Dynamics of Co-integration: A Story from United Kingdom`s Economy

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Abstract
Exchange rate is a significant factor in international macroeconomics; it affects are witnessed in the recent past on different currency crises in many economies and has attracted focus of policy makers around the globe. But the question is can the exchange rate policy really be used to influence trade flows? Whether we really can say what effect on trade balance a depreciation or appreciation of exchange will have? Is the connection between exchange rate, trade balance and balance of payments is strong enough for us to be able to base a policy on it? So, this research study focuses on the above questions for United Kingdom (UK) economy. Data of defined variables is collected on annual basis for thirty one years. By applying cointegration, it is estimated that there exist a long run relationship. UK has significantly and correctly signs the short run dynamic. Exchange rate does not Granger cause balance of payment and balance of payment does not granger cause exchange rate. In conclusion, we

found that determinatnts of balance of trade affect the exchange rates, also, these rates have an considerable effect (positive or negative) on balance of payments.
Keywords: Dynamics of cointegration, United Kingdom`s Economy, Balnace of payments.
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1. Introduction

Exchange rate calculation is one of the essentials for policy formulation for countries, (Qiao, 2007) states that we still are waiting to have comprehensive theory to predict exchange rate depreciation and appreciation on the trade balances, the empirical findings in exchange rate and balance of trade showed the mixed trends (Koray & McMillin, 2006). Exchange rate is a significant factor in international macroeconomics; it affects are witnessed in the recent past on different currency crises in many economies and has attracted focus of policy makers around the globe. Exchange rate has proved its behavior in determining the country economic position in this age of globalization and trade liberalization. Summing up, from the literature their exist numerous studies of exchange rates with all macroeconomic and microeconomic determinants, therefore, exchange rates accounts for many macroeconomic policy changes. Its relationship with monetary policy is important for small, open economies (Grenville & Gruen, 1999). In addition to this (Kearns & Manners, 2006) results concluded that monetary policy decision can bring variation in exchange rates. Historic analysis of balance of payments data at times of previous crisis can be used to advise the recommendations over the specific policies to be pursued. Through balance of payments and other data policymakers are able to see the impact of past policies on both reversing Balance of payment deficits and on other variables such as output, employment and inflation. External trade can be stimulated by a through several channels. In particular, preferences, subsidies, quotas, taxes and other limitation could be used to push the trade balance in the desired direction. That is why the exchange rate policy stays almost only possible tool. But the question is can the exchange rate policy really be used to influence trade flows? Whether we really can say what effect on trade balance a depreciation or appreciation of exchange will have? Is the connection between exchange rate, trade balance and balance of payments is strong enough for us to be able to base a policy on it? How exchange rate and affect determinants of trade in emerging and developed countries? So, this research study focuses on the above questions for United Kingdom economy.

2. Litrature Review

First section, considers the relationship between exchange rate and the macroeconomic determinants (e.g., imports, exports, industrial growth, capital goods, consumption level, oil prices) whereas, second section focuses the literature related to balance-of-payments and exchange rate nexus. One of the foremost pillars of an economy is international trade, many developed and developing economies are facing challenge of trade deficit. Results of this deficit on current account balances are very unfavourable, and becoming a considerable challenge for different economies around the world, due to vulnerabilities existence in international and local markets. Later, the elasticity model presented by (Koray & McMillin, 2006) provides the evidence of theoretical connection between both of exchange rate and the international trade. Furthermore, there have been numerous studies, which results in determination of the exchange rate and trade balance relationship, and provides important insights for and direction for development of new policies to balance out a country's foreign trade (A. K. Rose, 1991); (Himarios, 1989);(Bahmani-Oskooee, 1998); (Arize, 1997); (Parsley &

