The Nexus Of Geopolitical Risk And The Stock Returns; Evidence From Turkey Using Wavelet Analysis.

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Abstract:
This study evaluates the nexus between the stock market in Turkey; proxied with the Istanbul Stock Market and Geopolitical risk with the use of wavelet method. Monthly data ranging from January 1991 to March 2017 were used in the study. The Johansen cointegration test reveals that there exists no cointegration between the variables. Hence, the wavelet analysis was employed to account for the time-varying properties of the series. The result of the wavelet analysis shows that both the Istanbul Stock Market and Geopolitical Risk comove in the short run. The Toda- Yamamoto test used to check for causality shows that IST would lead to Geopolitical risk in the long run.

Keywords: Istanbul Stock Market, Geopolitical Risk, Granger Causality, Wavelet method.

1. Introduction
The Geopolitical atmosphere has become a significant source of concern for the world economies as this has created high global risks. Events such as the financial crisis of 2008, the oil glut of 2014, the Presidential election in the United States of America, the proposed withdrawal of the United Kingdom from the Eurozone and the increased nuclear power of North Korea have all created great uncertainties around the world. All these have led to countries and businesses increasing their risk countering costs which have invariably led to increased costs of businesses. Issues such as food scarcity and water scarcity are also threatening. According to the recent report on Global Risks, the failure of national governance ranks among the top three in the risks of doing business around the world (Global Risk Report, 2018).

The political environment plays a crucial role in the level of investment in any economy. Multinational firms always seek to invest their resources where they can determine to a great extent the viability of their investments and the level of returns that could be earned. This, therefore, makes it important for the government of every nation to create a conducive environment for businesses to thrive as this helps to encourage foreign direct investments in such an economy.

Turkey plays a very significant role in world trade as it is strategically located in the midst of four regions which are; Balkans, Caucasus, West Asia and Europe. The West Asian Countries which includes Qatar, Saudi Arabia, Iraq, Iran, United Arab Emirates, and so on, who are major suppliers of the world energy see Turkey as a link to the Western World. Also, Turkey is seen as the safest passage to an export route as a result of the increased United State military activities in these regions and the nearness of Turkey to the countries. Turkey plays an important role strategically in the world.

The terrorist attacks and the degree of participation of Turkey in these countries’ could lead to conflict between her and world powers such as the United States which could affect the ability to attract investments.

Although extant studies have been devoted to checking the relationship that exists between political instability and economic growth, on the one hand, economic policy uncertainties and economic growth, on the other hand, not much attention has been given into examining the relationship that exists between geopolitical risk and the economic performance of Turkey. As this could help Turkey exploit the opportunities that abound as a result of her strategic positioning...
geographically. This study, therefore, examines the nexus between geopolitical risk and the economic performance of Turkey which would be proxied with the Istanbul Stock Market.

2. Literature Review

Different analysts and authors have examined the impacts of political stability and other risks on various economies, but no research has been carried out to look at the effect of geopolitical risk on the stock market in Turkey.

Alesina et al., (1996) in the investigation of the relationship between political instability and per capita GDP growth using 113 countries from 1950 to 1982 found out that in countries and period in which the propensity of government collapse is high, there is significantly slower growth than otherwise.

Ahmed and Poluk (2013) in their study of the role of political stability and economic performance in Bangladesh argued that political stability is expected to foster economic growth in the short run. This is in agreement with the study carried out by D.T. Nomor et al., (2017) on Political Stability and Economic in Nigeria for the period of 1999 to 2014 using the ADRL model approach which showed that there exists a positive and significant relationship between political stability and economic growth both in the short run and long run.

Yunis et al., (2008) investigated the effects of various political instability factors on economic growth for selected Asian countries for the years 1990 to 2005 in which it was found out that there exists a close relationship between political stability and economic growth and that political stability plays a greater role in the achieving economic growth than economic freedom.

Furthermore, Aisen and Veiga (2010) in their investigation of the link between political instability and economic growth in 169 countries and a five-year period from 1960 to 2004 found out that lower growth rate is associated with higher degree of political instability.

