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-RESEARCH ARTICLE-

FOREIGN DIRECT INVESTMENTS UNDER UNCERTAINTY AND RISK: A STRUCTURAL VECTOR AUTOREGRESSION (SVAR) ANALYSIS

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─Abstract─

The research aims to examine whether risk and uncertainty affect foreign direct investments into the Turkish economy, on both global and national scale, using the Structural Vector Autoregression Model. World Uncertainty Index, World Uncertainty Index for Turkey, Global geopolitical risk, Turkish geopolitical risk for Turkey, and Economic and Political Uncertainty indices were chosen to represent risk and uncertainty. While foreign direct investments support economic growth of a country, uncertainty, and risks are important factors for investors looking for a stable environment. Therefore, considering risk and uncertainty together and examining them nationally and globally is extremely important. Therefore, it is essential to consider risk and uncertainty both nationally and globally. It is seen that foreign direct investments are affected by the uncertainty in Turkey. Turkey's geopolitical risk is quite effective, and global geopolitical risk is effective. Turkey should encourage foreign direct investments by reducing geopolitical risks with stable policies, introducing reassuring measures, and dealing with global geopolitical risks through international cooperation.

Keywords: Geopolitical Risk, the World Uncertainty Index, Economic-Political Uncertainty, Foreign Direct Investments, Structural Vector Autoregression Analysis

JEL Codes: C32, C51, E22, D81, F21

INTRODUCTION

While globalization offers new investment opportunities, it concurrently increases global risks, uncertainty, and complexity. National problems can scale up to affect the entire world, as was the case during the 1973 oil crisis. Furthermore, problems within a sector in a country can quickly extend to other financial areas, causing a spread of a crisis from a particular field of the economy to wider economic areas. The risks and

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uncertainties that arise in a market will rapidly spread to other markets (Allen & Gale, 2000). Considering that risks and uncertainties in a market can rapidly spread to other markets (Allen & Gale, 2000), both factors are centrally involved in shaping economic performance on a global scale.

Developing countries, which frequently face the lack of capital, tend to bridge this deficiency through foreign investments and/or borrowing. However, considering the burdens of debt, it is clear how important investments are of paramount importance. In addition, the investing companies' knowledge, and experience, such as advanced technology, production methods, marketing, and management skills, are transferred to the country. thereby increasing local economies' competitiveness and raising the local workforce's skill level. To date, extensive evidence is available showing promotion of investments a critical element needed for a sustainable economic growth and development (Hossain, 2016; Iamsiraroj, 2016; Makki & Somwaru, 2004; Mody & Murshid, 2005; Owusu-Nantwi & Erickson, 2019; Reisen & Soto, 2001; Sahu, 2021).

The periods of risk and uncertainty lead to a significant decrease in investment and consumption expenditures. Overall, investors and consumers who have to decide in uncertain circumstances frequently behave more cautiously, which may adversely affect economic growth (Carrière-Swallow & Céspedes, 2013). In an environment of uncertainty, the countries that are affected the most are developing countries, as they are characterized by more fragile economies. This situation increases investors' risk perception and may negatively affect economic growth and employment. Therefore, it is important to reduce uncertainty and ensure stability.

In this context, an important domain of research is that of geopolitics. The term geopolitics (from jeo "land" and political "critical, evaluation, policy") came into its contemporary use in 1916, in the writings of a Swedish researcher Rudolf Kjellen, even though the first references to geopolitics emerged as early as in 1887 in Halford Mackinder's "land domination theory". Geopolitics refers to the determination of foreign politics based on economic and political geography data. It also includes an examination of the relations between the geographical characteristics of states, on the one hand, and their economy and politics, on the other hand. Geopolitics is a science that analyzes countries' social, cultural, economic, and political situations and examines their military, internal, and foreign policies, with a particular focus on global, regional, and national effects and the corresponding geopolitical risks.

Classical geopolitics is an approach that examines the power dynamics of geography in international relations, with due consideration of historical and social dimensions. Accordingly, geopolitics seeks to understand how geography affects states' strategic decisions and what impact countries' geographical position has on their political and cultural stance (Konat et al., 2021; Tuathail, 2003).

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To date, numerous studies have sought to explain the determinants of foreign direct investments (FDI) into countries based on those countries' economic factors, with a particular focus on macroeconomic variables such as exchange rate, inflation, and employment. However, previous research on the impact of geopolitical, economic, and political uncertainties on FDI on a global and national scale has been scarce. In this study, it has been investigated whether geopolitical risks, uncertainties and economic-political risks have an impact on FDI on a global and national scale, in which risks and uncertainties are more effective, and which explains FDI more.

This study differs from other studies in the literature with several features. These features are: i) conduct a comprehensive analysis taking into account both uncertainties and risks; ii) investigate the effects of both economic and political uncertainty; iii) conduct a detailed examination of risks and uncertainties on a global and national scale; iv) while panel data analysis is mostly done in these studies, making predictions with time series methods in the study, v) using the unit root (modified ADF) test to take structural breaks into account; vi) Estimation with a structural vector autoregression (SVAR) It is thought that it will contribute to the literature in this direction.

The remainder of this paper is structured as follows. The concepts of geopolitical risk, economic-political uncertainties, and the World Uncertainty Index are defined in Section 2. In the third section, there is a literature review; in the fourth section, econometric methodology; in the fifth section, the data set and empirical findings are included. Finally, there is a conclusion and recommendations section.

GEOPOLITICAL RISKS, ECONOMIC POLICY UNCERTAINTY, POLITICAL INSTABILITY

Geopolitical Risks

Turkish Language Association defines the concept of geopolitics as the relationship between the policy implemented in the state or region and the geography of that place. Accordingly, geopolitics is concerned with the advantages and disadvantages that geography provides to states. In this context, geopolitical risks refer to risks that emerge when humanitarian solutions are inadequate for countries or institutions to maintain control of the corresponding region or to deal with their competitors. Geopolitical risks may thus arise from terrorist acts, nuclear threats, wars, and tensions between countries, all of which adversely affect the peaceful course of international relations.

Geopolitical risk elements cover all uncertainties, including but not limited to local, national, international, and global terrorist threats and attacks, as well as war risks, military threats, tensions, and political regime changes that affect countries' peace and prosperity of countries. The main reason for these risks is institutional behavior and struggles arising from political inconsistencies and turmoil, as well as anti-democratic practices. Geopolitical risks lead to increased tensions between countries, rupture of

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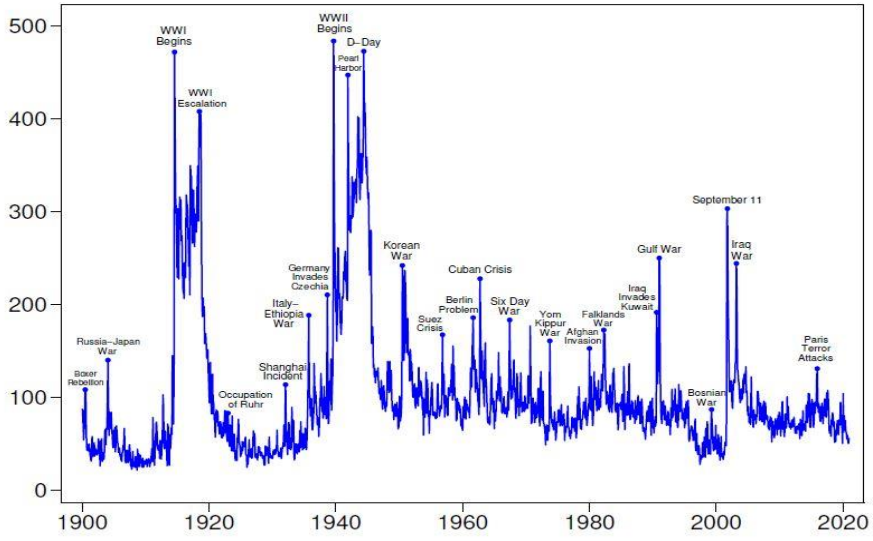
diplomatic relations, and a general deterioration in global stability, thereby seriously affecting international politics, security, and global trade.

