IJCEAS

International Journal of Contemporary Economics and Administrative Sciences
ISSN: 1925 – 4423
Volume: XIII, Issue: 1, Year: 2023, pp. 181-199

Comparative Investigation of Inflation in Pakistan and Turkey: Fresh Insights from the Wavelet Coherence Approach

Shabeer KHAN[1]
Abdullah Talha GENÇ[2]
Mervan SELÇUK[3]

Received: 26.09.2022, Accepted: 28.06.2023
DOI Number: 10.5281/zenodo.8332801

Abstract

Pakistan and Turkey share the same macroeconomic fundamentals as energy dependence, double digits inflation, and tremendous currency depreciation. This paper aims at analyzing the impact that exchange rate, interest rate, and oil price have on the inflation rate in Turkey and Pakistan by using the data period of 2010:M1-2021:M12 and employing the wavelet coherence model. The results show that currency deprecation boosts inflation in both economies. Interest contribution to inflation is more significant in the case of Pakistan compared to Turkey while oil prices only increase inflation in Pakistan compared to turkey. To reduce the impact of currency depreciation on inflation in both nations, an increase in export policy can be implemented, similarly, foreign direct investment can be attracted. Additionally, both nations need to increase the inflow of funds and need to reduce the outflow of funds which will also help them stabilize the currency.

Keywords: Exchange Rate, Oil Price, Inflation, the Wavelet Coherence, Turkey, and Pakistan

JEL Code: E30, E43, C30

[1] Assist. Prof. Sakarya University, Faculty of Political Sciences, Islamic Economics and Finance, Turkey, shabeer@sakarya.edu.tr, https://orcid.org/0000-0003-4739-6543
[2] Res. Asst., Sakarya University, Faculty of Political Sciences, Islamic Economics and Finance, Turkey, abdullahgenc@sakarya.edu.tr, https://orcid.org/0000-0001-8811-8609
[3] Assist. Prof. Sakarya University, Faculty of Political Sciences, Islamic Economics and Finance, Turkey, mervanselcuk@sakarya.edu.tr, https://orcid.org/0000-0001-8384-373X

IJCEAS

International Journal of Contemporary Economics and Administrative Sciences
ISSN: 1925 – 4423
Volume: XIII, Issue: 1, Year: 2023, pp. 181-199

1. Introduction

The connection between the inflation rate, exchange rate, and oil prices remained one of the crucial issues for policymakers and economists of emerging markets. Inflation changes the income distribution against the wage earners, affects the employment and production levels, increases the circulation rate of money, and accelerates the escape from the local currency (Krugman, 2013).

Inflation is a major problem in an economy, and there are various reasons behind the aggravation in the level of prices. Fluctuations in the prices of oil and the changes found in the exchange rate are two of some variables that affect inflation in fragile economies. Moreover, the impact of the change in the prices of oil on inflation varies concerning the economic structure of that country, the distribution of its economic activities, whether it is an oil-producing country or not, and the taxation levels on oil (Bari & Adalı, 2020). However, the change in the exchange rate affects both economic actors and economic transactions, especially those with a high dependency on imported inputs.

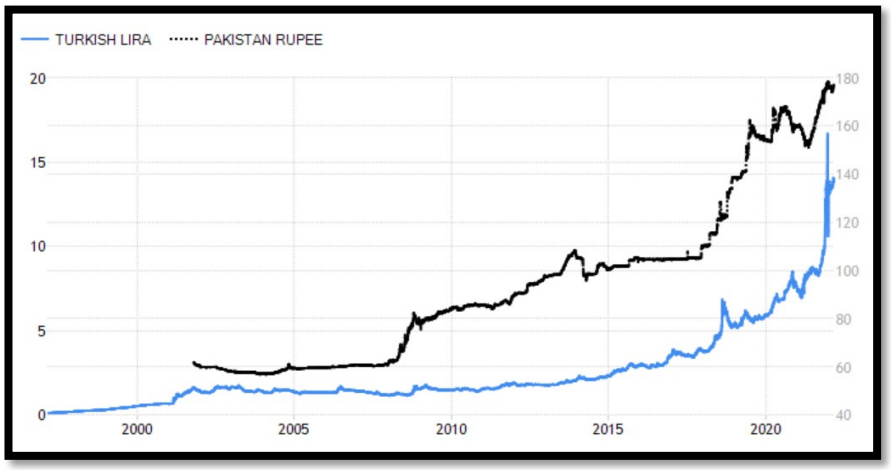
Aggravation in the prices of oil has substantial and negative impacts on developing and developed countries (Öksüzler & İpek, 2011). Especially in net energy importing countries, the influence of changes in prices of oil is more important because of their dependence on oil. From a supply perspective, increases in oil prices increase production costs. In addition, increases in oil prices are instantly reflected in consumer prices. Oil price changes in a country primarily depend on global oil supply and demand, and secondly, changes in exchange rates affect domestic oil prices (Bari & Adalı, 2020).

The aggravated exchange rate, that is, the currency devaluation for a nation, increment in the costs related to imported goods and decreases the prices of exported goods, negatively affecting net foreign trade for a short period. Additionally, the rate of exchange can affect rising prices by causing an increase in the price of imported inputs. Especially in Turkey, the high dependence on imported products in production reflects the changes in the pass-through inflation related to the exchange rate (Kara et al., 2022). While in the Turkish economy, the inflation is about 26% due to the exchange rate pass-through, the pass-through in oil prices is estimated at 14% (Ozgur et al., 2021).

Turkey and Pakistan have an increasing energy demand due to their growing populations and economies and the lack of sufficient domestic oil production. Hence, changes in oil prices and volatility in exchange rates make these two countries fragile. The fact that both countries are in an inflationary environment and the fragility they have due to oil prices and exchange rate volatility has made them the subject of this study together.

