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The Impact of Geopolitical Risk on Corporate Investment: Evidence from Turkish Firms

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This study analyzes the effects of geopolitical risk on the corporate investment of 164 Turkish manufacturing firms listed in Borsa Istanbul (BIST). The time covers the period from 2005 to 2019, applying the system Generalized Methods of Moments (GMM) estimator. The results indicate that geopolitical risk hurts corporate investment in Turkey. Under uncertainty induced by geographical risk, firms prefer to decline their investment. Additionally, financially constrained (non-dividend, small, young) firms are more negatively affected than financially unconstrained firms. Our findings are robust under alternative measures of geopolitical risk. Overall, this study reveals that geopolitical risk is a significant uncertainty affecting the investment decisions of manufacturing firms in Turkey.

Keywords: *Geopolitical Risk Index; Corporate Investment; Borsa Istanbul; Financial Constraints, GMM*

JEL Classification: D89, B23, 016

Introduction

Geopolitical risk is defined as the risk associated with wars, terrorist acts, and tensions between states that affect the normal and peaceful path of international relations. It indicates both the risk of these events occurring and the new risks associated with the escalation of existing circumstances. Geopolitical risk has recently been seen as an alternative political risk criterion because of the wide-area it affects. However, it greatly differs from other measures of political instability and macroeconomic risks. Geopolitical risk is inherently broader because it encompasses all local and international events rather than focusing solely on domestic political issues (Alsagr & Almazor, 2020).

Geopolitical conditions directly affect a country's commercial and economic activities (The Economic Times, 2019). Events, such as terrorist incidents, civil wars, cyberattacks, trade and energy battles, oil supply drops, migration waves caused by wars and conflicts, economic sanctions, and political tensions increase the level of geopolitical risk. These events are external shocks that increase uncertainty in the economy and cause adverse effects on economic factors (Julio & Yook, 2012; X. Wang, Wu & Xu, 2019). Since the 90s, many economies, especially developing economies, have been exposed to various events that increase geopolitical risks such as the Arab Spring, nu-

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clear tension related to Iran and North Korea, the 2014 Russia Ukraine Crisis and the military rebellion, and the Covid-19 pandemic. The uncertainties created by these geopolitical occurrences have caused various consequences along with the spillover effect on all developing and developed countries in the age of globalization (Lu, Gozgor, Huang & Keung, 2020).

At the micro level, which is also the focus of this study, geopolitical risk can be an important determinant of capital investment decisions. Geopolitical risks may have indirect effects on trade flows; they often prompt firms to reduce capital investments because of the increased cost of trading and doing business. Therefore, the export and import decisions of firms may be affected indirectly (Balcilar, Bonato, Demirer & Gupta, 2018; Gupta, Gozgor, Kaya & Demir, 2019). Most modern investment agreements are intended to facilitate global investments by including protection against many risks, such as expropriation. However, geopolitical risks are largely excluded from these agreements. The heightened cost of return on investments in an environment of high uncertainty – caused by the limited access to accurate information associated with geopolitical risk – can lead firms to postpone, restrain, or cancel investment and loan activities. This is due to the uncertainty over the future return of the investments as well as the partial or complete irreversibility of the investments (Demir & Danisman, 2020; Dixit & Pindyck, 1994). One of the key points of geopolitical risk determining how to measure it. In the study conducted by Caldara & Iacoviello (2018), a geopolitical risk (GPR) index was created and started to be used as an indicator in academic studies. The geopolitical risk index was calculated both globally and for individual countries.

This study intends to analyze the impact of geopolitical risk on corporate investment for Turkish firms. We choose Turkey as a country of interest because it has an important geographical location that serves as a bridge between Europe and Asia. Turkey is bordered by Greece in the west, Russia in the north, and Armenia, Azerbaijan, Iran, Iraq, and Syria from the east to the south. There are several challenging circumstances affecting Turkey's geopolitical state: the ongoing Aegean Sea continental shelf dispute with Greece, the Cyprus problem in the Mediterranean Sea, the European migrant crisis caused by the Syrian civil war, and the Eastern Mediterranean natural gas conflict that emerged in the west, whose borders with Armenia in the east are closed, are conducting so-called genocide talks with this country. It also supports Azerbaijan by being a direct party to the Azerbaijan-Armenia tension as a brother country. The tension and instability that started with the US invasion of Iraq in 2003 in the southeast region increased with the 2011 Arab Spring and the emergence of the civil war in Syria. The direct involvement of the US and Russia in the Syrian civil war, the ISIS terrorist organization that emerged by taking advantage of the vacuum in the region, the bombings in Istanbul and Ankara, and the migration of many people to Turkey as refugees adversely affected Turkey and the region. In addition, the conflict with Iran over Syria, sectarian disputes (Sunni-Shiite), and the US embargo on Iran are some of the other problems in the region. Having a volatile relationship with Russia in the north has increased tension in the region after Turkey shot down a Russian plane in 2015. Finally, the PKK terrorist organization, which has existed in the southeastern region of Turkey for 30 years, and the fact that neighboring countries use this as a trump card from time to time, increase tension in the region. Considering all these events, we thought that it would be important and interesting to analyze the impact of geopolitical risk on firms' physical investments in Turkey. In this direction, 164 Turkish manufacturing firms are included, and the effect of geopolitical risks on the investment decisions of these firms between the years 2005-2019 is analyzed.