Abeyasingbe (2004) in his work “Democracy, Political Stability and Developing Country Growth” reported that political stability regardless of the level of democracy has the greatest effect on the country’s economic growth.

Emma Fitzsimons and Minghong Sun (2012) in their study of Political Risk Components and how they affect the stock return and volatility in which they considered different economic development levels, it was found out that less economically developed countries are more susceptible to political risks than the developed nations.

Koksal Çalışkan (2011) and Mustafa (2002) found out that both stock returns of the stock market and the stock market volatility are affected by political developments.

In their study of how a political event might affect the stock returns of companies that are in joint ventures with China, Yulong, Huey-Lian, and Tang (2002); which was based on the Tiananmen Square incident, it was realised that political events had a significant impact on the returns of the firms. They were also of the opinion that the market reacted efficiently and that the effect of the political events was small in magnitude and not long lasting.

Spyridon Repousis surveyed Greek Bank’s stock reaction to September 11, 2001, terrorist attack in New York, in the United States; the bombing of the Madrid train that occurred on March 11, 2004, in Spain and the London Train bombing of July 7, 2005. It was found out that only the terrorist attack that happened in New York had a significant effect on the Greek bank stocks as it experienced abnormal returns. Also, in the study carried out on stock Prices in Germany, it was discovered that between 1914 and 1920, the stock prices in Germany experienced a downward shift which coincided with the war and that volatility occurred at the beginning and end of the war.

Mario Arturo. R.E et al., (2017) using the TAVE(Terrorists Attack Vulnerability Evaluation) model to evaluate the effect that terrorism has on the economic performance of Turkey from 1990 to 2016 found out that economic leaking, economic to growth, and economic wear increased from the 1990s to 2016. This can be supported by the fact that there have been 27 terrorist incidents from 1990 to 2016.

Robin. L.Diamante et al., (1996) in their study of ‘Political Risk in Emerging and Developed Markets’ stated that political risk represents a more important factor in the emerging markets more than
in the developed markets. It was also noted that average returns in emerging markets which experience reduced political risk was more than those of emerging markets that experienced increased political risk by an estimate of 11% a quarter. This was done using the analysts' estimates of political risk. Also, it was realised that there was a significant difference between the impacts of Political risk in emerging markets as compared to the developed ones statistically.

In investigating the relationship and volatility spillover between the stock market in the United States of America and the stock market in Turkey, using bivariate cointegration technique, Ugur Ergun and Abu Hassan. S. M. N,(2010), found out that there exists a dynamic relationship between the National Association of Securities Dealers Automated Quotation(NASDAQ) and the Istanbul Stock Exchange with the use of daily data from 1988 to 2008. Also, the Stock Market in the United States, United Kingdom, Germany, and Japan were seen to have a significant cointegrating relationship with the Istanbul stock exchange and that these four markets are major sources of volatility spillovers to the Istanbul Stock Exchange (ISE) (Darrat and Bentako, 2003).

Jianping Mei and Limin Guo (2002) in their paper ‘political Uncertainty, Financial Crisis, and Market Volatility’ which examined the impact political uncertainty has on financial crisis examining twenty-two (22) emerging markets with the use of panel data found out that eight financial crises out of the nine political election cycle examined occurred during the periods of political election and transition. The study also revealed that there was increased market volatility during the political election and transition periods. However, Cutler,Pand Summers(1989) revealed that there is little proof of a significant impact made on the US market by political news.

Other factors apart from political instability and risk also can affect the stock market value. Berkaet and Harvey (2000) found out that after Capital Market liberalisation, the cost of capital always goes down. This is also in conformity with the study carried out by Henry (2002) who found out that changes in policy such as the liberalisation of the stock market are capable of causing movement in the prices of stocks.

