Foreign Exchange Rate Movement in Pakistan: An empirical study to find out currency mix and holding period

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Abstract

This study consists foreign exchange rate moment in Pakistan. Foreign exchanges rates of currencies (USD, EURO, AED, GBP, QAR, INR, CNY, MYR) were taken from January 2010 to December 2019. The data of currencies used in this study were taken on the daily bases from official websites of exchange rate. Two modern techniques M-GARCH-DCC, Continuous Wavelet Transforms (CWT) were used to find out the optimized currencies pair which has least holding period for investment decision. The result of this study shows that **AED/GBP, AED/MYR, CNY/USD, GBP/MYR, INR/MYR, INR/USD** are the currencies pairs having least holding period and optimized currencies pair for investment decision.

PURPOSE – The main purpose of this study is to find out the optimal currencies pair which has least holding period for the investment.

Keywords: M-GARCH-DCC, CWT, Foreign exchange rates, optimal currencies pair

Introduction

Before the currencies, countries used to change the goods directly, giving one good to exchange for another good. It was barter system on national scale. Barter system is an oldest system of exchange and it was started in 6000BC. The Oxford Advanced Learners Dictionary (2010) defines as a system in which one good or service is exchanged to get other in return without use of money. In the starting, trading (buying and selling) partners used to use a

frequent form of money to do their business, which was usually gold or silver. Then one day the advantage of folding money or paper currency become noticeable, but since each country issued its own currency, it wasn't very useful for international trading, since the purchasing power of each currency differed considerably and will differ over time depending on how much currency the countries issued.

When foreign goods or services are bought or to invest in other countries, individuals, companies, and other organizations usually needs to exchange their domestic currency for the foreign currency of that country with which business is done. Some exporters do and accept foreign currencies, mostly the United States dollar is used because it is widely used in the import export business. Chenyu Hana and Yiming Wanga (2020) defines Foreign exchange (Forex) is the exchange of one country's currency to another currency. Exchange rate is defined as the rate at which one currency is exchanged for other or how much one currency can buy another currency.

The foreign exchange market also known as FX market or global market that determines the exchange rate of currencies around the world. Where participants are able to buy, sell, exchange and speculate on currencies. Foreign exchange market consists of financial institutions, mostly banks, that stand to ready to exchange one currency to another currency. In 1944, exchange rate system was developed with the appointment of US dollar as the international reserve currency. In exchange rate system three major types of systems are used. Those are Fixed exchange rate system, Floating exchange rate, Pegged float. In this study, we will study the foreign exchange rate movement in Pakistan. In this study, We will use the Forex exchanges rate as a case study by using every day data from January 2010 - December 2019. We will analyze on two recent and appropriateness methodology, M-GARCH-DCC, Continuous Wavelet Transforms (CWT), on selected eight currencies (USD, URO, AED, GBP, QAR, INR, CNY, MYR).

2. Literature Review

Articles and research papers related to our research work have been discussed in this part of study. It is seen that how other authors have done research related to this research work in distinct domains, perspectives, techniques, tools and situations. The findings and recommendations we have received from the literature to strengthen this research are also discussed in depth.

Fatbardha Morina et al (2020) concluded the effect of exchange rate volatility on economic growth by using the annual data for fourteen countries CEE for the period of 2002 – 2018 to analyze bases of these movements on growth. There is a major negative effect of real economic growth due to the uncertainty of exchange rate. The findings appear strong with alternative measures of exchange rate volatility such as standard deviation and z-score.

Asghar et al (2020) found the relationship between the exchange rate and balance of trade by using correlation and regression. From 1983 to 2014, the data was used for 31 years. The results show that there is constantly negative relationship among the exchange rate and balance of trade. It shows that Pakistan is facing a severe problem in exchange rate because of its interest and inflation rate. Pakistan has less saving then its investment that's why it causes the negative trade balance. The increasing of exchange rate shows that Pakistan rupee is depreciating continuously.

Soharwardi et al (2020) explained the impact of exchange rate volitality on trade deficit in Pakistan. The monthly data set was taken from July 1981 to April 2017, the number of observations were taken 430 and this data was carried out by the time series in mothly case beacause of having enough more observations. ARCH and GARCH models are developed to find out the unpredictable impact of exchange rate on trade in paskiatn. The outcomes appreas as there is negative and massive long run connection between exchange rate volatality and trade deficit but still in short run it is noteworthy and positive.

Amit R. Nagpur (2019) predicted the conversion standard among top of world's exchanged currencies such as USD/EUR, USD/JP Y, USD/GBP,USD/AUD, USD/CAD, USD/CHF, USD/CNY, USD/SEK, USD/NZD, USD/MXN and USD/INR from information day by day, 30-39 years till December 2018. The results are completely promising; results showed that the average accuracy of the predicting model (Deep learning model Support Vector Regressor (SVR), Artificial Neural Network (ANN), Long Short-Term Memory (LSTM), Neural Network) exceeds 99%.

Mahmood Mahroowal &Hedayatullah Salari (2019) examined the performance of Afghanistan exchange rate by using GARCH family models (symmetric GARCH, GARCH – M and Asymmetric EGARCH models) to predict the uncertainty behavior. Afghan Daily foreign exchange rate with the USD data is used from 2018-09-01 to 2019-10-16. By comparing the above models it has been found that GARRCH model is best model to explain the volatility of return on exchange rate of AFN with USD dollar.

Thuy, V.N.T et al (2019) used the Autoregressive distributive lag (ARDL) bounds research technique to examine the effect of exchange rate fluctuations between Vietnamese Dong (VND) and basket of eight currencies (USD (United States), EUR (EU), CNY (China), THB (Thailand), JPY (Japan), SGD (Singapore) KRW (Korea), and TWD (Taiwan) on export in Vietnam by using quarterly data from first quarter of 2000 to the fourth quarter of 2014. The findings show that there are negative effects of exchange rate on export volume in long run.

Elhussein, N. H. A., and Ahmed, A. E. I. (2019) used ARDL model and agreed upon Johansen Joselius models to analyze the determinants of exchange rate in Sudan and determines their effect on its volatility. The study consists the quarterly based data from 2000 – 2017 published by central bank of Sudan and Central Bureau of Statistics also data from International Monetary Fund (IMF) website has been used. Balance of trade, gold purchases, money supply, inflation and foreign reserves are the major determinants of exchange rate in Sudan these are demonstrated by the statically analysis.

Recently Guesmi et al., (2019) have explored the properties of Bitcoin within the financial marketplace. Authors use multivariate GARCH specifications to determine the effects of conditional cross and volatility spillovers in between financial indicators and Bitcoin. The results show that there comes significant returns and volatility spillovers confirming all of the models used in this research but the main finding suggests that there is a best-fit model in order to model various financial assets with regards to the joint dynamics that is VARMA (1,1)-DCC-GJR-GARCH (proposed by Glosten et al., 1993

Raja Rehan et al (2019) analyzed the exchange rate price and price of stock exchange with the background of South Asian countries. The result was found that there is no any type relation of price of stock and exchange rate in Pakistan and India. According to this research the results shows that investors can get information of exchange rate when to invest in Sri

Lankan stock market, the different trends of interest rates, GDP rate can be seen by the Pakistani and Indian investors.

Alba Rodriguez et al (2019) has examined exchange of currency and co-movements for the currency of European and Euro while financial crises and results were combined with many substitution obtained from the Euro and Non Euro currencies. CRPTOCURENCY

Ross C et al (2018) studied that there is medium term relationships with online factors strengthen during the Crypto currency price bubbles. The wavelet analysis is assessed at a time to know that how factors are related to each other at various frequencies and how the connection has developed over the time and generated over the time. This is an alternative and important feature of wavelet including time and frequency.

