TIME AND FREQUENCY DEPENDENCY OF FOREIGN EXCHANGE RATES AND COUNTRY RISK: EVIDENCE FROM TURKEY

Derviş Kirikkaleli*, Mustafa Tevfik Kartal**, and Tomiwa Sunday Adebayo***

* European University of Lefke, Faculty of Economic and Administrative Sciences, Department of Banking and Finance, Lefke/Northern Cyprus, via Mersin/Turkey. Email: dkirikkaleli@eul.edu.tr
** Corresponding author. Borsa İstanbul Strategic Planning, Financial Reporting, and Investor Relations Directorate, İstanbul/Turkey. Email: mustafatevfikkartal@gmail.com
*** Cyprus International University, Faculty of Economics and Administrative Science, Department of Economics, Lefke/Northern Cyprus, via Mersin/Turkey. Email: twaikline@gmail.com

ABSTRACT

This study examines the time and frequency dependency nexus between foreign exchange (FX) rates and country risk in Turkey. We considered Turkey because it is a negative outlier country in terms of the progress of these indicators. Using quarterly data from 1990/Q1 to 2018/Q4 and the Wavelet Coherence approach, we find that an increase in the country risk causes an increase in the FX rates at different frequencies, especially in the medium and long term and different periods. The results highlight the significance of country risk for the progress of the FX rates. Policy implications are discussed.

Keywords: Country risk; FX rates; Wavelet coherence; Turkey.
JEL Classifications: C22; F31.

I. INTRODUCTION

The literature includes a variety of studies on economic and financial indicators like country risk, current account balance, FX rates, foreign trade, Gross Domestic Product (GDP) growth, inflation, interest rates, and stock market index. All these indicators have crucial functions for economies (Orhan *et al*., 2019).

The FX rates and country risk are two significant indicators affecting nearly all other economic and financial indicators (for example, Korhonen, 2015; Demir, 2019; Kartal *et al*., 2020; Kartal *et al*., 2021a). Sudden increases and decreases in the FX rates and country risk cause adverse impacts on the above-mentioned indicators as well as countries and economies thorough affecting cost, prices, and competition power of domestic producers (Kartal *et al*., 2021b). For this reason, sustainability in the FX rates and country risk is quite significant for the development of countries, economies, and markets.

Many researchers examine the FX rates from different perspectives in the current literature. For example, Onanuga and Shittu (2010), Maitra (2017), Obeng and Sakyi (2017), and Kartal (2020) examine the FX rates from the interest rates perspectives, while Hajilee and Al Nasser (2014), Korhonen (2015), Jebran and Iqbal (2016), Demir (2019), Kartal *et al*. (2020), Narayan *et al*. (2020), Depren *et al*. (2021), and Kartal *et al*. (2021a) examine the FX rates from stock market index perspectives, and Sujit and Kumar (2011), Wang and Chueh (2013), and Dinçer *et al*. (2018) examines the FX rates from the gold prices. Moreover, the FX rates are examined in terms of the nexus with Credit Default Swap (CDS) spreads (Fontana and Scheicher, 2016; Hassan *et al*., 2017), economic policy uncertainty (Krol, 2014; Beckmann and Czudaj, 2017; Sharif *et al*., 2020), geopolitical risk (Iyke *et al*., 2022), foreign portfolio inflows (Kartal *et al*., 2020), monetary policy indicators like emission (Depren *et al*., 2021), oil prices (Kartal, 2021); sovereign credit risk (Augustin *et al*., 2020), and volatility (Depren *et al*., 2021; Devpura *et al*., 2021; Kartal *et al*., 2021a).

Also, the current literature includes various studies concerning country risk and its sub-components, which are economic risk, financial risk, and political risk that all constitute the country risk (Political Risk Services (PRS) Group, 2021a). For instance, Bordo *et al*. (2009) explore the nexus between country risk and FX rates. Rodriguez (2016) examines the nexus between political risk and exchange rate regimes. Bahmani-Oskooee *et al*. (2019) examine the nexus between political risk and real FX rates. Iyke *et al*. (2022) examine the impact of geopolitical risk on FX rates. Gökmenoğlu *et al*. (2019) examine the nexus between economic risk and foreign direct investment. Kirikkaleli and Özün (2019) examine the nexus between political risk and sovereign credit risk. Kirikkaleli (2020a) examines the effect of economic, financial, and political risk on the stock market in Taiwan. Kirikkaleli and Gökmenoğlu (2020) examine the nexus between political risk and sovereign credit risk. Athari *et al*. (2021) examine the nexus between economic risk and sovereign credit ratings.

In addition to these studies, there are also some other studies that examine the nexus between risk sub-components. For example, Kirikkaleli (2016) examines the nexus between political, financial, and economic risks. Ertuğrul *et al*. (2019) focus on the nexus between political, financial, and economic risks. Kirikkaleli (2019) examines the nexus between economic risk and financial risk. Kirikkaleli (2020b)

reviews the significance of political risk for economic and financial risk. Shuaibu and Kirikkaleli (2020) investigate the nexus between economic risk and political risk. Kirikkaleli (2021) reviews the nexus between economic risk and financial risk. Moreover, Kondoz *et al*. (2021) research the nexus between economic risk and financial risk.

On the other hand, when the current literature is examined by considering the FX rates and country risk at the same time, it can be stated that the literature is not much rich although the number of studies has been increasing. For example, Saeed *et al*. (2012) consider the effect of political instability on the FX rates for Pakistan. Bouraoui and Hammami (2017) consider the role of political instability on the FX rates. Liu *et al*. (2020) examine the nexus between country risk and exchange rate regimes. Moreover, there are some studies, like Demir (2009), Topak and Muzir (2011), Kartal (2020), Münyas (2020), and Yıldırım (2020), that examine the nexus between the FX rates and country risk, including CDS spreads, country risk premium, and sub-components of the country risk for countries including Turkey. Hence, it is possible to state that the nexus between the country risk and FX rates have not been comprehensively examined for the case of Turkey.