According to Global Economy Watch, it was reported according to their CEO Pulse survey that thirty per cent (30%) of business leader expected more than one crisis to hit their businesses within the next three years. It was also revealed that policy-related uncertainty peaked at an all-time high at the beginning of the year even more significantly than that of the financial crisis in 2008. This was according to the Economic Uncertainty Index (EPU) used to monitor and evaluate policy-related uncertainty. In support of the above statements, it was stated that the IMF estimates that a one standard deviation increase in uncertainty is associated with a 0.4 – 1.3 per cent point decrease in output growth.

In a recent report on climate change by the CDP in October 2017, which was based on mandatory environmental disclosure, countries, industries, and firms are beginning to respond to the risks that are arising as a result of climate change. It is said that as the world moves towards a low-carbon economy, this will create beneficiaries, and also, some sectors would be affected adversely. Hence, regulators have started to respond to the risks notably with the Task Force on Climate-related Financial Disclosure which was founded by the Financial Stability Board that has moved forward the Climate Disclosure Agenda by emphasising the relationship between financial stability and climate risk. Investors and Companies have therefore been charged with the responsibility of climate change information and set out the impacts of their strategies taken.

The Global Risk Report 2017, stated that ‘the failure of climate-change mitigation and adaptation’ has been identified as an important global risk and is stated to be an uncertain event. It also emphasized that if the climate change is not planned against, its occurrence will cast a significant negative impact on many countries and industries in the next decade(WEF 2017:61)

Anto Joseph et al. (2015) stated that the wavelet analysis offers an effective alternative tool to examine the inter-temporal causal relationship. Also, it helps to show the frequency domains which helps to provide a deeper understanding about the direction, strength, and extent of such causal relationship unlike the other traditional econometric tools used to check for causality that focus only on the time domain.
This research work hence would serve as a bridge to the gaps in the literature by using the wavelet analysis to check for the nexus that exists between Geopolitical Risk which is proxied with the Geopolitical Risk Index (GPR Index) and the stock market in Turkey proxied with the Istanbul Stock Market.

3. Model
The structure for the model adopted to investigate the topic follows related method employed by Dario Caldera & Matteo Iacoviallo (2017) while using the Vector Auto Regression analysis to check for the impact of Geopolitical Risk Shock (GPRSHOCK) on stock market returns of a total of 17 countries. Hence, this study would however further employ the wavelet analysis to examine the relationship that exists between Geopolitical Risk (GPR) and the stock market in Turkey using monthly data spanning from January 1991 - March 2017 obtained from statistical institutions like Borsa Istanbul among others. The need to capture events that cause too great extent volatilities and uncertainties which might be exogenous to financial and business cycles informed the use of the GPR index as the best proxy for uncertainty.

3.1 Wavelet Method
According to Heil and Walnut (1989) and Labat .D (2005), the wavelet analysis objective is to determine a variable's frequency content with the aim of getting out the temporal variation of this frequency content. Fan.Y and Gençay. R (2010) describes a wavelet as a function which has a zero mean that is localised in both frequency and time and also, it grows at a very quick rate within a limited period decays.

A wavelet (ψ) is described as a square integral function which has a real value and a mean which is equal to zero. The wavelet function will flutter from one side of the T-axis to another like a wave. Goupillaud etal., (1984) employed the morlet wavelet which would be used in this study. The wavelet is simplified as:

$$ψ(t) = π^{-1/4}ω_0^2 e^{-t^2/2}$$

In the equation above, the wavelet works on a limited time series p (t), t = 1,…, T.

There exists some level of uncertainty between scale localisation and the time as stated by the Heisenberg principle of uncertainty. However, there is a sufficient selection of the central frequency of the market wavelet at 6, i.e. (ω = 6) as this according to Rua and Nunes (2009) helps to stabilise the time and scale localisations.

3.1.1 The Continuous Wavelet Transform
The location or time (a) and scale (b) are the two parameters that the wavelet is consisted of. The parameter of time dictates the specific location in time by changing the wavelet while the scale parameter helps to localise various frequencies by controlling the distended wavelet. Also, when the scale is lower (higher), the wavelet becomes more (less) compacted, and this means a higher (lower) frequency.