Wei, 2001); (Liew, Baharumshah, & Chong, 2004); (Singh, 2002). Moreover, countries when compete internationally for trade of goods and services, is also affected by the current prevailing trade policies, if they are favorable then it will help them in long run and can result in improving balance of payment situation. Furthermore, any change in the currency rates and demands affects bilateral trade between two countries; therefore, these trade balances are also vulnerable to any movement in currency rates. Theoretical models, such as (Nagy & Furtan, 1978) identify valuable reasons of variation in imports and export; he defined the link between the increased trade balances with currency rates to minimize the domestic expenditures. The exchange rate devaluation improves the balance of trade balance. Such results match with the Murshall-Lerner condition. Similarly, (Broda & Romalis, 2011) examine data of 30 years with larger sample of tradable goods and commodities within different countries concluded that frequent two-sided trading in countries has dried out real exchange rate volatility. Furthermore, (Perée & Steinherr, 1989)) in study of volatility of exchange rate impact on export of different Asian countries and results showed that long run unstable relationship. Many researchers suggest that, changes in the oil price have considerable effects on the aggregate economic activity. Such effects are expected to be unlike for oil importing and exporting economies. Moreover, (Jiménez-Rodríguez* & Sanchez, 2005) and (Hamilton, 2008) investigated oil prices fluctuations and economy effect through the exchange rate. Since, crude oil is a fundamental production input; it is usually predicted by the theory that supply-side importance of oil price hikes includes a narrowing of aggregate economic activity and inflationary pressures. In developed countries like USA and Canada results indicates very less significant relationship among the currency rates and oil prices when calculated on basis of yearly data, on the contrary, strong significant relationship is found when daily data is used to test these variables in study conducted by (Ferraro, Rogoff, & Rossi, 2012). Moreover, conclusion of the study by (Amano & Van Norden, 1998) found cointegration in the U.S. real exchange rate results with the price of oil. Major exports from this sector includes textile and sports goods. In addition, there are many international companies operations are also helping in boosting exports of industrial sectors. (Ndulu & Semboja, 1995) found the significance of effective exchange rate on manufacturing exports. In review of existing literature so far, it is observed that exchange rate plays critical role in international monetary transactions of an economy. Balance of Payments is a summary statement of these international transactions. In other words, balance of payment is used for the accounting of any specific country's total payments made during the certain period of time along with the receipts collected from any other country from private of government exchange sources. Though, studying the relationship between both is quite significant for developing mix of trade reforms, formulation of new trade policies, regulation and restriction for uplifting trade balances to improve balance of payments. Hence, making this relationship entirely an empirical issue (Ostry, 1992; A. K. a. Y. Rose, J.L, 1989),and recent panel studies of twenty two emerging countries in this area suggest made trade liberalization responsible for disturbance of balance of payment (Santos-Paulino, 2002). Moreover, (Oladipupo, 2011)stated that some countries use dual exchange rates systems because of their weak balance of payments situations, rather than devaluation of their currency, this approach sometime proves costly from a political and social point of view. However, if managed properly this dual exchange rate policy can be valuable for improving balance of payments of developing countries. Also, (Oladipupo, 2011)viewed international trade and foreign exchange markets constancy can be achieved by fixed exchange rates.

3. Methodology

Objective of research can be achieved with the help of econometric technique which is used to test the existence of a long run association among the different time series of data for UK. The data of exchange rate (ER) and balance of payment (BOP) is collected from International Financial Statistics (IFS). The data for imports (IM), exports (EX), capital goods (CG) and industrial growth (IG) are taken from World Data Bank indicators. Furthermore, Oil prices (OP) (US $ per barrel) are taken from OANDA forex. Objective of research can be achieved with the help of econometric technique which is used to test the existence of a long run association among the different time series of data for UK.

Exchange rate = $\beta_0 + \beta_{1\,(Exports)} - \beta_{2\,(Imp)} - \beta_{3\,(Capital\,goods)} - \beta_{4\,(industrial\,growth)} - \beta_{6\,(Consumption\,level)} + \beta_{7\,(Oil\,prices)} + \varepsilon$ ....(1)

Balance of payment and exchange rate has significant relationship with each other. Role of government is very significant in making advantage from this variation with the help of devising country favorable policies for boosting exports and reducing imports helps in their trade reforms, and eventually constructs a strong positive impact on balance of payment.
Balance of payment = $\beta_0 + \beta_{1\,(exchange\,rate)} + \varepsilon$ ....(2)
Following test was conducted to analysis of the data. The details are given below as follows;

3.1 Unit Root test Augmented Dickey-Fuller (ADF)

We have selected ADF unit root test for this study, with an objective to find out properties before the application of an econometric model. In analyzing the relationship between different time series, some of the variables in different time series may result in non-standard distribution and false regression results. Therefore, for the meaningful results and measurement of long & short run relationship between data series, our data series should be classified, and variables are called stationary or integrated.