The current study focuses mainly on the nexus between FX rates and country risk and, hence, addresses the research gap by considering that the nexus changes at different times and frequencies. Our analysis considers Turkey becuase it is a negative outlier country in terms of the progress of these indicators, as it can be seen from Figure A.1 (See Appendix). To summarize, the United States Dollar/ Turkish Lira (USD/TRY, hereafter) FX rates increased in some years like 2000, 2002, and 2018, while the country risk also increased around these years. Therefore, analyzing the time and frequency dependency of the FX rates and country risk can provide contributions to the literature. Also, such an examination can enable policymakers to develop and implement new policies to prevent the negative effects of these indicators on each other.

By considering the studies in the current literature, our hypothesis is that there is a positive nexus between the FX rates and country risk. Moreover, we ask whether country risk causes FX rates. To test the hypothesis, we used quarterly data from 1990/Q1 to 2018/Q4 on country risk index and USD/TRY rates, and the Wavelet Coherence (WC) approach. We used the USD because it is highly used in developed and emerging countries (Khan *et al*., 2019; Atmaca and Karadaş, 2020). The results show that an increase in country risk leads to an increase in the USD/ TRY rates, especially in the medium and long term, and in different periods. The results show that country risk is a significant predictor of Turkey's USD/TRY FX rates.

The study has two major contributions. First, it is the first to examine the time and frequency dependency between the FX rates and country risk in Turkey. Second, it applies the WC approach for the first time to examine the nexus between the FX rates and country risk for Turkey. Moreover, policy implications are constructed based on the outcomes gathered from the WC approach. This study consists of a total of four sections. After the introduction section that includes the literature review, Section II introduces the data and methodology. This section presents both the theoretical background of the country risk, the methodology, some major events regarding sub-components of the country risk in Turkey, and

empirical methodology. Section III presents the empirical results, discussion, and policy implications. Section IV presents the conclusion.

II. DATA AND METHODOLOGY
A. Data
The data on the country risk of Turkey is gathered from the PRS Group (2021b), while the data on the USD/TRY FX rates are gathered from the Central Bank of the Republic of Turkey (CBRT, 2021). We use quarterly data because the country risk is calculated quarterly. Table 1 presents a description of the variables used in the empirical analysis.

Table 1.
Description of Variables

This table presents the details about the data sources of the variables. In this table, the variables column presents the variables that are considered; the symbols column presents the symbols used to represent the variables; the descriptions column presents the long definition of the variables, and the source column presents the data sources from which data for the variables are obtained.

Variables	Symbols	Descriptions	Source
Country Risk	CR	Country Risk Index	PRS Group (2021b)
Foreign Exchange Rate	USD/TRY	USD/TRY FX Rates	CBRT (2021)

B. Country Risk Methodology
Although it is possible to examine the nexus between the risk variables (i.e., economic, financial, and political risks) and the FX rates and vice versa, another option is to combine these risks into a composite index (PRS Group, 2021a). The PRS Group (2021a) calculates a country risk index that combines economic, financial, and political risks for countries by taking each component into account. Table 2 shows a summary of the sub-components that are considered in the country risk.

Table 2.
Country Risk Components

This table presents the main risk groups included in the country risk calculation. In the PRS Group approach, there are 3 main components as economic risk, financial risk, and political risk. This table also presents a summary of the sub-components of these three components.

Economic Risk
Annual Inflation Rate GDP per Head
Budget Balance as a Percentage of GDP
Current Account as a Percentage of GDP
Real GDP growth
Financial Risk
Current Account as a Percentage of Exports of Goods and Services
Exchange Rate Stability
Foreign Debt as a Percentage of GDP
Foreign Debt Service as a Percentage of Exports of Goods and Services
Net International Liquidity by Months of Import Cover

Table 2.
Country Risk Components (Continued)

Political Risk
Bureaucracy Quality
Corruption
Government Stability
Democratic Accountability
Ethnic Tensions
Investment Profile
Internal/External Conflict
Law and Order
Military in Politics
Religious Tensions
Socioeconomic Conditions

Source: PRS Group, 2021a.

Hence, the country risk index includes economic, financial, political risks and hence it is more appealing to relate it to the FX rates, rather than doing so for its components and the FX rates. In the country risk, political risk has 50% weight, while each of economic and financial risk has a 25% weight. The country risk is classified as very high (0-50), high (50-60), moderate (60-70), low (70-80), and very low (80-over) (PRS Group, 2021a). The risk level is low when the score is high, and the risk level is high when the score is low. As can be seen from Table 1, the country risk of Turkey has increased significantly in times of crisis (for e.g., in 2000, 2001, and 2018). In this context, Table 3 summarizes some events that occurred in Turkey over the period between 1990 and 2018.

Table 3.
Some Economic, Financial, and Political Events in Turkey (1990-2018)

This table presents some economic, financial, and political events. In this table, the column of major events presents the events, the column of components presents the sub-heading of the risk types, and the column of the risk types presents main risk groups based on the PRS Group's classification.

Year	Major Events	Components	Risk Types
1994	Public deficit crisis	Budget balance	Economic
1994	Depreciation of TRY	Exchange rate stability	Financial
1997	Military memorandum	Internal conflict	Political
1999	Natural disaster (earthquake)	GDP per head	Economic
2000	Banking crisis	Real GDP growth	Economic
2000	Depreciation of TRY	Exchange rate stability	Financial
2001	Banking crisis	GDP per head	Economic
2001	Depreciation of TRY	Exchange rate stability	Financial
2002	General election	Democratic accountability	Political
2007	E-memorandum	Democratic accountability	Political
2007	General election	Democratic accountability	Political
2007	Presidential election	Democratic accountability	Political
2008	Global crisis	Real GDP growth	Economic

Table 3.
Some Economic, Financial, and Political Events in Turkey (1990-2018) (Continued)

Year	Major Events	Components	Risk Types
2010	Constitutional referendum	Democratic accountability	Political
2011	High current account deficit	Current account (% of GDP)	Economic
2013	Civil war	Internal conflict	Political
2013	Corruption investigations	Bureaucracy quality	Political
2014	Presidential election	Democratic accountability	Political
2015	Terrorism	Internal conflict	Political
2016	Military coup attempt	Internal conflict	Political
2017	Constitutional referendum	Democratic accountability	Political
2018	Currency crisis	Exchange Rate Stability	Financial
2018	High FX rates & debt	Foreign debt (% of GDP)	Financial
2018	Presidential election	Democratic accountability	Political
2018	High consumer price index	Annual inflation rate	Economic

Source: Authors' collection through the internet.