By scaling or translating ψ, the wavelet daughters ψ a,b can be generated from the source wavelet □. Hence,

$$ψ_{a,b}(t) = \frac{1}{b}ψ_ψ(\frac{t-a}{b}), a, b \in \mathbb{R}, b \neq 0$$

By comparing p with a whole family of wavelet daughters, the time series finite length (t) and the continuous wavelet transformation can be gotten from the wavelet □□ as a function of (a):time or (b); location and the scale (b), Wp(a, b)

$$Wp(a, b) = \int_{-\infty}^{\infty} p(t)ψ_ψ(\frac{t-a}{b}) dt$$

The bar above the equation signifies complex conjugation.

The initial time series p(t) can be restated with the coefficients of wavelet as;

$$p(t) = \frac{1}{c_ψ} \int_{-\infty}^{\infty} \left[ \int_{-\infty}^{\infty} |Wp(a, b)|^2 da \right] \frac{db}{b^2}$$
Information about the maximum displacement from the equilibrium moved of the specific time series can be gotten from the squared value, or the Wavelet Power Spectrum (WPS) stated as:

\[ WPS_p(a, b) = |W_p(a, b)|^2 \]

### 3.1.2 Wavelet Coherence

The traditional correlation and the wavelet coherence have similar characteristics, but the wavelet coherence is different in that it portrays in a combined time-frequency domain, any correlation of two-time series \( p(t) \) and \( q(t) \).

The cross wavelet transform (CWT) of \( p(t) \) and \( q(t) \) is represented as:

\[ W_{pq}(a, b) = W_p(a, b)W_q(a, b) \]

The cross wavelet transform of \( p(t) \) and \( q(t) \) are represented by \( W_p(a, b) \) and \( W_q(a, b) \) respectively (Torrence and Compo, 1998). The complex conjugate is denoted by the bar. The covariance of the two time series of a specific scale is indicated by the CWT which can be described as the covariance for a particular time and scale.

According to Torrence and Compo (1998), the squared wavelet coherence is evaluated as:

\[ R^2(a, b) = \frac{|s|}{s^2 + |w|^2} \]

From the illustrations above, \( S \) represents the smoothing process over time and also the scale with \( 0 \leq R^2(a, b) \leq 1 \). If the value of the squared wavelet coherence is nearer to 1, this means that the two-time series that are being taken into consideration move together at a particular scale and this is depicted by the colour red. If the values are closer to zero (0), this signifies that the time series under study are not strongly correlated and this is portrayed by a blue colour.

Torrence and Compo (1998) stated that the chi-squared distribution accurately approximates the WPS of AR (0) or AR (1) and it helps to determine the significance level of the wavelet coherence. The wavelet coherence is represented by a thick-black contour.

#### 3.1.3 Phase

It is not possible to identify the existence of a positive or negative correlation given the squared value of the wavelet coherence coefficient. Hence, to be able to detect the wavelet coherence difference, the indication of deferrals in the wavering of the two-time series was is required. (Torrence and Compo, 1998). The phase of the wavelet coherence difference is determined as:

\[ \Phi_{pq}(a, b) = \tan^{-1} \left( \frac{\Im \{ s(b^{-1}W_{pq}(a, b)) \}}{\Re \{ s(b^{-1}W_{pq}(a, b)) \}} \right) \]

Where \( \Im \) represents an imaginary operator and \( \Re \) represents a real part operator. In the above, we are talking about a two-dimensional plot that shows the results of the wavelet coherence difference. Arrows that are Black signifies phase differences. If there is a co-movement of the two-time series, that is, a positive correlation, the phase difference is zero at a specific scale, and the arrows would be pointing to the right. In the case of a negative correlation, the arrows would be pointing to the left. Arrows pointing downwards means that the first time series is leading the second time series by \( \pi/2 \) as arrows that point upwards signify that the second time series leads the first time series byme value. Generally common is the combination of positions.