According to Bloom (2009), with an increase of geopolitical risks, consumers tend to postpone their spending, and companies concurrently postpone their investments. This pressure may bring about the risk of societies losing their welfare gains. In this context, an important parameter is the Geopolitical Risk (GPR) Index, originally proposed by (Caldara & Iacoviello, 2022), which is calculated based on the number of articles (as a share of the total number of news) about negative geopolitical events in different newspapers to analyze geopolitical tensions.



Note: Historical Geopolitical Risk Index from January 1900 through December 2020. Index is normalized to 100 throughout the 1900-2019 period.

Figure 1: Geopolitical Risk Index.
Source: (Caldara & Matteo, 2022)

Fluctuations in geopolitical risks are frequently linked to major international events. Accordingly, sudden, and significant changes in international relations increase geopolitical risks. As can be seen in Figure 1, the GPR index was the highest during the First and Second World Wars. Other periods characterized by high GPR values across the globe were the Korean War (1950-1953), the Cuban Missile Crisis (1962), the Gulf War (1990-1991), the September 11 attacks (2001), and the Iraq war (2011) (Figure 1).

Regarding differences among the countries, the states with relatively low geopolitical risk are Malaysia (70%), Colombia (75%), Tunisia (78%), Argentina (82%), and Mexico City (92%). By contrast, the countries with the highest GPR values are Ukraine (1792%), Finland (388%), Sweden (319%), Poland (299%), China (277%), Russia (269%), and Brazil (223%). Turkey (162%) can be said to be in the medium risk group

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(Figure A in Appendix).

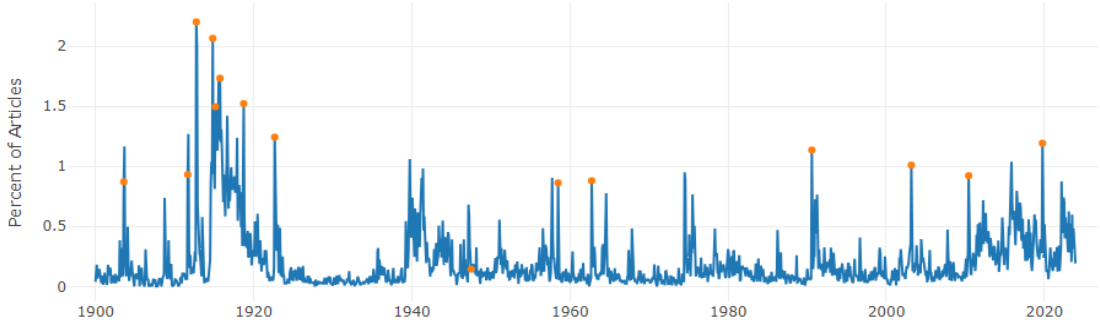

Figure 2: Geopolitical Risk Index Turkey GPR Index.
Source: (Caldara & Matteo, 2022)

As can be seen in Figure 2, the periods of global high risk and uncertainty were equally high-risk for Turkey. Such periods included When Figure 2 is examined, it is observed that many of the periods that are risky for the world are also risky for Turkey, and geopolitical risks remain constantly high. The 1st Balkan War (1912), World War I (1914), Çanakkale War (1922), Çanakkale Crisis (Chanak Affair) (1922), Lebanon crisis (1958), Cuban missile crisis (1962), Gulf War (1990), Iraq war (2003), Gaza flotilla raid (2010) and Syrian Peace Spring Operation (2019) are important incidents in this period. This situation shows that suggests that Turkey reacts sensitively to regional and global events and is exposed to geopolitical risks. It will be important for accordingly, Turkey should develop its political and security strategies by increasing its resistance to such events, maintaining its economic stability, and managing its international relations in a balanced manner (Figure 2).

To this end, policy makers and international investment decision makers should create their strategies and strengthen risk management by considering potential effects of major political events and conflicts on economic and financial stability. An important step towards a safe and sustainable global economy is conducting in-depth analyses of the impact of geopolitical developments on economic interests.

Economic-Policy Uncertainty

Policy uncertainty refers to uncertainties regarding future policy decisions and regulations. This uncertainty includes uncertainties about the government's economic, social, and foreign policy directions. Policy uncertainty can affect future planning and decision-making processes of businesses, investors, and consumers alike, leading to reduced economic activity. Uncertainty may arise particularly more clearly in developing economies. The main reasons for this situation include factors such as the production of low-value-added products, dependence on the production of variable and risky products, ineffectiveness of stabilization measures, and being more vulnerable to

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political shocks and natural disasters (Bloom, 2014).

Several approaches to measuring uncertainty has been proposed in the literature. Most approaches are based on the volatility of key economic and financial variables (Bloom, 2009). Alternatively, uncertainty was measured (X) using principal component analysis, a statistical technique used by Pearson (1901) and Hotelling (1933).

Furthermore, several studies relied on information searches to measure uncertainty calculations. For instance, Dzielinski (2012) used Google Trends internet search frequency (Dzielinski, 2012), while Altig et al. (2022) and Baker et al. (2021) relied on the word usage frequency of Twitter users (Baker et al., 2021). Similarly, Alexopoulos and Cohen (2009) and Baker et al. (2016) scanned the information in newspapers (Baker et al., 2016), while Ahir et al. (2022) obtained uncertainty indices by counting the frequency of references to uncertainties or related words in Economist Intelligence Unit (EIU) country reports (Ahir et al., 2022). Likewise, Baker et al. (2016) calculated the economic-policy uncertainty index based on relevant data sources such as newspapers. Specifically, in studying the US, the authors analyzed the frequency of words such as economy, uncertainty, congress, budget deficit, US central bank, law, regulation, or White House in 10 major US newspapers. Expanding their research to 21 further countries, Baker et al. (2016) evaluated uncertainty using the EPU index, which was computed based on the relative frequency of the corresponding country's newspaper articles containing terms related to the economy (E), politics (P), and uncertainty (U). They also computed the GEPU Index, which is a GDP-weighted average of national EPU indexes (Baker et al., 2016) (Figure 3).