As it can be seen from the Table 3, there are various economic, financial, and political events that affected the country risk of Turkey. Hence, it can be beneficial to research the nexus between the country risks and the FX rates in Turkey.

C. Empirical Methodology
Using a novel technique, this study contributes to the literature by investigating the linkage between the FX rates and country risk. This study detects a time and frequency dependence between the variables. For this purpose, the study employs the WC approach that includes phase differences developed by Goupillaud *et al*. (1984) and Torrence and Compo (1998). The spectral nature of the time series is revealed by the wavelet analysis, especially in a manner such that several periodic features of the time series change over time. The wavelet transformation tool permits the decomposition of the time series into different frequencies. This study employs the Morlet wavelet function because it offers an adequate balance between time and frequency, which are the major components of any wavelet analysis. The Morlet wavelet function has the following form (Kartal *et al*., 2021b):

$$\varpi(t)\pi^{-\frac{1}{4}}e^{-i\varpi t}e^{-\frac{1}{2}t^2} \tag{1}$$

where i is $\sqrt{-1}$, and e depicts the non-dimensional frequency. Adebayo and Kirikkaleli (2021) argue that the use of continuous wavelet transformation is good for extracting the time-series features. Furthermore, Orhan *et al*. (2021) conclude that the Continuous Wavelet Transform (CWT) helps the cross-wavelet analysis to discover the time and frequency interaction between two-time series. The CWT for a discrete-time series is defined as:

$$\varpi_{k,f}(s) = \frac{\rho t}{\sqrt{s}} \sum_{n'=0}^{N-1} x_{n'} \varpi^* \left((n' - m) \frac{\rho t}{s} \right) \tag{2}$$

where $m=0,1,2,\cdots,N\text{-}1$ and the indicator $|W_n^x(s)|^2$ depicts the wavelet power spectrum, which reveals the variance of the time series. A cone of impact shows the effects of the observations. The process of generating data is the null hypothesis, in which the stationary process has a power spectrum background. The power spectrum is formed as follows:

$$D \left(\frac{|W_n^x(s)|^2}{\theta_x^2} < p \right) = \frac{1}{2} P_f X_v^2, \tag{3}$$

where Fourier frequency is depicted by the scale of the mean spectrum (P_f). The parameter θ represents the variance, and X^2 illustrates the two series. In addition, p is less than P_f, when 1 is real wavelets and 2 is the complex wavelets for v. The co-movement of the two-time series (p,q) is investigated using the WC as:

$$R_n(s) = \frac{\left| S \left(s^{-1} W_n^{pq}(s) \right) \right|^2}{S \left(s^{-1} |W_n^p|^{\frac{1}{2}} \right) S \left(s^{-1} |W_n^q|^{\frac{1}{2}} \right)} \tag{4}$$

where S depicts the smoothing operator for time and scale. The phase difference (ϕ_{pq}) of series (p,q) is investigated in the WC as:

$$\phi_{pq} = \tan^{-1} \left(\frac{L\{W_n^{pq}\}}{O\{W_n^{pq}\}} \right) \tag{5}$$

And $\phi_{pq} \in [-\pi,\pi]$. Where the imaginary and real component operators are denoted by O and L, respectively; and p leads q, when $\phi_{pq} \in \left[0, \frac{\pi}{2}\right]$ but q leads p, when $\phi_{pq} \in \left[-\frac{\pi}{2}, 0\right]$ correspondingly. Alternatively, the anti-phase difference also occurs for the series, whereby p leads q, when $\phi_{pq} \in \left[-\pi, -\frac{\pi}{2}\right]$ but q leads p, when $\phi_{pq} \in \left[\frac{\pi}{2}, \pi\right]$ correspondingly.

The wavelet analysis has some advantages over the Fourier method as it combines information from both simultaneously time and frequency domains. To the best of our knowledge, no study has previously used the wavelet coherence approach to obtain information on the dynamic correlation and/or causality between country risk and FX rates at different frequencies and different time periods in Turkey. Therefore, this allows us to capture the long- and short-run causal links between FX rates and country risk. As argued by Adebayo and Akinsola (2021), if time series exhibit structural breaks, researchers risk producing inaccurate findings when using traditional causality tests. Using the wavelet coherence approach ensures accurate findings if times series exhibit structural breaks.

III. EMPIRICAL RESULTS

A. Descriptive Statistics

Our quarterly data has 116 observations and runsfrom 1990/Q1 to 2018/Q4. Table 4 presents the descriptive statistics of the variables.

Table 4.
Descriptive Statistics

This table presents descriptive statistics of the variables that are used in the study. The figures contain descriptive statistics of the raw variables that are for Turkey for the period between 1990/Q1 to 2018/Q4. All figures are in points.

	Country Risk	USD/TRY
Mean	58.63014	1.299952
Median	60.68150	1.357500
Maximum	68.50000	5.836067
Minimum	40.25133	0.002400
Standard Deviation	6.335245	1.191812
Skewness	-1.062220	1.160860
Kurtosis	3.721887	4.785178
Jarque-Bera	24.33278	41.45668
Probability	0.000005	0.000000
Observations	116	116
Units	Points	Points

As Table 4 shows, the country risk has the highest mean value (58.63), ranging from 40.25 to 68.5, and the USD/TRYrate has a mean value of 1.299 that ranges from 0.002 to 5.84. Moreover, standard deviation values indicate that the USD/TRY is less volatile as compared to the country risk—the standard deviation of country risk is five times higher than that of USD/TRY. The Jarque-Bera probability values show country risk and USD/TRY are not normally distributed.

