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Fundamental Determinants of Real Effective Exchange Rate: Empirical Evidence from Bahrain

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Abstract: This study investigates the long-run fundamental determinants of the real effective exchange rate (REER) of the Bahraini dinar (BHD). The annual time series data were mostly collected from economic indicators of Trading Economics 2016 and UNCTAD stat 2016. The study analyzes the impact of a range of macroeconomic variables including balance of payments as a proxy for supply and demand of Bahraini dinar, foreign direct investment outflows, inflation, interest rates, trade balance, trade openness, trade structure, money supply, gross domestic product, and trade similarity on the real effective exchange rate. Using E-views software and employing ordinary least square (OLS) regression, the empirical findings reveal that the main long-run determinants of the foreign exchange rate are supply and demand, foreign direct investment outflows, inflation, interest rate changes, trade openness, trade structure, money supply, GDP, and trade similarity. Trade balance, however, was found to be insignificant determinant of the exchange rates. The real effective exchange rate was found to be positively correlated with each of balance of payments, trade structure, money supply, gross domestic product, and trade similarity. However, it was found to be negatively correlated with each of foreign direct investment outflows, inflation, changes in interest rates, and trade openness. In addition, the impact of these explanatory variables comports, to a major extent, with the economic theory. Though the determination of exchange rate may depend on several other explanatory variables, the findings of this study may provide insight to monetary authorities on how to control exchange rate movements more effectively.

Keywords: GDP, inflation, money supply, trade openness, foreign direct investment outflows, trade balance, balance of payments, trade structure, trade similarity, OLS.

1. INTRODUCTION

Exchange rate or a foreign-exchange is the rate at which one currency will be exchanged for another. It is also regarded as the value of one country's currency in relation to another currency (O'Sullivan and Steven, 2003). The real effective exchange rate is the weighted average of a country's currency relative to an index or basket of other major currencies, adjusted for the effects of inflation.¹ Modeling of exchange rate behavior is one of the unsolved issues of research to be dealt with (Ahmed Saeed *et al.* 2012, p 184).

The exchange rate plays an important role in a country's trade performance whether determined by exogenous shocks or by policy (Alessandro Nicita, 2013). Most developed as well as developing economies have experienced high real exchange rate volatility, which means high degree of uncertainty in the attainment of major macroeconomics and monetary policy objectives (Ajao and Igbekoyi, 2013). This implies that there is a need to study the variations in the exchange rate, how they are determined and how they behave in the foreign exchange markets. The literature of foreign exchange reveals numerous factors that significantly influence the rate of exchange for any currency. Therefore, it seems that there is a need to further understand the behavior of exchange rates in the foreign exchange markets as they have massive implications on any economy in the world today. Behaviors of exchange rates were primarily revealed in the previous literature to be studied through their associations with macro and/or microeconomic variables. This study attempts to examine the associations between a range of macroeconomic variables and the real effective exchange rate of the Bahraini dinar (BHD). Notably, the study examines the relationships between two non-conventional explanatory variables and the real effective exchange rates. These variables are trade similarity and trade structure (the bilateral concentration of merchandise export import). Trade similarity index is the indicator of the similarity in merchandise trade. It helps determining whether the trade structures of two economies are similar or not. It is calculated using the following formula²:

$$S_{ik} = 1 - \frac{1}{2} \sum_i |b_{ij} - b_{ik}|$$

Where,

S_{jk} = Indicator of similarity in merchandise trade structures

b_{ij} = Share in total merchandise exports or imports of product i of country or country group j

b_{ik} = Share in total merchandise exports or imports of product i in country or country group k

The bilateral concentration index of merchandise export import index shows how exports and imports of individual countries are concentrated on several products or otherwise distributed in a more homogeneous manner among a series of products³. Bilateral concentration index enables user to specify the group of countries as destination/origin. It has been normalized to obtain values ranking from 0 to 1 (maximum concentration), according to the following formula⁴:

$$H_{jk} = \frac{\sqrt{\sum_{i=1}^n \left(\frac{x_{ijk}}{X_{jk}} \right)^2} - \sqrt{1/n}}{1 - \sqrt{1/n}}$$

With:

$$X_{jk} = \sum_{i=1}^n x_{ijk}$$

Where,

H_{jk} = concentration index of country or country group j exports to/imports from partner country group k

x_{ijk} = exports or imports of product i for reporter country j and trading partner k

X_{ik} = total value of exports/imports for country j to/from country k and product i

n = number of products (SITC Revision 3 at 3-digit group level).

1.1 Objectives of the Study

The main objective of this research is to empirically identify the main factors determining the real effective exchange rate of the Bahraini dinar (BHD) over the long-run. It tries to empirically examine the long-run relationships between the real effective exchange rate (the dependent variable) and a wide range of macro-economic indicators (explanatory variables). The study also endeavors to identify the sign of the relationships (negative or positive) between the dependent variable and each of the independent variables. Specifically, this study examines the impact of balance of payments as well as foreign direct investment outflows, inflation, interest rates changes, trade balance, trade openness, trade structure, money supply, gross domestic product, and trade similarity on the value of real effective exchange rate.