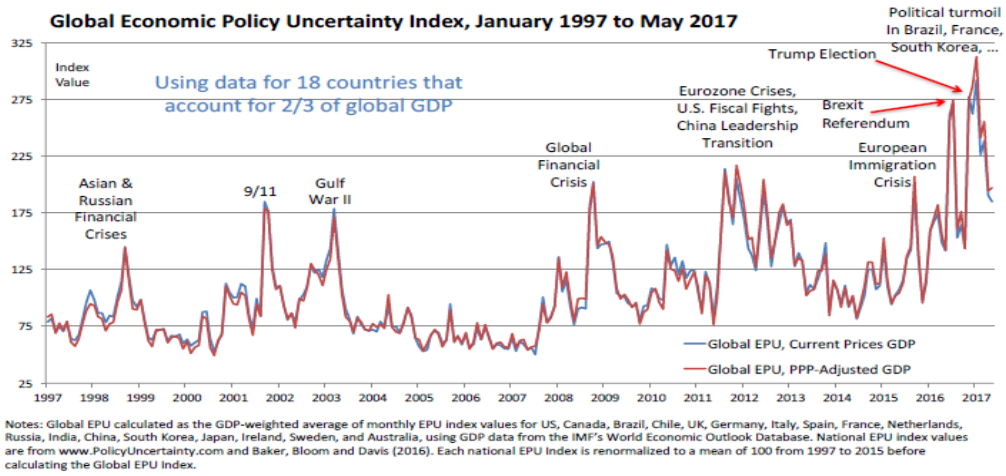

Figure 3: Global Economic Policy Uncertainty Index.
Source: (Baker et al., 2016)

As can be seen in Figure 3, important events that, in the years 1997–2017, led to higher

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economic-political uncertainty indices worldwide were the Asian and Russian Financial crises (1998) (141.88), 9/11 (2001) (179.71), Gulf War II (2003) (167.58), global financial crisis (2008) (204.75), Eurozone crises, U.S. fiscal fights, China leadership transition (2012) (187.98), European immigration crisis (2015) (173.71), Brexit referendum (2016) (165.72), and Trump election (2016) (249.39) (economic-political uncertainty values are given in parentheses).

World Uncertainty Index (WUI)

Another relevant indicator of uncertainty is the World Uncertainty Index (WUI). The WUI, which covers 143 countries in the world with populations of at least 2 million as of 1996, is computed based on the frequency of the word uncertainty (and its variants) in the Economist Intelligence Unit's (EIU) quarterly country reports and captures important political and economic developments in each country (Ahir et al., 2022). Since the WUI is calculated based on a single source for all countries, a direct comparison of the levels of uncertainty among the participant countries is possible (Ahir et al., 2022).

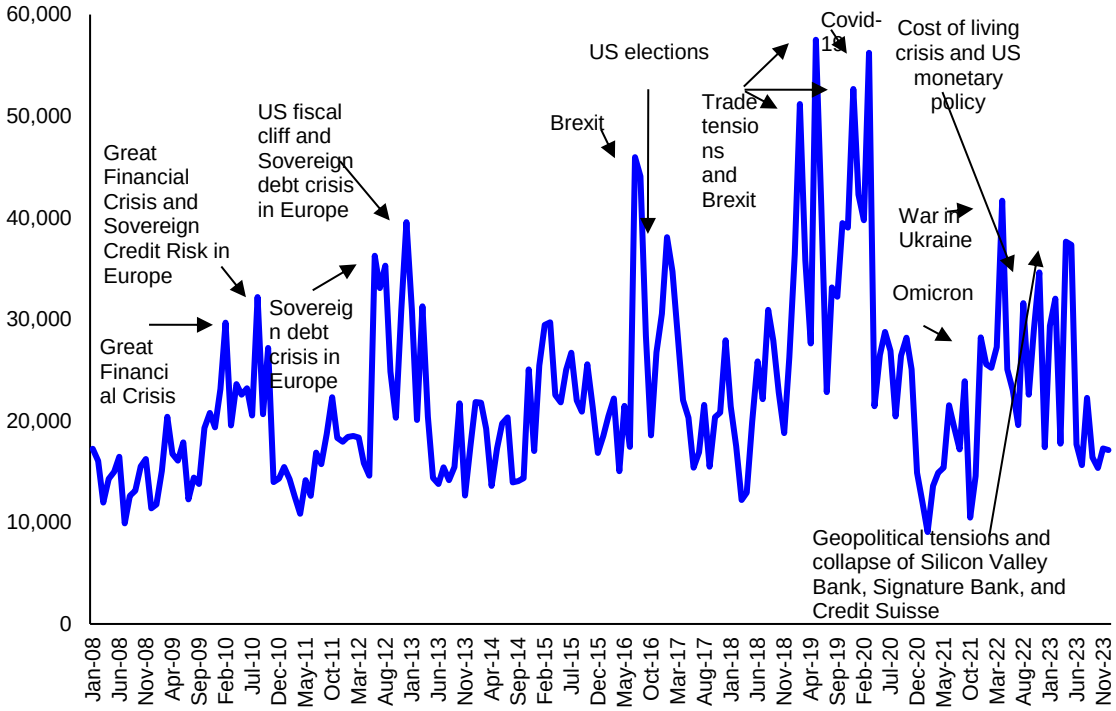

Figure 4: World Uncertainty Index (WUI), (GDP Weighted Average).
Source: (Ahir et al., 2022)

The WUI differs from the EPU in two key dimensions. First, the sources used to build the indexes are different. While the EPU relies on a large set of newspapers, the WUI is constructed using country reports from the same Economist Intelligence Unit source adapted to national economic and political developments. Accordingly, the WUI has

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fewer concerns about the ideological bias and consistency. Second, it can be more easily compared across countries, which makes the WUI particularly useful for researchers interested in examining the impact of cross-country variations in the level of uncertainty on economic outcomes (for example, whether foreign investors invest more in countries with lower levels of uncertainty). Yet, despite the differences between the EPU and the WUI, the global WUI shows a strikingly high correlation (0.705) with the global EPU index (Ahir et al., 2022).

Important events that led to increases in the global WUI were the First Gulf War in 1991, the September 11 attacks in 2001, the Gulf War and the SARS epidemic in 2003, the financial debt crisis caused by the 2008 US mortgage crisis, the European debt crisis in 2010 and beyond, the European border control crisis, the 2011 Iraq war, the FED's contractionary monetary policy in 2014, Brexit referendum, the 2016 US presidential elections, the USA-China trade wars that started in 2019 and the COVID-19 global epidemic (Figure 4). Cross-country comparisons revealed that the level of uncertainty varies across countries and is, on average, smaller in developed economies than in the rest of the world. It is predicted that, under the influence of globalization, the uncertainty index will continue to grow (Ahir et al., 2022).

