# The Relationship Between Geopolitical Risks and Housing Returns in Türkiye: Evidence from the Cross – Quantilogram

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## ABSTRACT

The aim of the study is to analyze whether geopolitical risks have an effect on housing returns in Türkiye based on the data for the period January 2010 – September 2021. Considering its geography, Türkiye is one of the countries most likely to be exposed to geopolitical risks in the world. For this reason, from the point of view of both domestic and foreign investors investing in housing market, it is important to know whether this situation affects real estate returns, especially in periods when the growth in geopolitical risks is high and very high. For this purpose, in this study, the Cross-Quantilogram method introduced in the paper of Han et al. (2016), which is a robust measure of quantile dependence of two variables, was used. As a result of the analysis, it is seen that median and high-level geopolitical risks do not have an effect on housing prices or housing returns, but very high geopolitical risks have a short-term negative effect on returns. Based on all the findings, it is concluded that the geopolitical risks in Türkiye do not have a significant and permanent effect on the housing market.

**Key words:** *Geopolitical Risk Historical Index, Housing Price Index, Quantile Dependence, Directional Predictability, Cross - Quantilogram*

**JEL Codes**: C01, C13, F50, R31

## 1. INTRODUCTION

Uncertainty brings to mind the concept of risk because risk is a variable that moves proportionally with uncertainty. Every person, every company, every country has different uncertainties within itself. At the human level, it is impossible to know what life will bring, positive or negative, even in the next seconds because the future contains many kinds of known or unknown uncertainties. For example, in the banking sector, there are many different risks such as market, credit or operational risk. The same is true for countries. Countries contain many types of uncertainty such as economic policy uncertainty, macroeconomic, financial and geopolitical uncertainties.

When it comes to housing, the need for shelter, one of the most basic human needs, comes to mind. Archaeological research shows that since the earliest known times of human history, people have sought different ways to meet their shelter needs in order to survive. Today, housing is seen as an important factor in raising people's quality of life, as well as meeting people's shelter needs. Looking at the houses from the point of view of investors, it is striking that the perception of housing investment as one of the investment instruments with low risk is strong.

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In this study conducted for the Turkish housing market, the validity of the perception of housing as a safe investment tool against geopolitical risks is analyzed. Considering its geography, Türkiye is one of the countries most likely to be exposed to geopolitical risks in the world. For this reason, from the point of view of both domestic and foreign investors investing in housing, it is important to know whether this situation affects real estate returns, especially in periods when the growth in geopolitical risks is high and very high. Based on the January 2010-September 2021 period data, the research question was formed as follows: "Do the geopolitical risks that Türkiye is frequently exposed to due to its geography have an impact on housing returns?"

In order to answer the research question of the study, the "Cross-Quantilogram" method introduced by Han et al. (2016) was used. Technically this method is important in that it is robust to extreme values and does not require any distribution conditions. In terms of interpretation, it is one of the practical benefits of the method that it makes possible to focus on different regions of the distributions of the variables studied.

As for the literature review, it is seen that studies are mainly conducted on the effects of different types of uncertainty on financial markets. There are few studies examining the effects of uncertainty types on the housing market. Apart from that, this study also differs in terms of the method it uses. Considering both the subject and the method used, it can be said that this study is important especially in terms of its empirical contribution to the existing literature, since it is the first study conducted specifically in Türkiye.

In the study, first of all, the "Introducing the Variables" section, in which the variables are introduced with important lines, is included. In the “Literature Review”, various studies carried out in recent years, measuring the impact of different types of uncertainty on different markets are reviewed. In the "Data Set and Econometric Method", various graphics and statistics related to describing the variables to be used in the study are included, the stationarity of the series is analyzed and the cross-quantilogram method is discussed with different aspects. The results obtained are analyzed in the “Empirical Findings”. Finally, the answer given to the research question was revealed along with the interpretation of the findings in the "Conclusion".

## 2. INTRODUCING VARIABLES

In this section, first of all, geopolitical risks which is one of the variables of the study and which has a great importance especially for a country like Türkiye, whose geographical location is quite difficult and the "Geopolitical Risk Historical Index" which has been used in the measurement of these risks in recent years, will be discussed. Secondly, information will be given about the "Housing Price Index", which can be used as a basis for the calculation of housing returns in Türkiye and whose data are available since 2010.

### 2.1. Geopolitical Risk Historical Index (GPRH)

In their study, Caldara and Iacoviello (2022) developed a news-based measure called the "Geopolitical Risk Index (GPRI)" to measure adverse geopolitical events and the risks associated with these events and they defined geopolitical risks as threats, realizations and escalations caused by wars, terrorism and tensions affecting the peaceful course of international relations between states and political actors.