State Bank of Pakistan along with the Central Bank of the Republic of Turkey and focus on achieving and maintaining price stability. Inflation is an important issue for two countries. While Turkey transitioned to liberal and market-oriented policies in the 1980s, similarly, Pakistan did in the 1990s (Chaudhry et al., 2021). After the deep crisis in 2001, the inflation-targeting regime has been applied by Turkey in 2002. Meanwhile, after the standby agreement with the IMF, a tight fiscal policy was implemented. The implementation of structural reforms also significantly reduced inflation. Inflation targeting became fully operational in 2006. Although the exchange rate is crucial in many economies for balancing output and inflation, the traditional inflation targeting method does not provide any commitment to the currency rate (Zdemir, 2020). Following the global financial crisis, issues of financial stability were also embedded in inflation targeting. At this point, some authors divide Turkey's inflation targeting experience into 2006-2010: conventional inflation targeting regime and 2011-2016 non-conventional multi-target and multiple tools periods (Kara et al., 2017). Between 2006 and 2016, annual consumer inflation in Turkey was 8.2% on average, above the targets. The impact that the exchange rate has on inflation between these years is relatively up. Therefore, from 2011 to 2016, the influence of the rate of exchange on inflation reached an average of 2 points (Kara et al., 2017). In addition, a (Yilmazkuday, 2021) study between 2005:M1 and 2021:M8, it was determined that inflation in Turkey is largely propelled by the global oil prices along with the exchange rate and.

Graph 1: Turkish Lira and Pakistan Rupee vs U.S. Dollar



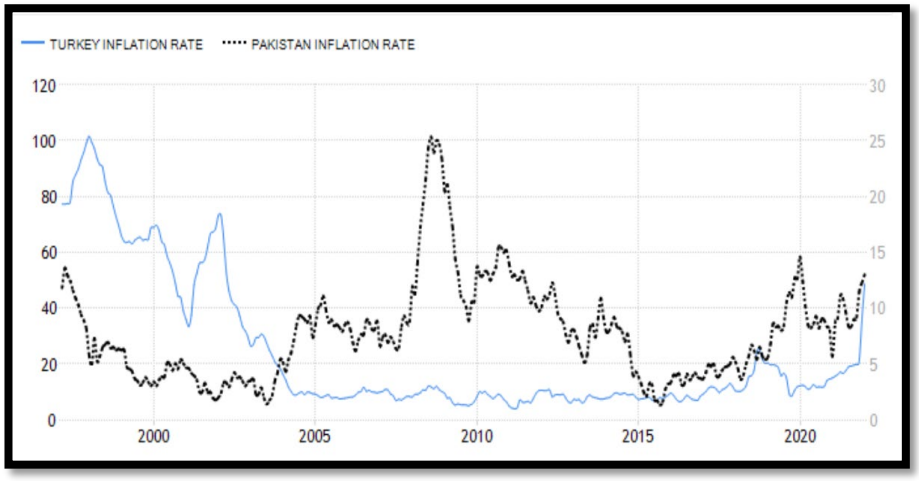
Source: https://tradingeconomics.com/

As can be seen in Graph 1, the Turkish Lira (left side) and Pakistani Rupee (right side) have depreciated against the dollar, especially in recent years.

IJCEAS

International Journal of Contemporary Economics and Administrative Sciences
ISSN: 1925 – 4423
Volume: XIII, Issue: 1, Year: 2023, pp. 181-199

Graph 2: Turkey and Pakistan Inflation Rate



Source: https://tradingeconomics.com/

Graph 2 shows the inflation in Turkey and Pakistan. Turkey (left side) has a relatively regular course of inflation, especially between 2005 and 2012. Pakistan, on the other hand, experienced fluctuating inflation that rose during the years of the global financial crisis.

Inflation has always been an essential problem for the Pakistani economy. After the low inflation rates were seen between 2000 and 2007, the increase in energy and food prices following the world's financial crisis along with the political events inside and around Pakistan caused inflation to get out of control (Akbar, 2021; Muhammad Asif Amjad et al., 2021). A tight policy was implemented against inflation within the framework of the IMF's macroeconomic stability program at 2008. Although the measures are taken by the government on the supply and demand side, tight fiscal and monetary policy took effect in 2015 and brought inflation under control. It started to increase again after 2017. In the Pakistan Economics Survey 2018-19 announced by the Ministry of Finance, the main causes of inflation, especially in 2019, are fluctuations in the exchange rate and high fuel prices (*Pakistan Economic Survey 2018-19*, 2019).

Following these reasons, this paper aims to analyse the influence of the rate of exchange, the interest rate along with oil price on the inflation for Turkey and Pakistan in the period between 2010M1 and 2021M12. We employ wavelet coherence to examine these relationships. To the authors' best knowledge, there are several papers studying the connection between inflation, rate of exchange, and prices of oil changes, but there is no study on the comparative analysis for Turkey and Pakistan. Thus, the key contributing factor to the literature is wavelet coherence usage. Moreover, Turkey and Pakistan were analysed simultaneously, considering the macroeconomic similarity.

The first part of the study comprises the investigation of the literature along with the previous studies on the subject. The related literature signifies that our study is distinctive concerning the selected countries. The methods related to econometrics and data have been discussed in the later section. Moreover, the empirical findings and discussion are presented in the third segment. the last section of the study mentions the conclusion.

2. Literature Review

There has been a substantial discussion on the association between inflation, rate of exchange, and oil price in the literature especially related to fragile economies. Many studies examine the relationship between these variables using different techniques, such as exploring how they affected the countries' macroeconomic variables when they changed (Akkoç et al., 2021; Bari & Adalı, 2020; Çatık & Önder, 2013; Gokmenoglu et al., 2015; Hayat et al., 2021; Meo et al., 2018; Tursoy & Mar'i, 2020).

The impacts of the oil prices, exchange rate, and inflation for Turkey and Pakistan are examined in several studies. Some of these studies studied the causal relationships between these variables using the VAR techniques. Tursoy & Mar'i (2020) examine the association between Turkey's interest rate and exchange rate by employing wavelet analysis from 2005 to 2019. The findings demonstrate that the long-term and short-term association amidst the exchange rate and the interest rate is normally positive, and this approves the theory of purchasing power parity (PPP). Özmen & Yılmaz (2016) employ the coherency analysis of wavelet to investigate the dynamics of the association between the fluctuation of exchange rate and several financial determinants for the period 2005-2015. The results show that the co-movement of exchange rate fluctuations is the strongest with the CDS and interest rate in Turkey. Akbar et al. (2019) study the dynamic relationship between the price of gold and stock; exchange rate and interest rate connection between 2001:M1 and 2012:M12, employing the Bayesian VAR model in Pakistan. The direct association between the rate of interest and exchange in Pakistan is in agreement with the International fisher effect theory.