According to the results, geopolitical risk is negatively associated with corporate investment. Based on the real options theory, firms prefer to wait and postpone their investment decisions until the geographical risk disappears. Moreover, while firms decline their investment because of geopolitical risks in the second and the third lagged times, this condition is not statistically significant for the fourth and

subsequent lagged times; in other words, the influence of uncertainty disappears. The negative impact of geopolitical risks on corporate investment is higher for financially constrained firms because of the increasing cost of external financing during uncertainty. Finally, we find robust results under alternative measurements of the GPR index. Our findings may be beneficial to the government and business world to cope with the geopolitical risks to support the economy. The remainder of this paper is organized as follows: Section 2 reviews the related literature and presents the hypotheses. Section 3 explains the data and empirical model. Section 4 indicates the empirical results and discussions, and finally, Section 5 is the conclusion part.

Literature Review and Hypothesis Development

Financial markets and commodity asset prices are among the areas where the impact of geopolitical risk is most studied in the literature. Apergis, Bonato, Gupta, & Kyei (2018); Balcilar et al., (2018); Demiralay & Kilincarslan (2019), and Hoque & Zaidi (2020) analyzed the impact of geopolitical risks on stock returns. Al Mamun, Uddin, Suleman, & Kang (2020) examined the relationship between geopolitical risk and stock returns, as well as five-year treasury bonds, the dollar index, gold futures, and the Bitcoin price index. Antonakakis, Gupta, Kollias & Papadamou (2017) measured whether the relationship between stock returns and oil prices is affected by geopolitical risk. Mei, Ma, Liao & Wang (2020) investigated the effects of geopolitical risk on the change in oil futures prices.

Economic growth is another area where the effect of geopolitical risk is examined. Akadiri, Eluwole, Akadiri & Avci (2020); Demir & Danisman (2020); Lu et al. (2020); Soltani, Triki, Ghandri, & Abderzag (2021), and Soybilgen, Kaya, & Dedeoğlu (2019) investigated the relationship between geopolitical risks and economic growth. Bilgin, Gozgor & Demir (2018) examined the impact of political risk on Turkey's export to 43 Islamic Development Bank member countries. They revealed that the macroeconomic instability in the importing countries is negatively related to Turkish exports. Tourism is another area where the impact of geopolitical risk is measured (Demir, Gozgor, & Paramati, 2019; Demir et al., 2020; Tiwari, Das, & Dutta, 2019). Gupta et al. (2019) examined the effects of geopolitical risks on trade flows between developing and developed countries. Oanh & Hoang (2020) studied the relationship between geopolitical risk and corporate social responsibility. Hao, Prapan, Gavriilidis, Petmezas, & Vagenas-Nanos, (2019) and Shen, Liang, Li, Liu & Lu (2021) analyzed the relationship between geopolitical risk and mergers and acquisitions. Pan (2019) measured the impact of geopolitical risk on corporate research and development (R&D) investment.

While Rajput, Bajaj & Siyal (2019) examined the impact of geopolitical risk on foreign currency transfers, Demir, Díez-Esteban, & García-Gómez (2019); Lee & Wang, (2021) and K.-H. Wang et al., (2020) analyzed the relationship between geopolitical risks and corporate cash holdings. Kotcharin & Maneenop (2020a) evaluated the geopolitical risk and cash holding decisions of global transportation firms. The study covered the period 1987-2017 and observed that transportation firms increased their cash reserves significantly after geopolitical risk increased. Furthermore, they found that the impact of geopolitical risk is higher for firms with greater financial constraints. Kotcharin & Maneenop (2020b) investigated the role of geopolitical risk in the financial leverage preferences of shipping firms from BRI (Belt and Road Initiative) member and non-member countries. The study documented that firms decrease their financial leverage as the geopolitical risk increases. X. Wang et al. (2019) searched for the relationship between geopolitical risk and institutional investments using data of 9.088 firms from 1987 to 2016. They found a strong negative relationship between firm-level corporate investments and geopolitical risk. Nonetheless, the impact was found to be less for labor-intensive firms. In addition, the impact of geopolitical risk is higher for firms in the tourism and re-

lated sectors and lower for firms in the defense sector. Fania et al. (2020) studied the impact of geopolitical risks on foreign direct investments in 16 West African countries. They revealed that geopolitical risk effects on foreign direct investment.

Considering the studies examining the relationship between geopolitical risk and capital investments, Bilgin, Gozgor & Karabulut (2020) measured the effects of geopolitical risks on general government investment (gross fixed capital formation). Using panel data for 18 countries from period 1985-2015, the study demonstrated that geopolitical risks have a positive impact on government investment. On the other hand, the effects on private sector firms are just the opposite. Dissanayake, Mehrotra & Wu (2018) investigated the impact of geopolitical risks on capital investments. They asserted that firms respond to geopolitical risks by reducing their capital investments. Kim, Park & Kwon (2019) analyzed the effects of geopolitical risk on investors' investment strategies in the Korean market, using the daily data of 505 firms for the period 2015-2017. They submitted that when the risk of North Korea increases at a high level, domestic investors increase the value of Korean portfolios while foreign investors decrease it. However, they observed that domestic institutional investors perform significantly better than foreign investors because of increased information asymmetry. Le & Tran (2021) examined the impact of geopolitical risk on emerging Asian countries and found that geopolitical risk hinders corporate physical investment. Firms with a higher degree of investment irreversibility are affected to a greater degree; on the other hand, firms with greater cash holdings can diminish the negative impact of geopolitical risk. Therefore, we propose the following hypothesis:

Hypothesis 1: *When geopolitical risk increases, firms reduce their corporate investment.*

Financially constrained firms reduce their investment more in an uncertain environment (Tan, 2010). The decline or postpone their investment more, as it will be financially costly to access external financing under uncertainty and risk (Dejuán & Ghirelli, 2018). We examine the effects of firms' financial constraints on the link between GPR and investment. Hence, we propose the following hypothesis:

Hypothesis 2: *When geopolitical risk increases, financially constrained firms to reduce their investment more than unconstrained firms.*

Data and Research Methods

GPR Index

Academicians and industry analysts create geopolitical risk barometers to help investors measure and overcome instability caused by geopolitical events (Petrov, Hentov & Zumbo, 2018). In addition, organizations such as the Global Risk Institute are also acting with the mission of cooperating with field experts in industry and academicians to assist efforts to cope with increasing uncertainty in global politics and establish risk management strategies in response to geopolitical developments (Global Risk Institute, 2020). It is difficult to measure geopolitical risk objectively and quantitatively. However, Dario Caldara and Matteo Iacoviello put forward a geopolitical risk measure, the GPR index, using terms such as 'geopolitical tensions,' 'war risk,' and 'terrorist threat' (Middeldorp, Groenewegen & Vreede, 2017). Caldara and Iacoviello (2016) developed this index based on newspaper reports containing a broad set of terms related to geopolitical tensions. The GPR Index is created by calculating the number of times (frequency of appearance) words related to geopolitical tensions appear in leading international newspapers (Cheng & Chiu, 2018; Lu et al., 2020). It measures the risk associated with events such as wars, political tensions, and terrorist acts that affect the normal course of domestic politics and international relations. Additionally, the Index reflects automated text searches in electronic archives of 11 national and international newspapers for articles containing a variety of keywords, including "war risk," "terrorist threats," and "geopolitical tensions" (Datta et al., 2017).

The importance of the index comes from its

Table 1. Sector Classification

Division	*Sectors*	*Obs.*	*%*
C10	Manufacture of food products	288	13.54
C11	Manufacture of beverages	89	4.18
C13	Manufacture of textiles	254	11.94
C16	Manufacture of wood and products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	15	0.71
C17	Manufacture of paper and paper products	120	5.64
C18	Printing and reproduction of recorded media	78	3.67
C19	Manufacture of coke and refined petroleum products	30	1.41
C20	Manufacture of chemicals and chemical products	212	9.95
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	15	0.71
C23	Manufacture of other non-metallic mineral products	325	15.28
C24	Manufacture of basic metals	155	7.29
C25	Manufacture of fabricated metal products, except machinery and equipment	100	4.70
C27	Manufacture of electrical equipment	139	6.54
C28	Manufacture of machinery and equipment n.e.c.	30	1.41
C29	Manufacture of motor vehicles, trailers, and semi-trailers	236	11.1
C31	Manufacture of furniture	30	1.41
C32	Other manufacturing	11	0.52
	Total	**2127**	**100**

perception that it measures real-time geopolitical risk perceived by global investors, policymakers, the media, and public opinion (Gupta et al., 2019). In particular, its impact on investment decisions is also highlighted by policymakers and included in a triad of uncertainty (along with economic and policy uncertainty) that can have significant negative economic effects (Carney, 2016; Hao et al., 2019). Because of its significance, many recent studies use GPR measurement as a representative of geopolitical uncertainty (Kotcharin & Maneenop, 2020a).

Data and Empirical Model

This study considers firms listed in the Borsa Istanbul (BIST) from 2005 to 2019. Firm-level data and macroeconomic variables are obtained from Thomson Reuters DataStream. If there is a missing value at the firm level, we benefit from the annual reports of the firms. The Geopolitical Risk Index (GPR) data is taken from its website[1]. The original sample is subjected to several sample selection parameters. Firms are included in or excluded from the sample based on the following factors: (a) Only manufacturing firms in the Borsa Istanbul are included; (b) firms with missing data or negative leverage, sales, and tangible assets are not included in the sample; (c) firms are included if they have at least four years of consecutive data available to implement panel data methodology, and both active and inactive firms are included so as not to reflect a survivorship bias; (d) all variables are winsorized at 1% and 99^{t0}% percentiles to reduce the effect of outliers. Because Turkey has an inflation problem, all firm-level variables are US Dollar denominated. After data processing, we have unbalanced data from 164 manufacturing firms that represent 2127 firm-year observations. Since the listed firms have different initial public offerings (IPO), we use an unbalanced panel regression method to test the hypotheses. Finally, firms are classified based on their sector classification. The Statistical Classification of Economic Activities in the European Community[2], referred to as NACE[3], is used, and Table 1 displays the sector classification. Manufacture of other non-metallic products (325), manufacture of food products (288), and manufacture of textiles (254) have the highest observations, respectively.

Examining the effects of geopolitical risk on a firm's corporate investment, we follow related studies, and our baseline regression model is based on the literature (Demir, Díez-Esteban,

[1] For the detailed information https://www.matteoiacoviello.com/gpr.htm
[2] For detailed information https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF
[3] The French version is "Nomenclature statistique des activités économiques dans la Communauté européenne".

Table 2. Definition of Variables

Explanatory Variables	*Definitions*	*Source*
CAPEX	Capital Expenditure	Thomson Reuters
CASFLOW	Pretax Income + Depreciation	As Above
SALES	Annual Sales	As Above
SIZE	Natural Logarithm of Total Assets in current USD	As Above
LTD	Long-Term Debt	As Above
GPR_TURKEY	Natural Logarithm of the Annual Average of Country-Specific GPR	https://www.matteoiacoviello.com/gpr.htm
GPR	Natural Logarithm of the Annual Average of overall GPR	https://www.matteoiacoviello.com/gpr.htm
GPR_THREAT	Natural Logarithm of the Annual Average of GPR Threat	https://www.matteoiacoviello.com/gpr.htm
GPR_ACT	Natural Logarithm of the Annual Average of GPR Act	https://www.matteoiacoviello.com/gpr.htm
GPR_BROAD	Natural Logarithm of the Annual Average of GPR Broad	https://www.matteoiacoviello.com/gpr.htm
GPR_NARROW	Natural Logarithm of the Annual Average of GPR Narrow	https://www.matteoiacoviello.com/gpr.htm
GDP	Growth Rate of Gross Domestic Product (%)	Thomson Reuters
IR	Annual Interest Rate (%)	Thomson Reuters
GC	Global Crisis (2008-2009)	Thomson Reuters

et al., 2019; Dissanayake et al., 2018; Kotcharin & Maneenop, 2020a; Le & Tran, 2021; X. Wang et al., 2019).