In the measurement of GPRI, approximately 25 million news articles published in leading newspapers that continue to be published in English since 1900 were used. The GPRI is formed by determining the proportion of articles that discuss adverse geopolitical events and the risks associated with these events, among the articles published each month in selected newspapers (Caldara and Iacoviello, 2022:1197). The "Geopolitical Risk Historical Index (GPRH)" used in this study, which also includes index values specific to Türkiye and dates back to 1900, is based on historical research in the archives of the Chicago Tribune, the New York Times and the Washington Post (Caldara and Iacoviello, 2022: 1198). While measuring the geopolitical risk specific to a country, the number of places where the geopolitical terms and the name of the relevant country (or capital city) appear together are taken into account in the scanned newspapers (Caldara and Iacoviello, 2022:1207).

In accordance with the definition of geopolitical risks, it is possible to talk about eight research categories when searching the electronic archives of the leading newspapers. These can be expressed as follows: threats of war, threats to peace, military build-ups, nuclear threats, terrorist threats, beginning of war, escalation of war and terrorist acts (Caldara and Iacoviello, 2022: 1199).

### 2.2. Housing Price Index (HPI) [1]

By definition, the HPI has been put forward to monitor price changes in the Turkish housing market. In the calculation of the index, the prices of all the houses for sale across the country are taken into account. To represent the housing prices, the housing values in the valuation reports prepared by the real estate appraisal companies and created during the loan applications made to the commercial banks that provide housing loans are used. For this purpose, the “Hedonic Regression Method” is used in order to recovery the price changes of the houses from the quality factor depending on the identifiable housing characteristics (housing, district, environment, etc.). Underlying the use of this method is the idea that there are large increases in housing quality over time, and for this reason, it would be wrong to see price increases as purely real valuation (Hülagü et al., 2016: 1).

In the case of technical analysis of the HPI, it is seen that the "logarithmic-linear" form, which is a functional form that corresponds to the modelling of housing prices according to housing characteristics, is used in the hedonic regression model estimation. For the sampling, due to the heterogeneity of the housing market, "stratified sampling technique" was used. Thus, it is possible to reach the general price index by weighting the index formed in each homogeneous layer with the number of sales and average house values. In the calculation of the indices in the layers, the unit prices determined as extreme values are excluded from the analysis. The unit price mentioned here is obtained by dividing the house value by the gross square meter of the house. No seasonal adjustment was made in the housing price index.

Values regarding the housing price index in Türkiye are calculated by the Central Bank of the Republic of Türkiye sub-unit and the data is published monthly in the Electronic Data Distribution System (EVDS) since January 2010. HPI includes houses that can be valued in 75 provinces where sufficient data can be obtained. The index takes 2017 as the base year.

[1]In the writing of this subsection, the file titled "Metadata", which is located under the title of "Real Sector Statistics" on the Central Bank of the Republic of Türkiye website and provides detailed information about the housing price index, was used.

## 3. LITERATURE REVIEW

In this section, studies in the last years examining the effects of different types of uncertainty (economic policy uncertainty, macroeconomic, financial, geopolitical uncertainties) on the returns that can be obtained by investors investing in markets such as finance, commodities, especially the housing market, are included.

Ajmi et al. (2015) examined the effect of uncertainty shocks on the conditional volatility of real estate investment trusts listed in the USA, taking into account the period from January 4, 1999 to June 28, 2013. As a result of the study, it is seen that there is a two-way transmission channel between the conditional volatility of real estate investment trusts and macroeconomic uncertainty.

Antonakakis et al. (2015) examined the dynamic correlations between housing market returns and the economic policy uncertainty index and by means of the dynamic conditional correlation model for the period 1987 – 2014, they found that negative correlations were valid among the relevant variables, which change over time and increase sharply during periods of high economic uncertainty and recession. Based on this finding, they concluded that investors in residential or residential securities should be alert to the possibility of unusual losses in the periods after large increases in uncertainty.

Andre et al. (2017) examined whether news-based economic policy uncertainty is effective in predicting movements in real housing returns, using the "Non-Parametric Granger Causality Test", based on the January 1953 – February 2014 period data. As a result of the study, it was concluded that economic policy uncertainty directly affects real housing returns and volatility.
Antonakakis et al. (2017) examined the situation of being affected by geopolitical risks of the time-varying stock-oil covariance, returns and variances with the “VAR-BEKK-GARCH Model” using monthly stock and oil market data for the period 1899 – 2016. According to the findings, it was concluded that the WTI oil market index was more affected by geopolitical risks than the S&P 500 stock market index in terms of average return and volatility and the conditional covariance between two markets decreased significantly with the increase in the degree of lag of the geopolitical risk index.