Kumar et al (2017) studied the change in returns in the value of the currency in dollar, euro, pound, and yen currency in pairs, when exchanging Indian Stock exchange using the wavelet union method. Results conclude the financial destiny is almost entirely mixed in the market for the long period time, with small imbalance which disappears away inside 3–6 months. Based on numerous violet relationships and across-sectional studies, the pound has been found to represent the expected significant amount on all scales.

Karlsson, H. K et al (2017) analyzed whether Purchasing Power Parity (PPPT) holds economies or not in the developing regions located in Africa, Asia and Latin America. To investigate this issue monthly data was used from 1970 to 2011. A nonlinear panel unit root test is used to determine real exchange rate of some or all in a panel follow a stationary exponential smooth transition autoregressive process. The findings indicate an empirical support for the theory of PPP for the economies in developing reigns.

Li (2016) examined monitory contagion between the United States and 5 EU countries (UK, Switzerland, Netherlands, Germany, France). The results show that venture business will advance connections between business units around the world, when financial professionals need to mitigate risk through portfolio expansion.

Yang et al (2016) followed the wavelet method to take a look at the co-movement between currency rate (pound, euro and yen) at some point of the world economic crisis and the European debt disaster. These show a strong interdependence between the currencies in each respect frequencies usually for the euro and the pound.

Muhammad Ali et al (2015) investigated the effects of money supply, inflation and interest rate on the volatility of exchange rate in Pakistan. Monthly data was taken from July 2000 to June 2009 to find short and long run relationship among variables by using Johansen Co integration (trace test & eigenvalue) Tests and Vector Error Correction Model (VECM). Impulse Response Function (IRF) and Granger Causality Test were also used to determine effect and response of variables on each other. The findings reveal that there is short run also long run relationships between exchange rate volatility and inflation.

B. Rizwana et al (2014) investigated the relationship between forward and spot exchange rate efficiency with reference to Pakistan. On Regression analyses monthly data was analyzed from July 2006 to December 2013, data was taken from State Bank of Pakistan and KIBOR rates. The results show that on average forward exchange rate strongly forecasts the future spot exchange rate

According to the results of Proti (2013) empirical findings shows that there is a negative relationship between exchange rate movement and total national debt, real interest rate and

GDP growth, but no such relationship exists between exchange rate movement and inflation and value of imports and exports

S. Muhammad et al (2012) investigated changes in real exchange rate and trade balance for Pakistan by using monthly data July 1980 to June 2006 in Auto Regressive Distributed Lag (ARDL) approach to co integration. The results show that the actual exchange rate and trade balance have a positive relationship, and the coefficient of elasticity is negative and statistically important.

Research Methodology and Material

Research Approach

In this study we have applied deductive approach of research that results more efficient in small sample, where respondents have small characteristics. This approach begins with general to specific results in information and on the bases of these observations theories and laws are constructed that make scientific knowledge (Hasan Zalaghi 2016).

Collection of data

In this study secondary data has been used for exchange rates of eight currencies (USD, EURO, AED, GBP, QAR, INR, CNY, MYR) as a Pakistan Rupees which have been taken from the official website of exchangerates. The significant of this study is Methodology is to achieve the aims and objectives of study. The secondary data has been collected from January 2010 to December 2019.

Data Analysis

The data has been analyzed which has been taken from the official website of exchangerates to achieve the aims and objectives this study. The software of MATLAB, Conditional Correlation has been used. We use Microfit 5.5 to produce the Continuous Wavelet Transform (CWT) graphs. Microfit 5.5 is typically used for time series analysis.

ANALZATION TECHNIQUES

M-GARCH-DCC (Multivariate Generalized Autoregressive Conditionally Heteroskedastic Dynamic conditional correlation)

Correlation and uncertainty and spillover impact studies are investigated by M-GARCH models. Strulz is a good example of this (2003). By using this model it can be known either it is positive or negative in direction and strong or weak then portfolio can be diversified to hedge the risk.

Dynamic conditional correlation is used to determine time varying volatilities and correlation among the assets (Ahmed Shafique Joyo and Lin Lefen, 2019). It is also used to identify the correlations between changes in financial variables over time (Fatima M. Abdulkarim et al 2019). The equation is given below

$H_t=D_tR_tD_t$

H_t: $Conditional\ covariance\ matrix$

D_t:$Diagonal\ matrix\ of\ conditional\ time\ varying\ standardized\ residuals$

R_t:$Time\ varying\ correlation\ matrix$

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Continuous Wavelet Transforms (CWT)

It is used to convert the original time series into a function which includes time and frequency variables. Wavelet coherence, which means the degree of association between two factors such as time and frequency, is the correlation between two CWTs (Fatima M. Abdulkarim et al 2019).

METHOD

The detailed description of wavelets methodology is provided before the explanation of results of our analysis.

Wavelets

A wavelet $\psi(t)$ is a complex-valued square integrable function generated by functions of the form

$$\psi_{u,s}(t) = \frac{\psi\left(\frac{t-u}{s}\right)}{\sqrt{s}}$$

with scale s and location u at time t. Given the admissibility condition [12], any time series can be reconstructed back from its wavelet transform. A wavelet has a zero mean and is standardly normalized so that $\int_{-\infty}^{+\infty}\psi(t)dt = 0$ and $\int_{-\infty}^{+\infty}|\psi|^2(t)dt = 1$. A continuous wavelet transform $W_x(u,s)$ is obtained via the projection of a wavelet $\psi(.)$ on the examined series $x(t)$ so that

$$W_x(u,s) = \int_{-\infty}^{+\infty} \frac{x(t)\psi^*\left(\frac{t-u}{s}\right)dt}{\sqrt{s}}$$

Where $\psi^*(.)$ is a complex conjugate of $\psi(.)$. The original series can be reconstructed from the continuous wavelet transforms for given frequencies so that there is no information loss [13 , 14]. From a wide range of complex-valued wavelets that allow for a multivariate analysis, we opt for the Morlet wavelet, which provides a good balance between time and frequency localization[14,15].

The continuous wavelet framework can be generalized for a bivariate case to study the relationship between two series in time and across scales. A continuous wavelet transform is then generalized into a cross wavelet transform as

$$W_{xy}(u,s) = W_x(u,s)W_y^*(u,s)$$

Where $W_x(u,s)$ and $W_y(u,s)$ are continuous wavelet transforms of series $x(t)$ and $y(t)$, respectively [16]. As the cross wavelet transform is in general complex, the cross wavelet power $|W_{xy}(u,s)|$ is usually used as a measure of co-movement between the two series. The cross wavelet power uncovers regions in the time-frequency space where the series have common high power, and it can be thus understood as a covariance localized in the time-frequency space. However, as for the standard covariance, the explanation power of $|W_{xy}(u,s)|$ is limited because it is not bounded. To address this weakness, the wavelet coherence is introduced as

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$$R_{xy}^2(u,s) = \frac{\left|S\left(\frac{1}{s}W_{xy}(u,s)\right)\right|^2}{S\left(\frac{1}{s}|W_x(u,s)|^2\right)S\left(\frac{1}{s}\left|W_y(u,s)\right|^2\right)},$$

Where S is a smoothing operator [14,17]. The squared wavelet coherence ranges between 0 and 1 , and it can be interpreted as a squared correlation localized in time and frequency. Due to the above mentioned complexity of the used wavelets and in turn the use of the squared coherence rather than coherence itself, information about the direction of the relationship is lost. For this purpose, a phase difference is introduced as