$$CAPEX_{i,t} = \beta_o + \beta_1 CAPEX_{i,t-1} + \beta_2 GPR_{i,t-1} + \beta_3 CASHFLOW_{i,t} + \beta_4 SALES_{i,t} + \beta_5 SIZE_{i,t} + \beta_6 LTD_{i,t} + YEAR + SECTOR + \varepsilon_{it}; \quad (1)$$

$$CAPEX_{i,t} = \beta_o + \beta_1 CAPEX_{i,t-1} + \beta_2 GPR_{i,t-1} + \beta_3 CASHFLOW_{i,t} + \beta_4 SALES_{i,t} + \beta_5 SIZE_{i,t} + \beta_6 LTD_{i,t} + \beta_7 Z_{,t} + YEAR + SECTOR + \varepsilon_{it}; \quad (2)$$

In the model, our main independent variable is GPR which represents the natural logarithm of the *GPR_TURKEY, GPR, GPR_THREAT, GPR_ACT, GPR_BROAD and GPR_NARROW,* respectively. To distinguish the effect of each index over investment, we do not add these indices into one equation simultaneously because of the potential multicollinearity problem. We use them in separate equations (Kayhan, 2017). We use one lagged period of all GPR indices (Dejuán & Ghirelli, 2018; Lee & Wang, 2021; Phan, Nguyen, N., Nguyen, H. & Hegde, 2019). GPR indices are updated monthly. Since our financial data is annual, indices are calculated as an annual averages. *CAPEX* is a capital expenditure that is our dependent variable. We use lagged capital expenditure as an independent variable in the model as it significantly affects the current investment rate (Bloom, Bond, & Van Reenen, 2007). *CASHFLOW* is the sum of the pretax income plus depreciation. *SALES* is the annual sales of the firm. Sales give information about the growth opportunities of the firm. It is expected to be a positive relationship between sales and investment (Akron, Demir, Díez-Esteban & García-Gómez, 2020; X. Wang et al., 2019; Yizhong Wang, Chen & Huang, 2014). *LTD* is the long-term debt of the firm. All values are divided by total assets to avoid spurious regression. *SIZE* is the natural logarithm of the total assets. Size is included to capture the economics of the scale of cash management. *Z* represents the components of the annual interest rate, yearly change in the gross domestic product (GDP), and global crisis (2008-2009). We analyze each of the variables separately to capture their effect on corporate investment decisions. Firms decline their investment as it will be harder for firms to access external financing when interest rates are high. A high-interest rate is the top financial obstacle for the firm (Beck, Demirgüç-Kunt, Laeven & Maksimovic, 2006). GDP growth captures the current effect of macroeconomic conditions on corporate investment (Akron et al., 2020). Finally, we add the year and sector dummies to control the variations based on them. Table 2 demonstrates the definition of each variable.

Econometric Methodology

In this study, it is suitable to use dynamic variables because the equation includes a lagged variable of the dependent variable as the explanatory variable (Anderson & Hsiao,

Table 3. Descriptive Statistics

Variables	*Obs.*	*Mean*	*Median*	*P25*	*P75*	*Std. Dev.*
CAPEX	2127	0.05	0.03	0.01	0.06	0.08
CASHFLOW	2127	0.07	0.07	0.01	0.13	0.19
SALES	2127	0.93	0.85	0.61	1.17	0.49
SIZE	2127	11.70	11.65	10.56	12.62	1.60
LTD	2127	0.10	0.04	0.00	0.15	0.18
GPR_TURKEY	2127	4.80	4.87	4.55	4.94	0.24
GPR	2127	4.46	4.39	4.15	4.73	0.33
GPR_THREAT	2127	4.50	4.41	4.14	4.77	0.37
GPR_ACT	2127	4.20	4.30	3.99	4.45	0.25
GPR_BROAD	2127	4.44	4.40	4.29	4.65	0.21
GPR_NARROW	2127	4.49	4.41	4.15	4.76	0.35
GDP	2127	5.07	5.30	3.1	7.40	3.75
IR	2127	10.00	7.45	5.78	14.83	5.15

Notes: CAPEX is a capital expenditure. CASHFLOW is a pretax income + depreciation. SALES is annual sales. LTD is the long-term debt. All values are divided by the total assets. SIZE is the natural logarithm of total assets. GPR_TURKEY is the natural logarithm of the annual average of the country specific GPR index. GPR is the natural logarithm of the annual average of the overall GPR index. GPR_THREAT is the natural logarithm of the annual average of the GPR Threat index. GPR_ACT is the natural logarithm of the annual average of the GPR Act index. GPR_BROAD is the natural logarithm of the annual average of the GPR Broad index. GPR_NARROW is the natural logarithm of the annual average of the GPR Narrow index. GDP is the growth rate. IR is the annual interest rate in Turkey.