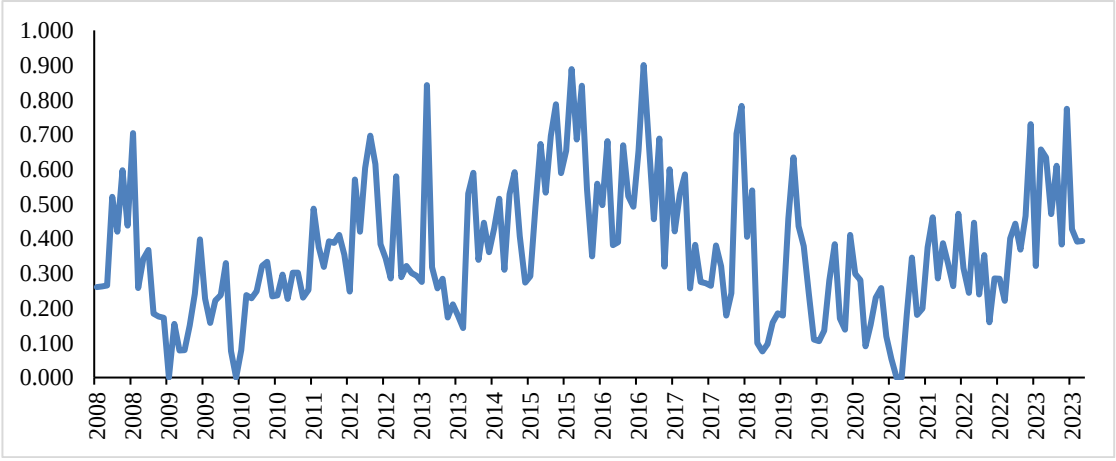

Figure 5: World Uncertainty Index in Turkey.
Source: (Ahir et al., 2022)

Foreign policies in Turkey, which started with the liberalization movements after 1980 and gained momentum with the liberalization of capital movements in 1989, are currently active. However, along with the positive aspects of this opening, the country also opened to negative developments abroad. Accordingly, the events arising from external factors affected the uncertainty situation in Turkey. Relevant events in this respect were the 1st Gulf War in 1990, the Iraq War in 2003 and 2011, the European Foreign Debt Crisis in 2012, the FED's monetary tightening in 2015, the US Presidential Election in 2016, and the failed coup attempt on July 15, 2016, when the index rose to its historically highest

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level. Some increases were also observed during the Kobani protests, also known as the 6-7 October events, and during the COVID-19 pandemic (Figure 5).

ECONOMETRIC METHODOLOGY

Unit Roots with Structural Breaks (Modified ADF Test)

To be consistent with the existing literature, it is assumed that at most one break has occurred in the trend function. The date of the break (should it occur) is denoted by T_b^c with $1 < T_b^c < T$, where T is the sample size. (Here the superscript 'c' denotes the 'correct' break date). Since we assume the break date to be unknown, regressions are estimated using break dates, Tb, that differ from the correct break date. The models are labeled as follows: Model 1 allows a shift in the intercept; Model 2 allows both a shift in intercept and slope; and Model 3 allows a 'smooth' shift in the slope by requiring the joining of the end points of the two segments of the broken trend (Vogelsang & Perron, 1998).

The Additive Outlier Model

The AO model applies to cases where the break is assumed to occur instantly and is not affected by the dynamics of the series. They are given by the following:

$$y_t = \mu + \beta_t + \theta DU_t^c + z_t \quad \text{(Model 1)}$$
$$y_t = \mu + \beta_t + \theta DU_t^c + \gamma DT_t^c + z_t \quad \text{(Model 2)}$$
$$y_t = \mu + \beta_t + \gamma DT_t^c + z_t \quad \text{(Model 3)}$$

Where $DU_t^c = 1(t > T_t^c)$, $DT_t^c = 1(t > T_t^c)(t - T_t^c)$ and 1(.) is the indicator function. The error z_t is specified to be an ARMA (p + 1, q) process defined as A (L)zt=B (L)et, where e_t is i.i.d. $(0, \sigma^2)$ with finite fourth polynomials in L of order p + 1 and q, respectively, where A(L) can be factored as A(L) = (1- αL) A*(L), and A*(L) is a pth order polynomial in L. It is assumed that A*(L) and B(L) have all roots outside the unit circle.

The Innovational Outlier Model

The innovational outlier model is applicable to cases where it is more reasonable to view the break as occurring more slowly over time. In principle, the dynamic path of adjustment of the shift can take any form. However, a natural and convenient way to model the dynamics is to assume that the series reacts to shocks to the trend function identically as it responds to shocks to the innovation process. This assumption can be captured using the following specification. Under the null hypothesis of a unit root, Y_t is given by the following:

$$y_t = y_{t-1} + \beta + \psi^*(L)(\theta D(T_b^c)_t + \varepsilon_t) \quad \text{(Model 1)}$$
$$y_t = y_{t-1} + \beta + \psi^*(L)(\theta D(T_b^c)_t + \gamma DU_t^c + \varepsilon_t) \quad \text{(Model 2)}$$
$$y_t = y_{t-1} + \beta + \psi^*(L)(\gamma DU_t^c + \varepsilon_t) \quad \text{(Model 3)}$$

Note that the immediate impact of a shift in slope in, for instance Model 3 is given by

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γ, while the long-run impact is given by $\psi^*(1)\gamma$. Under the alternative hypothesis, Y_t is given by the following:

$$y_t = \mu + \beta_t + \psi^*(L)(\theta DU_t^c + \varepsilon_t) \quad \text{(Model 1)}$$

$$y_t = \mu + \beta_t + \psi^*(L)(\theta DU_t^c + \gamma DT_t^c + \varepsilon_t) \quad \text{(Model 2)}$$

$$y_t = \mu + \beta_t + \psi^*(L)(\gamma DT_t^c + \varepsilon_t) \quad \text{(Model 3)}$$

Structural Vector Auto Regression (SVAR) Analysis

To overcome the estimation problems arising in econometric models, Sims (1980), established a simultaneous equation system that accepted all variables as endogenous (Sims, 1980). By including the lagged values of all variables in the equations, the author examined the dynamic interactions of all variables with each other. VAR models are easy to estimate and flexible models for time series analysis. However, since there are no restrictions in VAR models, the coefficients obtained from variance decomposition and impulse response functions may not yield clear results. To attend to this concern, Sims (1980) and Bernanke (1986), developed the Structural Vector Auto Regression (SVAR) model that considered the distinction of error terms in the system, basically the linear combination of external shocks was included in the model. SVAR analysis focuses on the errors of the system, also referred to as external shocks, instead of interpreting the calculated coefficients as in VAR analysis. Obtaining structural shocks is central to a wide range of VAR analysis, including impulse response, forecast variance decomposition, historical decomposition, and other forms of causal analysis (Bernanke, 1986; Sims, 1986).

The structural form of the VAR model, Structural Vector Auto Regression (SVAR), can be written shown in Eq. (1) (Bernanke, 1986):

$$Ay_t = A_1^s y_{t-1} + \cdots \ldots \ldots + A_p^s y_{t-p} + C^s x_t + Bu_t \quad (1)$$

Where A, all of the A_i^s, and C^s are the structural coefficients, K sets a set with internal variables, and the u_t are the orthonormal unobserved structural innovations with $E(u_t u_t') = I_k$. i=1, ⋯, p for A_i (KxK) dimensional coefficient matrices, and u_t is $(kx1)$ dimensional random errors vector. The main diagonal values of vector A are 1 (Pfaff, 2008).

One of the main advantages of the SVAR model is that impulse-response functions are obtained by placing short- and long-term constraints in the calculation process of the model. Obtaining impulse-response functions obtained through the SVAR model is similar to VEC models (Breitung et al., 2004; Lütkepohl, 2005).

While classical variance decomposition shows which variable is the most effective on a variable and its percentage, impulse-response functions show the effect duration of this shock. Structural variance decomposition expresses which structural shock is the most effective on a variable and its percentage. Variance decomposition analysis, which

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investigates the sources of structural shocks occurring in variables, indicates the extent to which the changes in endogenous variables caused by the changes in the internal variables and how much the changes are caused by shocks in the system (Damane, 2018).