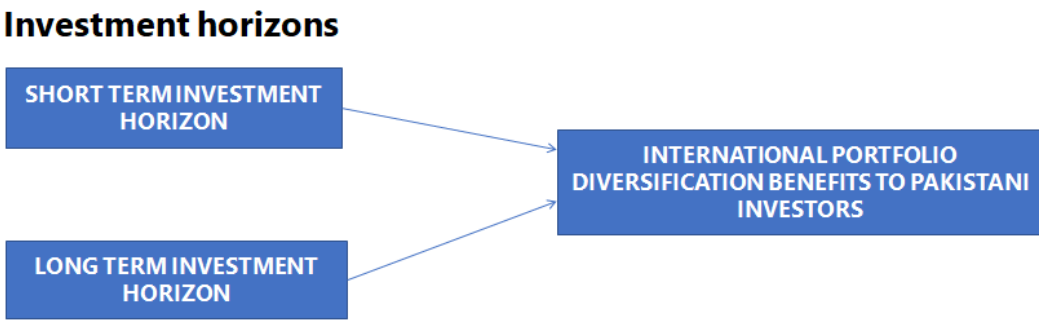
$$\varphi_{xy}(u,s) = \tan^{-1}\left(\frac{\Im\left[S\left(\frac{1}{s}W_{xy}(u,s)\right)\right]}{\Re\left[S\left(\frac{1}{s}W_{xy}(u,s)\right)\right]}\right),$$

Where $\Im$ and $\Re$ represent an imaginary and a real part operator, respectively. Graphically, the phase difference is represented by an arrow. If the arrow points to the right (left), the series are positively (negatively) correlated, i.e., they are in the in-phase or the anti-phase, respectively, and if the arrow points down (up), the first series leads the other by $\frac{\pi}{2}$ (vice versa). The relationship is usually a combination of the two, i.e., if the arrow points to the northeast, the series are positively correlated and the second series leads the first. Note that the interpretation of phase relationships is partially dependent on specific expectations about the relationship because a leading relationship in the in-phase can easily be a lagging relationship in the anti-phase. Please refer to Ref. [14] for a detailed description.
Recently, the partial wavelet coherence has been proposed to control for the common effects of two variables on the third [18,19], and it is defined as

$$RP_{y,x_1,x_2}^2 = \frac{\left|R_{yx_1} - R_{yx_2}R_{yx_1}^*\right|^2}{\left(1-R_{yx_2}^2\right)^2\left(1-R_{x_2x_1}^2\right)^2}.$$

The partial wavelet coherence ranges between 0 and 1, and it can be understood as the squared partial correlation between series y(t) and $x_1(t)$ after controlling for the effect of $x_2(t)$ localized in time and frequency. For a more detailed treatment of the partial wavelet coherence, we refer interested readers to Refs. [18, 19].

Results and Discussion



Conceptual framework {Source: Maryam Buriro et al., (2020)}

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RESULTS

Table 4.1 contains the descriptive statistics of daily exchange rate of eight selected currencies. It contains mean, median, maximum, minimum, standard deviation, skewness and kurtosis values and number of observations for eight selected currencies. The results of mean shows that Euro (173.7112863) and GBP (153.136742) have highest mean. Whereas the means of INR (1.756046893) and CNY (16.1428585). As compared to all mean the Euro has highest mean value. The median range from INR (1.7136) to GBP (151.7789). The highest maximum value in USD (163.7568) and INR (6) and the lowest minimum value in USD (1) and INR (1.5221). The standard deviation range from INR (0.1856211) to USD (18.54246857).

According to given statistics the measurement of volatility range of standard deviation is considered. From the given statistics exchange rate of currencies it is concluded that the exchange rate of INR (0.185621156) and CNY (2.493993033) show less volatility but the exchange rate of USD (18.54246857) and GBP (18.54246857) show highest volatility.

Descriptive Statistics Of Exchange Rates

	USD	Euro	INR	CNY	MYR	GBP	AED	QAR
Mean	84.738075	173.7112863	1.756046893	16.1428585	29.07151679	153.136742	35.84031244	28.85080063
Median	102.7883	122.176	1.7136	15.9141	28.589	151.7789	28.0083	27.9985
Maximum	163.7568	179.8292	6	23.8478	39.6223	208.7524	44.584	44.9697
Minimum	1	170.7115	1.5221	7	23.1111	4	28.4016	5
Standard Deviation	18.54246857	17.44711564	0.185621156	2.493993033	3.607402627	18.38738115	5.038364924	5.091372619
Skewness	1.394055335	1.135535609	4.170424817	0.832228954	0.563019538	0.612399822	1.408342234	1.438222276
Kurtosis	1.89847494	1.57477095	74.95658303	0.675554034	-0.090396099	1.256477587	1.822312905	1.801693404
Observation	3652	3652	3652	3652	3652	3652	**3652**	**3652**

OBJECTIVE 01: To carry out volatility analysis of currencies

Data has been analyzed on M-GARCH for eight currencies (USD, EURO, AED, GBP, QAR, INR, CNY, MYR). Figure 4.2 shows the results. These figures confirm the time-varying nature of volatility and correlation. Figure 4.2 shows that in early 2010, CNY exchange rates were most volatile followed by AED and EURO exchange rates while exchange rates of USD were least volatile. In 2011 MYR exchange rates were most volatile followed by EURO, CNY and GBP exchange rates while exchange rates of QAR were least volatile. In 2012 INR exchange rates were most volatile followed by EURO and GBP exchange rates while exchange rates of USD

were least volatile. In 2013 and 2014 INR exchange rates were most volatile followed by MYR and CNY exchange rates while exchange rates of USD were least volatile. In 2015 EURO exchange rates were most volatile followed by GBP and MYR while exchange rates of QAR were least volatile. In 2016 GBP exchange rates were most volatile followed by QAR and EURO while exchange rates of USD were least volatile. In 2017 QAR exchange rates were most volatile followed by EURO and GBP while exchange rates of AED were least volatile. In 2018 INR exchange rates were most volatile followed by AED and CNY while exchange rates of USD were least volatile. In 2019 EURO exchange rates were most volatile followed by GBP and CNY while exchange rates of MYR were least volatile.

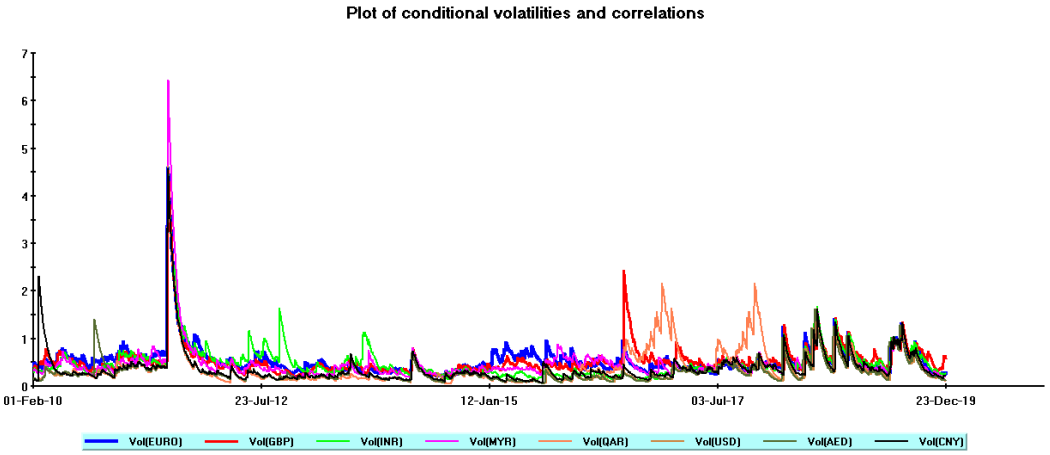


Figure 4.2 Conditional Volatilities Correlations

OBJECTIVE 02: To carry out wavelet analysis of pair of currencies with Pakistan Rupees.

