection arrow in the network analysis also signifies a significant relationship, implying that changes in credit volume can considerably affect the exchange rate.

Effect of M1 on REER

M1 → REER: The connection arrow in the network analysis points from the M1 money supply to the real effective exchange rate. This indicates that changes in the money supply affect the exchange rate. The thickness of the arrow reflects a moderate level of impact, suggesting that expansion or contraction of the money supply may have a noticeable but comparatively limited effect on the exchange rate relative to other factors.

Isolated State of GPR

According to the analysis, geopolitical risk (GPR) remains disconnected from other variables. This indicates that geopolitical risk has no direct effect on other variables or that there is a weak interaction within the existing interaction network.

In summary, this graph shows that credit volume has a strong impact on both the money supply and the real effective exchange rate. The money supply also influences the exchange rate, but the strength of this effect is weaker compared to its relationship with credit. Geopolitical risk does not appear to have a direct effect among these variables.

Figure 4. Network Plot of Volatility Spread of Variables
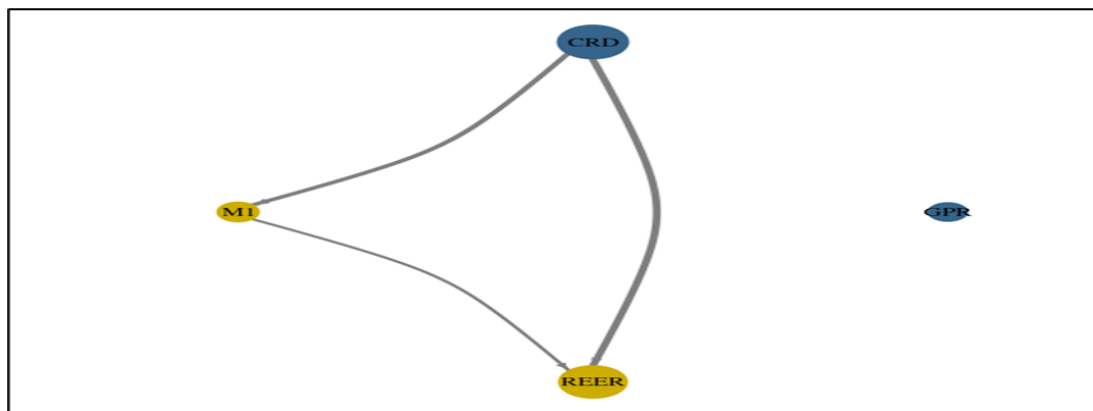
Source: Figure 4 was created by the authors.

Conclusion and Evaluation

This study analyzes the interaction between Türkiye's geopolitical risk and monetary policy instruments such as credit volume, M1 money supply and real effective exchange rate for the period February 2012-August 2024. The results of the TVP-VAR analysis conducted in the research reveal the dynamic relationships of these variables over time, highlighting which variables are more sensitive to external shocks and how they impact the economy.

The research results can be summarized as follows. The geopolitical risk index has a limited impact of 10.51% on the variables. Geopolitical risk is relatively independent of other variables; 90.43% of its changes stem from its own internal dynamics. This finding indicates that in countries like Türkiye, where geopolitical risks are high, these risks have a limited direct effect on variables such as credit volume, money supply, and the real effective exchange rate. However, this does not mean that geopolitical risks do not create indirect effects on the expectations of economic actors. Particularly, political and geopolitical developments can influence investor confidence and capital movements. Regarding the critical role of credit volume, its high impact of 65.16% on other

macroeconomic indicators demonstrates that credit markets hold significant importance in the Turkish economy. Credit volume stands out as one of the main determinants of economic growth and commercial activities. However, 56.82% of its changes are influenced by external factors, particularly variables such as geopolitical risk and M1 money supply. This suggests that Türkiye's credit markets may be vulnerable to external economic and political shocks. It can be said that credit growth can fluctuate due to dependence on external resources and geopolitical risks. M1 money supply affects other variables by 54.42%, indicating that monetary policy plays an important role in the economy. The sensitivity of money supply to external factors, especially variables like credit volume and geopolitical risk at a rate of 55.96%, reveals that Türkiye's liquidity policy is largely influenced by geopolitical risks and credit dynamics. It can be said that fluctuations in money supply can significantly impact the stability of economic activity and credit markets. The real effective exchange rate also has an impact of 44.04% on other economic variables. It has been determined that the exchange rate has a certain weight on credit volume and money supply variables. On the other hand, it has also been observed that 51.79% of the exchange rate is affected by external factors.

Based on the findings of the TVP-VAR analysis examining the effects of Türkiye's geopolitical risks on credit volume, M1 money supply, and the real effective exchange rate, the following policy implications and recommendations can be made. Although the geopolitical risk index shows a limited direct effect (10.51%) on the analyzed variables, it should not be overlooked that there may be more significant indirect effects. In this process, Türkiye should take steps to ensure stability in its foreign policy, which will enhance investor confidence and reduce economic vulnerabilities in the long run. In this context, policies should be developed to improve international relations and minimize risks in strategic regions for the management of geopolitical risks. It is crucial for policymakers to strengthen the framework of monetary policy while also developing contingency plans to mitigate the effects of geopolitical tensions on economic stability.