Yilmazkuday (2021) examine the determinants of Turkish inflation by employing an SVAR model to analyse the prices of oil and rates of unemployment, inflation, policy, and exchange of the Turkish economy. The empirical findings demonstrate that inflation is negatively affected by an inverse policy rate shock, or a positive, exchange rate shock and oil price shock. The instability of inflation is usually clarified by the long-run movements in the oil prices and exchange, while the causation of the shocks in the exchange rate to inflation has persistently increased in the period. Çatık & Önder (2013) investigate the regime-dependent asymmetric impact on inflation and exchange rate through oil price for Turkey from 1988 to 2011 employing the Vector Autoregressive (VAR) model. The results show that the association connecting the oil price and macroeconomic variables demonstrates a haphazard pattern and the price of oil has a significant impact on

inflation. Dedeoğlu & Kaya (2014) examine the association linking the oil price change and inflation using the VAR model with the help of monthly data for the period during 1990-2012 for Turkey. The results illustrate that the influence of oil prices on inflation has a significant relationship. Oil prices affect the producers' prices two folds than the consumers' prices. Bari & Adalı (2020) investigate the influence that changes in oil prices have on consumer inflation in two different ways between 2009 and 2020 in Turkey employing ARDL models. The first way demonstrates the impacts of changes in domestic crude oil prices to understand the effect of the exchange rate too. The other way indicates the impact of the gasoline price change. The findings demonstrate that both oil prices have asymmetrical impacts on consumers' inflation in the short term. Nevertheless, decreasing the oil prices has a limited effect compared to the increasing oil prices on consumer inflation. Turna & Özcan (2021) find that in the short and long term, the exchange rates and interest rates has caused inflation between 2005 and 2019 in Turkey employing the ARDL method.

Demirel & Karaoğlu (2021) investigate the non-symmetric association linked with the exchange rate and inflation employing a NARDL approach in the period of 2004:Q1–2019:Q4. The results of the long run demonstrate that inflation is asymmetric in the exchange rate pass-through in Turkey. A percent increase in the exchange rate causes an increase in the annual inflation by 0.11 percent in the long run, while a 1per cent decrease in the exchange rate decreases inflation by 0.28 per cent. Akkoç et al. (2021) study the influence of price shocks of crude oil on inflation and exchange rate between 2005 and 2018 in Turkey employing the FAVAR approach. The results found indicated that shocks in the oil price have inflationary impacts on Turkey because of the dependence on imported oil. The impulse of the positive shocks in the oil price to different price indices is statistically significant and persistent. Mostly the price increases are set in the sectors like transportation, food, and beverage. However, no significant effect have been found between the oil prices and exchange rates. The sector of tourism is also among the most affected sectors from exchange rate changes. (Meo et al., 2018) The paper examines the asymmetric relationship between the exchange rate, inflation, and oil prices in Pakistan from 1980 to 2016 using the NARDL technique, which provides the explanation of the probable asymmetric influence in both the long-term and short-term. The results indicate that the currency rate, inflation, and oil prices have an unbalanced effect on tourism demand over the long term. Ozdemir (2020) examines whether Turkish monetary policy may be described by an enhanced Taylor rule with the exchange rate using a TAVR approach during 2002-2017. The role of the exchange rate in monetary policy under inflation targeting has been illustrated through the linear model whereas the non-linear model illustrates the asymmetric stance of monetary policy in relation to exchange rate fluctuations.

These studies demonstrate the relationship connecting the inflation, exchange rate, and prices of oil is controversial. Thus, this paper extends the literature to fulfil a need for further examination. It can be shown that many studies

focus on time-domain analysis to empirically analyse the association between the inflation, exchange rate, and oil price. After all, the wavelet approach we employ in the study allows us to analyse the association among these variables for both the domains of time and frequency. This study is among the earliest approaches to scrutinize the effect of inflation, exchange rate, and oil price for Pakistan and Turkey employing the wavelet methods. Thus, the study fills the gap in the literature by employing quarterly data.

3. Data and Econometric Methods

Data

Data is acquired from IMF's IFS (The International Financial Statistics) and FRB (Federal Reserve Bank) of St. Louis dataset in Turkey along with Pakistan, and the monthly dataset covers the period of 2010-2021. Table 1 shows the descriptions and sources of variables.

Table 1: Abbreviations and Sources

Abbreviations	Description	Source
Exchange Rate	National Currency Per U.S. Dollar, Period Average	IMF
Interest Rate	Central Bank Discount Rates	IMF
Inflation Rate	Consumer Price Index (CPI)	IMF
Oil Price	Global price of Brent Crude, U.S. Dollars per Barrel	Federal Reserve Bank of St. Louis

Source: Authors' Calculations

In this dataset, we select the exchange rate (national currency per U.S. dollar), interest rate (central bank discount rates), inflation rate (consumer price index) and prices of oil (brent crude, U.S. dollars per barrel) between 2010:M1 and 2021:M12. The data of exchange rate, interest rate and inflation rate were acquired from the IMF - The International Financial Statistics, whereas oil price were obtained from the FRB of St. Louis dataset.

Table 2 illustrates the descriptive statistics of full sample and sub-samples of Turkey and Pakistan, respectively. The average rate of inflation in Pakistan remains less than Turkey while the average interest rate remains higher in the case of Turkey compared to Pakistan. Turkey's average inflation rate is about three times more than Pakistan's. The average exchange rate in turkey remains stable 2.34 compared to Pakistan which is 87.54. The mean oil price is 69.28 US dollars in the period.

Table 3 represents the correlation matrix; the association between exchange rate and interest rate is positive in the case of Turkey, while on the contrary, a negative relationship is observed in Pakistan. In both economies, a strong

association connecting the inflation and exchange rate is observed. Interestingly oil price associated with the exchange rate is found negative in Turkey and Pakistan.