1.2 Research Problem

There have been debates about the ideal exchange rate regime for decades, reflecting the development of the world economy and the bearings of monetary policies. Some emerging markets for example chose the freely floating regime while others adopt the managed float or the fixed rate system. A nation's choice as to which currency regime to follow reflects national priorities about all facets of the economy, including inflation, unemployment, interest rate levels, trade balances, and economic growth⁵. The available empirical evidence existing here in Bahrain is quiet lacking the concrete clarification of the determination of currency value as influenced by factors like for example inflation, gross domestic product (GDP), changes in interest rates, foreign direct investment (FDI), balance of payments (BOP), trade openness, trade structure, and money supply.

Monetary authorities will primarily need to know how to create a suitable setting for the fixed exchange rate regime or to create a fixed rate regime that is suitable for the existing macroeconomic fundamentals. They may also need to know whether to keep the current exchange rate regime or to switch to the freely floating one. To be able to know how to administer the economic fundamentals, they will need to know what cause(s) the exchange rate to appreciate (rise) or to depreciate (drop). Thus, monetary authorities are inclined to identify the specific macroeconomic factors that influence the exchange rate behavior. They may also need to know the direction of the influence (*i.e.*, positive or negative).

To fill the gap in the literature, this study attempts to find out the degree and the direction of association between a number of hypothesized macroeconomic variables and the real effective exchange rate of the Bahraini dinar. The outcomes of this study will possibly help government (monetary) authorities identify those factors that are anticipated to alleviate the exchange rate.

1.3 Significance of the Study

Voluminous studies were conducted all over the world to examine the factors that influence foreign exchange rates in various nations being developed or developing. To the best of the researcher's knowledge, this

study is the first of its kind to exclusively study the potential long-run determinants of the real effective exchange rate in Bahrain. The literature even lacks studies that have examined the determinants of local currencies in the Gulf Cooperation Council (GCC) countries per se. Even if there are some, those studies might have not utilized similar explanatory variables or not cover similar period of as used in this study. In addition, the study exclusively examines trade similarity and trade structure as new explanatory variables to the real effective exchange rate. Thus, this study attempts to bridge the gap of the literature by empirically studying the implications of a new group of macroeconomic variables on the long-run real effective exchange rate of the Bahraini dinar (BHD). It will possibly help policy makers (monetary authorities) to better manage exchange rate movements and to set a value of the exchange rate that works to the best of the economy and the nation.

2. EMPIRICAL EVIDENCE

The implication of macroeconomic variables on the real exchange rate changes has received sizable attention by scholars with considerable contributions being made to both the empirical understanding and the theory of exchange rate determination. Significant developments in econometrics, along with the growing availability of high value data, have inspired scholars to conduct a vast amount of empirical work on exchange rate determination.

The literature on exchange rate determination unveils various approaches of research (*i.e.*, the asset approach, the purchasing power parity approach and monetary approach. The asset approach emphasizes the importance of asset prices in determining the exchange rate. According to this approach, the foremost driving force of the exchange rate variation is interest rate differential among nations. Thus, interest parity conditions are used to determine the foreign exchange rates. Another route of research uses the monetary approach to study the potential determinants of exchange rates. Several scholars have found evidence in support of monetary theories linked to the determinants of exchange rate. Camarero and Tamarit (2002), Sarno *et al.* (2004), Crespo-Cuaresma *et al.* (2005), Bitzenis and Marangos (2007), Hsing (2006), Uz and Ketenci (2008), and Loría *et al.* (2010), were among these.

Camarero and Tamarit (2002), for instance, examine the determinants of the real exchange rate of the Peseta using the monetary approach. They found out that both supply and demand variables were significant in the growth of the peseta relative to nine EU members. Their outcomes, in general, confirm the prominence of the demand side of the economy as a determinant of the real exchange rate.

Several endeavors were made to test for deviation from purchasing power parity (PPP), as an everlasting phenomenon, by emphasizing those real exchange rate movements that might be produced by changes on the real side of the economy (Neary, 1988). These models vary depending on the factors that are considered to influence the real exchange rate behavior. Models constructed on productivity differentials were emphasized by Balasa Bela (1964) and Obstfeld (1993). Ostry (1988) and Edwards (1989) have found exogenous changes in terms of trade as important players in determining the real exchange rate behavior.

Numerous other studies have used the PPP conditions to study exchange rate behavior. Under the PPP approach, the relative price level is the key determinant of the exchange rate variation.

Following are selected empirical evidences of the determinants of the real effective exchange rates conducted after the year 2000.

Utilizing standard co-integration techniques and using the behavioral equilibrium exchange rate (BEER) approach, Francisco *et al.* (2001) empirically analyses the determinants of the effective exchange rate of the euro. They used quarterly data covering the period from 1975 to 2000 to test the influence of the productivity differential, the real interest rate differential, time preferences, the relative fiscal stance, the real price of oil and the accumulated current account on the effective exchange rate of the euro. They suggest that the euro effective exchange rate is mainly influenced by real interest rate differentials, productivity developments, and external shocks arising from the oil dependence of the euro area.