Ge (2008) insists that conducting a significance test for the phase-difference should be refrained from, but instead, the phase difference that corresponds to the coherence that is significant statistically should be concentrated on only. This is as a result of the lack of available statistical tests to determine the phase difference because it is very difficult to describe the null value. (Sousa et al., 2014).

### 4. Empirical Findings

#### Descriptive statistics

<table>
<thead>
<tr>
<th>STATISTICAL TOOLS</th>
<th>IST</th>
<th>GPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>9.599728</td>
<td>114.0510</td>
</tr>
<tr>
<td>Median</td>
<td>10.19854</td>
<td>104.7384</td>
</tr>
<tr>
<td>Maximum</td>
<td>11.39580</td>
<td>254.0297</td>
</tr>
<tr>
<td>Minimum</td>
<td>4.947837</td>
<td>42.70267</td>
</tr>
</tbody>
</table>

Table 1: Descriptive statistics and Normality Test
The table above shows the central tendency of the data. It can be seen from the mean values that IST and GPR from the first month of 1994 to the third month of 2017 averaged approximately 9.60 and 114.05 respectively. The Istanbul Stock Market experienced the highest increase at 11.40, and its lowest was 4.94 while the Geopolitical Risk was highest at 254.03 and lowest at 42.70. The standard deviation describes the degree to which variable variates from its means. The standard deviation for both variables is lower than their mean values, therefore, a low coefficient of variation. Since the probability values for IST and GPR are less than 5%, we accept the null hypothesis that the variables are not normally distributed but we do not reject the null hypothesis of normality. Furthermore, it can be seen from the skewness values that IST is negatively skewed (-1.078052), while GPR is positively skewed (0.960202). Kurtosis measures the peakedness or flatness of a series. For IST and GPR, the skewness values are greater than 3. Therefore, the variables are peaked (platykurtic).

4.1 Unit Root Test

To prevent having a spurious analysis, the unit root test is very important as regards time series data. This helps to check if time series data are stationary or not as this helps in the study of time series models and cointegration. Time series is said to be stationary if there is the absence of unit root while they are non-stationary if the unit root is present.

Table 2: ADF Unit Root Test

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>AT LEVEL I(0)</th>
<th>AT FIRST DIFFERENCE I(1)</th>
<th>SUMMARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>IST</td>
<td>-2.732059(0.0699)</td>
<td>-16.41013**(0.0000)</td>
<td>I(1)</td>
</tr>
<tr>
<td>GPR</td>
<td>-5.837481**(0.0000)</td>
<td>-12.49600**(0.0000)</td>
<td>I(0)</td>
</tr>
</tbody>
</table>

Source: Author’s computation (2017)

The Augmented Dickey-Fuller unit root test was used to check for the behaviour of the time series used. The table above shows that GPR is stationary at levels while the IST became stationary at the first difference. This means that the variables are integrated into order 0 and 1.

4.2 Granger Causality

The Fourier Toda Yamamoto Causality test (Toda Yamamoto, 1995) was used in this section to enhance the reliability of the Granger Causality test which was developed by Granger (1986) and is said to be sensitive in the VAR model to the lag length and is also subjected to the assumptions of stationarity. The Fourier Toda Yamamoto test for causality produces a valid parameter estimates not only for cointegrated VAR system but also for non-cointegrated VAR systems (Soytas and Sari, 2006).

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1* the probability values are presented in the parenthesis()  
** means the variable is significant at 1% level of significance.  
* means the variable is significant at 1% level of significance.
The Toda-Yamamoto causality test estimates an augmented VAR (K+d_{max}), where d_{max} is the maximum order of cointegration of the variables. The risk of identifying the order of integration wrongly is reduced to the bearest minimum (Lee and Chang, 2015).