Aye (2018) examines whether economic policy uncertainty is the cause of real housing returns in eight emerging economies (Brazil, Chile, China, India, Ireland, Russia, South Africa, South Korea) using “Cross-Sample Validity (CSV) Granger Causality" method. It was concluded that the growth in economic policy uncertainty in countries other than Chile and China in the analyzed period was not the Granger cause of real housing returns. Looking at the CSV rolling window results, time-varying causality was detected in countries other than India.
Balcılar et al. (2018) investigated the effect of geopolitical uncertainty on the return and volatility dynamics of the BRICS stock markets by means of “Causality Tests in Nonparametric Quantiles”. According to the findings, it is concluded that geopolitical risks do not affect the return dynamics in the examined stock markets in a single way (uniformly) and that these risks are more effective on volatility dynamics than returns.

Aysan et al. (2019) analyzed the effect of the global geopolitical risk (GGPR) index on Bitcoin's return and price volatility, based on the data for the period of July 18, 2010 - May 31, 2018 by using the "Bayesian Graphical Structural VAR" method and concluded that GGPR index has predictive power on Bitcoin return and volatility. Looking at the quantile-on-quantile estimates, it has been determined that while Bitcoin returns and volatility are in high quantiles, GGPR has

a positive effect in high quantiles. Thus, it is seen that Bitcoin has the quality of a “hedging tool” especially against extraordinary global geopolitical risks.

Chien and Setyowati (2020) examined the effect of uncertainty shocks on global housing markets (housing price instability) using the "Panel Generalized Method of Moments" and "Quantile Regression" based on data from 56 countries for the period 2001Q1 - 2018Q2. For this purpose, Macroeconomic Uncertainty Index, Financial Uncertainty Index, Global Geopolitical Risk Index and Global Economic Policy Uncertainty Index were used. According to the findings, it is determined that these four uncertainty indices have a significant effect on different quantile levels of house price instability.

## 4. DATA SET AND ECONOMETRIC METHOD

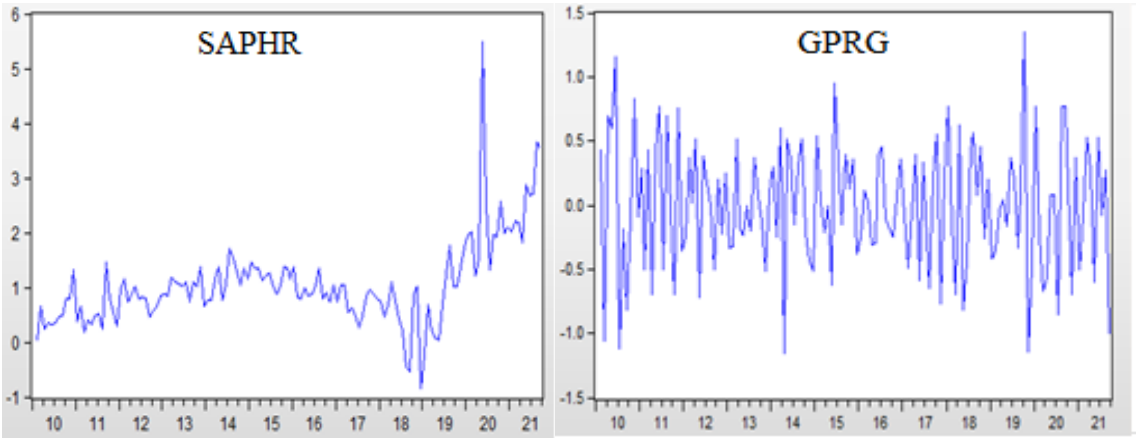
Türkiye-specific GPRH data was obtained from https://www.matteoiacoviello.com/gpr.htm and the HPI data was obtained from the Electronic Data Distribution System (EVDS). The period between January 2010 and September 2021 was chosen for econometric analysis. It can be said that the reason for choosing this period is that the data on HPI is available since January 2010 and that Türkiye has entered a problematic period in terms of market dynamics after September 2021. This section consists of two subsections. In the first subsection, the properties of the data set will be determined. In the second subsection, the "Cross-Quantilogram" will be introduced with its various aspects.

### 4.1. Data Set

In the correlogram of the housing return series created by calculating the logarithmic difference of the housing price index (HPI), it is thought that there is a seasonal effect because the autocorrelations are significant in the 12th and 24th seasonal lags. Therefore, the return series is seasonally adjusted by using the "Census X-13" method. Finally, the return series is multiplied by one hundred and the “Seasonally Adjusted Percentage Housing Return (SAPHR) Series” is obtained. In addition, the “Geopolitical Risk Growth (GPRG) Series” was calculated by taking the logarithmic difference of the GPRH index.