In this part of research we will use modern technique Continuous Wavelet Transform **(CWT)** to analyze the effect which pair of currencies individually has more benefit with Pakistani Rupees and when Pakistani investor will invest their investment.

In the following given figures, we have estimated different phases and wavelet coherence of Pakistani investor's investment. From scale point 1 (one day) through scale point 10, points are assigned (64 days) by using continuous wavelet coherence transform (CWT). In the given figures time is shown on horizontal line in terms of number of days in the sample year January 2010 to December 2019, while vertical axis refers to investment horizons in terms of exchange rates duration of investors, such as two to four days, four to eight days, eight to sixteen days, sixteen to thirty two days, thirty two to sixty four days and so on are shown on vertical axis.

These figures follow a color code, which are on the right side with power ranges from blue (which indicates low correlations that means this color suggest the poor relationship between two time series), to red (which indicates high correlations that means this color suggest strong relationship between two time series), to yellow which indicates a bad link between two time series.

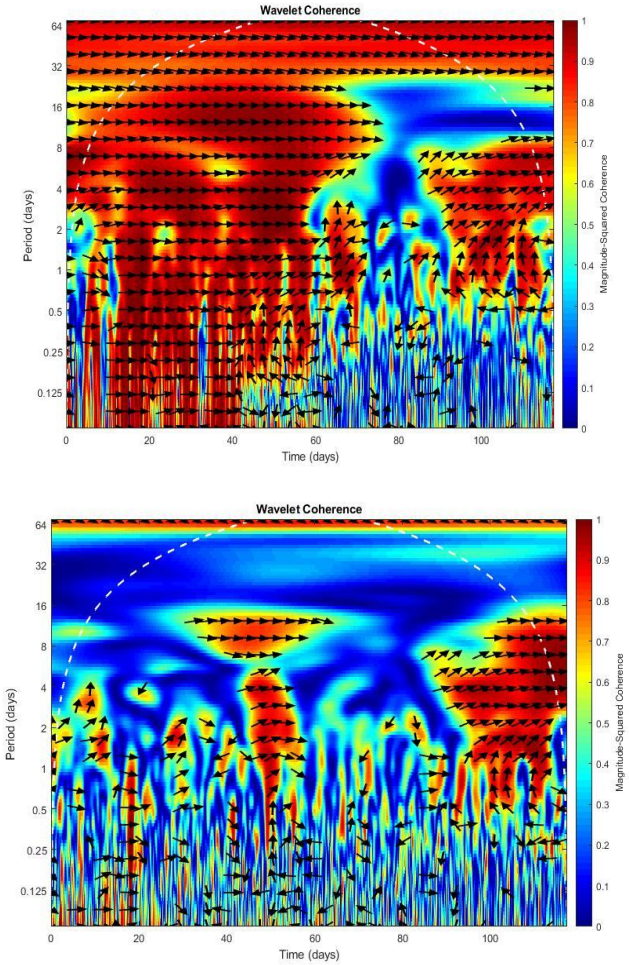


Figure 4.3 Different phases and wavelet coherence of AED vs CNY
Figure 4.4 Different phases and wavelet coherence of AED vs EURO

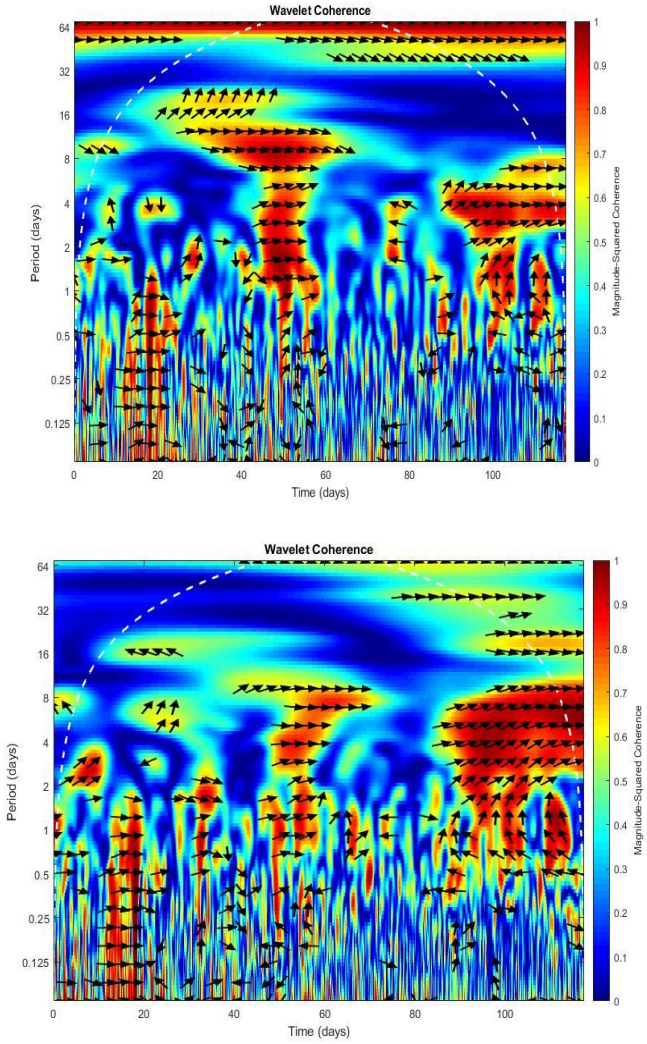
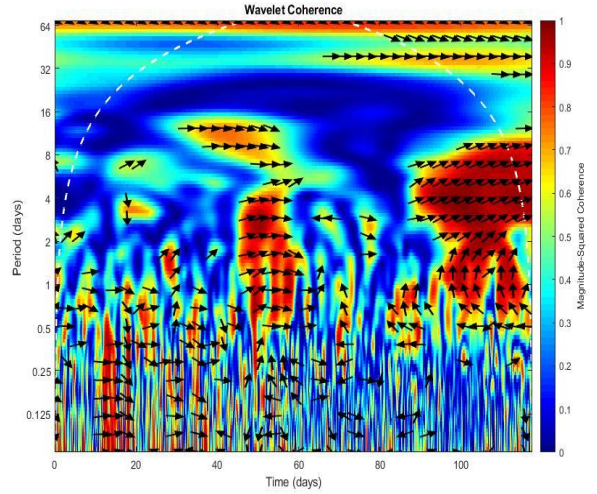


Figure 4.5 Different phases and wavelet coherence of AED vs GBP
Figure 4.6 Different phases and wavelet coherence of AED vs INR



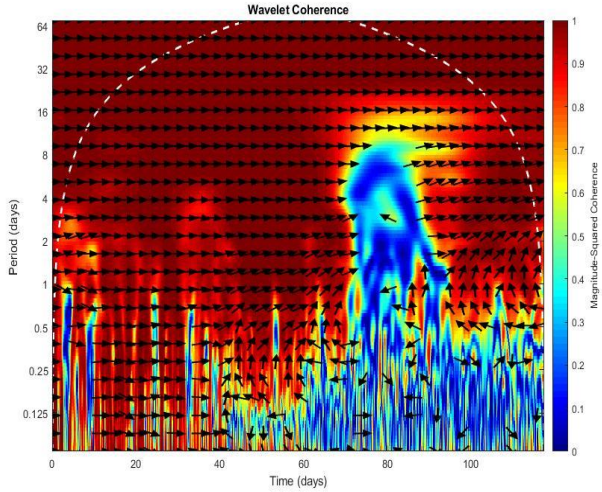


Figure 4.7 Different phases and wavelet coherence of AED vs MYR
Figure 4.8 Different phases and wavelet coherence of AED vs QAR