3.2 Johansen Cointegration:

Johansen Cointegration is a detail procedure of vector cointegration method. When we compare this test with the EG and PO methods this method has advantage over the other methods used for cointegration. Johansen Cointegration method is not limited to few time series but this method can make relationship estimation of more than three time series as well. Objective of using this cointegration technique is used for finding out mutual integration between some groups of non-stationary series, which can result in positive or negative relationship between these groups. Similarly, this is based on finding long term relationship between different variable, hence we have used similar technique.

3.3 Vector Error Correction Model:

This model is used in finding the short run relationship between two variables. Long run equilibrium relationship is obtained from the cointergration between two or more series, then to find out behavior properties in short run we use this model.Furthermore, in the case if there is no relationship exists among the series we do not apply this VECM and we directly proceed to granger causality test to establish causal link between variables. Furthermore, Banerjee et al. (1993) view the error correction mechanism as a useful way of estimating dynamic regression models that incorporate both the long-term focus on levels found in cointegration analysis and the short-term focus on changes found in first-differenced regression models, such as those used by Cantor and Land (1985).

3.4 Granger Casualty test:

For determining the statistical test hypothesis, Granger Casualty test is used in which one time series forecasting over another. The purpose of Granger Casualty test is to check the short run effect as likewise vector error correction model (VECM) approach. Similarly, in the case, if there is no relationship exists among the series we do not apply VECM which is stated above and we directly proceed to ganger causality test to establish causal link between variables. Long run ganger cause in exchange reserves of china and in short run ganger causality from foreign exchange reserves to exchange rate is found. Therefore, in this research we also test the ganger causality of different variables in short run and long run (Box; Johansen, 1988; Johansen & Juselius, 1990).

4. Results

Table 1 explains the results of ADF test on unit root on level, first and second difference for UK. As the null hypotheses time series is non-stationary (unit root). Likewise, if we see the result of UK, the variables i.e. exchange rate, oil prices, consumption level, Export, Import, industrial growth, Capital goods and balance of payment are stationary on first difference I (1).

Table1: ADF Test

	Variables	Types of Test	ADF test Statistics	R^2	Stationary	D-W Statistics	Probability
	Δ Exchange Rate	0 t 0	-4.836774*	0.47003	1st Diff	1.768198	0.0028
	Δ Import	0 t 0	-3.26614***	0.293264	1st Diff	1.785784	0.0913
	Δ Export	0 t 0	-4.679341*	0.449642	1st Diff	1.921436	0.004
	Δ Industrial Growth	0 t 0	-3.373232***	0.297817	1st Diff	1.70561	0.0742
	Δ Capital Goods	0 t 0	-3.313879***	0.301483	1st Diff	1.57669	0.0833
	ΔConsumption Level	0 t 0	-4.392701***	0.437881	1st Diff	1.635636	0.0083
	Δ Oil Prices	0 t 0	-4.288914*	0.40954	1st Diff	1.557016	0.0102
UK	Δ Balance of payment	c 0 0	-5.876857*	0.543576	1st Diff	1.864588	0.000

After taking the order of stationary at d time as I (d), the next step is to apply the cointegration. Since before applying the Johansen cointegration test, lag length is selected. Firstly, we estimate vector autoregressive model and determined the optimal number of lags by ER, IM, EX, IG, CG, CL and OP as endogenous variable. So the optimal numbers of lags for UK is 1.

As the Johansen Cointegration results are shown in table 2. For UK trace test shows 3 cointegration equation(s) at 5% critical value. These statistics indicates that four null hypothesis is rejected. This means that there are three Cointegration equation r = 3 among the seven variables at a significance level of 5 %. Max-Eigen value test indicates 2 cointegration equation(s) at the 5% level.