Table 2: Descriptive statistics

Full Sample	Obs	Mean	Std. Dev.	Min	Max
Exchange Rate	288	59.242	58.902	1.422	177.556
Inflation Rate	288	205.896	133.354	63.602	686.95
Interest Rate	288	11.160	3.468	6.25	18.5
Oil Price	288	69.283	22.273	16.55	109.53
Turkey					
Exchange Rate	144	3.713	2.281	1.423	10.574
Inflation Rate	144	308.806	117.6	174.07	686.95
Interest Rate	144	12.717	3.532	8.750	18.500
Oil Price	144	69.283	22.312	16.550	109.530
Pakistan					
Exchange Rate	144	114.772	27.351	83.989	177.556
Inflation Rate	144	102.988	23.077	63.603	158.183
Interest Rate	144	9.604	2.606	6.25	14
Oil Price	144	69.283	22.312	16.550	109.53

Source: Authors' Calculations

Table 3: Correlation matrix

Full Sample	Exchange Rate	Inflation Rate	Interest Rate	Oil Price
Exchange Rate	1			
Interest Rate	-0.675	1		
Inflation Rate	-0.439	0.413	1	
Oil Price	-0.122	-0.269	0.335	1
Turkey				
Exchange Rate	1			
Inflation Rate	0.9919	1		
Interest Rate	0.2357	0.1979	1	
Oil Price	-0.4929	-0.5058	0.282	1
Pakistan				
Exchange Rate	1			
Inflation Rate	0.9507	1		
Interest Rate	-0.1138	-0.3496	1	
Oil Price	-0.4876	-0.5406	0.5136	1

Source: Authors' Calculations

Estimation technique (Wavelet Coherence)

We have utilized the wavelet coherence (WC) procedure to analyze the data. WC's objective is to inquire not only about co-movement between the exchange rate, inflation rate and oil price but also, the lead-lag association too. With the help of WC we can getting the our results without dividing the data into different time span. Additionally, with the help of WC, we can also investigate the correlation patterns of different regimes.

Wavelet algorithms are advantageous in that they can offer output without dividing the data into distinct sample periods. Using this technique, we may study the correlation sequence between financial data during various regimes. Wavelet coherence also permits a three-dimensional analysis by simultaneously evaluating the components of time and frequency along with the strength/weakness of the correlation within the time-series parts. However, conventional time series econometric techniques analyse time and frequency separately (Aguiar-Conraria & Soares, 2011; Grinsted et al., 2004). In conclusion, the WC method has four significant benefits: (1) evaluating the dynamic relationship connecting variables as opposed to implying a fixed relationship. Bodart & Candelon (2009); (2) identification of structural breaks when there is a full breakdown in the shift or a correlation related to the specific band of a frequency; (3) determining the causality association at numerous frequencies; and (4) according to Vacha & Barunik, (2012) other estimation techniques require parameters while wavelet model is free from following such jargons. Grinsted et al., (2004) explained Wavelet coherence as:

$$R_n^2(s) = \frac{|s(s^{-1}W_n^{XY}(s)|^2}{s(s^{-1}W_n^X(s)|^2 . S(s^{-1}W_n^Y(s)|^2} \quad (1)$$

Where S is used for something the series otherwise all times and scales it would be identical to one. Convomeion in scale and time would be employed to get smoothness.

$$S(W) = S_{scale}(S_{time}(W_n(s))) \quad (2)$$

Where S_{time} and S_{scale} show time and scale smoothness in wavelet correspondingly. Taking into consideration the nature of our variables and data, Torrence & Webster, (1999) smoothing operator i.e. Morlet Wavelet is employed:

$$S_{time}\,(W)|_s = (W_n(s) * c_1 \frac{-t^2}{2s^2})|_s; S_{time}\,(W)|_s = (W_n(s) * c_2\pi(0.6\,s))|_n \quad (3)$$

The normalization constants C1 and C2 and rectangular functions are represented by, 0.6 is considered for the Morlet wavelet's scale decorrelation length, per Torrence and Compo (1998). 0R n2 (s)1 is the range of two-time Wavelet coherence that indicates linear association within two-time series at each scale. W nXY (s) represents cross wavelet power and indicates the time scale region where time series exhibit strong common power and where local covariance within

two series at each scale can be determined. The explanation for the two series y(t) and x(t), i.e., cross wavelet power, is as follows:

$$W_n^{XY}(s) = W_n^X(s)W_n^{*Y}(s) \quad (4)$$

In the above equation $W_n^X(s)$ and W_n^{*Y} show two continuous wavelet transform series correspondently where the * represents a complex conjugate.

Lead-lag associated can be depicted by the wavelet coherence different phases where the phase of wavelet coherence can be explained as:

$$\emptyset_n^{XY}(s) = tan^{-1}\left(\frac{I\{S(s^{-1}W_n^{XY}(s))\}}{R\{S(s^{-1}W_n^{XY}(s))\}}\right) \quad (5)$$

In the above equation R and I show the smooth power spectrum's real and imaginary slices of the.

The WC (wavelet coherence) is used to locate regions within the time-frequency spaces where dual series co-vary. Red (warmer colours) shows regions with a high-intensity interrelation, while colder colours (blue) indicate less interrelation i.e., less dependence between two series. Outside of the significant areas, cold regions reflect time and frequencies with no dependency on the sequence. Consequently, the frequency and time intervals at which macroeconomic factors and COVID -19 alter in tandem can be evaluated. Because a transformation of a continuous wavelet uses information from adjacent data sets at any one time, the start and the end of the time interval should be interpreted with care. So, just scales up to 256 days are utilised. In the wavelet coherence plots, the lead/lag phase relationships between the studied series are indicated by an arrow. On a particular scale, a phase difference of 0 indicates that two-time series move in unison. The arrows point to the right when the time series are in phase (anti-phase) (left). When two series are in phase, they move in the same direction; when they are out of phase, they move in the other direction. COVID-19 leads to macroeconomic variables with arrows pointing to the right or left, whereas macroeconomic variables lead with arrows pointing to the right or left.

4. Results and Discussion

The paper mainly aims to get time and frequency information from a variable identified by a time that can be extracted by the WC technique because the WC technique has the ability to extract time and frequency information from a variable that is signal in time. The following graphs illustrate the estimated wavelet coherence along with the phase difference of the inflation rate with the exchange rate, interest rate, and oil price in Pakistan and Turkey at scales ranging from 4 to 32 using WC. Diagrams of Wavelet Coherence are presented in the figures and can be described as follows: The horizontal axis indicates the time with respect to the number of months from 2010:M1 to 2021:M12.The horizontal axis presents time

while the frequency is displayed by the vertical axis as having a low frequency means a larger scale whilst the vertical axis refers to the variables. The curved line demonstrates the per cent significance level, estimated using Monte Carlo simulations.