The significant dependence of changes in credit volume (56.82%) and money supply (55.96%) on external factors indicates that the Turkish economy is vulnerable to external shocks. It is important for policymakers to closely monitor international developments and their potential effects on local credit markets and liquidity to enable timely interventions when necessary. The critical role of credit volume on macroeconomic indicators (65.16%) emphasizes the need to enhance the resilience of credit markets. Given the important role of credit markets in the Turkish economy, measures should be taken to reduce the sensitivity of credit growth to external shocks. To mitigate vulnerabilities in the financial sector, the capital adequacy of the banking sector should be strengthened, risk management practices should be widely implemented, and long-term planning should be incorporated into credit policies. Additionally, reducing dependence on external borrowing sources can help ensure that credit growth is based on a more sustainable foundation.

The significant impact of M1 money supply on other economic variables (54.42%) necessitates those economic policies be effectively oriented towards managing liquidity. Implementing targeted measures to control money supply growth can alleviate inflationary pressures and help maintain exchange rate stability, especially during periods of increased geopolitical risks.

The significant impact of the real effective exchange rate on credit volume and M1 money supply (44.04%) is an important finding that directs Türkiye's economic dynamics. This situation emphasizes not only the role of the exchange rate in the economy but also its interaction with credit volume and money supply. First and foremost, it is essential for policymakers to take measures to ensure exchange rate stability, as fluctuations in the exchange rate can affect credit volume. This is particularly critical in periods of rising geopolitical risks, as maintaining investor confidence is crucial. Furthermore, considering the effect of M1 money supply on the exchange rate, it is advisable to manage monetary policy more proactively. Fluctuations in money supply can influence inflation and exchange rate stability; therefore, adopting a tight monetary policy can alleviate inflationary pressures. Lastly, the finding that external factors have a high impact of 51.79% on the exchange rate necessitates careful monitoring of international developments. In this context, it is important to prepare for external economic and geopolitical risks to ensure economic and financial stability.

The findings of this study reveal that the impact of geopolitical risks on Türkiye's monetary policy tools is limited. This result aligns with several studies in the literature. For instance, Plakandaras et al. (2019) examined the effects of geopolitical risks on oil prices, exchange rates, national stock market indices, and gold prices in 14 developing countries using support vector regression. They found that these effects were temporary and regionally significant. This finding indicates that the geopolitical risks have a limited global impact, which is consistent with the limited effect observed in the case of Türkiye, which forms the sample of this study. Demir and Ozturk Danisman (2021) analyzed data from 2,439 banks in 19 countries between 2010 and 2019, showing that geopolitical risks did not have a statistically significant effect on overall bank credit growth. However, they found negative effects on consumer and housing loans. This finding partly overlaps with the result obtained in this study, where credit

volume is the most significant interaction center in the system, but the limited effect of geopolitical risks on overall credit volume is also in parallel. Kyriazis and Economou (2022) investigated the impact of geopolitical risks on the volatility of the Turkish Lira from 2003 to 2020 and found that geopolitical risks decreased the value of the Turkish Lira against the US Dollar, Swiss Franc, and Swedish Krona, although the effect was not statistically significant. This result points to a similar conclusion found in this study, where exchange rates are only slightly influenced by geopolitical risks. Akçayır (2023), using CDS premiums, geopolitical risk indices, and uncertainty indices, examined the impact of geopolitical risks on the Turkish Lira between 2010 and 2021. The study found that the strongest effect came from CDS premiums, while the impact of geopolitical risks remained weaker. This finding aligns with the results obtained in this study, where geopolitical risk is shaped more by its intrinsic volatility, and its effect on other economic variables is limited. Finally, Ginn and Saadaoui (2024), in their study using panel data from 20 economies, examined the impact of geopolitical risk shocks on monetary policies. They found a statistically insignificant negative relationship in linear models, while non-linear models revealed that geopolitical risk shocks generally led to limited monetary policy responses. This finding is like the results obtained in this study, which also shows limited effects on monetary policy indicators such as money supply and exchange rates. It supports the conclusion that the overall impact of geopolitical risks on monetary policy is weak.

Based on the findings of the study, several important policy implications can be drawn. First, considering that credit volume emerges as the center of interaction, central banks may be advised to develop strategies sensitive to credit markets when formulating monetary policies. Since changes in credit volume can affect economic balance, interest rate and reserve policies should be carefully implemented. Additionally, money supply and exchange rates are identified as instruments with limited volatility transmission. In this context, central banks could focus on more cautious and softer intervention methods aimed at reducing market volatility rather than direct interventions. It has been found that geopolitical risks are largely influenced by their own internal volatility. This necessitates governments and central banks to develop flexible policy measures to be prepared for geopolitical crises. Furthermore, the limited impact of geopolitical risks requires long-term and sustainable economic planning. Instead of short-term crisis management, balanced growth strategies aimed at the overall structural stability of the economy should be implemented. Finally, the identification of credit volume as a significant interaction center may lead to regulations on credit policies. Measures to prevent excessive credit growth could support financial stability. These implications present strategic steps to strengthen Türkiye's economic stability.

In future studies, comparisons can be made at regional and global levels by using different countries and samples. More advanced econometric methods, structural models, and new techniques such as machine learning can be employed. Additionally, the long-term effects of geopolitical risks on financial markets, sectoral dynamics, and other economic variables can be analyzed in depth. These studies could contribute to the development of more flexible and effective monetary policy strategies.

AUTHOR STATEMENT

Research and Publication Ethics Statement: This study was prepared in accordance with the rules of scientific research and publication ethics.

Ethics Committee Approval: This study does not require ethics committee approval since it does not include analyses that require ethics committee approval.

Author Contribution: Authors contributed equally.

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