1981). Under the dynamic models, when series are persistent or if the variance of individual-specific effect is greater than the variance of the error, the first-differenced GMM estimator of Arellano & Bover (1995) suffers from bias (Dbouk, Moussawi-Haidar & Jaber, 2020). Hence, the equation model is estimated by the system generalized method of moments (system-GMM model) created by Arellano & Bover (1995) and Blundell & Bond (1998) with the orthogonal transformation to overcome possible endogeneity and heterogeneity issues and eliminate the autocorrelation problem. Residuals should be correlated with the first-order autocorrelation AR(1),and not with the second-order autocorrelation AR(2). The Hansen test for over-identifying restrictions is used to test the validity of the instrumental variables. A system-GMM model is applied and includes Windmeijer (2005)'s correction for standard errors. We ran the *-xtabond2-* Stata package program proposed by Roodman (Roodman, 2009a, 2009b). As suggested by Roodman (2009b), instruments are collapsed to prevent proliferation problems of variables.

Results and Discussions

Table 3 displays the descriptive statistics of the variables. The mean and median value of the investment to the total assets is around 5% and 3% respectively. The mean (median) value of GPR_TURKEY is around 4.80 (4.87) and 4.46 (4.39) for overall GPR. GPR_TURKEY has a higher average than overall GPR but a lower standard deviation. The average growth rate of the country is around 5% and the average of the annual interest rate is 10%.

The findings are displayed in Table 4, where column (1) reports the results of the Model 1. Columns (2) through (4) report the results of the Model 2 that include the GDP, interest rate, global crisis (2008-2009), respectively. For all models, residuals are correlated in the first-order autocorrelation *(ar1)* and not in the second-order autocorrelation *(ar2)*. The Sargan and the Hansen test reject the null hypothesis, which means overidentifying restrictions and instrumental variables are valid. The Wald test denotes the validity of the general model. Time and sector dummies are included to capture unobservable year-specific and sector effects.

According to the analysis results, the relationship between investment and country-specific geopolitical risk is negative and significant for all model specifications. The coefficients of four models are statistically significant at 5%. Le & Tran (2021) also finds 5% significance for the relationship between geopolitical risk and investment for Turkish firms. This result supports our *hypothesis 1,* denoting that increasing geopolitical risks lead to a decrease in corporate

Table 4. Country-specific GPR and Investment

	1	*2*	*3*	*4*
L.CAPEX	0.64334***	0.65080***	0.64815***	0.64334***
	(0.169)	(0.168)	(0.169)	(0.169)
GPR_TURKEY	-0.02138**	-0.02263***	-0.01930**	-0.02138**
	(0.009)	(0.009)	(0.008)	(0.009)
CONTROL VARIABLES	YES	YES	YES	YES
GDP		0.00192***		
		(0.000)		
IR			-0.00081**	
			(0.000)	
GC				-0.02572***
				(0.009)
YEAR	YES	YES	YES	YES
SECTOR	YES	YES	YES	YES
# Observations	1963	1963	1963	1963
# Firms	164	164	164	164
# Instruments	113	114	114	113
Wald Test	795.33***	973.95***	780.91***	795.33***
ar1	-2.97***	-3.00***	-2.99***	-2.97***
ar2	0.153	0.182	0.185	0.153
Sargan	0.168	0.154	0.142	0.148
Hansen	0.232	0.194	0.200	0.208

Notes: GPR_TURKEY is the natural logarithm of the annual average of the country specific GPR index. GDP is the growth rate. IR is the annual interest rate in Turkey. GC is a global crisis. GC is a dummy variable and takes "1" if the year is 2008 and 2009 and "0" otherwise. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

investment of firms. Our results might be associated with the explanation of real options theory (Bernanke, 1983; Dixit & Pindyck, 1994). During uncertain times, the option value of delaying investment might be costly because of high asymmetric adjustment costs; firms prefer to "wait and see" during periods of uncertainty until the resolved over time (Dissanayake et al., 2018; Gulen & Ion, 2016; Le & Tran, 2021; X. Wang et al., 2019). Uncertainty provoked by political and geographical environments raises the uncertainty of future cash flows, increases the borrowing cost, magnifies the complexity of forecasting market trends and decreases the business investment (Gao, Grinstein & Wang, 2017). Firms defer their investment under the risk and keep more cash to take advantage of any possible investment projects when some or all of the risk disappears (Julio & Yook, 2012). Our results are consistent with the findings of (Dissanayake et al., 2018; Kayhan, 2017; Le & Tran, 2021; X. Wang et al., 2019).

We find that lagged investment has a positive and significant relationship with current investment (Bloom et al., 2007). Cash flow has a positive effect on corporate investment (Yizhong Wang et al., 2014). Sales has a positive effect on investment. An increase in sales is a significant growth opportunity indicator for firms to enhance their corporate investment (Gulen & Ion, 2016; Jirasavetakul & Spilimbergo, 2018; Kang, Lee, & Ratti, 2014; Tran, 2014; Yizhong Wang et al., 2014). The firm size has a positive and significant effect on investment (Abdoh & Maghyereh, 2020; Chen, Lee, & Zeng, 2019; Yizhong Wang et al., 2014; Yong Wang et al., 2017) Long-term debt and investment have a negative relationship. Firms prefer to pay their debt instead of investing (Abdoh & Maghyereh, 2020; Bhaduri, 2005; George, Kabir, & Qian, 2011). GDP has a positive and significant effect on investments. When macroeconomic conditions are going well, firms want to increase their investment rate (Guizani, 2019, 2020; Kashefi-Pour, Amini, Uddin & Duxbury, 2020). The interest rate has a negative but insignificant effect on investment. The global crisis has a significant and negative impact on investment.