The area beyond the line, like cold regions, shows no dependence in the series with respect to time and frequencies. On the right side of each figure, there are colour codes depicted that correspond to power ranges starting from blue to red. The colour blue illustrates the poor correlation between the two-time series, i.e. their weak relationship. In contrast, the red colour implies a significant association between the two-time series, denoted by a high correlation. If arrows point to the right, it indicates that two WC have a positive association and that two-time series are in phase. If arrows point to the left, it indicates that variables are negatively connected and that two-time series are out of phase. Moreover, we also analysed casual (lead-lag) relationship and phase differences between variables where the arrows inside the significance level show the phase difference between the Exchange rate and inflation rate. Right-up or left-up arrows shows that the number one variable is ahead of the second variable, whereas right-up or left-down arrows show the opposite. (Çıkıryel et al., 2022).

For instance, in Figure 1, such as arrows moving right side show that both rates of the exchange rate and the inflation are in phase while arrows moving left side indicate that both the exchange rate and the inflation rate are out of phase in the first and second figures. Inside the phase shows positive association between exchange rate and inflation rate while outside of phase indicates a negative association within exchange rate and inflation rate. Similarly, arrows moving right-upward show the inflation is leading and the exchange rate is following, and vice versa in the case of arrows moving left-downward. On the other hand, arrows moving right-downward display that the exchange rate is leading, and the inflation is lagging and vice versa in the case of arrows left-upward.

As we see in the case of both figures 1 and 2 (Pakistan and Turkey), regions of strong coherence between exchange rate and inflation rate have been observed in both short-run and long-run frequencies. In Figures 1 and 2, we observe that there is a strong positive (inside the phase) coherence between exchange rate and the rate of inflation at scales corresponding to periods between 2012 and 2015 at a middle frequency (scale 8–16) in the case of Pakistan while a higher frequency between 2016 and 2020 (scale 4–16) in case of Turkey. Moreover, as the arrows moving right-upward display that the exchange rate is lagging and the inflation rate is leading in both countries, these findings illustrate the negative effect that the increasing value of inflation affects the exchange rate positively in both countries after 2017. The findings are also in line with the correlation of variables i.e. in table 3, and there is a strong (0.99) positive association between exchange rate and inflation in the case of Pakistan while (0.95) in the case of Turkey (Ha et al., 2020).

The results of the relationship between interest rate and inflation are demonstrated for both Pakistan and Turkey in figures 3 and 4. We see that there is

a positive coherence between interest and inflation at scales corresponding to periods between 2012-2014 and 2017-2020 at a middle frequency (scale 8–32) in the case of Pakistan. Interest is leading and inflation is following, which is in line with a mainstream economic theory where interest is used as a tool to control inflation (Selçuk & Görmüş, 2022).

However, no causal and directional relationship has been found in the case of Turkey, even though some associations have been spotted between interest rate and inflation between 2014 and 2017 at a frequency (scale 32). On of the possible reason is that in Turkey, the government is not increasing interest rate despite double-digits inflation. In other words, the government is not using interest as a tool to control inflation (Butler & Kucukgocmen, 2022).

Both nations, responses to the exchange rate are more a less same which suggests that Pakistan and Turkey had more a less same reaction to the change in inflation. One of the possible reasons can be that both countries are facing high inflation and currency depreciation, as presented in graphs 1 and 2. Thus the results of the study suggested that both the countries need to adopt a similar policy to control inflation.

Turkey and Pakistan have a high dependency on natural resources, especially oil, as they are oil-importing countries. As we see in figure 4 there is a weak correlation between oil and inflation in the case of Turkey. One of the possible reasons may be that because of having a high level of tourism income, such impact can be naturalized to some extend (Katircioglu et al., 2018).

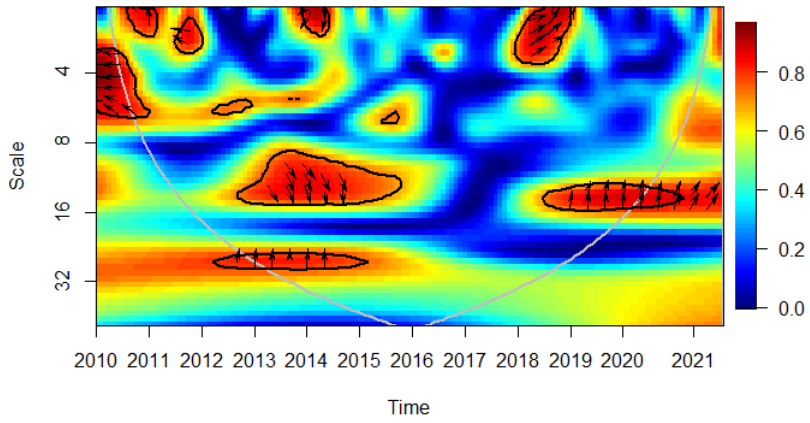
Contradictorily, a positive coherence between oil price and inflation rate has been found at scales corresponding to periods between 2014 and 2016 at a lower frequency (scale 8–16) in Pakistan, which suggests that an increase in the prices of oil boosts inflation in case of Pakistan. The reason is that there is a high oil dependency in Pakistan which results in an increase in energy prices in the country (Yousaf Raza & Lin, 2021).

The results show both the nations are facing the same problems i.e. currency depreciation and inflation, the problem is further filed by increasing in oil prices. The impact of currency deprecation is very strong in both nations. On the flip side, the influence of oil price on inflation is not much strong in both country. Therefore, the government officials of both nations need to put forward policies in such a way to control deprecation and stabilize inflation. Controlling the depreciation of currency will bring stability in the prices.

To reduce the impact of currency depreciation on inflation in both nations, an increase in export policy can be implemented, similarly, foreign direct investment can be attracted (Agudze & Ibhagui, 2021). Contradictorily, to counter the negative effect of oil, both nations need to be energy self-sufficient and move

away from oil dependence on other nations (Dreger et al., 2016). Both nations also need to reduce the cost of production by adopting modern means of production (Kalehsar, 2019; Rauf et al., 2015). Both nations need to increase the inflow of funds and need to reduce the outflow of funds which will also help them stabilize the currency (Ahmad et al., 2022; Polat & Payaslıoğlu, 2016). Finally, the trust and confidence of foreign investor will also contribute to stability of currency of both nations. By doing so both nations can bring stability in currency and prices.