B. Wavelet Power Spectrum

Figure 1 depicts the wavelet power spectrum of the country risk of Turkey from 1990/Q1 to 2018/Q4. There is strong volatility at frequencies at the period of scale 0-32 in between 1990 and 1997 for the country risk. The probable reasons for this volatility may be attributed to the public deficit crisis in 1994 and the military memorandum in 1997. Furthermore, there is proof of significant volatility at high frequency at the scale of 0-8 between 1998 and 2003. There are a series of events that can be attributed to this volatility, such as natural disaster (earthquake) in 1999, the banking crisis in 2000 and 2001, the FX rate crisis in 2001, and the general election in 2001.
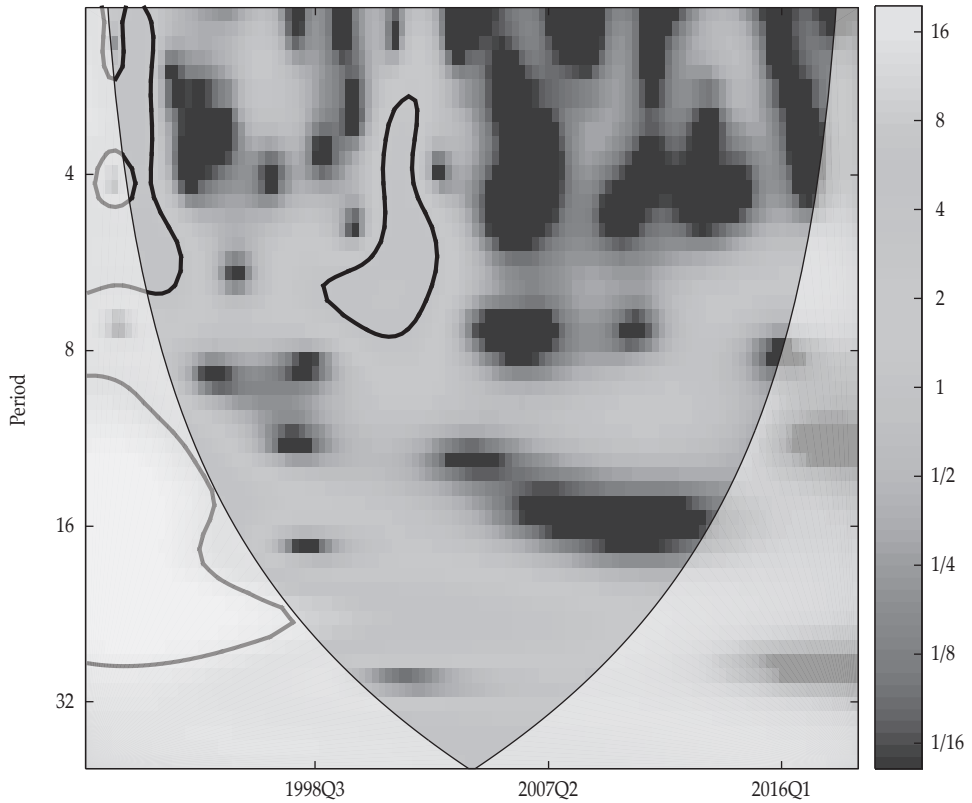
Figure 1.
Power Spectrum for Country Risk

The horizontal axis shows times in quarterly period, whereas the vertical axis shows the frequency. The black cone shows the influence area. The lighter colors show a higher degree of dependence between the variables. 0-8 scale shows short term, 8-16 scale shows medium-term, and 16-32 scale shows long-term. 1/16-1/2 shows low-frequency, 1/2-4 shows medium-frequency, 4-16 shows high-frequency. Right arrows show a positive correlation, while left arrows show a negative correlation between variables. Right-down and left-up arrows show that the first variable causes the second variable. Also, right-up and left-down arrows show that the second variable causes the first variable.

Figure 2.
Power Spectrum for USD/TRY

The horizontal axis shows times in quarterly period whereas the vertical axis shows the frequency. The black cone shows the influence area. The lighter colors show a higher degree of dependence between the variables. 0-8 scale shows short term, 8-16 scale shows medium-term, and 16-32 scale shows long-term. 1/32-1/4 shows low-frequency, 1/4-0.4 shows medium-frequency, 4-32 shows high-frequency. Right arrows show a positive correlation, while left arrows show a negative correlation between variables. Right-down and left-up arrows show that the first variable causes the second variable. Also, right-up and left-down arrows show that the second variable causes the first variable.
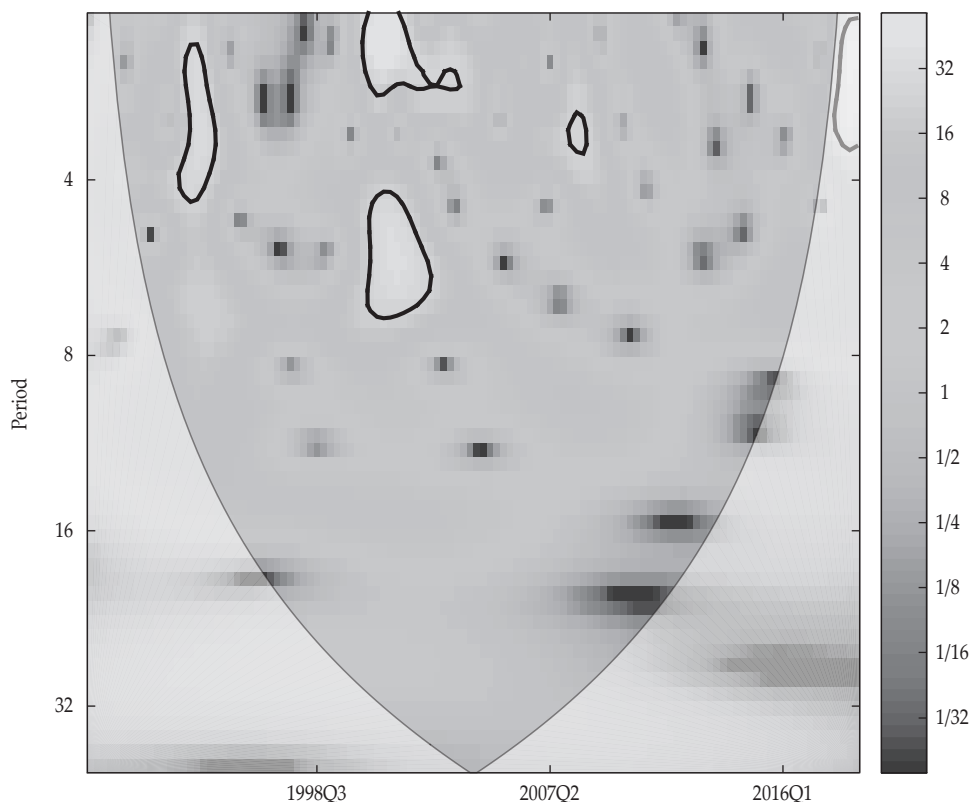

