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Fluctuation of Yuan/Dollar: Time Series Co Integration Analysis

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Abstract

In this era of new revolution of globalization and trade liberalization, exchange rates (ER) are one of the fundamental factors in international trade. This research focus on the determinants of trade i.e. Import, export, industrial growth, consumption level and oil prices fluctuation brings changes in exchange rate and its influence eventually on balance of payments in China. Data was collected on annual basis for thirty one years. By applying cointegration, it is estimated that there exist a long run relationship. China 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 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. Moreover, apart from the selected determinants of trade, there are many other macroeconomic factors (inflation rates, interest rates, speculation, change in competitiveness, relative strength of other currencies and government debt) and microeconomic factors (political stability position and regional relationship) which may also play role in determination of exchange rates.

Key words: Time series cointegration, Exchange rate, Yuan/Dollar.
JEL: F33, F31, P30

1. Introduction

Exchange rates measure the cost of a one country currency value in contrast with other international currencies (Oladipupo, 2011). These rates are measured in international markets at which one currency exchange with other country for completion of their transaction (Iyoha, 1996). Exchange rate (currency appreciation or depreciation) plays a vital part in calculations of these balances. Generally, in most of the developed counties flexibility is seen in exports imports against variation in currency rates in comparison with different emerging and none developed countries where it is inelastic. Similarly, this volatility in exchange rates also effects (increase or decrease) current account balances, payments, transfer to other countries, remittances, inflows/outflow of funds and hence upset the balance of payments in developed or developing countries. In this era of new revolution of globalization and trade liberalization, exchange rates (ER) are one of the fundamental factors in international trade. It acts as a basic feature in every single transaction between the two trading counties. It has emerged as a topic of great discussion coupled with the trade balances. Exchange rate has its worth as a permanent source of conversation in macroeconomics. Since, the start of international trade in different countries. In 1930s, many unused resources and demands were not elevated between the trading countries, later, exchange of demand between different industrialized countries resulted in leaving traditional gold standards. With the emergence of new economic policies due to start of globalization in 70s and 80s, exchange rates acted as a shield against high inflation. Therefore, many financial crises in different decades resulted due to the use of these fixed exchange rates and eventually highlighting need for use of flexible exchange rates. In the case of Pakistan there are factors related to the determination of exchange rates like purchasing power also plays its part in holding long run stability, it is an empirical test on Pakistan's long run real exchange rate (Olekalns, 1998). Moreover, a monetary expansion cause's long run affects, because any considerable rise in money circulation in country or appreciation of expected inflation causes long run depreciation because it decreases the demand for the currency (Frankel, 1979). On the other hand the increase in exchange rates is due to monetary expansion policy. Similarly, (Levich & Thomas III, 1993) highlighted importance of real exchange rates effectiveness on current account balances. Similarly, countries under great debt burden, this debt servicing costs and interest payments on receives debts sometime exceeds the cost of new annual investment outflows to other countries. Whereas, talking about foreign investments, does not give rise to any problems intrinsically, different from those created by domestic investment, public or private (Eaton & Taylor, 1986). The outcome of foreign debt on the balance of trade; he inferred that foreigner investor may fear the trade negotiation with the countries because of the results of debt default. Countries already under international debts refrain adequate amount of investment and loose opportunities of seeking credit international and national due to default factors and result in wiping of finances and trade (Rose, 2007). 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 (see, for example, (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. The objectives of this research study are;

- To explore the relationship of the factors which are affecting the exchange rate?
- To explore the bilateral and unilateral effect of exchange rate.