In order to assess the appropriateness of the peg to the U.S. dollar, Juan Zalduendo (2006), examines the determinants of the Venezuela's Bolivar equilibrium real exchange rate. He studies the role of foreign exchange controls by extending the application of a vector error correction model. He found that that oil prices and declining productivity have played a significant role in determining a time-varying equilibrium real exchange rate path. His results suggest that the Venezuelan government was able to maintain sharp deviations between the official and equilibrium rates. Contemporarily, Hsing Yu (2006) examines the behavior of short-term real exchange rates for Venezuelan Bolivar. Applying the Mundell-Fleming model to examine the relationship between the real effective exchange rate (REER) for Venezuela and several major macroeconomic variables, he found that the REER is negatively influenced by real money supply M2, the expected inflation rate, the world interest rate, and country risk. His findings, on the other hand, revealed positive association between the real effective exchange rate and the real government deficit spending.

Stancik (2007) investigates the factors contributing to the misalignment in the real exchange rate of the New EU member's countries. He found that interest rates, the level of output, the openness of an economy, inflation, the exchange rate regime, central bank independence, and domestic and foreign money supply were among those factors. In another part of the world, Suthar (2008) studies the impact of various supply-side variables that are deemed to be significant in exchange rate determination in India. He used monthly time series data from April 1996 to June 2007. Examining the unanticipated changes in the monetary policy, money supply, and foreign exchange reserves he found that domestic interest differentials, the rate of change of foreign exchange reserves, and the monetary policy intentions are significant determinants of the monthly average exchange rate.

Using quarterly data from 1983 to 2000, Charfi (2008) estimates the equilibrium real exchange rate of the Tunisian dinar vis à vis the euro and the \$US. Examining the influence of the differential of productivity, net capital inflows, and the terms of trade on the value of the Tunisian dinar she noted the dinar was close to its equilibrium value over the 1990s. She also found that the dinar was overvalued before the 1986 devaluation. She confirmed that the beginning of 21st century has witnessed a permit of larger fluctuations of the real effective exchange rate by Tunisian authorities.

Hasanov and Huseynov (2009) examine the equilibrium real exchange rate EREER for Azerbaijani Manat (AZN) using quarterly data from 2001-2007. Using behavioral and permanent equilibrium exchange rate approaches, they found terms of trade, relative productivity, net foreign assets, oil prices, trade openness, and government expenditures as the main determinants of EREER misalignment. Juthathip (2009), on the other hand, examines the equilibrium real exchange rate misalignment and concluded that openness, productivity differentials, government spending, terms of trade, and net foreign assets are the major determinants of real exchange rate in developing Asia.

Catherine and Ariff (2011) report new findings from G-10 and Latin America on exchange rate dynamics on how non-parity factors influence exchange rates. By systematically retesting the model with high and low frequency data sets, they found both short and long-run behaviors. Using new econometric techniques (*i.e.*, pooled time series panel regression) they found evidence that non-parity factors are significantly correlated with exchange rates, after controlling for parity factor effects.

In Viet Nam, Ha Thi and Trinh (2012) test the degree of misalignment of Viet Nam Dong (VND) by estimating equilibrium real effective exchange rate. Empirical findings of the study suggest that government expenditure, trade openness, net foreign assets, and domestic credit are significant determinants of the real effective exchange rate of VND. They suggest reducing nominal and real exchange rate gap, creating a stable exchange rate, narrowing misalignments, attracting the investors, and promoting long-run competitiveness of the economy as recommendations.

In 2013, Ajao and Igbekoyi estimate and test the determinants of real exchange rate volatility in Nigeria for the period 1981-2008 using the ECM technique. Their co-integration analysis reveals the presence of a long term equilibrium association between the effective exchange rate and its determinants. Their findings explicitly reveal that government expenditures, interest rate movements, openness of the economy, and the lagged exchange rate are the major significant variables that influence real effective exchange rate. They recommend the Nigerian monetary authority to institute policies that minimize the magnitude of exchange rate volatility and the federal government to exercise control of macro-economic variables that have direct influence on exchange rate variation.

Amir Kia (2013) investigates the determinants of the real exchange rate in Canada using a theoretical monetary model tested on Canadian data for the period 1972–2010. He examines the relationships between the real exchange rate, on the one hand, and each of real GDP, domestic and foreign interest rates, real money supply, the deficit per GDP, outstanding debt per GDP, real government expenditures, commodity price, and externally financed debt per GDP, on the other. His results disclose that, domestic externally financed debt, real money supply, and domestic and foreign interest rate have statistically significant impact on the Canadian dollar real exchange rate. Over the short run, his results provide empirical evidence that the growth of the real exchange rate is negatively influenced by each of the growth of money supply, the change in interest rate, the US debt per GDP, and the commodity price. Concurrently, Bernardina (2013) investigates the forces that drive exchange rate dynamics of the Russian real effective exchange rate over the transition period. He used five macroeconomic components in a time series dimension. His estimated results show positive long-run co-integration between the real exchange rate, oil prices, productivity and government financial position, and negative co-integration with international reserves. Fiscal policies, however, were found to be alleviating of the influence of oil prices, terms of trade, and productivity shocks on the real exchange rate.