Figure 2 depicts the wavelet power spectrum of the USD/TRY from 1990/Q1 to 2018/Q4. There is proof of USD/TRY volatility at high frequency of a scale 0-4 during the period in between 1993 and 1994 . The most probable cause of this volatility is the currency and public deficit crisis in 1994, which resulted in a 6% drop in output, triple-digit inflation (almost 125%), loss of half of the CBRT's reserves, and nearly 50% increase in the USD/TRY. Furthermore, there is proof of volatility at a scale of 0-8 between 2000 and 2003. The probable reason for this volatility can be attributed to the depreciation of TRY in 2000 and 2001, respectively.

C. The WC Approach

The correlation and causality nexus between the USD/TRY and country risk are simultaneously captured at different frequencies (i.e. low, medium, and high), using the WC approach. Figure 3 portrays the results of the WC between the USD/TRY and country risk.

Figure 3.
The WC between USD/TRY and Country Risk

The horizontal axis shows times in the quarterly period whereas the vertical axis shows the frequency. The black cone shows the influence area. The lighter colors show a higher degree of dependence between the variables. 0-8 scale shows short term, 8-16 scale shows medium-term, and 16-32 scale shows long-term. 0-0.4 shows low-frequency, 0.4-0.6 shows medium-frequency, 0.6-1.0 shows high-frequency. Right arrows show a positive correlation, while left arrows show a negative correlation between variables. Right-down and left-up arrows show that the first variable causes the second variable. Also, right-up and left-down arrows show that the second variable causes the first variable.
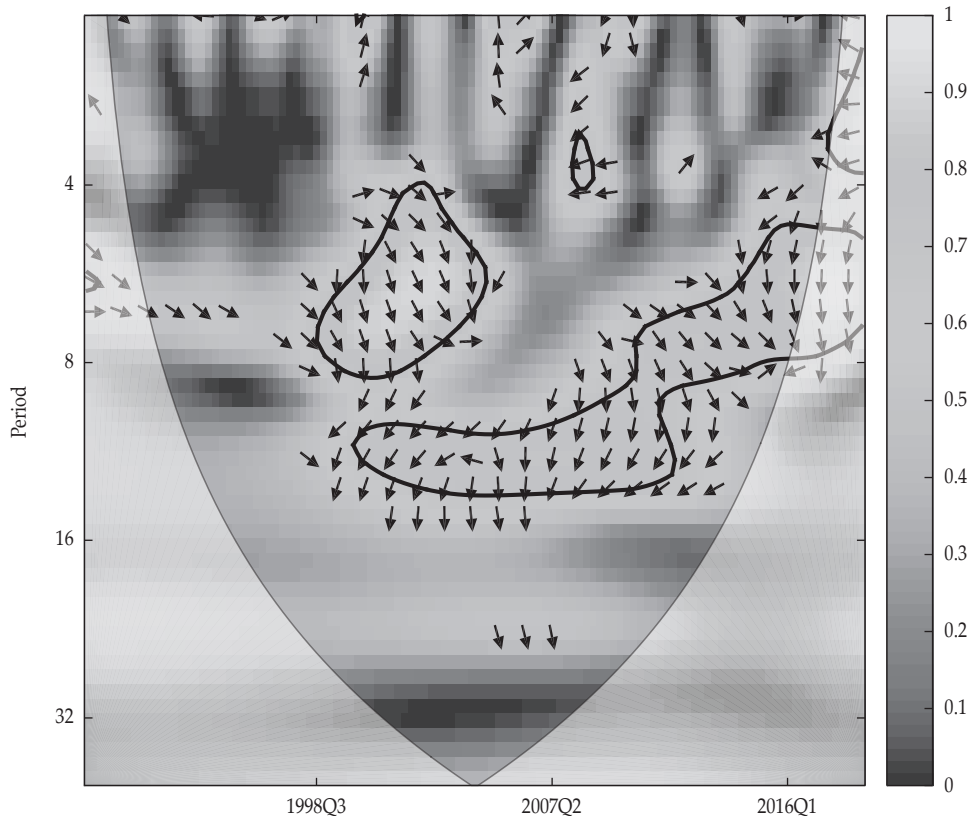
As Figure 3 shows, the majority of the arrows are rightward and down at the period of scale 4-16, and medium frequency, which suggests a positive connection between the USD/TRY and country risk between 2000 and 2018. This shows that the country risk leads the USD/TRY for these periods. Hence, an increase in the country risk also causes an adverse development in the USD/TRY in Turkey.

IV. DISCUSSION AND POLICY IMPLICATIONS

The WC approach results show that there is a time and frequency dependency between the country risk and USD/TRY in Turkey. Hence, the outcomes of the WC approach highlight the importance of the country risk for the progress of the FX rates (i.e., USD in this study) in Turkey. By considering the empirical results that are obtained from the WC approach, Turkey should always focus on keeping country risk at minimum levels to avoid an increase in the FX rates. The results gathered

from the WC approach are consistent with the current literature (for example, Bordo *et al*., 2009; Bahmani-Oskooee *et al*., 2019; Kartal, 2020; Kartal *et al*., 2021), which establishes a positive connection between the FX rates and country risk.

When considering the sub-components of the country risk (i.e., economic, financial, and political risks) and events that occurred in Turkey for the period examined, it is obvious that some of them cannot be managed by Turkey. However, Turkey can deal with most of these by firstly focusing on domestic issues. Later, Turkey can deal with other issues that are not fully or partially controlled by itself. Some policy proposals can be recommended based on our results.