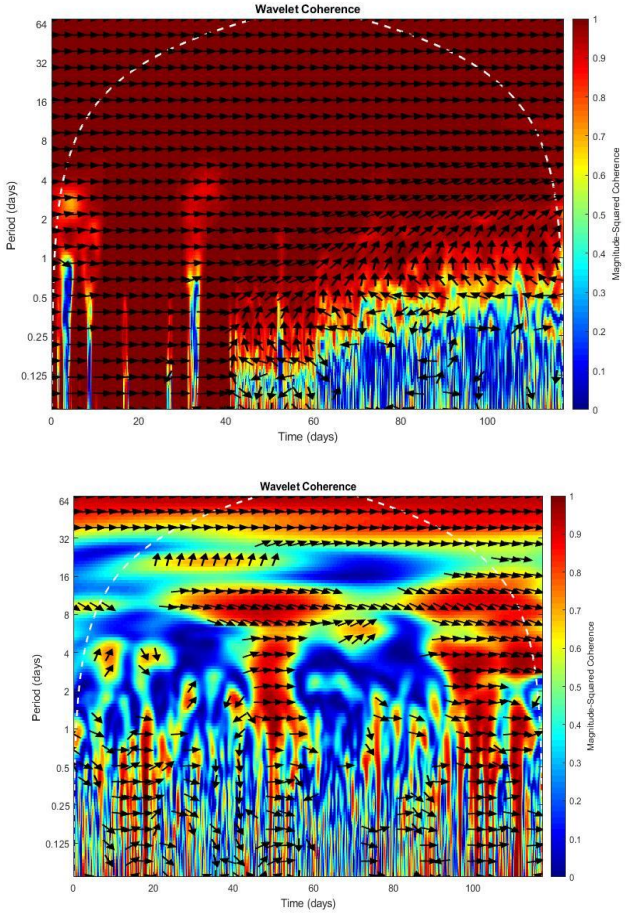
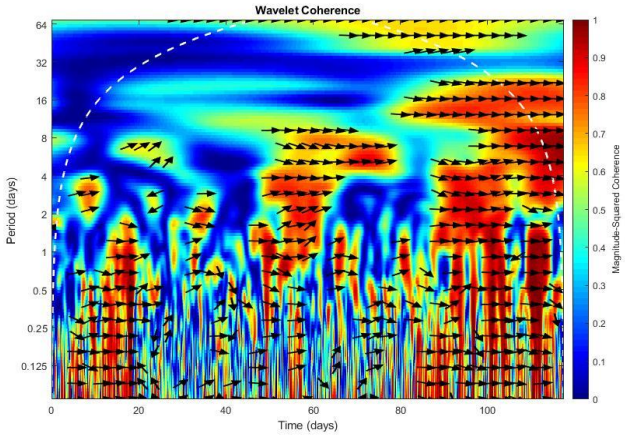


Figure 4.9 Different phases and wavelet coherence of AED vs USD

Figure 4.10 Different phases and wavelet coherence of CNY vs GBP



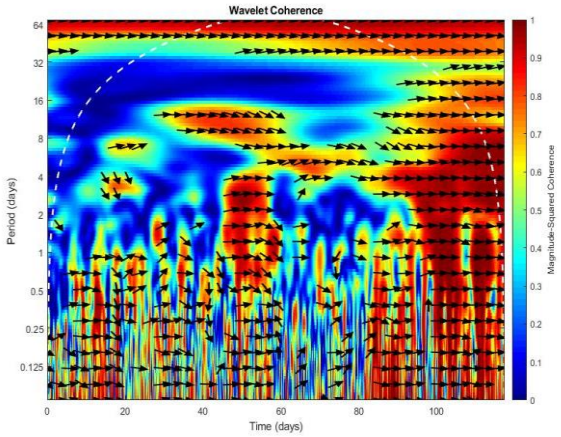
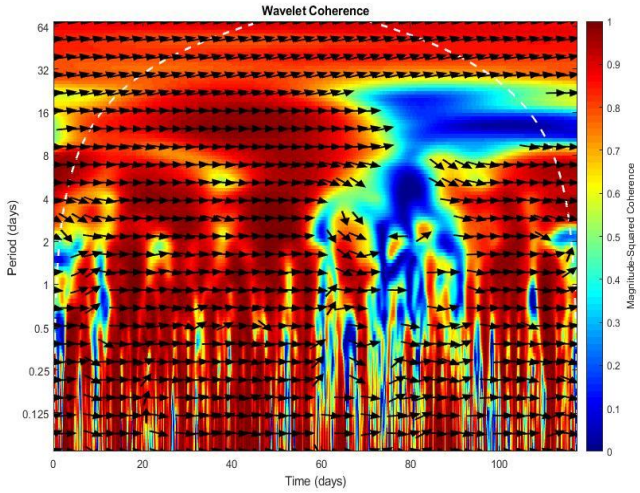


Figure 4.11 Different phases and wavelet coherence of CNY vs INR

Figure 4.12 Different phases and wavelet coherence of CNY vs MYR



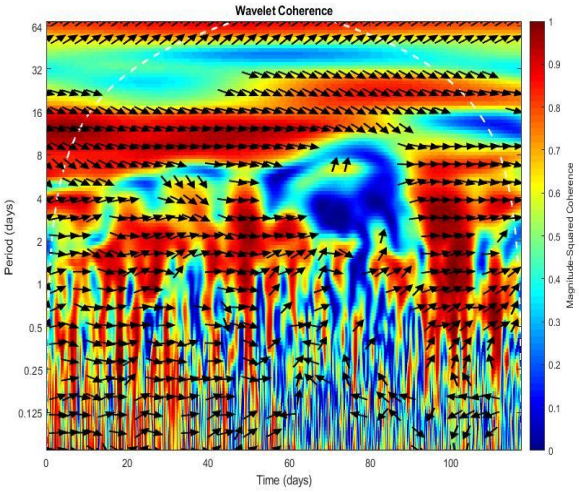
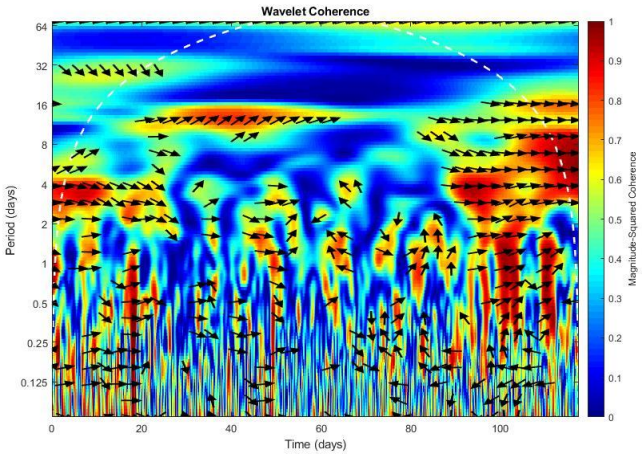


Figure 4.13 Different phases and wavelet coherence of CNY vs USD
Figure 4.14 Different phases and wavelet coherence of EURO vs GBP