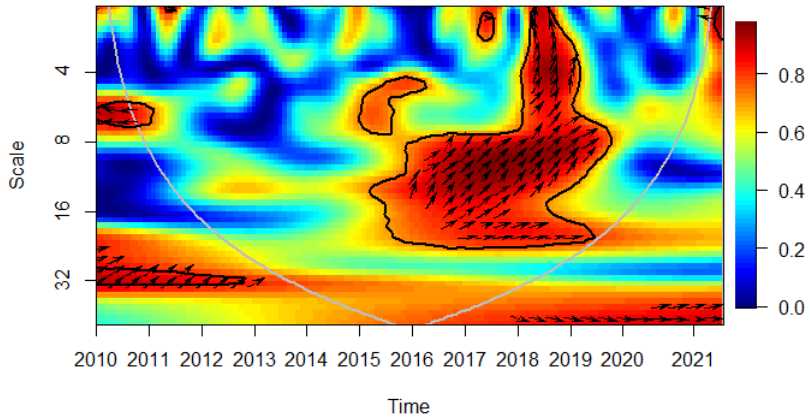
Figure 1. Wavelet coherency (WTC) between exchange rate and inflation rate in Pakistan



Source: Authors' Calculations

Note: the correlation level is displayed by the colour inside, where red colour shows higher correlation while blue shows weak correlation with respect to R-square (μ, σ).

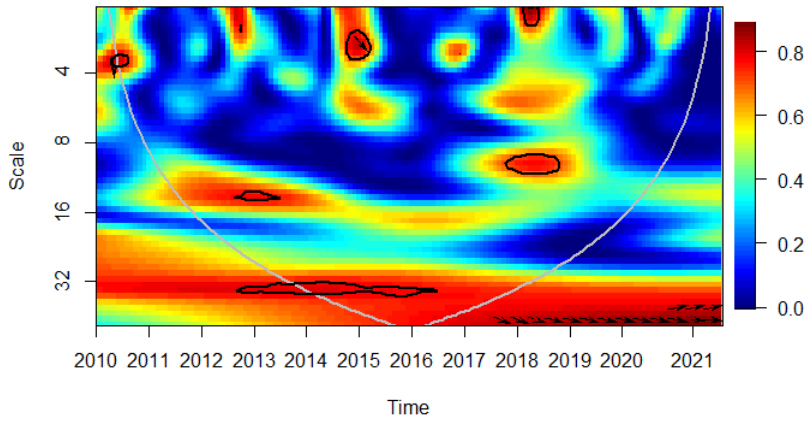
Figure 2. Wavelet coherency (WTC) between exchange rate and inflation rate in Turkey



Source: Authors' Calculations

Note: The correlation level is displayed by the colour inside, where red colour shows higher correlation while blue shows weak correlation with respect to R-square (μ, σ).

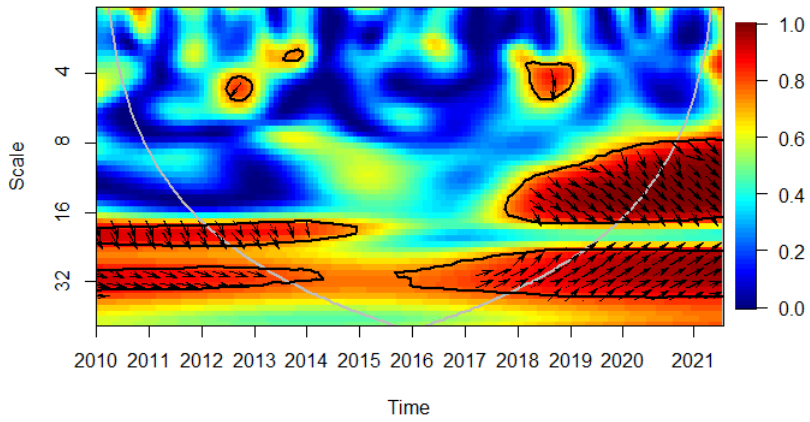
Figure 3. Wavelet coherency (WTC) between interest rate and inflation in Turkey



Source: Authors' Calculations

Note: the correlation level is displayed by the colour inside, where red colour shows higher correlation while blue shows weak correlation with respect to R-square (μ, σ).

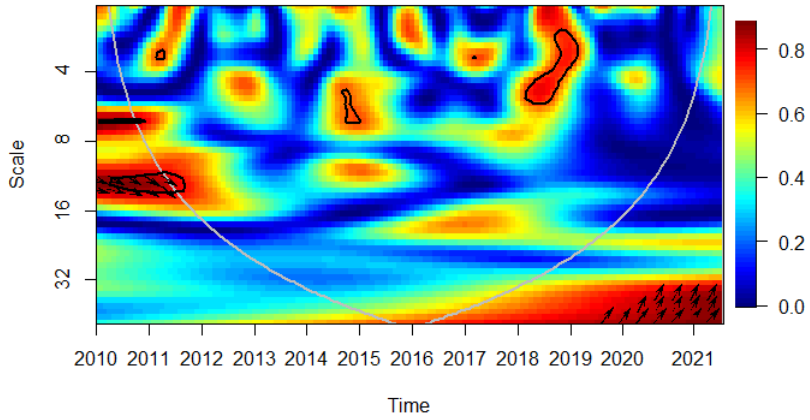
Figure 4. Wavelet coherency (WTC) between interest rate and inflation in Pakistan



Source: Authors' Calculations

Note: the correlation level is displayed by the colour inside, where red colour shows higher correlation while blue shows weak correlation with respect to R-square (μ, σ).