Concerning the political risk, Turkey was faced with some military coup attempts, terrorist attacks, and elections that are held in short periods. Hence, Turkey can prevent military coup attempts by increasing structural reforms and preventing terrorist attacks by using central intelligence capacity more efficiently. Moreover, making elections on time is also beneficial. Hence, Turkey can decrease the political risk and prevent the negative effects of political issues on the country risk.

Concerning the financial risk, it is known that Turkey has high FX-denominated debts and high FX rates. Negative progress in these two figures supports each other. For this reason, Turkey should try to decrease FX-denominated debts by making some regulatory legislation so that FX-denominated borrowing and lending activities should not be more attractive than TRY-denominated activities. Moreover, Turkey should re-arrange the financial infrastructure and markets to prevent the depreciation of TRY. Turkey can decrease the financial risk by limiting the dollarization effect.

Concerning the economic risk, Turkey has been faced with inflation, public deficit, and current account problems that sometimes result in crisis. Therefore, Turkey should focus on decreasing the negative issues in these areas so that the economic risk of Turkey can be decreased to prevent in turn any crisis. By taking actions to minimize the economic, financial, and political risks, Turkey can prevent a sharp deterioration of its currency.

As a summary, there are various issues that Turkey can address to minimize the negative effects of the country risk on the FX rates. Turkey can focus on factors that are mostly or partially under its control. Later, other less controllable issues can be dealt with.

Considering the importance of the country risk for the FX rates, we highly recommend that Turkey should position the following up and management of the country risk at the macro-prudential level, encouraging the participation of a large body of economic authorities like CBRT and the Ministry of Finance. This will ensure better country risk management. Lastly, decision-makers of Turkey can develop better policies by benefiting from the high-frequency data that are not available to researchers as well as the public.

V. CONCLUSION

This study investigates time and frequency dependency of the FX rates and country risk in Turkey. To our knowledge, these time and frequency dependency between the indicators has not been comprehensively examined for Turkey. We consider the USD/TRY exchange rate (because it is the most used FX rate in Turkey) and

country risk from 1990/Q1 to 2018/Q4, and use the WC approach. We find that changes in the country risk lead to changes in the FX rate in Turkey at different frequencies and different periods. This highlights the importance of country risk as a predictor of the FX rates in Turkey.

The results suggest that an increase in the country risk also causes an increase in the FX rates in Turkey. Hence, the country risk should be controlled to minimize its negative impact on the Turkish economy. This can be achieved by positioning the country's management of country risk at the macro-prudential level, ensuring a close monitoring of the nexus between country risk and FX rates. Naturally, by considering the importance and effect of the country risk on the FX rates, decision-makers in Turkey can develop better policies to minimize country risk induced FX rate volatility by exploiting high-frequency data that are not publicly available.

The study also has some limitations. We mainly focus on Turkey because it is one of the emerging countries that has high country risk. Some of the emerging countries with high country risk close to Turkey, like Brazil, Russia, Mexico, Italy, and Greece, should be considered in future studies. Also, other major currencies like Euro and Sterling can be investigated in terms of their nexus with country risks. Alternative proxies of country risk, like CDS spread or sub-components of the country risk, can be considered in future studies. Moreover, new and different methods, like machine learning algorithms and the quantile-on-quantile regression approach, can be used in future studies to establish the relation between country risk and exchange rates to obtain new insights.

REFERENCES

Adebayo, T. S., & Akinsola, G. D. (2021). Investigating the Causal Linkage Among Economic Growth, Energy Consumption and CO_2 Emissions in Thailand: An Application of the Wavelet Coherence Approach. *International Journal of Renewable Energy Development*, 10, 17-26.

Adebayo, T. S., & Kirikkaleli, D. (2021). Impact of Renewable Energy Consumption, Globalization, and Technological Innovation on Environmental Degradation in Japan: Application of Wavelet Tools. *Environment, Development and Sustainability*, 1-26.

Athari, S. A., Kondoz, M., & Kirikkaleli, D. (2021). Dependency between Sovereign Credit Ratings and Economic Risk: Insight from Balkan Countries. *Journal of Economics and Business*. https://doi.org/10.1016/j.jeconbus.2021.105984

Atmaca, S., & Karadaş, H. A. (2020). Decision Making on Financial Investment in Turkey by Using ARDL Long-term Coefficients and AHP. *Financial Innovation*, 6, 1-22.

Augustin, P., Chernov, M., & Song, D. (2020). Sovereign Credit Risk and Exchange Rates: Evidence from CDS Quanto Spreads. *Journal of Financial Economics*, 137, 129-151.

Bahmani-Oskooee, M., Amor, T. H., Nouira, R., & Rault, C. (2019). Political Risk and Real Exchange Rate: What Can We Learn from Recent Developments in Panel Data Econometrics for Emerging and Developing Countries? *Journal of Quantitative Economics*, 17, 741-762.

Beckmann, J., & Czudaj, R. (2017). Exchange Rate Expectations and Economic Policy Uncertainty. *European Journal of Political Economy*, 47, 148-162.

Bordo, M. D., Meissner, C. M., & Weidenmier, M. D. (2009). Identifying the Effects of an Exchange Rate Depreciation on Country Risk: Evidence from a Natural Experiment. *Journal of International Money and Finance*, 28, 1022-1044.

Bouraoui, T., & Hammami, H. (2017). Does Political Instability Affect Exchange Rates in Arab Spring Countries? *Applied Economics*, 49, 5627-5637.

CBRT. (2021). Electronic Data Distribution System (EVDS). https://evds2.tcmb.gov.tr/index.php?/evds/serieMarket, Accessed March 31, 2021.

Demir, F. (2009). Macroeconomic Uncertainty and Private Investment in Argentina, Mexico and Turkey. *Applied Economics Letters*, 16, 567-571.

Demir, C. (2019). Macroeconomic Determinants of Stock Market Fluctuations: The Case of BIST-100. *Economies*, 7, 8.