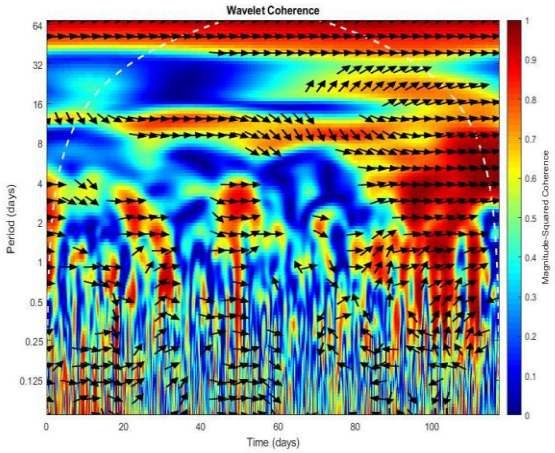
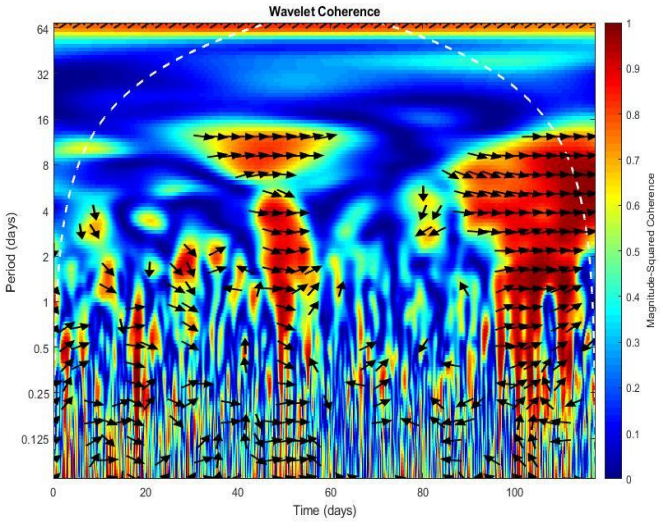


Figure 4.15 Different phases and wavelet coherence of EURO vs INR
Figure 4.16 Different phases and wavelet coherence of EURO vs MYR



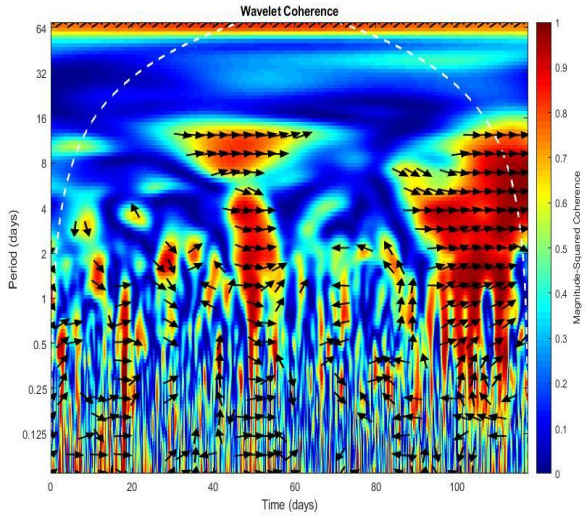
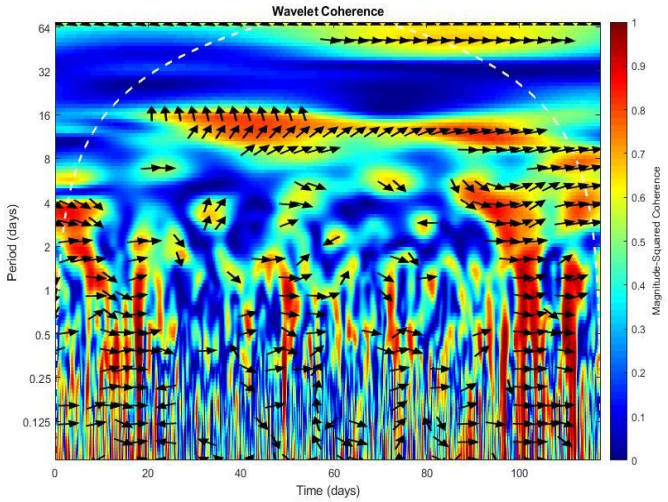


Figure 4.17 Different phases and wavelet coherence of EURO vs QAR
Figure 4.18 Different phases and wavelet coherence of EURO vs USD



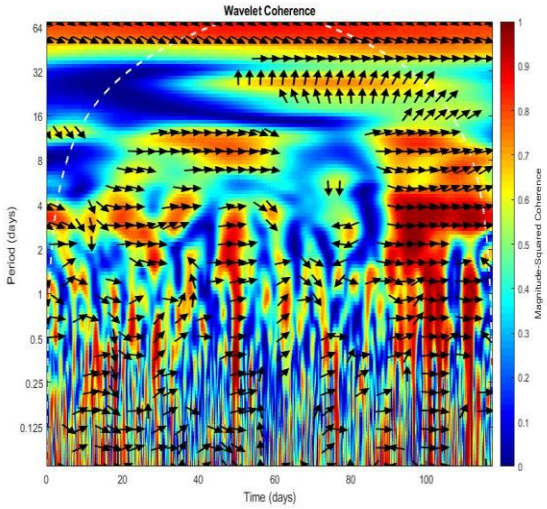
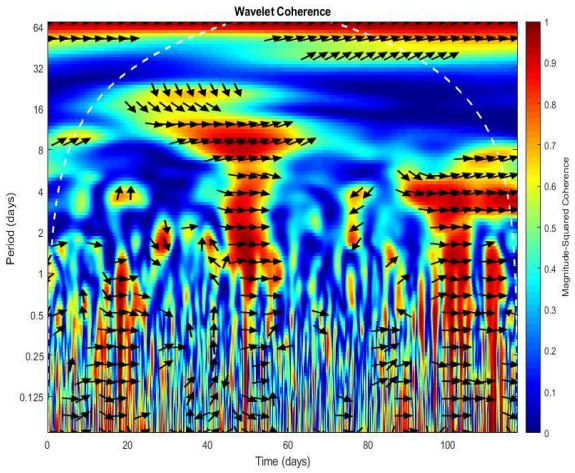


Figure 4.19 Different phases and wavelet coherence of GBP vs INR
Figure 4.20 Different phases and wavelet coherence of GBP vs MYR



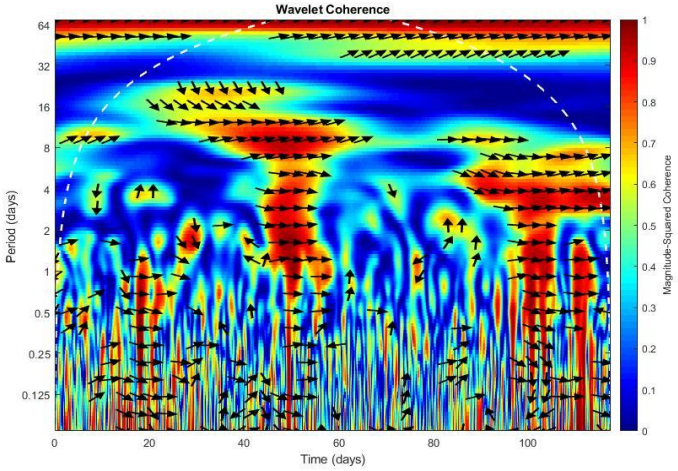
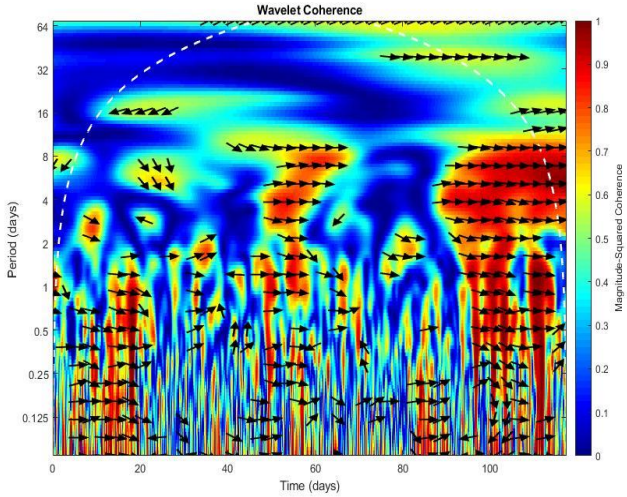