Table 5 displays the relationship between investment and other GPR indices. Column 1 has the overall GPR index, and the remaining columns have the four indices: GPR_THREAT, GPR_ACT, GPR_BROAD and GPR_NARROW, respectively. In all models, GPR has a

Table 5. Overall GPR and Investment

	1	*2*	*3*	*4*	*5*
L.CAPEX	*0.65302****	*0.65329****	*0.65112****	*0.65397****	*0.65154****
	(0.164)	(0.164)	(0.165)	(0.164)	(0.164)
GPR	-0.02173**				
	(0.009)				
GPR_THREAT		-0.02130**			
		(0.009)			
GPR_ACT			-0.02211**		
			(0.010)		
GPR_BROAD				-0.02201**	
				(0.009)	
GPR_NARROW					-0.02161**
					(0.009)
CONTROL VARIABLES	YES	YES	YES	YES	YES
YEAR	YES	YES	YES	YES	YES
SECTOR	YES	YES	YES	YES	YES
# Observations	1963	1963	1963	1963	1963
# Firms	164	164	164	164	164
# Instruments	113	113	113	113	113
Wald Test	856.85***	851.82***	906.81***	891.01***	845.77***
ar1	-3.04***	-3.04***	-3.02***	-3.05***	-3.03***
ar2	0.16	0.16	0.16	0.18	0.16
Sargan	0.192	0.180	0.304	0.154	0.217
Hansen	0.332	0.322	0.346	0.343	0.323

Notes: GPR is the natural logarithm of the annual average of the overall GPR index. GPR_THREAT is the natural logarithm of the annual average of the GPR Threat index. GPR_ACT is the natural logarithm of the annual average of the GPR Act index. GPR_BROAD is the natural logarithm of the annual average of the GPR Broad index. GPR_NARROW is the natural logarithm of the annual average of the GPR Narrow index. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6. Lagged GPR and investment

	1	*2*	*3*	*4*	*5*	*6*
L.CAPEX	0.64286***	0.66902***	0.62881***	0.66572***	0.63617***	0.66448***
	(0.174)	(0.154)	(0.177)	(0.153)	(0.174)	(0.154)
L2.GPR_TURKEY	-0.01342**					
	(0.006)					
L3.GPR_TURKEY		-0.01048*				
		(0.006)				
L2.GPR			-0.0188***			
			(0.006)			
L3.GPR				-0.01167*		
				(0.006)		
L2.GPR_ACT					-0.0217***	
					(0.007)	
L3.GPR_ACT						-0.01547**
						(0.006)
CONTROL VARIABLES	YES	YES	YES	YES	YES	YES
YEAR	YES	YES	YES	YES	YES	YES
SECTOR	YES	YES	YES	YES	YES	YES
# Observations	1799	1635	1799	1635	1799	1635
# Firms	164	164	164	164	164	164
# Instruments	111	110	111	110	113	110
Wald	6725.58***	4448.61***	2239.15***	13882.58***	2173.71***	2852.71***
ar1	-2.78***	-2.91***	-2.72***	-2.91***	-2.76***	-2.91***
ar2	0.03	0.04	-0.03	0.03	0.03	0.05
Sargan	0.075	0.172	0.079	0.201	0.141	0.203
Hansen	0.191	0.095	0.209	0.094	0.243	0.109

Notes: CAPEX is a capital expenditure. CASHFLOW is a pretax income + depreciation. GPR_TURKEY is the natural logarithm of the annual average of the country specific GPR index. GPR is the natural logarithm of the annual average of the overall GPR index. GPR_ACT is the natural logarithm of the annual average of the GPR Act index. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 7. Country-specific GPR and Financial Constraints

	DIV		SIZE		AGE	
	FC	NFC	FC	NFC	FC	NFC
	1	*2*	*3*	*4*	*5*	*6*
L.CAPEX	0.52598**	0.18959**	0.15017**	0.74677***	0.82483***	0.22495***
	(0.234)	(0.090)	(0.075)	(0.128)	(0.101)	(0.067)
GPR_TURKEY	-0.05988***	-0.03344	-0.04083*	0.00057	-0.01007	-0.00630
	(0.020)	(0.022)	(0.022)	(0.020)	(0.014)	(0.012)
CONTROL VARIABLES	YES	YES	YES	YES	YES	YES
YEAR	YES	YES	YES	YES	YES	YES
SECTOR	YES	YES	YES	YES	YES	YES
# Observations	832	1131	956	1007	1058	905
# Instruments	113	113	111	111	112	112
Wald	3199.05***	2436.35***	338.71***	1209.42***	254.85***	3133.13***
ar1	-2.14***	-3.66***	-4.58***	-2.56***	-4.03***	-3.01***
ar2	-0.08	-0.21	-0.62	0.21	-1.33	0.94
Sargan	0.172	0.000	0.104	0.499	0.002	0.448
Hansen	0.623	0.222	0.505	0.857	0.702	0.990

Notes: FC is financially constrained. NFC is financially unconstrained. Under the DIV criteria, if a firm pays dividends, it is categorized as financially unconstrained. If not, it is categorized as financially constrained. Under the SIZE criteria, firms are based on their assets and categorize as financially constrained (unconstrained) if their size is below (above) the median size value. Under the AGE criteria, firms are ranked based on age and categorize as financially constrained (unconstrained) if their age is below (above) the median age value. AGE is defined as the foundation year of the firm. GPR_TURKEY is the natural logarithm of the annual average of the country specific GPR index. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

negative and significant effect on investment in Turkey. The coefficients vary from -0.02173 to -0.2161 and are statistically significant at 5%. GPR_ACT has the highest coefficient (-0.02211) of all the GPR indices. GPR_ACT is inferred as the realization of adverse geopolitical events that could increase geopolitical risks.