Table 4.3 Fourier Toda Yamamoto Causality Test

<table>
<thead>
<tr>
<th>p</th>
<th>d</th>
<th>X=&gt;Y</th>
<th>p-value</th>
<th>Y=&gt;x</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.00000</td>
<td>1.00000</td>
<td>23.79995</td>
<td>0.021653</td>
<td>11.78257</td>
<td>0.463296</td>
</tr>
</tbody>
</table>

*Source: Author’s Computation(2017)*

From the table above, there exists a unidirectional causality between the variables. The probability value of 0.021653 is less than 5%. The indication is that the Istanbul Stock Market granger causes Geopolitical risk. But the p-value of 0.463296 shows that Granger causality does not run from Geopolitical risk to the Istanbul stock market which is supported by Mehmet Balciar et al., (2016) in their study of Geopolitical risk and stock market dynamics wherein it was found out that geopolitical risk does not Granger cause the stock market dynamics in India.

4.4 Wavelet Analysis

To check for the co-movement between the Istanbul Stock Market and Geopolitical Risk, the wavelet coherence shall be examined. The Wavelet Coherency analysis is presented as;

The above diagram shows the wavelet coherence of Istanbul stock market and Geopolitical risk. The vertical axis shows the period in months while the horizontal axis signifies time. The difference in phases is signified by the arrows. When the arrows are pointing to the right, this means that the series is in phase. Arrows that are pointing up rightwards means that the IST is leading while arrows pointing to the right down means that the IST is lagging. Arrows that point to the left upwards mean that the GPR is leading while GPR is lagging if the arrows are pointing left downwards. Arrows pointing to the left signifies that the variables are out of phase.

From the diagram above, it is shown that between December 1998 to February 2003, June 2008 to June 2011 and January 2014 to February 2017, the correlation between Istanbul Stock Market and Geopolitical risk was significant at the short term and medium scale term (16-32 scale periods). Also, it is shown that there is a correlation between IST and GPR between scale 16 and 32.

The periods of correlation can be supported as Turkey experienced three terrorist attacks between 1999 and 2003 which led to the loss of lives of 83 people as shown by the correlation from 1998 to 2003. Also, the correlation period between June 2008 and June 2011 was a period where the world experienced a financial crisis. The correlation periods between 2014 and 2107 is supported with
the reasons that during this period, there was the world oil shock (2008), the diplomatic breakdown between Turkey and the United States of America and also the breakdown with Germany. Furthermore, during this period, Turkey experienced a high volume of terrorist attacks of about 13 and the failed coup attempt of 2016.

5. Conclusion And Recommendation

The paper examines the nexus between Istanbul Stock Market and Geopolitical risk using data from January 1994 to March 2017. The study reveals that though the Istanbul stock Market and Geopolitical risk are correlated significantly, the correlation that exists is not strong. Also, the Istanbul Stock Market was seen to granger causes geopolitical risk. Also, it was however noticed that geopolitical risk sometimes has effects on the stock market in Turkey as shown by the leading of IST by GPR using the wavelet coherency and that the Turkish economy has a short time recovery frame from geopolitical events. First, the paper concludes that Geopolitical risks to an extent affect the stock market even though the effects are not that strong. Secondly, the performance of the stock market can lead to geopolitical risks. This could be, as investors lose confidence in the market, they withdraw funds from the market hence causing a shortage of funds for business/investment activities. Therefore, workers would be laid off, and this increases the unemployment rate. An increase in unemployment rate hence puts the society under pressure as some of the unemployed get entangled in crimes such as the terrorist groups thereby increasing social insecurity. The Turkish economy has a very fast recovery rate from periods of crisis as can be seen by the weak power of the wavelet spectrum.

In spite of strong and fast recovery shown by the Turkish economy, it could be seen that the stock market performance could lead to geopolitical risk. It is therefore highly recommended that the Turkish government should create an enabling environment for investors to thrive regarding her relationship with the international communities as this could further enhance the growth of the nation. Also, there should be more concerted efforts in the fight against terrorism as the study revealed that the periods of fall in the stock market performance coincides with high terrorism rates.

Further research in this context should be to verify the impact of the components of geopolitical risk such as Geopolitical threats and Geopolitical acts on the stock market performance and in to investigate the similarities between the effect of geopolitical risks on the stock market in Turkey and other developing markets.

References