In 2014, Mourad Madouni examines the Equilibrium real exchange rate of the Algerian dinar from 1971 to 2012. He uses a co-integration method in order to test the long-run association between the real effective exchange rate, on the one hand, and oil prices (as a proxy variable for the terms of trade), government expenditure, relative productivity, and the openness. He found that the EREER movement is explained by openness, oil prices, relative productivity and the government consumptions. More specifically, he found positive correlation exists between EREER and each of terms of trade, government consumptions and openness. However, EREER shows adverse association with relative productivity.

Recently, Eslamloueyan and Kia (2015) develop and estimate a model of the real exchange rate for oil-producing countries in the Middle East and North Africa (MENA) for the period 1985–2009. They find that over the long-run, oil price, GDP, money supply, the U.S. externally financed debt per GDP, and government expenditure influence the real exchange rate. Over the short run, the study found that money supply; the changes in domestic real GDP; government expenditure; the U.S. debt per GDP domestic as well as U.S. interest rates, are the main determinants of the real exchange rates in these countries. Dincer *et al.* (2015) test three versions of the monetary model (the real interest differential, the flexible price, and the forward-looking models). Applying Johansen co-integration technique they conclude that monetary models do not provide the expected results. Their empirical findings revealed several shortcomings of the models. They, then, claim that invalidity of Keynesian money demand function is responsible for the unfavorable results.

3. DATA AND METHODOLOGY

The time series data were primarily obtained from the Trading Economics indicators, United Nations Conference on Trade and Development, UNCTAD stat, data center, and International Financial Statistics published by the International Monetary Fund. The annual data samples cover the period from 1998 to 2014.

3.1 The study Hypotheses

The following null hypotheses were designed to attest the fundamental real effective foreign exchange rate determinants:

H₀₁: There is no statistically significant relationship between supply and demand and the real effective exchange rate of the Bahraini dinar.

H₀₂: There is no statistically significant relationship between foreign direct investment outflows and the real effective exchange rate of the Bahraini dinar.

H₀₃: There is no statistically significant relationship between inflation and the real effective exchange rate of the Bahraini dinar.

H₀₄: There is no statistically significant relationship between changes in interest rate and the real effective exchange rate of the Bahraini dinar.

H₀₅: There is no statistically significant relationship between trade balance and the real effective exchange rate of the Bahraini dinar.

H₀₆: There is no statistically significant relationship between trade openness and the real effective exchange rate of the Bahraini dinar.

H₀₇: There is no statistically significant relationship between trade structure and the real effective exchange rate of the Bahraini dinar.

H₀₈: There is no statistically significant relationship between money supply and the real effective exchange rate of the Bahraini dinar.

H₀₉: There is no statistically significant relationship between gross domestic product and the real effective exchange rate of the Bahraini dinar.

H₀₁₀: There is no statistically significant relationship between trade similarity and the real effective exchange rate of the Bahraini dinar.

Initially there were 13 hypotheses but reduced to 10 due to multi-collinearity and correspondence with other variables. These hypotheses were tested by examining the level of significance of the relationships between each of the independent variables and the real effective exchange rate.

3.2 The Study Model

This study uses multiple-regression model as an estimator of annual time series data.

The study model expresses real effective exchange rate as a function of: supply and demand, foreign direct investment outflows, inflation, interest rate, trade balance, trade openness, trade structure, money supply, gross domestic product, and trade similarity.

The study uses E-views software to estimate the model via the traditional ordinary least squared (OLS) technique.

The study sets up the estimated multiple-regression model to test the above-mentioned hypotheses as follows:

$$REER = f(BOP, FDIO, INFL, INTEREST, TBAL, TOPEN, BCIMXI, M1, GDPP, TSIML, \mu) \quad (1)$$

$$REER_t = \beta_0 + \beta_1 BOP_t + \beta_2 FDIO_t + \beta_3 INFL_t + \beta_4 INTEREST_t + \beta_5 TBAL_t + \beta_6 TOPEN_t + \beta_7 BCIMXI_t + \beta_8 M1_t + \beta_9 GDPP_t + \beta_{10} TSIML_t + \mu \quad (2)$$

Where:

B_0 : constant amount or the intercept

B_1 - β_{10} : are coefficients of the explanatory variables.

μ : stands for the error term

t = year for the period from 1998-2014.

$REER_t$ = real effective exchange rate (CPI based) for the year t .

BOP_t = balance of payments as a proxy for supply and demand measured by balance of payments in \$ current prices for the year t .

$FDIO_t$ = foreign direct investment outflows for the year t .

$INFL_t$ = inflation measured by (CPI) for the year t .

$INTEREST$ = interest rate measured by average annual interest rate on personal loan for the year t

$TBAL_t$ = trade balance captured by trade balance indicator for the year t .

$TOPEN_t$ = trade openness captured by trade openness indicators % of GDP for the year t

$BCIMXI_t$ = bilateral concentration indices of merchandise export import for the year t as a proxy for trade structure⁶.

$M1_t$ = Money supply measured by money supply (M1) for the year t .