In order to reveal the characteristics of the data set, first of all, it is necessary to examine the graphs of the SAPHR and GPRG variables. The time path graphs of the relevant variables are presented in Figure 4.1, respectively:

**Figure 4.1** Graphs of SAPHR and GPRG Variables



In the graph of the SAPHR, a significant change is observed in the level and slope in 2018. For this reason, the breakpoint unit root test was used to test the stationarity of the series. As a result of the breakpoint unit root test, the break date was determined as "June 2018". Due to the absence of a unit root in SAPHR, breaking dummies were created taking this date into account and the break in SAPHR is eliminated. The graph is presented in Figure 4.2.

In the graphic of the GPRG series; Mavi Marmara attack carried out by Israel at the end of May 2010, terrorist acts in the period after the June 2015 elections which were repeated in November 2015 due to the failure to form a government in Türkiye, FETÖ Attempt in July 2016 and Barış Pınarı Military Operation in October 2019 which was carried out by Türkiye to eliminate the threat of terrorism on the Syrian border, is seen as important events corresponding to the dates when geopolitical risks reached high levels.

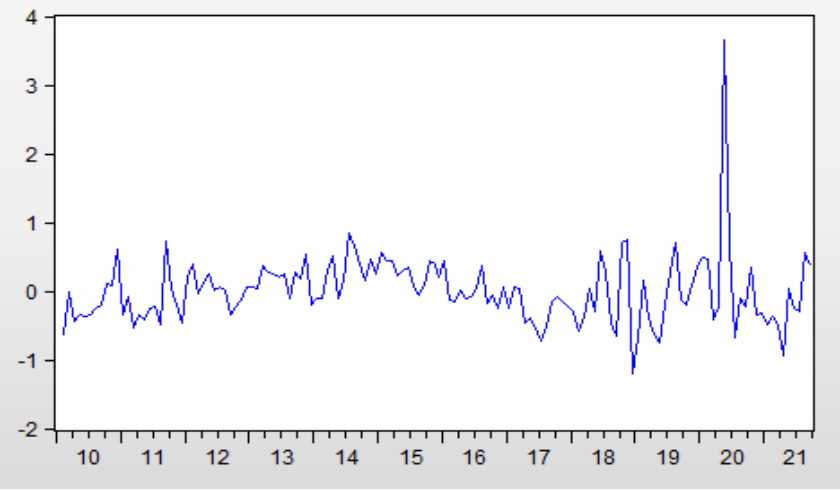
According to the results of the unit root tests for the variables whose graphs are given in Figure 4.1, it is concluded that the SAPHR and GPRG variables are stationary. Unit root test results are presented in Table 4.1:

| | Test Statistics | Critical Values |
|---|---|---|
| Breakpoint Unit Root Test for SAPHR | -9.038*** | -5.719 |
| ADF Unit Root Test for GPRG | -12.526*** | -2.582 |
| PP Unit Root Test for GPRG | -26.049*** | -2.582 |

**Table 4.1** Unit Root Test Results
*Note*: ***, **, * were used for 0.01, 0.05 and 0.10 significance levels, respectively.

The SAPHR series with the break eliminated (SAPHRBE) is one of the variables to be used in the analysis. The graph of the series is shown in Figure 4.2:

**Figure 4.2** Graph of the SAPHRBE Series



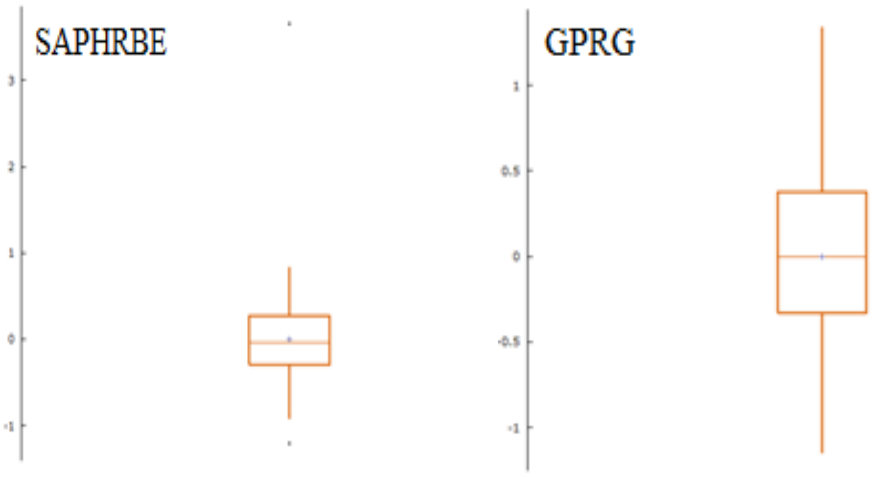

Descriptive statistics on stationary variables to be used in quantile dependence analysis are given in Table 4.2:

| | Mean | Median | Standard Deviation | Skewness | Kurtosis | J-B | Number of Obs. |
|---|---|---|---|---|---|---|---|
| SAPHRBE | 1.73e-16 | -0.039 | 0.496 | 2.789 | 22.609 | 2424.53*** | 140 |
| GPRG | -0.0016 | 0.000 | 0.496 | -0.077 | 2.672 | 0.767 | 140 |

**Table 4.2** Descriptive Statistics of SAPHRBE and GPRG Variables
*Note*: ***, **, * were used for 0.01, 0.05 and 0.10 significance levels, respectively.