The impact of shocks that will occur in the error terms of the variables in the model on other variables is measured by impulse-response functions. Said differently, whenever a unit standard deviation shock is applied to one of the variables, the reactions of the other variables in the model to this shock are measured by the impulse response function (Enders, 2004). Structural impact response functions show the course of this impact and how long it will last. Another important aspect to evaluate is whether this variable is effective and can be used as a policy tool. While the constraints applied to the system in the VAR model are made according to Cholesky decomposition, SVAR makes them according to structural decomposition. In this respect, there may be short-term constraints developed by (Bernanke, 1986), as well as long-term constraints developed by Shapiro & Watson, 1988. The use of short- or long-term constraints depends on whether the shocks are temporary or permanent (Enders, 2004).

For long-run constraints to apply, each shock must continuously affect at least one variable. The long-term multiplier is obtained from the cumulative sum of the moving average coefficients that show the impact of the structural shock on a certain internal variable.

The SVAR model can be examined in the following three groups (Pfaff, 2008):

- Matrix B is set as the identity matrix (IK), and at least $(K-1)/2$ restriction must be added to matrix A to define it.
- Matrix A is set as the identity matrix (IK), and to define it, at least $(K(K-1))/2$ restriction must be added to matrix B. Restrictions are added to both matrices, a minimum of $K2+(K(K-1)/2$ constraint must be added.
- Constraints are added to both matrices; at least $K2+(K(K-1)/2$ restrictions must be added to make a definition.

To estimate the effect of FDI change on these selected variables, we use a structural VAR (SVAR) model that includes; TWUI, WUI, GPR, TGPR, and EPU. The long-term restrictions matrix, which is the determinant of structural shocks, is given in the following matrix. SVAR model, the Matrix (2) consisting of variables can be expressed as follows (Table 3).

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$$\begin{bmatrix} \varepsilon_t^{FDI} \\ \varepsilon_t^{WUIT} \\ \varepsilon_t^{WUI} \\ \varepsilon_t^{GPR} \\ \varepsilon_t^{GPRT} \\ \varepsilon_t^{EPU} \end{bmatrix} = \begin{bmatrix} 1 & \ldots & \ldots & \ldots & \ldots & \ldots \\ \alpha_{21} & 1 & \ldots & \ldots & \ldots & \ldots \\ \alpha_{31} & \alpha_{32} & 1 & \ldots & \ldots & \ldots \\ \alpha_{41} & \alpha_{42} & \alpha_{43} & 1 & \ldots & \ldots \\ \alpha_{51} & \alpha_{52} & \alpha_{53} & \alpha_{54} & 1 & \ldots \\ \alpha_{61} & \alpha_{62} & \alpha_{63} & \alpha_{64} & \alpha_{65} & 1 \end{bmatrix} \begin{bmatrix} \mu_t^{FDI} \\ \mu_t^{WUIT} \\ \mu_t^{WUI} \\ \mu_t^{GPR} \\ \mu_t^{GPRT} \\ \mu_t^{EPU} \end{bmatrix} \quad (2)$$

DATA SET AND ECONOMETRIC ANALYSIS RESULTS

This study aims to analyze the dynamic effects of FDI in the dimension of risk and uncertainty for the period 2008:01-2022:12 in Turkey. FDI, TWUI, TGPR, WUI, GPR, and EPU using these variables, the SVAR model was estimated. The variables and the sources are summarized in Table 1.

Table 1: Variables and Data Sources.

Variables	Description of Variables	Source of Data
FDI	Foreign Direct Investments	TCMB
WUI	The World Uncertainty Index	Ahir et al. (2022)
TWUI	The World Uncertainty Index for Turkey	
GPR	Global geopolitical risk	Caldara and Iacoviello (2018)
TGPR	Turkey geopolitical risk for Turkey	
EPU	Economic-Political Uncertainty Index	Davis (2016)

Before starting the analysis, the ADF unit root test, which takes structural breaks into account, is applied for the stationarity analysis of the series. The H_0 hypothesis is rejected for all series. The results show that all series do not contain unit roots at their levels; the series is stationary (Table 2). Moreover, according to traditional unit root tests that do not take structural breaks into account, all series are stationary on the level.

Table 2: Unit Roots with Structural Breaks (Modified ADF Test).

	Model 1		Model 2		Model 3	
Variables	**t-Statistic**	**Break Date**	**t-Statistic**	**Break Date**	**t-Statistic**	**Break Date**
FDI	-7.00	2011M08	-8.23	2015M03	-8.29	2020M03
TWUI	-7.25	2018M06	-8.20	2018M06	-8.26	2017M07
TGPR	-9.08	2010M06	-9.52	20109M10	-9.81	2015M11
WUI	-7.02	2019M02	-8.35	2020M03	-8.29	2020M03
GPR	-8.62	2022M03	-8.87	2022M03	-9.52	2022M01
EPU	-5.90	2018M06	-6.18	2018M06	-6.18	2018M09

Vogelsang & Perron (1993) asymptotic one-sided p-values. -4.94, -4.44 and -4.19;

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Trend Specification: Trend and intercept -5.34, -4.85 and -4.60

Although, according to the final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC), and Hannan-Quinn information criterion (HQ) information criteria, the optimal lag length is 3, the error terms are not normally distributed, and there is a heteroscedasticity and autocorrelation problem. Since the model cannot be estimated in this way, the Sequential modified LR test statistic (LR) information criterion is used, which calculates the optimal lag length as 8. It is estimated using SVAR (8) in impulse response and variance decomposition estimates (Table A in Appendix).

Table 3: SVAR Model Long-Term Multiplier Matrix.

	FDI	TWUI	TGPR	WUI	GPR	EPU
FDI	0.614390 0.0000	0	0	0	0	0
TWUI	-0.338933 0.0000	0.927520 0.0000	0	0	0	0
TGPR	1.367658 0.0000	1.579659 0.0000	1.071336 0.0000	0	0	0
WUI	0.971040 0.0000	0.104837 0.0502	0.321020 0.0000	0.620051 0.0000	0	0
GPR	0.726752 0.0000	0.270418 0.0000	0.497726 0.0000	-0.250585 0.0000	0.458870 0.0000	0
EPU	3.100848 0.0000	-1.821031 0.0000	1.895203 0.0000	-0.008259 0.9152	0.282597 0.0000	0.976981 0.0000

The terms ($\boldsymbol{\alpha n}$) in Table 3 indicate the structural coefficients (constraints) in matrix A. SVAR analysis is estimated using the long-term constraints matrix to examine the structural effects of risks and uncertainties on FDI. The purpose of the SVAR model is to provide preliminary information about the impact of structural shocks on the signs and significance levels of the coefficients in the multiplier matrix. The results show that, except for ($\boldsymbol{\alpha}$18), all of the coefficients obtained from the long-term multiplier matrix are statistically significant.

Table 4: Diagnostic Test Results of the VAR Model.

Tests	Test Statistic	p-value
Normal distribution (Jarque-Bera)	1.92	0.3815
Heteroscedasticity WHT (Chi-Sq)	2020.97	0.4646
Autocorrelation LM	28.47	0.8102
AR Roots	It lies in the range of 0.07–0.97.	

Source: Author own computation

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Furthermore, the results reveal that the model does not contain any diagnostic problems. In addition, it is understood that the inverse roots of the AR characteristic polynomial are in the range of 0.07–0.97 (Table 4) and are within the unit circle, and the SVAR model is stable (Figure A2 in Appendix). All these evaluations show that the SVAR model is stable and contains no structural problems.