Figure 4.21 Different phases and wavelet coherence of GBP vs QAR

Figure 4.22 Different phases and wavelet coherence of GBP vs



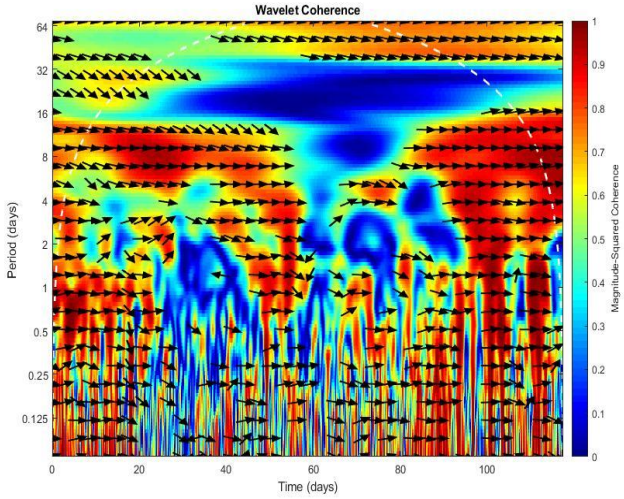
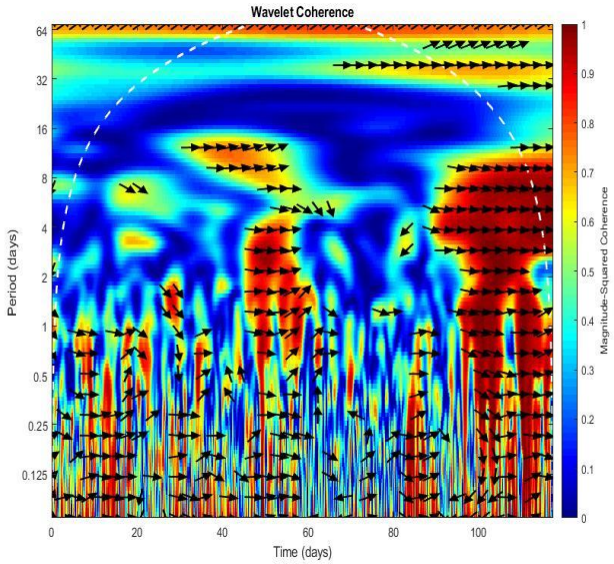


Figure 4.24 Different phases and wavelet coherence of INR vs QAR
Figure 4.23 Different phases and wavelet coherence of INR vs MYR



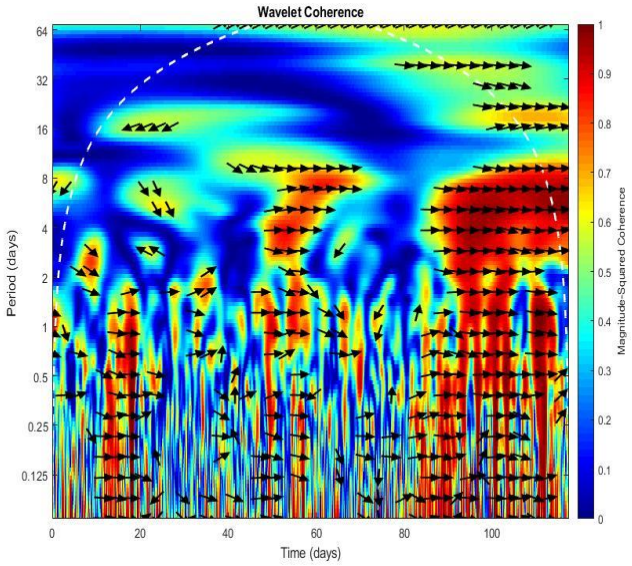
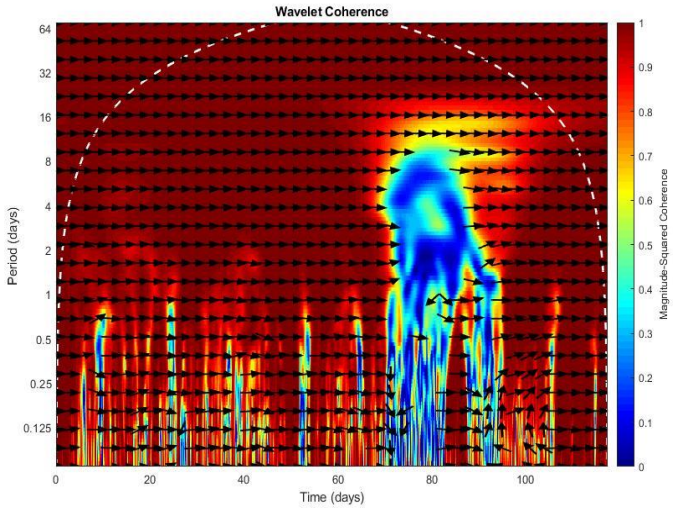


Figure 4.25 Different phases and wavelet coherence of INR vs USD
Figure 4.26 Different phases and wavelet coherence of MYR vs QAR



Foreign Exchange Rate Movement in Pakistan: An empirical study to find out currency mix and holding period

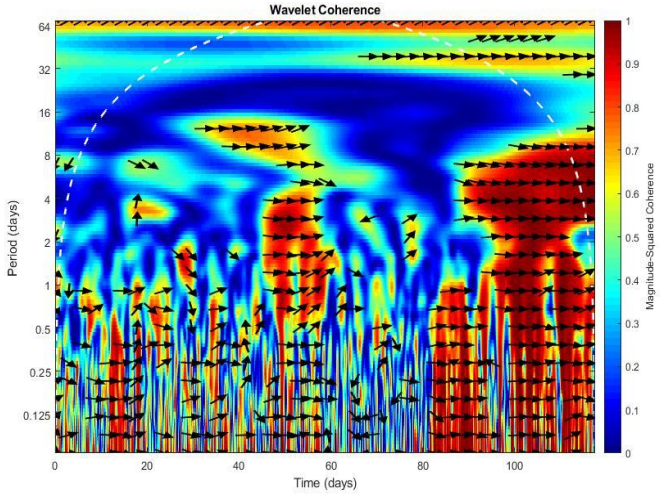


Figure 4.27 Different phases and wavelet coherence of MYR vs USD
Figure 4.28 Different phases and wavelet coherence of QAR vs USD

Interpretation of above figures 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.13, 4.14, 4.15, 4.16, 4.17, 4.18, 4.19, 4.20, 4.21, 4.22, 4.23, 4.24, 4.25 4.26, and 4.27, 4.28 can be described as the blue color is the symbol of low correlations thus whenever blue color spots are seen in these figures it means there are no portfolio diversification over there. While analyzing the figure of Pakistani investors in the pair of currencies AED/CNY, AED/EURO, AED/GBP, AED/INR, AED/MYR, AED/QAR, AED/USD, CNY/GBP CNY/INR CNY/MYR, CNY/USD, EURO/GBP, EURO/INR, EURO/MYR, EURO/QAR, EURO/USD, GBP/INR, GBP/MYR, GBP/QAR, GBP/USD, INR/MYR, INR/QAR, INR/USD, MYR/QAR, MYR/USD, QAR/USD.
While analyzing the above figure 4.3, Pakistani investors investing in AED/CNY yellow spots are seen in short term holding periods from four days to eight days indicating portfolio diversification in these days. Figure 4.4, Pakistani investors investing in AED/EURO yellow spots are seen in short term holding period four days to eight days indicating portfolio diversification in these days. Figures 4.5, Pakistani investors investing in AED/GBP yellow spots are seen in short term holding period one day to two days indicating portfolio diversification in these days. Figure4.6, Pakistani investors investing in AED/ INR yellow spots are seen in short term four days to eight days indicating portfolio diversification in these days. Figure4.7, Pakistani investors investing in AED/MYR yellow spots are seen highly scattered that shows very short term holding period from two days to four days. Figure4.8, Pakistani investors investing in AED/QAR yellow sports are seen in short term holding period from one day to two days indicating portfolio diversification. Figure 4.9, Pakistani investors investing in AED/USD yellow spots are seen highly scattered that shows very short term holding period from one day to sixty four days.
Figure4.10, Pakistani investors investing in CNY/GBP yellow spots are seen in short term holding period from two days to four days indicating portfolio diversification. Figure4.11, Pakistani investors investing in CNY/INR yellow spots are seen in short term holding period

from two days to four days indicating portfolio diversification. Figure4.12, Pakistani investors investing in CNY/MYR yellow spots are seen in short term holding period from two days to four days indicating portfolio diversification. Figure 4.13, Pakistani investors investing in CNY/USD yellow spots are seen in short term holding period from one day to two days indicating portfolio diversification.