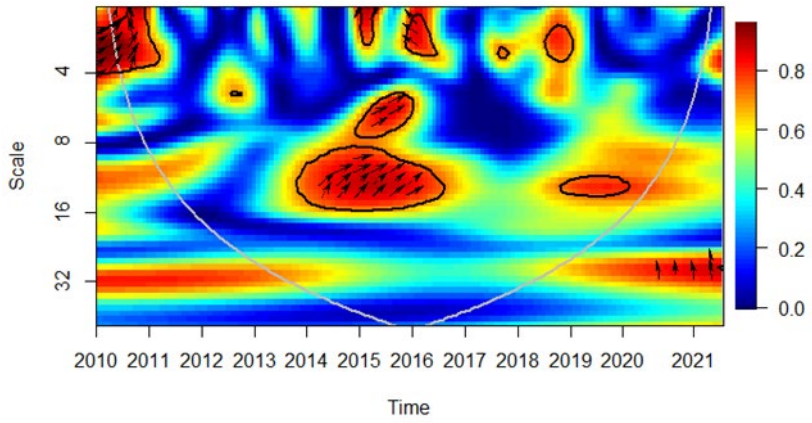
Figure 5. Wavelet coherency (WTC) between oil price and inflation in Turkey



Source: Authors' Calculations

Note: the correlation level is displayed by the colour inside, where red colour shows higher correlation while blue shows weak correlation with respect to R-square (μ, σ).

Figure 6. Wavelet coherency (WTC) between oil price and inflation in Pakistan



Source: Authors' Calculations

Note: the correlation level is displayed by the colour inside, where red colour shows higher correlation while blue shows weak correlation with respect to R-square (μ, σ).

5. Conclusions

This study shows that exchange rate depreciation has contributed highly to inflation in both countries, Pakistan and Turkey. The study also finds the different responses of inflation to the exchange rates. Moreover, the impact of the exchange rate was stronger on inflation in both nations. There are many factors which contribute to such impact such as lack of export, lack of FDI, energy dependence and import base production. All these factors contributed to the increase in inflation. Since the study has found more a less similar impact of the exchange rate in case of

International Journal of Contemporary Economics and Administrative Sciences
ISSN: 1925 – 4423
Volume: XIII, Issue: 1, Year: 2023, pp. 181-199

both countries, therefore, in both nations, a similar policy can be implemented to bring stability in the prices.

These findings show that both countries should apply more active policies regarding the exchange rate to maintain the stability of inflation. A tighter policy should be implemented to diminish the effect of depreciation in the exchange rate in terms of monetary policy in the Turkish lira and the Pakistani rupee. Export sectors that will provide foreign exchange inflows to the countries should be supported. The effects that the exchange rate has on inflation occur via the increase in the imported final good prices and the escalation in the prices of imported inputs. Moreover, the domestic substitute production for imported inputs will reduce the influence of the exchange rate on inflation. Pakistan need more to boost inflow of funds to counter the influence of oil price compared to Turkey.

REFERENCES

Agudze, K., & Ibhagui, O. (2021). Inflation and FDI in industrialized and developing economies. *International Review of Applied Economics*, 1–16. https://doi.org/10.1080/02692171.2020.1853683

Aguiar-Conraria, L., & Soares, M. J. (2011). Oil and the macroeconomy: using wavelets to analyze old issues. *Empirical Economics*, *40*(3), 645–655. https://doi.org/10.1007/s00181-010-0371-x

Ahmad, M. S., Szczepankiewicz, E. I., Yonghong, D., Ullah, F., Ullah, I., & Loopesco, W. E. (2022). Does Chinese Foreign Direct Investment (FDI) Stimulate Economic Growth in Pakistan? An Application of the Autoregressive Distributed Lag (ARDL Bounds) Testing Approach. *Energies*, *15*(6), 2050. https://doi.org/10.3390/en15062050

Akbar, M. (2021). Effects of inflation uncertainty and exchange rate volatility on money demand in Pakistan: Bayesian econometric analysis. *International Journal of Finance & Economics*. https://doi.org/10.1002/ijfe.2488

Akbar, M., Iqbal, F., & Noor, F. (2019). Bayesian analysis of dynamic linkages among gold price, stock prices, exchange rate and interest rate in Pakistan. *Resources Policy*, *62*, 154–164. https://doi.org/10.1016/j.resourpol.2019.03.003

Akkoç, U., Akçağlayan, A., & Kargın Akkoç, G. (2021). The impacts of oil price shocks in Turkey: sectoral evidence from the FAVAR approach. *Economic Change and Restructuring*, *54*(4), 1147–1171. https://doi.org/10.1007/s10644-020-09295-4

Bari, B., & Adalı, Z. (2020). How Oil Prices Drive Inflation in Turkish Economy: Two Different Channels. *Fiscaoeconomia*, *4*(3), 705–721. https://doi.org/10.25295/fsecon.786956

Bodart, V., & Candelon, B. (2009). Evidence of interdependence and contagion using a frequency domain framework. *Emerging Markets Review*, *10*(2), 140–150. https://doi.org/10.1016/j.ememar.2008.11.003

Butler, D., & Kucukgocmen, A. (2022). *Turkey's inflation jumps to 20-year high as energy prices surge*. Reuters; Reuters. https://www.reuters.com/world/middle-east/turkeys-inflation-jumps-611-march-highest-since-2002-2022-04-04/

Çatık, A. N., & Önder, A. Ö. (2013). An asymmetric analysis of the relationship between oil prices and output: The case of Turkey. *Economic Modelling*, *33*, 884–892. https://doi.org/10.1016/j.econmod.2013.06.004

Chaudhry, I. S., Iqbal, A., Umar, M. M., & Faheem, M. (2021). Impact of Monetary Policy on Inflation and Investment in Pakistan: A Time Series Analysis. *Journal of Accounting and Finance in Emerging Economies*, *7*(4), 931–945.

Çıkıryel, B., Aslan, H., & Özdemir, M. (2022). Impact of Brexit on Islamic stock markets: employing MGARCH-DCC and wavelet correlation analysis. *International Journal of Islamic and Middle Eastern Finance and Management*, *15*(1), 179–202. https://doi.org/10.1108/IMEFM-01-2020-0007

Dedeoğlu, D., & Kaya, H. (2014). Pass-through of oil prices to domestic prices: Evidence from an oil-hungry but oil-poor emerging market. *Economic*

Modelling, *43*, 67–74. https://doi.org/10.1016/j.econmod.2014.07.038

Demirel, B., & Karaoğlu, N. (2021). Asymmetric Exchange Rate Pass-Through into Inflation in Turkey: An NARDL Approach. *Fiscaoeconomia*, *5*(3), 845–861. https://doi.org/10.25295/fsecon.925369

Dreger, C., Kholodilin, K. A., Ulbricht, D., & Fidrmuc, J. (2016). Between the hammer and the anvil: The impact of economic sanctions and oil prices on Russia's ruble. *Journal of Comparative Economics*, *44*(2), 295–308. https://doi.org/10.1016/j.jce.2015.12.010