Furthermore, we examine impulse response functions and variance decomposition to interpret the reactions of the variables used in the analysis to structural shocks. Cholesky decomposition is used in the VAR model, while prediction is made with impulse response functions obtained with the help of structural decomposition in the SVAR model.

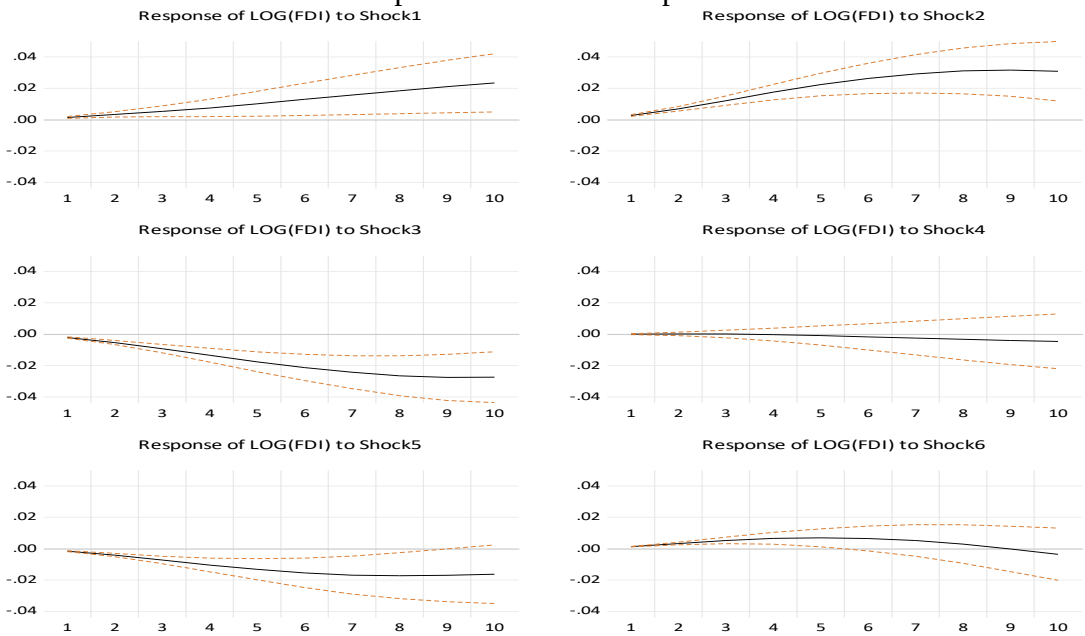

Figure 7: Long-Term Results of Structural Impulse-Response Functions.
Source: It is estimated in the EViews program.

Figure 7, which shows the impulse-response functions, shows the course of shocks to FDI. It shows in which direction other variables will react to a standard deviation in one variable. The impact of Shocks 1 and 2 on FDI has a positive trend; the impact of Shocks 3 and 5 on FDI is negative; the impact of Shocks 4 and 6 on FDI appears to be stable and quite small.

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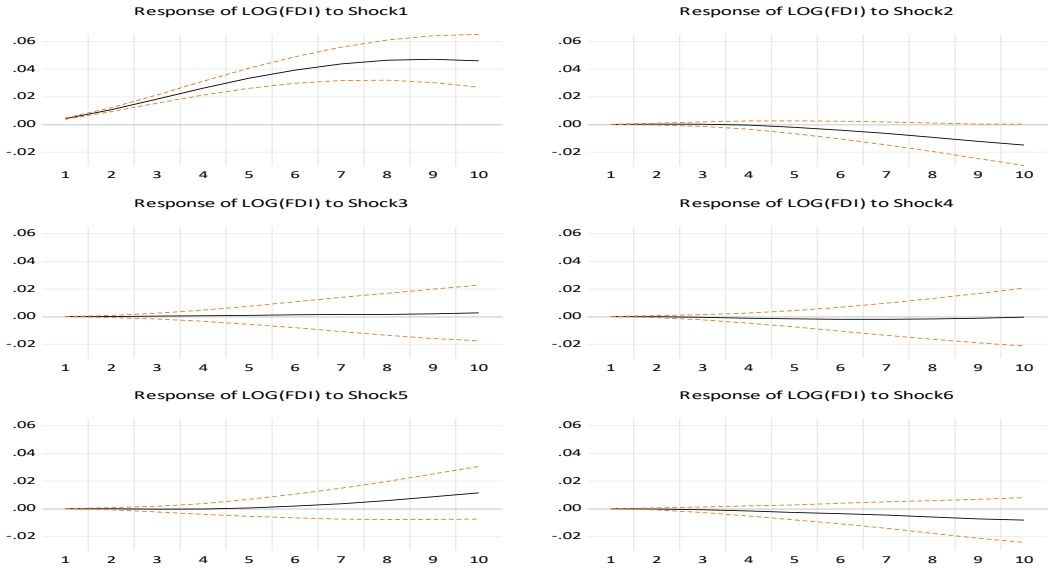

Figure 8: Short-Term Results of Structural Impulse-Response Functions.
Source: It is estimated in the EViews program.

In the short term, the impact of shock 1 is positive, while, in the long term, Shocks 2 and 6 have a negative effect, Shocks 3 and 4 have little effect, and Shock 5 follows a positive course. Only Shocks 1 and 4 have the same effect in the short and long term. Of note, the effect of global uncertainty does not change in the short and long term and has identical effect. The next step in the SVAR analysis is to perform variance decomposition analysis to determine the sources of changes in FDI.

- Shock 1: Structural changes in FDI
- Shock 2: Simultaneous changes in FDI and TWUI
- Shock 3: simultaneous changes in FDI, TWUI, and TGPR
- Shock 4: Simultaneous changes occurring in FDI, TWUI, TGPR, and WUI
- Shock 5: Simultaneous changes occurring in FDI, TWUI, TGPR, WUI, and GPR
- Shock 6: Simultaneous changes occurring in occurring FDI, TWUI, TGPR, WUI, GPR, and EPU

Table 5: Structural Variance Decomposition of FDI in the Long Term.

Period	S.E.	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6
1	0.004164	10.21233	38.83103	26.84560	0.000424	14.74447	9.366151
2	0.011458	9.706312	40.85869	25.38849	0.011106	14.63127	9.404138
3	0.021670	8.585282	42.35822	25.33741	0.004451	15.25379	8.460842
4	0.034115	8.167457	43.43448	25.75343	0.010095	15.49159	7.142945
5	0.047931	8.543202	43.76245	26.61743	0.039455	15.37337	5.664101
6	0.062340	9.338875	43.55201	27.35423	0.104503	15.23620	4.414183
7	0.076737	10.32801	43.17600	28.06103	0.176396	14.88679	3.371781

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8	0.090628	11.52200	42.70391	28.69121	0.259707	14.30143	2.521751
9	0.103552	12.95029	42.03486	29.07879	0.350758	13.65323	1.932071
10	0.115205	14.58937	41.12325	29.14864	0.442685	13.03841	1.657644

Source: It is estimated in the EViews program.