2. Litrature Review

Likewise, some of developed countries, i.e. USA, UK and Spain are also facing problem of trade deficit at large; on the other hand, many other developed countries like Germany, Australia, Finland and other European countries are enjoying benefit of trade. Despite of the fact, there is large number of factor affecting these trade balances (Bahmani-Oskooee* & Ratha, 2004)tried to find the major factor which are disturbing trade balances in different economies, his study found that there are many critical factors which are affecting international trade, he found exchange rate as one of the main theoretical models, such as (Nagy & Stahl, 1967) 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. Furthermore, (Doğanlar, 2002) in study of volatility of exchange rate impact on export of different Asian countries including Pakistan also results in long run unstable relationship. However, this increase in exchange rate effect can benefit only if the country make export friendly policies to encourage exports. In list of expensive commodities, great volume of oil import is mass expenditure for country not producing it. These countries rely mostly on the import of this commodity to facilitate manufacturing of their products and goods. 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 (Amano & Van Norden, 1998). 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. Additionally, aggregate demand is expected to decrease in an oil importing economy, and escalates for oil exporting economy. This inference is applicable for real currency rates, which is an actual price of local and international currencies. These can be stated as the nominal exchange rate aligned for inflation differentials amongst the countries. Hence, (Edwards, 1988) study depicts significant and negative relationship among the exchange rate and the economy in the context of oil prices and other variables in the short run.In theory, the exchange rate depreciation disturbs the transfer of income between two trading countries, create hindrance in trade provisions and conditions, and hence, upset the economic growth process within them. Despite the academic thoughts about the liaison between real exchange rate and economic growth, (McKenzie, 1999) points out that at theoretical level, such models have been developed which guide the economy to positive or negative effects of variability, and there is no obvious way to characterize the superiority of the models. Similarly, various studies have shown that strong evidence exists among exchange rate and its relationship with country growth. The price of goods and services, which are tradable to those factors which are non-tradable like the exchange rate, plays an essential part in the country growth and progress. Recently, (Rodrik, 2007) in his study investigate that these relationship have made similar conclusions and related includes

industrial growth, capital goods, investment and consumption level growth as economic growth. 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.

3. Methodology

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 China.

Exchange rate = $\beta_0 + \beta_1$ (Exports) - β_2 (Imp) - β_3 (Capital goods) - β_4 (industrial growth) - β_6 (Consumption level) + β_7 (Oil prices) + ε .....(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) + ε .....(2)

Augmented Dickey-Fuller (ADF) unit root test is used and 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. With this we can conclude, unit roots problem can be resolved if when stationary of data is attained, then we will become in a position to draw a conclusion with meaningful results (Frankel & Wei, 2007)), similarly, (Maddala & Kim, 1998) also agreed with the stated notion in his studies regarding the s stationary of data sets for correlation. Johansen cointegration 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. The attraction of cointegration analysis in economics stems from the fact that several key economic relationships, such as the link between income and expenditure or prices and wages, are hypothesized to have long-term, stable relationships. In the literature review, by using Joheanson cointegration procedure in his study for testing relationship among income and energy use in different Asian countries, he also used error-correction analysis in his study (Asafu-Adjaye, 2000). It is conducted that similar kind of technique in testing relationship between the usage of energy and GDP of country in different six of Asian countries including, Singapore, Indonesia, Philippines, Malaysia, India and Pakistan (Masih & Masih, 1996) The

test for a cointegrating relationship provides a means for assessing the nature of this kind of relationship and for assessing the validity of economic theories hypothesizing equilibrium relationships. So, in this study we use the Johansen cointegration test (1991, 1995).After taking the order of stationary at I (d), this test is used to see whether there is long term relationship exists among the variables. Co-integration test is applied on non-stationary variables to check the long-term equilibrium. Vector error correction model (VECM) 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, 1999) 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 (Cantor & Land, 1985). However, changes in the time series are defined as departures from equilibrium. Regardless of the statistical accounting for these changes in the error correction factor, the dependent variable remains the level of the time series, and the main hypothesis is still one of looking at a stable, long-term relationship and not one of looking at changes in the dependent variable. Granger Casualty test used 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 (Box; Johansen, 1988; Johansen & Juselius, 1990).