GDPP_{*t*} = gross domestic product captured by GDP constant prices 2005 for the year *t*

TSIML_{*t*} = trade similarity proxied by exports trade similarity index for the year *t*

4. EMPIRICAL RESULTS AND DISCUSSIONS

This study uses descriptive statistics, correlation analysis in addition to regression analysis in order to achieve the final results. The following subsections demonstrate the results and their discussions.

4.1 Descriptive Statistics

The study uses descriptive statistics as a starter to analyze the acquired data. Table (1) shows the results of the descriptive statistics of the explained (dependent) and the explanatory (independent) variables. The Table reveals the Mean, Median, Maximum and Minimum, Standard deviation, Skewness, kurtosis, Jarque-Bera and probability for each of the variables.

The Mean shows the average value for each of the 14 measures⁷ used in the study. The maximum and minimum values show the ultimate highest and lowest of each of the study variables.

The low standard deviations, revealed for some of the variables, indicate that they are in the same range of values, whereas the high standard deviations, revealed for the remaining variable, indicate that they are relatively, not in the same range of values.

The Table shows that Skewness is positive for 8 out of the 14 measures indicating that fat tails are slightly on the right hand side of the distribution. Negative and positive signs of skewness values indicate that the results of this study are generally not normally distributed. Kurtosis values are fairly deviated from 3, designating, also, that the data is not normally distributed. Besides, the study uses Jarque-Bera statistics and its corresponding probability to test for the normality of the data. Based on the values corresponding to this statistics, the normality assumption is rejected at significance level of 5% (probability is less than or equal to 0.05) for 2 of the variables (FDII and FDIO). All the other variables show normal distributions as their probability values are greater than 0.10.

4.2 Correlation Analysis

This study uses the correlation coefficient statistics to explore the type and intensity of the relationships among the hypothesized dependent and independent variables. The correlation test is also used to determine the most significant factors in the list of the hypothesized independent variables (Gathogo and Ragui, 2014). Table 2 shows the correlations matrix of the 14 study variables.

Balance of payments (BOP), foreign exchange reserves (FXRES), inflation (INFL), money supply (M1), and trade similarity (TSIML) as shown in Table 2 seem to have the highest negative correlation with the real effective exchange rate (REER). Gross domestic product (GDPP) and interest rate (INTEREST), on the other hand, show the highest positive correlation with the real effective exchange rate. The remaining factors show less significant correlation with the dependent variable. In addition, the correlation matrix (Table 2) measures the degree of multi-collinearity among all the variables of the study. In statistics, multicollinearity (also collinearity) is a phenomenon in which two or more predictor variables in a multiple regression model are highly correlated, meaning that one can be linearly predicted from the others with a

substantial degree of accuracy. Since the correlation matrix shows that foreign exchange reserves (FXRES) is highly correlated with four other independent variable *i.e.* GDPP, INFL, M1, and TSIML, therefore, this factor was delisted from further investigations.

4.3 Regression Analysis

The study uses multiple regression analysis as a statistical tool to examine the relationships between the real effective exchange rate (the dependent variable) and a group of macroeconomic variables in order to identify the long term determinants of the former. As criteria for decision making, the study employed Durbin-Watson statistics, adjusted *R*-square, and Probability- value of the *t*-statistics. The study uses *P*-value for estimating the degree of significance of the relationships between the dependent and independent variables. It is the measure that helps decide whether to reject or to accept the proposed hypotheses of the study. The null hypothesis is rejected at 10% level of significance if a *P*-value equals 10% or less. This designates that there is only a 10% chance that the result would have come up in a random distribution and that there is 90% probability that the variable is having some effect. A *P*-value of 5% or less indicates that the null hypothesis is rejected at 5% level of significance. A *P*-value of 1% or less indicates that the null hypothesis is rejected at 1% level of significance. Rejecting the null hypothesis implies accepting the alternative one.

The magnitude of the effect that each of the independent variables have on the dependent variable is revealed in the coefficients demonstrated in Table 3. Positive coefficient indicates that the dependent variable is increasing, while negative coefficient indicates that the dependent variable is decreasing.

The coefficient of determination which is often referred to as the adjusted *R*-squared is a statistical technique used in multiple regression analysis to estimate the overall goodness-of-fit. The adjusted *R*-squared value of 0.993471 specifies that variations in the hypothesized independent variables can explain the variations in the dependent variable by 99.3471%. This denotes that 0.06529% of the variations in the real effective exchange rate of the Bahraini dinar are accounted for by other factors not captured by the study model.

Durbin-Watson value is a number that tests for autocorrelation in the residuals from a statistical regression analysis⁸. It is typically used to test for first order serial correlation in the errors of a regression model (Wooldridge, 2004). The estimated *d* value of 1.904655 signifies an absence of autocorrelation⁹ in the data as it is very close to 2.

Table 3 illustrates the estimated regression and related statistics of the dependent (regressand) variable (REER) and each of the independent (regressor) variables using Least Square Method.