Gokmenoglu, K., Azin, V., & Taspinar, N. (2015). The Relationship between Industrial Production, GDP, Inflation and Oil Price: The Case of Turkey. *Procedia Economics and Finance*, *25*, 497–503. https://doi.org/10.1016/S2212-5671(15)00762-5

Grinsted, A., Moore, J. C., & Jevrejeva, S. (2004). Application of the cross wavelet transform and wavelet coherence to geophysical time series. *Nonlinear Processes in Geophysics*, *11*(5/6), 561–566. https://doi.org/10.5194/npg-11-561-2004

Ha, J., Marc Stocker, M., & Yilmazkuday, H. (2020). Inflation and exchange rate pass-through. *Journal of International Money and Finance*, *105*, 102187. https://doi.org/10.1016/j.jimonfin.2020.102187

Hayat, M. A., Ghulam, H., Batool, M., Naeem, M. Z., Ejaz, A., Spulbar, C., & Birau, R. (2021). Investigating the Causal Linkages among Inflation, Interest Rate, and Economic Growth in Pakistan under the Influence of COVID-19 Pandemic: A Wavelet Transformation Approach. *Journal of Risk and Financial Management*, *14*(6), 277. https://doi.org/10.3390/jrfm14060277

Kalehsar, O. S. (2019). *Energy insecurity in Turkey: Opportunities for renewable energy* (No. 1058; ADBI Working Paper Series). https://www.econstor.eu/handle/10419/222825

Kara, A. H., Öğünç, F., & Sarıkaya, Ç. (2017). *Inflation Dynamics in Turkey: A Historical Accounting*.

Kara, A. H., Sarıkaya, Ç., Öğünç, F., & Özmen, M. U. (2022). *Exchange rate pass-through: Is there a magical coefficient?*

Katircioglu, S., Katircioğlu, S., & Altinay, M. (2018). Interactions between tourism and financial sector development: evidence from Turkey. *The Service Industries Journal*, *38*(9–10), 519–542. https://doi.org/10.1080/02642069.2017.1406479

Krugman, P. (2013). *Makro İktisat*. Palme Yayıncılık.

Meo, M. S., Chowdhury, M. A. F., Shaikh, G. M., Ali, M., & Masood Sheikh, S. (2018). Asymmetric impact of oil prices, exchange rate, and inflation on tourism demand in Pakistan: new evidence from nonlinear ARDL. *Asia Pacific Journal of Tourism Research*, *23*(4), 408–422. https://doi.org/10.1080/10941665.2018.1445652

Muhammad Asif Amjad, Nabila Asghar, & Hafeez-ur-Rehman. (2021). Historical Aspect of Inflation in Pre and Post Covid-19 Pandemic in Pakistan. *PERENNIAL JOURNAL OF HISTORY*, *2*(2), 383–401.

https://doi.org/10.52700/pjh.v2i2.80

Öksüzler, O., & İpek, E. (2011). Dünya Petrol Fiyatlarındaki Değişimin Büyüme ve Enflasyon Üzerindeki Etkisi: Türkiye Örneği. *ZKU Journal of Social Sciences*, *7*(14), 15–34.

Özdemir, M. (2020). The role of exchange rate in inflation targeting: the case of Turkey. *Applied Economics*, *52*(29), 3138–3152. https://doi.org/10.1080/00036846.2019.1706717

Ozgur, O., Aydin, L., Karagol, E. T., & Ozbugday, F. C. (2021). The fuel price pass-through in Turkey: The case study of motor fuel price subsidy system. *Energy*, *226*, 120399. https://doi.org/10.1016/j.energy.2021.120399

Özmen, M. U., & Yılmaz, E. (2016). *Co-movement of Exchange Rates with Interest Rate Differential, Risk Premium and FED Policy in "Fragile Economies"* (16/21).

Pakistan Economic Survey 2018-19. (2019).

Polat, B., & Payaslıoğlu, C. (2016). Exchange rate uncertainty and FDI inflows: the case of Turkey. *Asia-Pacific Journal of Accounting & Economics*, *23*(1), 112–129. https://doi.org/10.1080/16081625.2015.1032312

Rauf, O., Wang, S., Yuan, P., & Tan, J. (2015). An overview of energy status and development in Pakistan. *Renewable and Sustainable Energy Reviews*, *48*, 892–931. https://doi.org/10.1016/j.rser.2015.04.012

Selçuk, M., & Görmüş, Ş. (2022). D-8 Ülkeleri Arasında Parasal Birlik Mümkün Mü? Optimum Para Sahası Çerçevesinde İncelenmesi. *Journal of Economic Policy Researches / İktisat Politikası Araştırmaları Dergisi*, *9*(1), 75–101. https://doi.org/10.26650/JEPR1002262

Torrence, C., & Compo, G. P. (1998). A Practical Guide to Wavelet Analysis. *Bulletin of the American Meteorological Society*, *79*(1), 61–78. https://doi.org/10.1175/1520-0477(1998)079<0061:APGTWA>2.0.CO;2

Torrence, C., & Webster, P. J. (1999). Interdecadal Changes in the ENSO–Monsoon System. *Journal of Climate*, *12*(8), 2679–2690. https://doi.org/10.1175/1520-0442(1999)012<2679:ICITEM>2.0.CO;2

Turna, Y., & Özcan, A. (2021). The relationship between foreign exchange rate, interest rate and inflation in Turkey: ARDL approach. *Journal of Ekonomi*, *3*(1), 1–19.

Tursoy, T., & Mar'i, M. (2020). Investigating the co-movement between exchange rates and interest rates in the bi-variate form: Evidence from Turkey. *Journal of Public Affairs*. https://doi.org/10.1002/pa.2529

Vacha, L., & Barunik, J. (2012). Co-movement of energy commodities revisited: Evidence from wavelet coherence analysis. *Energy Economics*, *34*(1), 241–247. https://doi.org/10.1016/j.eneco.2011.10.007

Yilmazkuday, H. (2021). *Drivers of Turkish Inflation*. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3957382

Yousaf Raza, M., & Lin, B. (2021). Oil for Pakistan: What are the main factors affecting the oil import? *Energy*, *237*, 121535. https://doi.org/10.1016/j.energy.2021.121535