Table 2: Johansen cointegration test results

Unrestricted Cointegration Rank Test (Trace)				Unrestricted Cointegration Rank Test (Maximum Eigen value)			
Hypothesized	Trace	0.05		Hypothesized	Max-Eigen	0.05	
No. of CE(s)	Statistic	Critical Value	Prob.**	No. of CE(s)	Statistic	Critical Value	Prob.**
r =0*	191.3914	134.678	0.000	r =0*	65.56797	47.07897	0.0002
r <1*	125.8234	103.8473	0.0008	r <1*	48.21948	40.9568	0.0064
r <2*	77.60391	76.97277	0.0447	r <2	28.3311	34.80587	0.2413
r <3	49.27281	54.07904	0.1253	r <3	21.99966	28.58808	0.2751
r <4	27.27315	35.19275	0.2753	r <4	13.03481	22.29962	0.5533
r <5	14.23834	20.26184	0.2733	r <5	7.761894	15.8921	0.5763
r <6	6.474449	9.164546	0.157	r <6	6.474449	9.164546	0.157

Results indicates that there is a long-run relationship between the exchange rate, export, import, industrial growth, capital goods, and consumption level and oil prices in emerging and developed countries.

Table 3: Analysis of Exchange Rate and its Determinants of Trade among

Variables	Import	Export	Industrial Growth	I Capital Goods	Consumption Level	Oil Prices	Constant
United Kingdom	-0.002914	-0.001124	0.008865	-0.000142	0.00067	0.0163	-1.82618
	[-0.8320]	[-0.0511]	[+2.90725]	[-0.0482]	[+0.67651]	[+13.9873]	[-5.05311]

Export shows the positive affect in UK but the impact of export is lower in and on the other side the results are opposite for the imports. Industrial goods have negatively related. Capital goods has positive coefficient and consumption level has negative relations. Oil price is sensitive in UK and has negative relation. Negative relationship with exchange rate shows that direction i.e as it exports increases then currency appreciated and vice versa if all the variables remain constant then it means equilibrium level has been reached and constant term indicates the long run equilibrium. The intercept value indicates the change in constant change in exchange rate. All the constant term shows significant results.

Table 4: Vector Error Correction Model

	Error Correction:	D(ER)	D(IM)	D(EX)	D(IG)	D(CG)	D(CL)	D(OP)
	CointEq1	0.281603	-4.53917	-3.64654	17.40063	13.66968	17.51155	79.8575
		-0.23183	-33.0639	-3.15816	-11.1911	-14.7572	-26.1258	-19.8752
UK		[1.21471]	[-0.1328]	[-1.15464]	[1.55487]	[0.92630]	[0.67028]	[4.01795]

Table 4 exhibits the short run vector error correction results. For short run adjustment in the UK, exchange rate, exports and imports, capital goods, consumption level and industrial goods are not correctly signed while oil prices are correctly signed in short run adjustment for UK.
Table 5:

Granger Causality Test

Country	Null Hypothesis:	Obs	F-Statistic	Probability
UK	ER does not Granger Cause BOP	31	0.95008	0.33804
	BOP does not Granger Cause ER	31	0.07491	0.78632

In table 5, Granger causality checks the bilateral effect as balance of payments on exchange rates and exchange rates on balance of payments. In the cases of UK we do not reject the null hypotheses as exchange rates does not granger cause balance of payments and balance of payments does not Granger cause exchange rates as the p-value is greater than 1% ,5% and 10% significance level. Exchange rate is very important determinant of trading in an open economy. Dealing in foreign exchange market, currency change affects every economy including developed or developing. This occurs because of the market forces of supply and demand, which pushes countries exchange rate as depreciated and appreciated. For this research study, we examined that the balance of trade, economic growth factors and oil price brings changes in exchange rate. Furthermore, we found the unilateral or bilateral effect of balance of payment and exchange rate.

5. Conclusion

It is concluded that determinatnts of balance of trade affect the exchange rates, also, these rates have an considerable effect (positive or negative) on balance of payments and macroeconomic stability within a country; economists, policy makers and government should collectively device appropriately matched and synchronized monetary, trade and fiscal policies which stabilize the exchange rate and sustain the balance of payment objectives. It is recommended that it is crucial to have appropriate monitoring systems coupled with suitable macroeconomic policies policy mix for attracting foreign inflow in the markets. Limitation of the study is that only yearly data was included in this study, which may limit our understanding and inferences about the exchange rate volatility, future studies should include monthly, and if possible weekly or daily base data for more in-depth analysis to explore the root causes of volatility in exchange rates.

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