Depren, Ö., Kartal, M. T., & Kılıç Depren, S. (2021). The Impacts of Monetary Policy Responses to COVID-19 Pandemic on National Currencies: An Emerging Country Case. *International Journal of Economic Policy in Emerging Economies*, Forthcoming.

Devpura, N., Gunadi, I., & Sasongko, A. (2021). Volatility Spillover of Intraday Exchange Rates on Some Selected Asean Countries. *Buletin Ekonomi Moneter dan Perbankan*, 24, 335-364.

Dinçer, H., Hacıoğlu, U., & Yüksel, S. (2018). Evaluating the Effects of Economic Imbalances on Gold Price in Turkey with MARS Method and Discussions on Microfinance. *In Microfinance and Its Impact on Entrepreneurial Development, Sustainability, and Inclusive Growth*. IGI Global.

Ertuğrul, H. M., Özün, A., & Kirikkaleli, D. (2019). How is Financial Stability Impacted by Political and Economic Stabilities in Emerging Markets? A Dynamic Panel Analysis. *Journal for Economic Forecasting*, 4, 148-159.

Fontana, A., & Scheicher, M. (2016). An Analysis of Euro Area Sovereign CDS and Their Relation with Government Bonds. *Journal of Banking & Finance*, 62, 126-140.

Gökmenoğlu, K., Kirikkaleli, D., & Eren, B. M. (2019). Time and Frequency Domain Causality Testing: The Causal Linkage between FDI and Economic Risk for the Case of Turkey. *The Journal of International Trade & Economic Development*, 28, 649-667.

Goupillaud, P., Grossmann, A., & Morlet, J. (1984). Cycle-octave and Related Transforms in Seismic Signal Analysis. *Geoexploration*, 23, 85-102.

Hajilee, M., & Al Nasser, O. M. (2014). Exchange Rate Volatility and Stock Market Development in Emerging Economies. *Journal of Post Keynesian Economics*, 37, 163-180.

Hassan, M. K., Kayhan, S., & Bayat, T. (2017). Does Credit Default Swap Spread Affect the Value of the Turkish Lira Against the US Dollar? *Borsa Istanbul Review*, 17, 1-9.

Iyke, B. N., Phan, D. H. B., & Narayan, P. K. (2022). Exchange Rate Return Predictability in Times of Geopolitical Risk. *International Review of Financial Analysis*, 81, 102099. https://doi.org/10.1016/j.irfa.2022.102099

Jebran, K., & Iqbal, A. (2016). Dynamics of Volatility Spillover between Stock Market and Foreign Exchange Market: Evidence from Asian Countries. *Financial Innovation*, 2, 1-20.

Kartal, M. T. (2020). The Behavior of Sovereign Credit Default Swaps (CDS) Spread: Evidence from Turkey with the Effect of COVID-19 Pandemic. *Quantitative Finance and Economics*, 4, 489-502.

Kartal, M. T. (2021). The Effect of COVID-19 Pandemic on Oil Prices: Daily Evidence from Turkey. *Energy Research Letters*, 1, 1-4.

Kartal, M. T., Depren, Ö., & Kılıç Depren, S. (2020). The Determinants of Main Stock Exchange Index Changes in Emerging Countries: Evidence from Turkey in COVID-19 Pandemic Age. *Quantitative Finance and Economics*, 4, 526-541.

Kartal, M. T., Kılıç Depren, S., & Depren, Ö. (2021a). How Main Stock Exchange Indices React to COVID-19 Pandemic: Daily Evidence from East Asian Countries. *Global Economic Review*, 50, 54-71.

Kartal, M. T., Kirikkaleli, D., & Ayhan, F. (2021b). Nexus between Non-performing Loans and Economic Growth in Emerging Markets: Evidence from Turkey with Wavelet Coherence Approach. *International Journal of Finance and Economics*. https://onlinelibrary.wiley.com/doi/10.1002/ijfe.2474

Khan, M. K., Teng, J. Z., & Khan, M. I. (2019). Cointegration between Macroeconomic Factors and the Exchange Rate USD/CNY. *Financial Innovation*, 5, 1-15.

Kirikkaleli, D. (2016). Interlinkage between Economic, Financial, and Political Risks in the Balkan Countries: Evidence from a Panel Cointegration. *Eastern European Economics*, 54, 208-227.

Kirikkaleli, D. (2019). Time-frequency Dependency of Financial Risk and Economic Risk: Evidence from Greece. *Journal of Economic Structures*, 8, 1-10.

Kirikkaleli, D. (2020a). The Effect of Domestic and Foreign Risks on an Emerging Stock Market: A Time Series Analysis. *The North American Journal of Economics and Finance*, 51. https://doi.org/10.1016/j.najef.2018.11.005

Kirikkaleli, D. (2020b). Does Political Risk Matter for Economic and Financial Risks in Venezuela? *Journal of Economic Structures*, 9, 3.

Kirikkaleli, D. (2021). Analyses of Wavelet Coherence: Financial Risk and Economic Risk in China. *Journal of Financial Economic Policy*. https://doi.org/10.1108/JFEP-08-2019-0174

Kirikkaleli, D., & Gökmenoğlu, K. K. (2020). Sovereign Credit Risk and Economic Risk in Turkey: Empirical Evidence from a Wavelet Coherence Approach. *Borsa Istanbul Review*, 20, 144-152.

Kirikkaleli, D., & Özün, A. (2019). Co-movement of Political Risk and Sovereign Credit Risk: A Wavelet Coherence Analysis for Argentina, Brazil, and Venezuela. *Social Science Quarterly*, 100, 2094-2114.

Kondoz, M., Kirikkaleli, D., & Athari, S. A. (2021). Time-frequency Dependencies of Financial and Economic Risks in South American Countries. *The Quarterly Review of Economics and Finance*, 79, 170-181.

Korhonen, M. (2015). The Relation between National Stock Prices and Effective Exchange Rates: Does It Affect Exchange Rate Exposure. *Global Economy Journal*, 15, 241-256.

Krol, R. (2014). Economic Policy Uncertainty and Exchange Rate Volatility. *International Finance*, 17, 241-256.