According to the variance decomposition results in Table 5, there are no big differences between the first and last periods of FDI changes. Considering the latest period, approximately 14% of foreign direct investments originate from their historical values, approximately 41% from TWUI, and approximately 29% from changes in TGPR. It is seen that approximately 13% is explained by GPR. It is noteworthy that the changes in WUI and EPU are explained at a very low rate. Taken together, these results suggest that global geopolitical risk and economic-political uncertainty (WUI and EPU) affect FDI less than other factors. Conversely, it is seen that FDI is affected by Turkey's uncertainty, and Turkey's geopolitical risk (TWUI and TGPR) is quite effective, and GPR is effective. In addition to the individual impact-response graphs of the variables, the graphs showing the effects of all variables on FDI are shown Figure A3 in Appendix.

Table 6: Structural Variance Decomposition of FDI in the Short Term.

Period	S.E.	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6
1	0.004164	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.011458	99.93176	0.035267	0.003770	0.000904	0.000242	0.028058
3	0.021670	99.76638	0.015784	0.025924	0.047442	0.017937	0.126537
4	0.034115	99.50411	0.025772	0.046543	0.133541	0.011303	0.278728
5	0.047931	99.08545	0.202276	0.060555	0.173848	0.019735	0.458135
6	0.062340	98.46287	0.558179	0.081828	0.196998	0.106276	0.593848
7	0.076737	97.57789	1.085323	0.095091	0.192409	0.291172	0.758117
8	0.090628	96.28537	1.826746	0.100153	0.172705	0.632070	0.982954
9	0.103552	94.50971	2.797380	0.114086	0.144918	1.181044	1.252861
10	0.115205	92.33339	3.930521	0.146777	0.118058	1.950752	1.520497

Source: It is estimated in the EViews program.

The course of the variables explaining FDI differs in the short term. The power of Shock 1 to explain FDI is quite high compared to other shocks; that is, its own past values largely explain FDI. Risk and uncertainty do not seem to impact FDI in the short term.

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Table 7: Variables in the Short-Long Term Summary of Impulse-Response and Variance Decomposition Analysis Results.

	Structural Impulse-Response Functions		Structural Variance Decomposition	
	Long Term	**Short Term**	**Long Term**	**Short Term**
TWUI	Positive	Negative	41%	To a very small extent
TGPR	Negative	Fixed and very little	29%	To a very small extent
WUI	Fixed and very little	Fixed and very little	To a very small extent	To a very small extent
GPR	Negative	Positive	13%	To a very small extent
EPU	Fixed and very little	Negative	To a very small extent	To a very small extent

To avoid confusion related to examining risk and uncertainty in multiple dimensions with different indicators, national-global and short-long term with impact-response and variance decomposition analyses, the results are summarized in Table 7.

CONCLUSION, RECOMMENDATIONS AND POLICY IMPLICATIONS

While risks and uncertainties have always affected the world's countries, the early days' risks differ from the risks experienced today in many important ways. Globalization and technological developments have caused significant changes in risks. While historically, major risks arose from external factors such as natural disasters, epidemics, or wars, today, risks are mostly caused by economic, political, and social factors. In the early days, risks typically occurred on the local or regional level. Nowadays, risks (e.g., climate change, financial crises) can quickly spread globally.

Risk varies depending on demographic, economic, structural, and political characteristics of each individual country. Military tensions, war risks, political regime changes, economic and political uncertainties in countries bring economic problems to the countries in which investment will be made. In addition to affecting many factors, geopolitical risks that are among the major determinants of foreign direct investment decisions can affect the entire economy. Development of a country is a nonlinear yet interrelated process with numerous potential country risks. Risk and uncertainty situations play a decisive role for investors in making investment decisions. This having been said, risks can be measured and predicted based on statistical data where the probability distribution is known. Conversely, uncertainty is a situation where the probability distribution is unknown, and the probability cannot be measured exactly.

The study aims to examine the simultaneous effects of geopolitical risk, economic-political uncertainty, and global uncertainty on FDI, both on the Turkish economy and on a global scale. To see the impact of uncertainties and risks on FDI and to find out which factor affected FDI, the SVAR model was established, and impulse-response and

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variance decompositions were estimated.

According to results concerning impulse-response functions, in the long run, the effect of Turkey's uncertainty on foreign direct investments is positive until a certain period while Turkey's geopolitical risk and global geopolitical risk are negative. The results showed that the impact of global uncertainty and economic-political uncertainty on foreign direct investments is stable and quite low. Consequently, it can be concluded that, in the long term, global and economic-political uncertainty does not have a relatively large impact on FDI. The results showed that geopolitical risk has a negative impact on both national and global dimensions. Furthermore, in the short term, the effect of Turkey's uncertainty and economic-political uncertainty on FDI was found to be negative, the effect of Turkey's geopolitical risk and global uncertainty on FDI was quite low, and the effect of global geopolitical risk on FDI was positive.

In summary, results highlighted substantial differences between long- and short-term perspectives. While global uncertainty constantly affects FDI, in both the short and long term, in the event of global uncertainty, FDI for Turkey appears not to be considerably affected. According to results, Turkey's geopolitical risk has a negative impact on FDI in the long term and very little in the short term. Furthermore, global geopolitical risk has a negative impact in the long term and a positive impact in the short term. Geographically, Turkey is strategically located at the intersection of Asia and Europe. However, this advantageous geographical location exposes the country to high geopolitical risks, such as a negative impact on FDI in the long term. These factors may lead investors to delay or more carefully evaluate their investment decisions. In this context, to ensure investment environment, Turkey's important strategic priority should be effective preparation against geopolitical risks and strengthening its policy and security measures. However, in the short term, increasing global geopolitical risk may cause Turkey to be seen as a haven. Indeed, as revealed by the results, economic-political uncertainty does not have considerable effect on FDI in the long term but is negative in the short term.

When looking at the impact of FDI in terms of uncertainty and risk, the results show that geopolitical risk is much more effective than global and economic-political uncertainty. While the increase in Turkey's geopolitical risk negatively affects FDI, the increase in global geopolitical risk has a positive impact on FDI in the short term, but a negative one in the long term.

According to variance decomposition results, the FDI value does not considerably vary over the 10 tested periods. While approximately 14% of FDI is explained by its own past values, approximately 41% is due to Turkey's uncertainty, approximately 29% of which is largely explained by changes in Turkey's geopolitical risk. Furthermore, approximately 13% of FDI is explained by global geopolitical risk. Collectively, results

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highlight that global geopolitical risk and economic-political uncertainty (WUI and EPU) affect FDI less than other factors. However, we also find that FDI is affected by Turkey's uncertainty, as Turkey's geopolitical risk (TWUI and TGPR) is quite effective, and GPR is effective. In the short run, all variables explain FDI to a very small extent.

The results are largely consistent with those previously reported in the literature. Similar to the findings in this study, previous empirical studies on the effects of risks and uncertainty on foreign direct investments generally point to their negative effects (Canh et al., 2020; Nguyen & Lee, 2021; Türkmen & Yaşar, 2023). Yet, several previous studies also showed that risks and uncertainty do not have a significant effect (Fania et al., 2020; Wheeler & Mody, 1992; Yu & Wang, 2023).

Overall, increases in risk and uncertainty frequently result in individuals' reduction of their consumption expenditures, investors' postponement of their investment decisions, and producers' reluctance to open to new markets. These processes may decrease production and employment, thereby negatively affecting economic growth and countries' welfare. Accordingly, policymakers should be aware of the importance of policies to strengthen risk management and uncertainty coping strategies to ensure economic stability.