According to the skewness and kurtosis values of the series, it is seen that SAPHRBE has a right skewed and rather sharp distribution. Due to the right skewness, the probability of extreme positive returns is higher than in the case of extreme negative returns. The result of the J-B test indicates that SAPHRBE does not have a normal distribution. On the other hand, looking at the distribution of GPRG, it is seen that the distribution is slightly skewed to the left and slightly flattened. The J-B test result indicates that GPRG is normally distributed. In order to obtain information about the existence of extreme values in SAPHRBE and GPRG variables, Box-Plots can be used. The “Box-Plots” for the variables are as seen in Figure 4.3:

**Figure 4.3** Box-Plots of SAPHRBE and GPRG Variables, Respectively




In Figure 4.3, it is seen that there is one positive and one negative extreme value in SAPHRBE. The existence of such an extreme value was not found in GPRG. In terms of econometrics, the presence of extreme values in SAPHRBE and the fact that the distribution is far from normal indicates that it would be correct to continue the analysis with a robust estimator that is not based on the distribution assumption. From a practical point of view, the heterogeneity of the housing market in Türkiye and the investigation of the effects of different geopolitical risk levels on housing returns also point to the necessity of focusing on different regions of the distributions of both variables examined. For all these reasons, it was decided to use the quantile-based "Cross-Quantilogram" as the appropriate method in order to answer the research question.

## 4.2. Econometric Method

The purpose of the "Cross-Quantilogram" method introduced by Han et al. (2016) is to quantify the quantile dependence between two stationary time series at different conditional (or

regression) quantiles and to test the existence of directional predictability. This method can be considered as an improved version of the quantilogram for the bivariate situation, which was proposed in the study of Linton and Whang (2007) and suggested as a diagnostic tool that can be used for predictability measurement in case of only one stationary time series.

The cross-quantilogram is defined as the cross-correlation of quantile-hit processes as follows:

$$\rho_{\tau}(k)=\frac{E\left[\psi_{\tau_1}\left(y_{1t}-q_{1,t}(\tau_1)\right)\psi_{\tau_2}\left(y_{2,t-k}-q_{2,t-k}(\tau_2)\right)\right]}{\sqrt{E\left[\psi_{\tau_1}^2\left(y_{1t}-q_{1,t}(\tau_1)\right)\right]}\sqrt{E\left[\psi_{\tau_2}^2\left(y_{2,\mathrm{t-k}}-q_{2,t-k}(\tau_2)\right)\right]}} \quad \textbf{(1)}$$

Here $k$, denotes any integer and $(\tau_1,\tau_2)$, any quantile pair; $\{y_{1t}\le q_{1,t}(\tau_1)\}$, $\{y_{2,t-k}\le q_{2,t-k}(\tau_2)\}$ denote two different cases whose serial dependence is measured. The quantile-hit created based on two different situations can be written as $\{1[y_{it}\le q_{i,t}(.)]\}$, $i=1,2$ with the help of the indicator function (Han et al., 2016: 252). For its sample equivalent based on $\{(y_t,\mathrm{x}_t):t\in\square\}$ and formally expressed in number (1), the conditional quantile functions expressed as $q_{i,t}(\tau_i)=x_{it}^T\beta_i(\tau_i)$ need to be estimated. For this purpose, the minimization problem created for the parameters to be estimated is as shown in (2) (Han et al., 2016: 253):

$$\hat{\beta}_i(\tau_i)=\arg\min_{\beta_i\in\square^{d_i}}\sum_{t=1}^{T}\rho_{\tau_i}\left(y_{it}-x_{it}^T\beta_i\right) \quad \textbf{(2)}$$

Based on the calculated $\hat{\beta}_i(\tau_i)$, the "sample cross-quantilogram" is defined as shown in (3) (Han et al., 2016: 253):

$$\hat{\rho}_{\tau}(k)=\frac{\sum_{t=k+1}^{T}\psi_{\tau_1}\left(y_{1t}-\hat{q}_{1,t}(\tau_1)\right)\psi_{\tau_2}\left(y_{2,t-k}-\hat{q}_{2,t-k}(\tau_2)\right)}{\sqrt{\sum_{t=k+1}^{T}\psi_{\tau_1}^2\left(y_{1t}-\hat{q}_{1,t}(\tau_1)\right)}\sqrt{\sum_{t=k+1}^{T}\psi_{\tau_2}^2\left(y_{2,t-k}-\hat{q}_{2,t-k}(\tau_2)\right)}} \quad \textbf{(3)}$$

The cross-quantilogram takes into account the dependence in terms of the direction of deviation from the conditional quantiles (Han et al., 2016: 253).