Empirical evidence from the regression analysis indicates that there is a positive significant relationship at 10% level between BOP and REER. This finding is evident in the *P*-value of 0.0796 and coefficient of 0.001718. This denotes that there is a positive relationship between the real effective exchange rate and balance of payments. Since balance of payments is used as a proxy for supply and demand, then, the First null hypothesis that there is no statistically significant relationship between supply and demand and the real effective exchange rate of the Bahraini dinar is rejected and thus, the alternative hypothesis is accepted. This result mainly implies that an increase in balance of payments will invariably results in a significant increase in the real effective exchange rate of the Bahraini dinar. It may also indicate that supply and demand has a vital role in determining the real effective exchange rate. This result is consistent with the

Table 1
Descriptive statistics

	REER	BCIMXI	BOP	FDII	FDIO	FXRES	GDPP	IFLN	Interest	M1	TBAL	TINDX	TOPEN	TSIML
Mean	101.3	0.3969	1190.5	800.62	575.6	956.6	17669	104.2	8.5425	1307	0.1494	0.2313	75.061	0.2494
Median	99.10	0.4050	800.0	649.00	817.5	659.2	17857	101.1	8.1000	1020	0.1500	0.2000	75.610	0.2500
Maximum	115.7	0.4300	3247	2915.0	1669	1850	18581	120.6	11.800	2759	0.2500	0.3000	84.640	0.3000
Minimum	85.00	0.3300	-777.0	-275.0	-1791	377.6	16528	94.60	5.9400	359.5	0.0100	0.2000	57.110	0.2000
Std. Dev.	9.865	0.0294	1221.3	859.77	823.0	572.5	628.4	8.948	1.904	886.7	0.0559	0.0479	7.0513	0.028
Skewness	0.092	-0.7257	0.2139	1.4394	-1.334	0.464	-0.603	0.455	0.633	0.461	-0.382	0.8090	-0.8352	0.0667
Kurtosis	1.721	2.6444	1.772	4.3506	5.340	1.4676	2.0895	1.720	2.286	1.641	4.0250	1.6546	3.6563	2.1479
Jarque-Bera	1.113	1.4886	1.128	6.7410	8.395	2.140	1.5206	1.645	1.409	1.798	1.0890	2.9523	2.1473	0.4959
Probability	0.573	0.4751	0.5689	0.0344	0.015	0.343	0.4676	0.439	0.494	0.407	0.5801	0.2286	0.3418	0.7804
Observations	16	16	16	16	16	16	16	16	16	16	16	16	16	16

Source: Author's computation.

Table 2
Correlation Matrix

	REER	BCIMXI	BOP	FDII	FDIO	FXRES	GDPP	IFLN	Interest	M1	TBAL	TINDX	TOPEN	TSIML
MREER	1.000													
BCIMXI	0.34930	1.000												
BOP	-0.7834	0.070	1.000											
FDII	-0.485	0.274	0.610	1.000										
FDIO	-0.296	0.476	0.591	0.568	1.000									
FXRES	-0.829	-0.496	0.672	0.258	0.117	1.000								
GDPP	0.745	0.622	-0.415	0.004	0.148	-0.848	1.000							
IFLN	-0.812	-0.363	0.683	0.216	0.129	0.958	-0.830	1.000						
INTEREST	0.776	0.36453	-0.660	-0.362	-0.342	-0.759	0.609	-0.766	1.000					
M1	-0.830	-0.406	0.706	0.242	0.146	0.976	-0.849	0.987	-0.807	1.000				
TBAL	-0.592	-0.168	0.752	0.207	0.180	0.681	-0.459	0.664	-0.638	0.723	1.000			
TINDX	-0.488	-0.258	0.519	0.273	0.101	0.669	-0.401	0.683	-0.461	0.647	0.381	1.000		
TOPEN	-0.446	0.356	0.700	0.740	0.608	0.155	0.165	0.125	-0.417	0.184	0.510	0.131	1.000	
TSIML	-0.772	-0.454	0.552	0.361	0.074	0.809	-0.662	0.819	-0.742	0.799	0.448	0.821	0.182	1.000

Source: Author's computation.

Table 3
The estimated regression and related statistics

Dependent Variable: REER				
Method: Least Squares				
Sample (adjusted): 1999 2013				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	53.30315	25.92039	2.056418	0.1089
BOP	0.001718	0.000735	2.337361	0.0796*
FDIO	-0.002799	0.000511	-5.476197	0.0054***
IFLN	-2.289539	0.330154	-6.934766	0.0023***
D(INTEREST)	-2.438043	0.528660	-4.611745	0.0099***
TBAL	16.56729	13.05467	1.269070	0.2732
TOPEN	-1.196865	0.108209	-11.06066	0.0004***
BCIMXI	112.6714	14.49049	7.775543	0.0015***
M1	0.023716	0.003813	6.219634	0.0034***
GDPP	0.016141	0.001132	14.25731	0.0001***
TSIML	46.07543	18.00433	2.559130	0.0627*
R-squared	0.998135	Mean dependent var	100.3467	
Adjusted R-squared	0.993471	S.D. dependent var	9.406447	
S.E. of regression	0.760041	Akaike info criterion	2.434022	
Sum squared resid	2.310649	Schwarz criterion	2.953259	
Log likelihood	-7.255164	Hannan-Quinn criter.	2.428491	
F-statistic	214.0397	Durbin-Watson stat	1.904655	
Prob (F-statistic)	0.000052			

***, **, and *, signify levels of significance at 1%, 5% and 10% respectively.

Source: Author's computation.

research results of Ahmed Saeed *et al.* (2012) who found the increase in the relative debt to finance balance of payment deficit as an important source affecting the nominal exchange rate in Pakistan. It is also consistent with the research findings of Wong (2014) who found relative demand to be a long-run determinant of the exchange rate in Malaysia.