Table 6 exhibits the impact of the second and further geopolitical risk on investment. Columns (1) and (2) include the GPR_TURKEY index. Columns (3) and (4) contain the GPR_ ACT, which has the highest coefficient in Table 5, and columns (5) and (6) contain the overall GPR index. According to the analysis results, while firms decrease their investment due to geopolitical risk in the second and the third lagged times, this is not statistically significant for the fourth and subsequent lagged time; in other words, the influence of uncertainty disappears.

Although the concept of financial constraints has been one of the most debated topics in the field of corporate finance in the last three decades, it continues to be a subject that has not been precisely defined. In the studies conducted in the literature, we can observe the attempt to explain with different financial variables, but these efforts fail to produce an accepted general theory or concept. The discussion begins with the article written by (Fazzari, Hubbard, Petersen, Blinder & Poterba, 1988). They reveal that low dividend payout (financially constrained) firms have higher investment-cash flow sensitivity than high dividend payout (financially unconstrained) firms. Beck et al. (2006) use survey data from a study of over 10,000 firms in 80 countries to determine how effective a priori classifications are in distinguishing between financially constrained and unconstrained firms. Their results affirm that size and ag are useful as a priority classification of financing constraints.

In Table 7, we first categorize firms based on dividend payment, size, and age, respectively. For the dividend criteria, if a firm does not pay a dividend each year, it is expected to be financially constrained and if it does, it is called financially unconstrained in each year. Second, firms are ranked based on the natural logarithm of their total assets and we classify them as financially constrained (unconstrained) if their size is below (above) the median size value in each year (Almeida, Campello, & Weisbach, 2004; Arslan, Florackis, & Ozkan, 2006; Kadapakkam, Kumar, & Riddick, 1998; Riaz, Shabab, Bibi & Zeb, 2016). Third, firms are classified based on their foundation year and defined as financially constrained or unconstrained, depending on whether their age is

Table 8. GPR and Sector investment

	C10	*C11*	*C13*	*C17*	*C18*	*C19*	*C20*
L.GPR_TURKEY	-0.0104***	-0.0076***	-0.0061**	-0.0078***	-0.0069***	-0.0102***	-0.0077***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
GPR_TURKEY*SECTOR	0.0049**	0.0026***	-0.0038***	0.0004	-0.0043***	-0.0104***	-0.0003
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
CONTROL VARIABLES	YES	YES	YES	YES	YES	YES	YES
YEAR	YES	YES	YES	YES	YES	YES	YES
SECTOR	YES	YES	YES	YES	YES	YES	YES
Observations	1963	1963	1963	1963	1963	1963	1963
R-squared	0.050	0.042	0.046	0.041	0.043	0.046	0.041
	C23	*C24*	*C25*	*C27*	*C28*	*C29*	*C31*
L.GPR_TURKEY	-0.0079***	-0.0082***	-0.0089***	-0.0085***	-0.0072***	-0.0079***	-0.0077***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
GPR_TURKEY*SECTOR	0.0024***	-0.0035***	0.0067***	-0.0045***	-0.0028***	-0.00068	0.00089
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
CONTROL VARIABLES	YES	YES	YES	YES	YES	YES	YES
YEAR	YES	YES	YES	YES	YES	YES	YES
SECTOR	YES	YES	YES	YES	YES	YES	YES
Observations	1963	1963	1963	1963	1963	1963	1963
R-squared	0.044	0.044	0.048	0.045	0.041	0.041	0.041

Note: GPR_TURKEY is the natural logarithm of the annual average of the country specific GPR index. C10: Manufacture of food products. C11: Manufacture of beverages. C13: Manufactureof textiles. C17: Manufacture of paper and paper products. C18: Printing and reproduction of recorded media. C19: Manufacture of coke and refined petroleum products. C20: Manufacture of chemicals and chemical products. C23: Manufacture of other non-metallic mineral products. C24: Manufacture of basic materials. C25: Manufacture of fabricated metal products, except machinery and equipment. C27: Manufacture of electrical equipment. C28: Manufacture of machinery and equipment n.e.c. C29: Manufacture of motor, vehicles, trailers, and semi-trailers. C31: Manufacture of furniture. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

below or above the median age value (Cunningham, 2004; Guariglia & Mateut, 2010; Schiantarelli & Sembenelli, 2000). Our results confirm *Hypothesis 2;* the coefficient of the geopolitical risk index of financially constrained firms is higher than the financially unconstrained firms. Small, young, and non-dividend payer firms decrease their investment more when they face uncertainty induced by geopolitical events. This situation can be interpreted as follows since it will be more difficult to access external finance in an environment of uncertainty; all firms primarily focus more on their internal financing. The coefficients are more significant for financially constrained firms because internal funds become more important in the period of uncertainty (Baum, Caglayan & Talavera, 2010). According to the dividend and size criteria, the coefficient is statistically significant for financially constrained and not significant according to age criteria. Firms paying less dividends are financially constrained (Fazzari et al., 1988). Small firms are generally younger, have a greater degree of firm-specific risk and have less collateral, thus decreasing their chances of receiving external finance (Gertler & Gilchrist, 1993, 1994).

Greater recognition of big firms by financial institutions leads to less asymmetric information. (Bernanke, Gertler, & Gilchrist, 1996). Younger firms are not widely known, and less information is available about them. However, there is ample awareness about older firms, and they have a reputation in the market (Guariglia & Mateut, 2010).