Liu, J., Wei, W., Shi, Y. B., & Chang, C. P. (2020). The Nexus between Country Risk and Exchange Rate Regimes: A Global Investigation. *The North American Journal of Economics and Finance*, 51, 100842.

Maitra, B. (2017). Monetary and Fiscal Factors in Nominal Interest Rate Variations in Sri Lanka under a Deregulated Regime. *Financial Innovation*, 3, 1-17.

Münyas, T. (2020). Evaluation of the Relationship between Credit Default Swaps and EURO and USD Exchange Rates: The Case of Turkey. *Business & Management Studies: An International Journal*, 8, 1113-1130.

Narayan, P. K., Phan, D. H. B., & Liu, G. (2020). COVID-19 Lockdowns, Stimulus Packages, Travel Bans, and Stock Returns. *Finance Research Letters*, 101732.

Obeng, S. K. & Sakyi, D. (2017). Macroeconomic Determinants of Interest Rate Spreads in Ghana. *African Journal of Economic and Management Studies*, 8, 76-88.

Onanuga, A. T., & Shittu, A. M. (2010). Determinants of Interest Rates in Nigeria: An Error Correction Model. *Journal of Economics and International Finance*, 2, 261-271.

Orhan, A., Adebayo, T. S., Genç, S. Y., & Kirikkaleli, D. (2021). Investigating the Linkage between Economic Growth and Environmental Sustainability in India: Do Agriculture and Trade Openness Matter? *Sustainability*, 13, 4753.

Orhan, A., Kirikkaleli, D., & Ayhan, F. (2019). Analysis of Wavelet Coherence: Service Sector Index and Economic Growth in an Emerging Market. *Sustainability*, 11, 6684.

PRS Group. (2021a). International Country Risk Guide. https://www.prsgroup. com/explore-our-products/international-country-risk-guide, Accessed March 31, 2021.

PRS Group. (2021b). Data of Country Risk. Obtained from the PRS Group via e-mail on March 31, 2021.

Rodriguez, C. M. (2016). Economic and Political Determinants of Exchange Rate Regimes: The Case of Latin America. *International Economics*, 147, 1-26.

Saeed, A., Awan, R. U., Sial, M. H., & Sher, F. (2012). An Econometric Analysis of Determinants of Exchange Rate in Pakistan. Inte*rnational Journal of Business and Social Science*, 3, 184-196.

Sharif, A., Aloui, C., & Yarovaya, L. (2020). COVID-19 Pandemic, Oil Prices, Stock Market and Policy Uncertainty Nexus in the US Economy: Fresh Evidence from the Wavelet-based Approach. *International Review of Financial Analysis*, 101496.

Shuaibu, S. M., & Kirikkaleli, D. (2020). Investigating the Nexus Between Political Risk and Economic Risk: A Wavelet Coherence Analysis for Greece, Albania, Bulgaria and Romania. *Economic Computation & Economic Cybernetics Studies & Research*, 54, 283-299.

Sujit, K. S., & Kumar, B. R. (2011). Study on Dynamic Relationship among Gold Price, Oil Price, Exchange Rate and Stock Market Returns. *International Journal of Applied Business and Economic Research*, 9, 145-165.

Topak, M. S., & Muzir, E. (2011). Examination of Country Risk Determinants Using Artificial Neural Networks: The Case of Turkey. *International Research Journal of Finance and Economics*, 75.

Torrence, C., & Compo, G. P. (1998). A Practical Guide to Wavelet Analysis. *Bulletin of the American Meteorological Society*, 79, 61-78.

Wang, Y. S., & Chueh, Y. L. (2013). Dynamic Transmission Effects between the Interest Rate, the US Dollar, and Gold and Crude Oil Prices. *Economic Modelling*, 30, 792-798.

Yıldırım, Z. (2020). External and Domestic Shocks, Exchange Rate, Country Risk Premia and Macroeconomic Conditions in Turkey. *İstanbul İktisat Dergisi*, 70, 73-112.

APPENDIX

Figure A.1.
Progress of the USD/TRY FX Rates and Turkey's Country Risk

This figure shows the progress of the USD/TRY FX rates and country risk of Turkey. The country risk is presented in left axis, while USD/TRY FX rates are presented in right axis. Also, an increase in the USD/TRY FX rates represent an adverse progress, whereas a high level rating in country risk indicate low risk and a low level rating implies high risk.
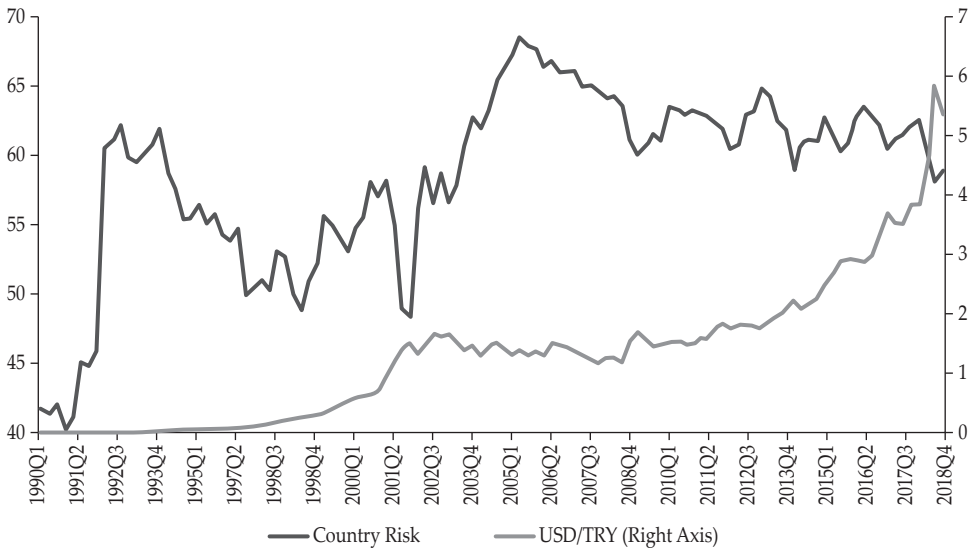
Source: PRS Group, 2021b; CBRT, 2021

This page is intentionally left blank