The regression analysis shows the coefficient of FDIO of -0.002799 is statistically significant at 1% level with p-value of 0.0054. This implies that the Second null hypothesis that there is no statistically significant relationship between foreign direct investment outflows and the real effective exchange rate of the Bahraini dinar is rejected and, thus, the alternative hypothesis is accepted. The inverse relationship, as shown by the coefficient of -0.002799, suggests that an increase in foreign direct investment outflows will lead to a decrease in the real effective exchange rate. It also implies that foreign direct investment outflows are significant in the determination of the real effective exchange rate. This finding comports with the results of Niko Hobdari (2008), who observed that a smaller Tanzania's REER appreciation have resulted from higher FDI in the mining sector.

Another empirical finding from the regression analysis denotes that a significant negative relationship exists between INFL and REER. This is evident in the coefficient of -2.289539 and P -value of 0.0023 . This implies that the Third null hypothesis that there is no statistically significant relationship between inflation rate and the real effective exchange rate of Bahraini dinar is rejected and thus the alternative hypothesis is accepted. This result principally implies that an increase in inflation rates will invariably result in a significant decrease in the real effective exchange rates. This also indicates that inflation is a major determinant of the real effective exchange rates. This finding is consistent with the results of Stancik (2007). It is also consistent with the results of Niko Hobdari (2008), who found that the REER movements were largely influenced by Tanzania's higher inflation relative to its trading partners.

The empirical results confirm a statistically significant negative relationship at 1% level of confidence exists between the real effective exchange rate and changes in interest rates D (INTEREST) with p -value of 0.0099 . This implies that the Fourth null hypothesis that there is no statistically significant relationship between change in interest rate and the real effective exchange rate of the Bahraini dinar is rejected and thus the alternative hypothesis is accepted. This suggests that the change in interest rate is a major determinant of exchange rates. This finding is consistent with the findings of Stancik (2007) and Eslamloueyan and Kia (2015). It is also consistent with the findings of Jeffrey Frankel (2007) who found that high South African interest rates raise international demand for the rand and lead to real appreciation. It is also in line with the results of Wong (2014) whose autoregressive distributed lag (ARDL) approach shows a long-run relationship between exchange rate in Malaysia and interest rate differential.

Trade Balance (TBAL) is revealed to have a statistically insignificant association with real effective exchange rate at 10% level with p -value of (0.2732) . Thus, the Fifth null hypothesis that is no statistically significant relationship between trade balance and the real effective exchange rate of the Bahraini dinar is accepted. This implies that trade balance is not a significant factor in determining the exchange rate. This result deviates from the findings of Michael Mussa (1984) who pointed out that "the asset price property of the exchange rate is reflected in formulas expressing the long-run equilibrium real exchange rate... affecting excess demands for domestic and foreign goods (and hence the trade balance)".

The empirical findings disclose that a significant negative association exists between TOPEN and REER with a coefficient of -1.196865 and p -value of 0.0004 . Therefore the Sixth hypothesis that there is no statistically significant relationship between trade openness and the real effective exchange rate of the Bahraini dinar is rejected. This implies that the alternative hypothesis is accepted and designates that trade openness is a major factor in explaining the real effective exchange rates. This result is consistent with the results of Stancik (2007) Hasanov and Huseynov (2009), Juthathip (2009), Ajao and Igbekoyi (2013), Jamel Saadaoui *et al.* (2013), and Osigwe and Obi (2016), who found the openness of an economy is, *inter alia*, contributing to the misalignment in the real exchange rate.

It is also consistent with the results of Ha Thi and Trinh (2012) who found trade openness as an important determinant of the real effective exchange rate of VND. However, this finding is not consistent with the finding of Murat *et al.* (2013), which, based on vector error correction method, revealed that trade openness does not have significant effect on the real effective exchange rate in the long-run in the Republic of Macedonia.

BCIMXI is revealed by the results to have positive and statistically significant association with the REER with a coefficient of 112.6714 and p -value of 0.0015 . Since the bilateral concentration indices of

merchandise export import (BCIMXI) is used as a proxy for trade structure, then, the Seventh hypothesis that there is no statistically significant relationship between trade structure and the real effective exchange rate of the Bahraini dinar is rejected, and, thus the alternative hypothesis is accepted. This implies that trade structure is a significant factor in determining the real effective exchange rate. This result is unique as trade structure, proxied by bilateral concentration indices of merchandise export import (BCIMXI), has never been examined by any other scholar as a factor determining real effective exchange rate. This may be considered as a contribution to the knowledge.