The contribution of FDI to economic growth is closely related to technology transfer, employment increase, and potential to support human capital. Accordingly, the fact that these investments sustainably exist in the country and support financial development stands out as an important factor in economic development processes.

The results of the present study provide an important guide for policymakers to strengthen their strategies to attract FDI, support sustainability, and optimize the positive effects of these investments on economic growth. Incorporating uncertainty into the policy-making process will help to develop appropriate policy responses. Reducing the effects of geopolitical risk factors and creating safe investment environments will contribute to economies, thereby helping to achieve a more dynamic and effective structure.

Furthermore, policymakers should take into account that economic agents may become more cautious in an environment of uncertainty, which eventually may result in a decrease in the economy's response to stimulatory policies. In this case, a more aggressive policy may need to be implemented, which again underscores the importance of an accurate assessment of uncertainty. Considering that FDI is affected by global geopolitical risks and global uncertainty, it is important to support it with proactive foreign policies. Doing so will lead to positive results in areas such as sustainable economic growth and employment.

From the perspective of investors, the results of the present study suggest that

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investment decisions should be taken considering systematic risks and uncertainties such as market, exchange rate, interest rates, inflation, and political and geopolitical risks. deciding in favor of investing into a foreign country comes with many advantages, such as strengthening the relations between countries, increasing economic cooperation, and establishing strong ties in trade, all of which create a positive dynamism between countries. Good relations between countries; It should not be forgotten that this will be possible with a fair, balanced strategy and effective diplomacy.

This having been said, it should also be noted that industrial activities resulting from the increase in FDI may create significant pressure on the environment, with the corresponding negative effects such as environmental pollution, depletion of natural resources, and climate change. Accordingly, it is important to minimize the environmental impacts of FDI and act in accordance with sustainability principles. In this context, it is pivotal for the host country and investors to ensure that FDI creates within a sustainable environment.

These topics can be recommended for researchers who want to examine the effects of foreign direct investments on risk and uncertainty in a different dimension, with cultural and social factors as well as environmental risks, technology, innovation impact, sectoral and regional analyses. Examining it from different perspectives can contribute to a better understanding of investment decisions and policies and develop more effective strategies.

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Appendixes

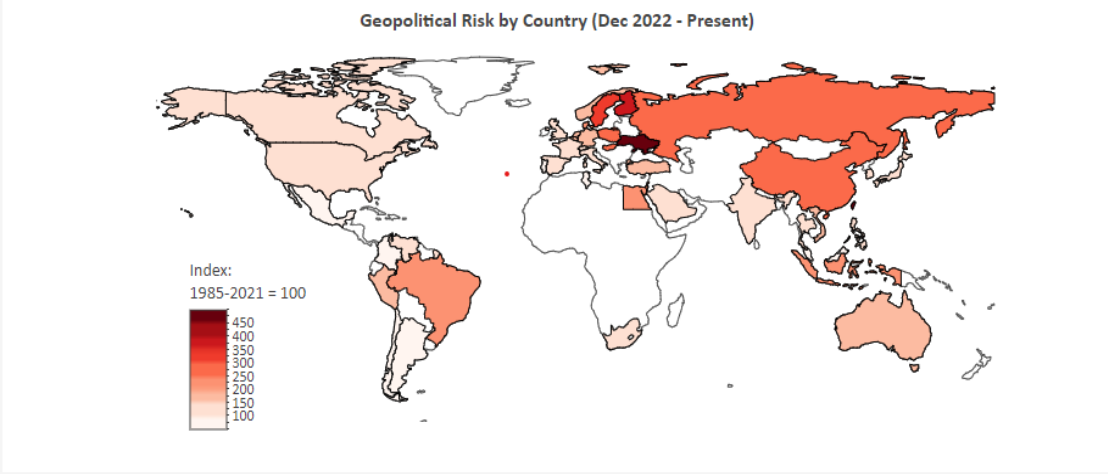

Figure A: Geopolitical Risk Values of Countries.

Table A: Optimal Delay Length Values of the Model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-153.8320	NA	2.58e-07	1.858512	1.968308	1.903059
1	431.2503	1122.542	4.36e-10	-4.526167	-3.757592	-4.214336
2	764.3320	615.8139	1.38e-11	-7.980605	-6.553253	-7.401491
3	862.4348	174.5317	6.73e-12*	-8.702731*	-6.616601*	-7.856334*
4	886.8520	41.73623	7.75e-12	-8.568046	-5.823138	-7.454366
5	902.8068	26.15854	9.90e-12	-8.334963	-4.931277	-6.953999
6	932.7080	46.93787	1.08e-11	-8.264046	-4.201582	-6.615799
7	966.5286	50.73097	1.14e-11	-8.238705	-3.517463	-6.323175
8	1004.929	**54.92083***	1.14e-11	-8.266611	-2.886591	-6.083798

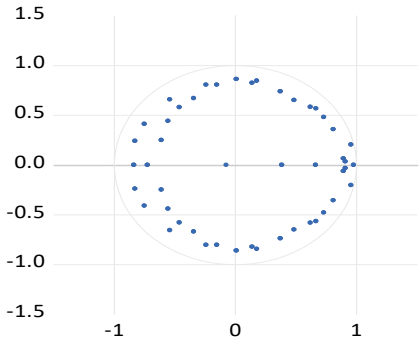

Figure A2: Inverse Roots of AR Characteristic Polynomial.

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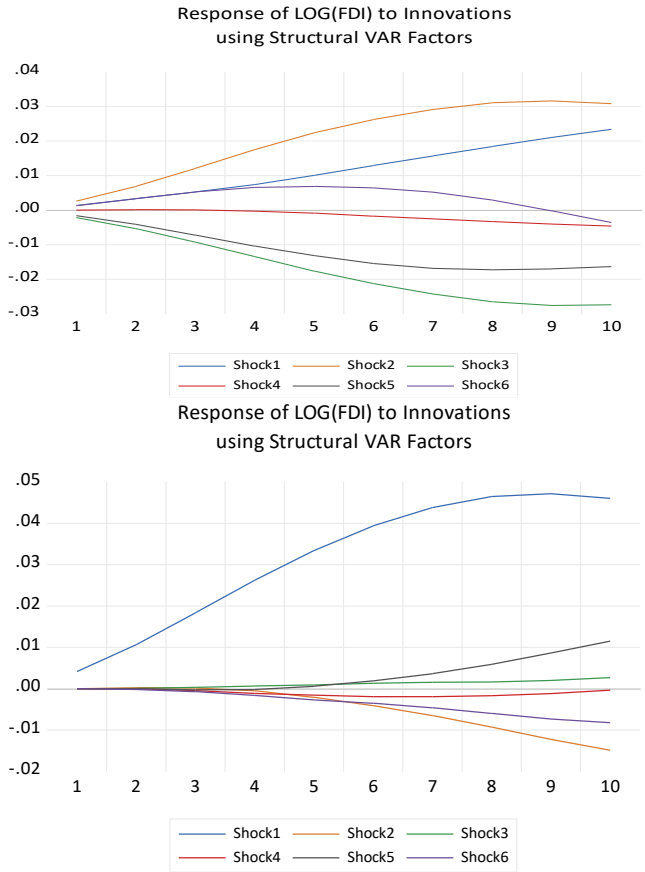

Figure A3: Response of LOG(FDI) to Innovations using Structural VAR Factors (Combined Graphs).