The "Stationary Bootstrap" method, which was examined in the study of Politis and Romano (1994), is used to create asymptotically valid confidence intervals and make inferences based on the cross-quantilogram. By means of this method, the standard errors of the estimators can be calculated and confidence regions can be created for the parameters based on weakly dependent stationary observations (Politis and Romano, 1994: 1303).

In order to test $H_0$ claiming that the quantilogram is zero, the test method developed by Lobato (2001) to test the null hypothesis that a dependent stochastic process is uncorrelated was used. Although the asymptotic distribution of the proposed test statistic under the null hypothesis is not standard, the critical values are tabulated through simulations. For small samples, it was concluded that the related test controls the Type - I error better and the power loss does not reach significant levels (Lobato, 2001: 1066).

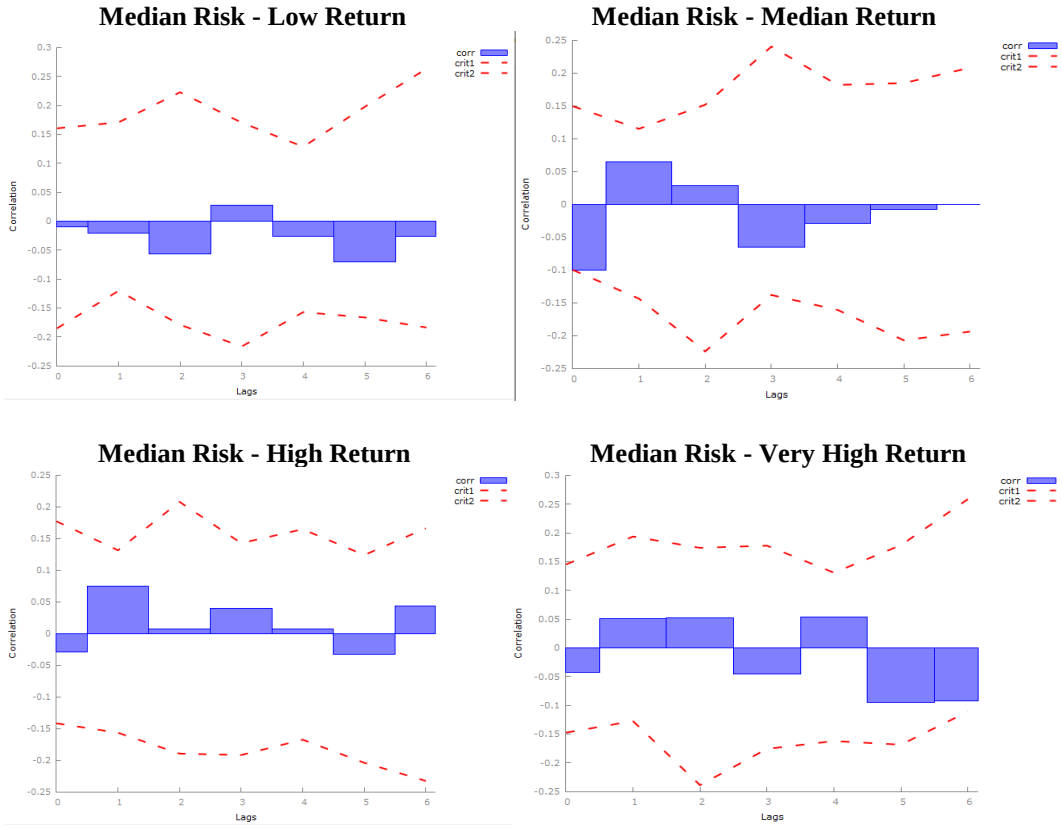
## 5. EMPIRICAL FINDINGS

Considering its geography, Türkiye is one of the countries most likely to be exposed to geopolitical risks in the world. For this reason, from the point of view of both domestic and foreign investors investing in housing, it is important to answer the question of whether this situation affects real estate returns, especially in periods when the growth in geopolitical risks is high and very high. In this section, in order to answer the aforementioned question, the results were obtained by using the "Cross-Quantilogram" method to see whether geopolitical risks have an effect on the housing return during periods of median and higher geopolitical risk growth in Türkiye and if there is, how many periods this effect persists.