The empirical findings indicate that Money Supply (M1) has statistically significant positive impact on real effective exchange rates at 1% level with p-value of (0.0034). This indicates that, the Eighth null hypothesis that there is no statistically significant relationship between money supply and the real effective exchange rate of the Bahraini dinar is rejected and thus, the alternative hypothesis is accepted. This implies that money supply is a major factor in determining the real effective exchange rate. This result is consistent with the results of Stancik (2007), Suthar (2008), Amir Kia (2013), and Wong (2014) who found money supply as having a statistically significant impact on the real exchange rate. It is also comports to Eslamloueyan and Kia (2015) results which shown money supply as one of the major determinants of the real exchange rates in the oil producing MENA countries over the long as well as the short runs.

A positive significant relationship exists, as shown in Table 3, between gross domestic product (GDPP) and the real effective exchange rate at 1% level of significance with a p-value of 0.0001 and a coefficient of 0.016141. This implies that the Ninth null hypothesis that there is no statistically significant relationship between gross domestic product and the real effective exchange rate of the Bahraini dinar is rejected. This, of course, necessitates that the alternative hypothesis is accepted and suggests that gross domestic products is one of the major factors determining the real effective exchange rate of Bahraini dinar. This result comports with the results of Osigwe and Obi (2016) who found the real exchange rate of Nigeria's Niara, on the long-run, is positively influenced by the growth of real GDP.

Trade Similarity (TSIML), as clearly shown in Table 3, is found to have a positive and statistically significant relationship with the real effective exchange rate with p-value of (0.0627). Therefore, the Tenth hypothesis that there is no statistically significant relationship between trade similarity and the real effective exchange rate of Bahraini dinar is rejected. This indicates that the alternative hypothesis is accepted and that trade similarity is a major long term determinant of the real effective exchange rate. This result is unique as trade similarity, being a factor determining the real effective exchange rate, has not been tested by any other researcher. This may be considered as another contribution of this study to the knowledge. Though the exchange rate determination may depend on several other factors, these variables may be targeted by the monetary authorities proficiently to regulate exchange rate movements in case of superfluous volatility.

5. CONCLUSIONS

This study has empirically examined the long-run fundamental determinants of real effective exchange rates of the Bahraini dinar. It contributes insights into the relationships between the real effective exchange rates (REER) and a group of macroeconomic variables. In particular, an attempt was made to investigate the impact of balance of payments (BOP) as a proxy for supply and demand, foreign direct investment outflows, inflation, changes in interest rates, trade balance, trade openness, trade structure, money supply, gross domestic product, foreign direct investment inflows, foreign exchange reserves, trade indices, and trade similarity on the real effective exchange rate. Three variables (*i.e.*, foreign direct investment inflows

(FDII), foreign exchange reserves (FXRES) and trade index (TINDEX) were excluded from further investigation due to multicollinearity and correspondence with other variables.

The study used E-views software to analyze the time series data. Employing the ordinary least square regression method, the empirical findings link the major long-run determinants of foreign exchange rates to balance of payments, foreign direct investment outflows, inflation, interest rates changes, trade openness, trade structure, money supply, gross domestic product, and trade similarity. Variables like balance of payments, trade structure, money supply, gross domestic product, and trade similarity are positively correlated with the real effective exchange rates. Variables like foreign direct investment outflows, inflation, changes in interest rates, and trade openness are negatively correlated with the real effective exchange rates. Trade balance, however, is not significant with respect to the determination the exchange rates.

It is worth mentioning that trade structure and trade similarity have not previously been tested as exchange rate determinants. These variables having examined (let alone having found them to be significant determinants of the real effective exchange rates) represents a contribution of this study to knowledge beyond conventional determinants of exchange rates. The empirical findings of the study were mostly in line with those in the literature and support the associations between exchange rates and the investigated independent variables.

Results of the study may bear on the choice of an exchange rate regime.

The impact and the direction of the long term determinants of exchange rate are now clarified. In line with macroeconomic policy, monetary authorities may manage these variables to attain a targeted foreign exchange rate in the event of a free float of the Bahraini dinar. Accordingly, the current peg regime adopted in Bahrain may be reassessed based on the results of the study. Besides, the Bahraini monetary authority may introduce policies that minimize the level of exchange rate volatility and the government may exercises control of macroeconomic variables that have direct impact on exchange rate variation.

NOTES

1. <http://www.investopedia.com/terms/r/reer.asp#ixzz4Z9edTEPD>
2. UNCTAD, UNCTADstat Merchandise Trade Matrix
3. Ibid
4. Ibid
5. Muffet, Michael H., Stonehill Arthur I., and Eitman David K. (2016), *Fundamentals of Multinational Finance*, fifth edition, Pearson.
6. UNCTAD stat: Bilateral concentration indices of merchandise exports and imports measure products dependencies to specific market giving information on the number of exported/imported products by country.
7. Initially the study started with investigating thirteen independent variables and one dependent variable. Some were delisted from further investigations due to multi-collinearity and correspondence with other variables.
8. www.investopedia.com/corp.aspx
9. The study examines ten regressors as some were delisted from further investigations due to multicollinearity.

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