Figure 4.14, Pakistani investors investing in EURO/GBP yellow spots are seen in short term holding period from one day to two days indicating portfolio diversification. Figure 4.15, Pakistani investors investing in EURO/INR yellow spots are highly scattered that shows very short term holding period from four days to eight days indicating portfolio diversification. Figure 4.16, Pakistani investors investing in EURO/MYR yellow spots are highly scattered that shows very short term holding period from four days to eight days indicating portfolio diversification. Figure 4.17, Pakistani investors investing in EURO/QAR yellow spots are highly scattered that shows very short term holding period from four days to eight days indicating portfolio diversification. Figure 4.18, Pakistani investors investing in EURO/USD yellow spots are highly scattered that shows very short term holding period from four days to eight days indicating portfolio diversification.

Figure 4.19, Pakistani investors investing in GBP/INR yellow spots are highly scattered that shows very short term holding period from two days to four days indicating portfolio diversification. Figure4.20, Pakistani investors investing in GBP/MYR yellow spots are seen in short term holding period from one day to two days indicating portfolio diversification. Figure4.21, Pakistani investors investing in GBP/QAR yellow spots are seen in short term holding period from four days to eight days indicating portfolio diversification. Figure 4.22, Pakistani investors investing in GBP/USD yellow spots are seen in short term holding period from four days to eight days indicating portfolio diversification.

Figure4.23, Pakistani investors investing in INR/MYR yellow spots are seen in short term holding period from one day to two days indicating portfolio diversification. Figure 4.24, Pakistani investors investing in INR/QAR yellow spots are seen highly scattered that shows very short term holding period from two days to four days indicating portfolio diversification. Figure 4.25, Pakistani investors investing in INR/USD yellow spots are seen in short term holding period from one day to two days indicating portfolio diversification.

Figure 4.26, Pakistani investors investing in MYR/QAR yellow spots are seen highly scattered that shows very short term holding period from two days to four days indicating portfolio diversification. Figure 4.27, Pakistani investors investing in MYR/USD yellow spots are seen highly scattered that shows very short term holding period from two days to four days indicating portfolio diversification. Figure 4.28, Pakistani investors investing in QAR/USD yellow spots are seen highly scattered that shows very short term holding period from two days to four days indicating portfolio diversification.

OBJECTIVE 03: to identify the currency (Pair) holding period and optimized currency pair for investment decisions

The interpretation of above results shows that exchange rate changes with different holding period. Key findings can seen as more yellow spots are seen in case of investor who can invest in Figure 4.5: **AED/GBP,** Figure 4.8: **AED/MYR,** Figure 4.13: **CNY/USD,** Figure 4.20: **GBP/MYR,** Figure 4.23: **INR/MYR,** Figure 4.25: **INR/USD** within short term time period (1

day to 2 days). Therefore, it is concluded that overall opportunities of pair of currencies are in short term time holding period specially in **AED/GBP, AED/MYR, CNY/USD, GBP/MYR, INR/MYR, INR/USD,** whereas there is no any strong relation in medium term or long term holding period.

4.3 DISCUSSION

Exchange rate movements have been studied in the perspective of Pakistan investors. The aim of this study is to provide Pakistani investors information to get higher return when their investment is in these currencies. For examination, exchange rate movements of the selected currencies have been taken from official website (www.exchangerates.edu) from January 2010 to 2019 December.

The first object was "To carry out volatility Analysis of currencies", second object was "To carry out wavelet analysis of pair of currencies with Pakistan Rupees" and third object was "To identify the currency (Pair) holding period and optimized currency pair for investment decisions"

The analyzation of all objects at the same times shows that Pakistani investors can get more benefit in investment perspective in the given pairs of currencies (**AED/GBP, AED/MYR, CNY/USD, GBP/MYR, INR/MYR, INR/USD**). Pakistani investor can get more benefit in short term holding period (1 to 2 days).

Finding of first object shows that USD and AED are least volatile and MYR & EUR is more volatile in terms of investments. And the result of second object shows that short term investment holding periods are providing more benefit so Pakistani investor must apply in short term holding period in order to get higher benefit. The result of third object shows **AED/GBP, AED/MYR, CNY/USD, GBP/MYR, INR/MYR, INR/USD** are the currencies having least holding period and optimized currencies pair for investment decision.

5.1 CONCLUSION

This study is concerned with the analyzation of eight selected currencies for the information of Pakistani investors for investment. The time period of January 2009 to December 2019 was selected for investigation. The modern techniques MGARCH-DCC and CWT have been used for analysis. The data has been analayzed by using software of MATLAB & Mircofit 5.5. Through these software we have obtained results which are based on the research objectives. Objectives of this research are, first object is "To carry out volatility Analysis of currencies", the second object is "To carry out wavelet analysis of pair of currencies with Pakistan Rupees" and the third object is "To identify the currency (Pair) holding period and optimized currency pair for investment decisions"

The concluded results of objectives, the first object (To carry out volatility Analysis of currencies) is USD and AED are least volatile and M YR & EUR is more volatile in terms of investments. The second object (To carry out wavelet analysis of pair of currencies with Pakistan Rupees) shows that short term investment holding periods are providing more benefit so Pakistani investor must apply in short term holding period in order to get higher benefit. The third object (To identify the currency (Pair) holding period and optimized currency pair for investment decisions) shows **AED/GBP, AED/MYR, CNY/USD, GBP/MYR, INR/MYR, INR/USD** are the currencies having least holding period and optimized currencies

pair for investment decision.

5.2 LIMITATIONS

- This study is limited to time period of January 2009 to December 2019
- Analyzation of this research is limited to the techniques used in it
- It is limited to the eight selected currencies (USD, EURO, AED, GBP, QAR, INR, CNY, MYR).
- Data of different time series and different currencies may not necessary to give same results as this.

5.3 Significance of Study

This research has indentified the currency (Pair) from the basket of currencies that returns high and their holding period. This research would help the investor while investing in forex markets to get least return.

5.4 RECOMMEDATIONS

- The purpose of this study was to find out currency pair from the selected currencies (USD, EURO, AED, GBP, QAR, INR, CNY, MYR) which gives maximum benefit in short term holding time period. Thus from the result it is recommended to Pakistani investor that (**AED/GBP, AED/MYR, CNY/USD, GBP/MYR, INR/MYR, INR/USD**) will be better for investment in terms of getting high benefit.
- Pakistani investors are recommended to invest in short term horizon while investing

5.5 FUTURE RESEARCH DIRECTIONS

- Foreign exchange rate movement in developed countries (January 2020 to January 2022)
- Comparison of above selected currencies pairs which gives maximum benefit within short time period with other country
- Foreign exchange rate movement in Pakistan (January 2020 to January 2022) by using other technique for analyzation

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