In the cross-quantilogram graphs, the median level of the GPRG variable was used to represent ordinary geopolitical risks, while plots were made at the 75th and 90th quantiles of GPRG to express high and very high geopolitical risk levels, respectively. On the other hand, the 25th, 50th, 75th and 90th quantiles were used, respectively, when analyzing the cases where the SAPHRBE variable, which represents the housing returns, is at low, median, high and very high levels. In all cross-quantilogram plots, the correlations of variables SAPHRBE and GPRG at different lags were plotted for different pairs of quantiles. Gretl “qcorr package 0.5” was used to obtain the cross-quantilograms.

Considering Türkiye's geographical location, its importance in the world and the fact that the country is always open to geopolitical risks even at a certain level, and this level is evaluated as the median level in the study, the relationship between median geopolitical risks and different housing return levels is seen in Figure 5.1:

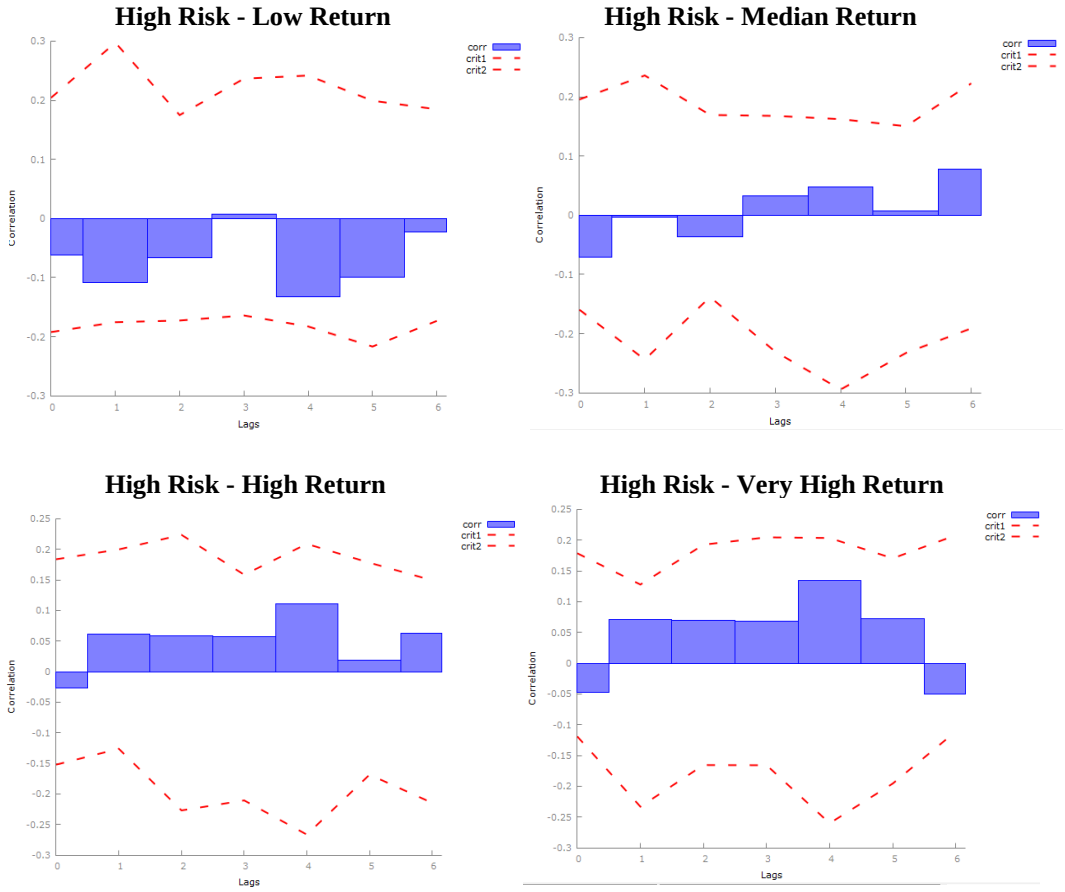
**Figure 5.1** Relationship Between GPRG (50th quantile) at Different Lags and SAPHRBE (25th, 50th, 75th and 90th quantiles)



According to Figure 5.1, it is seen that geopolitical risks at the median level in Türkiye are unrelated to all return levels. This is evident from the fact that all of the blue bars are within the confidence band.