Table 8 shows the impact of geopolitical risk on sub-industries. As shown in Table 1, there are 20 sub-industries in our study. We analyze the effects of geopolitical risk for each sector[4,5]. According to the results, the manufacture of textiles, printing and reproduction of recorded media, coke, and refined petroleum products, chemicals and chemical products, basic materials, electrical equipment, machinery, and equipment n.e.c., and motor, vehicles, trailers, and semi-trailers industries are negatively affected

[4] Due to the insufficient data, C16, C21, and C32 are not analyzed.
[5] For some analysis, the Sargan and Hansen test Show that the instrumental variables are not valid. For consistency, we do not apply the system-GMM for this analysis.

Table 9. Alternative measures of geopolitical risk

	1	*2*	*3*	*4*	*5*	*6*	*7*	8
L.CAPEX	0.64357***	0.64373***	0.64395***	0.64633***	0.64239***	0.64487***	0.64208***	0.65922***
	(0.169)	(0.169)	(0.169)	(0.168)	(0.169)	(0.168)	(0.168)	(0.163)
GPR_Q1	-0.02091**							
	(0.008)							
GPR_Q2		-0.02174**						
		(0.009)						
GPR_Q3			-0.02030**					
			(0.008)					
GPR_Q4				-0.02073**				
				(0.009)				
GPR_Q1Q2					-0.02151**			
					(0.009)			
GPR_Q3Q4						-0.02098**		
						(0.009)		
GPR_DECEMBER							-0.02161**	
							(0.009)	
POLITICAL RISK_ICRG								-0.02301**
								(0.012)
CONTROL VARIABLES	YES	YES	YES	YES	YES	YES	YES	YES
YEAR	YES	YES	YES	YES	YES	YES	YES	YES
SECTOR	YES	YES	YES	YES	YES	YES	YES	YES
# Observations	1963	1963	1963	1963	1963	1963	1963	1963
# Firms	164	164	164	164	164	164	164	164
# Instruments	113	113	113	113	113	113	113	113
Wald	812.70***	816.26***	810.82***	823.65***	804.94	806.97***	782.59***	984.39***
ar1	-2.97***	-2.97***	-2.97***	-2.98***	-2.97**	-2.97***	-2.97***	-3.05***
ar2	0.16	0.16	0.15	0.14	0.16	0.14	0.14	0.17
Sargan	0.130	0.188	0.178	0.164	0.164	0.172	78.32	0.200
Hansen	0.243	0.262	0.252	0.210	0.243	0.218	82.32	0.342

Notes: Q1 is the natural logarithm of the quarterly (January-February-March) average of the country specific GPR index. Q2 is the natural logarithm of the quarterly (April-May-June) average of the country specific GPR index. Q3 is the natural logarithm of the quarterly (July-August-September) average of the country specific GPR index. Q4 is the natural logarithm of the quarterly (October-November-December) average of the country specific GPR index. The political risk index is employed by the International Country Risk Guide (ICRG) published by the Political Risk Service Group. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

by geopolitical risks. The coke and refined petroleum products have the highest negative coefficient (-0.104).

In keeping with Le & Tran (2021) and Lee & Wang (2021), we use alternative measures of geopolitical risk, such as robustness checks in Table 9. Instead of taking the annual average of the quarterly data, we try to analyze the effect of geopolitical risk on investment by taking the average of each quarter individually, namely Q1, Q2, Q3 and Q4: the average of Q1 and Q2, and the average of Q3 and Q4, as well as GPR in December, and finally, Political Risk Index of the International Country Risk Guide (ICRG) developed by PRS Group.

The overall political risk measure has 12 subsections: 1) Government stability, 2) Bureaucracy quality 3) Democratic accountability 4) Ethnic tensions, 5) Law and order 6) Religious tensions 7) Military in politics, 8) Corruption, 9) External conflict, 10) Internal conflict, 11) Investment profile, 12) Socioeconomic conditions. Political risk has minimum and maximum values of 0 and 100. From 0 to 100, the political risk level decreases. The data is calculated monthly, but following (Bilgin et al., 2018), we use December as the benchmark political risk measure. Not surprisingly, the results remain stable. Under all alternative measures in Table 9, geopolitical risk has a negative and significant effect on investment.

Conclusions

From the previous literature, it is observed that uncertainty plays a significant role in firms' financial policy. Geographical risk is one of the

important uncertainty indicators that plays a crucial role in the investment decisions of firms. This paper analyzes the impact of the Geopolitical Risk (GPR) Index on the investment of 164 manufacturing firms listed in the Borsa Istanbul from 2005 to 2019, applying the system Generalized Methods of Moment (GMM) technique. According to the results, we first document that geopolitical risk has a negative effect on the investment of firms. Under the uncertainty caused by geopolitical risks related to the real options theory, firms take a "wait and see" position until geopolitical risk disappears. They may keep their cash reserves to catch investment opportunities after eliminating risks. Further analysis indicates that while firms decline their investment because of geopolitical risk in the second and the third lagged times, this condition is not statistically significant for the fourth and following lagged time; in other words, the influence of uncertainty fades. Because of the increasing cost of external financing during uncertainty, financially constrained firms, which are small, young, and non-dividend payers, firms are influenced more by geopolitical risk. Finally, we find robust results under alternative measurement of the GPR index. According to our findings, authorities and investors should pay more attention to the impact of geopolitical risk on corporate investment policy. As a result, policymakers in Turkey can use our empirical findings to develop appropriate regulations to deal with geopolitical risk to boost economic growth. Managers and investors should also consider geopolitical risk factor when they prepare short and long-term investment plans. This study examines only the firms in Turkey. In future studies, the number of countries and time span can be expanded. COVID-19 has increased uncertainty worldwide. Further studies might consider the impact of COVID-19 and geographical risk relations on corporate investment, and another interesting extension is to compare the influence of COVID-19 and global crisis on investment to reveal which one is more devasting for firms.

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