4. Results

ADF test is run to find out the stationary in the variable. As the null hypotheses time series is non-stationary (unit root). In the table 1 China has variables exchange rate, import, export, industrial growth, capital goods, and consumption level, balance of payment and oil prices are stationary in their second difference I (2)

Table 1: ADF Test China

	Variables	Types of Test	ADF test Statistics	R^2	D-W Statistics	Probability
China	ΔΔ Exchange Rate	0 t 0	-5.227901*	0.5031	1.987941	0.0011
	ΔΔ Import	0 t 0	-4.844953*	0.48123	1.791541	0.0028
	ΔΔ Export	0 t 0	-4.543969*	0.45616	1.516945	0.0058
	ΔΔ Industrial Growth	0 t 0	-4.457721*	0.45096	1.687815	0.0071
	ΔΔ Capital Goods	0 t 0	-5.773671*	0.56539	1.964793	0.0003
	ΔΔConsumption Level	0 t 0	-4.619584*	0.44562	1.922422	0.0047
	Δ ΔOil Prices	0 t 0	-4.288914*	0.40954	1.557016	0.0102
	ΔΔBalance of payment	0 t 0	-7.892583*	0.703	2.018909	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 China is 1. As the Johansen Cointegration results are shown in table 2. In china trace test, 7 cointegration equation(s) at 5% critical value. These statistics indicates that none null hypothesis is rejected. This means that there are four Cointegration equation r = 7 among the seven variables at a significance level of 5 %. Max-Eigen value test indicates 3 cointegration equation(s) at the 5% level.

Table 2: Johansen cointegration test results for China

Unrestricted Cointegration Rank Test (Trace)				**Unrestricted Cointeg. Rank Test (Maximum Eigen value)**			
Hypothesized	**Trace**	**0.05**		**Hypothesized**	**Max-Eigen**	**0.05**	
No. of CE(s)	**Statistic**	**Crit.Value**	**Prob.***	**No. of CE(s)**	**Statistic**	**Critical**	**Prob.****
r =0*	244.3089	134.678	0.000	**r =0***	76.76225	47.07897	0.000
r <1*	167.5467	103.8473	0.000	**r <1***	59.69061	40.9568	0.0002
r <2*	107.8561	76.97277	0.000	**r <2***	36.99568	34.80587	0.0269
r <3*	70.8604	54.07904	0.0008	**r <3**	26.66661	28.58808	0.0862
r <4*	44.19378	35.19275	0.0041	**r <4**	19.81693	22.29962	0.1071
r <5*	24.37686	20.26184	0.0128	**r <5**	14.72915	15.8921	0.0754
r <6*	9.647706	9.164546	0.0405	**r <6***	9.647706	9.164546	0.0405

In sum, annual data for last 31 years from 1977 to 2008 accomplishes our goal and 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 China. From the results generated after the application of test, it is stated that there is a positive and negative relationship of the exchange rate with the import in both 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**
China	0.345106	-0.190488	-0.05423	0.242901	0.00067	0.081479	+13.94935
	[+4.13257]	[-3.7184]	[-0.5496]	[+2.10892]	[+0.67651]	[+1.42935]	[+2.14534]

Export shows the positive affect in China and on the other side the relationship is opposite for the imports. Industrial goods has positively related in China. Capital goods has negative coefficient and consumption level has positive relations. Oil price is negatively relate in China. 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)
China	CointEq1	-0.03312	-0.69574	-2.53357	-0.59659	-0.331	0.549076	-0.46042
		-0.01763	-0.61366	-0.58478	-0.38788	-0.42255	-0.38312	-0.35841
		[-1.87878]	[-1.1337]	[-4.33254]	[-1.53806]	[-0.78334]	[-1.4337]	[-1.28460]

Table 4 exhibits the short run vector error correction results. China has significantly and correctly signs the short run dynamic and its adjustment is settled in the long run for exchange rate, industrial goods, consumption level, capital goods, oil prices, exports and imports.

Table 5: Granger Causality Test

Country	Null Hypothesis:	Obs.	F-Statistic	Probability
China	ER does not Granger Cause BOP	31	0.60358	0.44373
	BOP does not Granger Cause ER		0.01720	0.89660

In table 5, Granger causality checks the bilateral effect as balance of payment on exchange rate and exchange rate on balance of payment. In China we do not reject the null hypotheses as exchange rate does not cause granger in balance of payment and balance of payment does not granger cause exchange rate 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.

5. Conclusion

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. Moreover, apart from the selected determinants of trade, there are many other macroeconomic factors (inflation rates, interest rates, speculation, change in competitiveness, relative strength of other currencies and government debt) and microeconomic factors (political stability position and regional relationship) which may also play role in determination of exchange rates.

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