In determining the relationship between extraordinary geopolitical risks and housing returns at different quantile levels, primarily the high-risk level (75th quantile) was taken into account. The results are as shown in Figure 5.2:

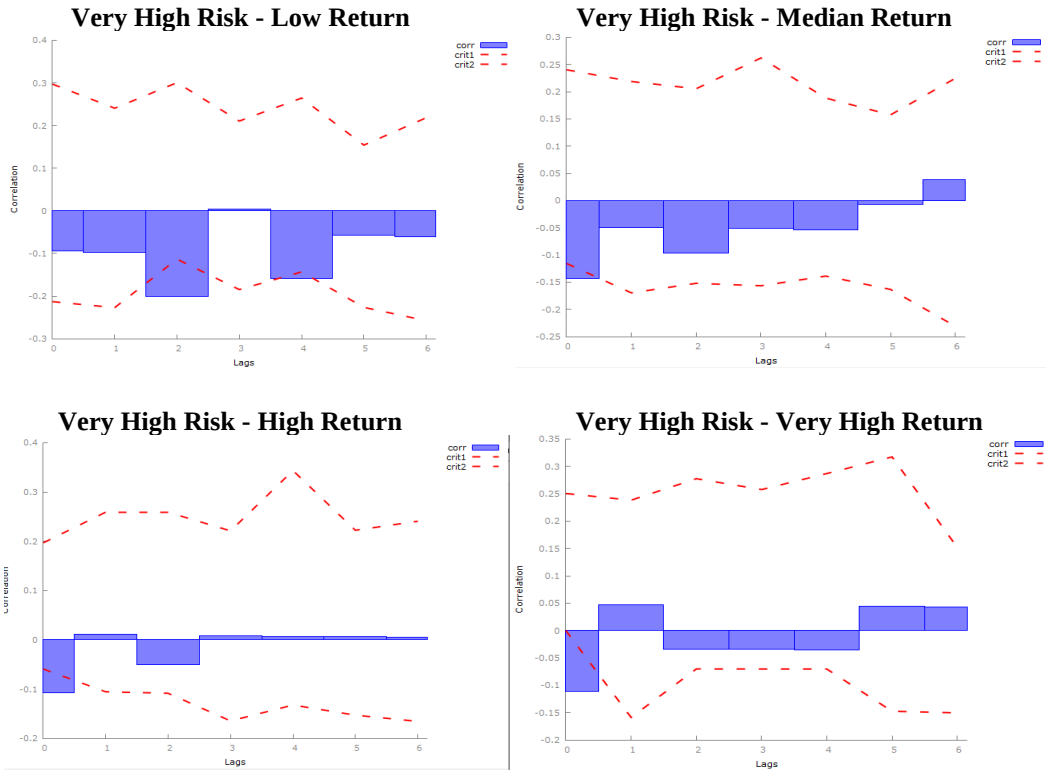
**Figure 5.2** Relationship Between GPRG (75th quantile) at Different Lags and SAPHRBE (25th, 50th, 75th and 90th quantiles)




In Figure 5.2, it can be seen that the comments made for Figure 5.1 apply here as well. It is seen that high geopolitical risks in Türkiye are unrelated to all return levels examined.

Finally, in the analysis of the relationship of very high geopolitical risks (especially during periods when different terrorist groups escalate their actions) with different levels of housing returns, the result is as shown in Figure 5.3:

**Figure 5.3:** Relationship Between GPRG (90th quantile) at Different Lags and SAPHRBE (25th, 50th, 75th and 90th quantiles)




According to Figure 5.3, unlike the previous cross-quantilograms, there are few significant blue bars. It is seen that very high geopolitical risks do not have a simultaneous reducing effect on low housing returns, but within four months following the emergence of very high geopolitical risks, such risks have a negative impact on low housing returns. When other graphs with median return, high return and very high housing return are examined, it is determined that very high geopolitical risk levels only have a simultaneous negative effect on housing returns, but this effect disappears within a month following the event that caused the very high geopolitical risk.

## 6. CONCLUSION

In the study, considering the data for the period between January 2010 and September 2021, the answer to the question "Does geopolitical risks have an effect on housing returns in Türkiye?" has been sought. It is of particular importance to select geopolitical risks among different risk types when making an analysis specific to Türkiye. Türkiye is a country that is highly exposed to geopolitical risks due to its location and importance. According to the graph of the geopolitical risk historical index for the period under review, it is seen that the events corresponding to the periods when these risks reached high and very high levels emerged as events originating from different terrorist organizations such as PKK, DAEŞ, FETÖ rather than tensions between states. This study is important in terms of examining the effects of such events on the housing market in which people operate in terms of meeting their housing needs and improving their quality of life, as well as investing and determining the sensitivity of the housing market to geopolitical risks.

As a result of the analyzes made in this study, which is the first study in Türkiye in terms of subject and method, it is seen that median and high-level geopolitical risks do not have an effect on house prices or house returns, but very high geopolitical risks have a short-term (four months

for low housing returns and less than one month for other return levels) negative effect on returns.

According to all the findings obtained in the study, it is seen that the geopolitical risks in Türkiye do not have a significant and permanent effect on the housing market where the spatial effect is strong and that the housing market is a market insensitive to such risks. This result can also be considered as a positive reflection within the borders of the country of the fact that Türkiye is a strong country in its region and highly experienced in the fight against terrorism.

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